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FACULTY OF DESIGN & ARTS

PRESENTS

PROCEEDINGS OF

3RD INTERNATIONAL CONFERENCE ON

Emerging Trends in Design & Arts

(ICETDA 2025)

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About The University

Poornima University (PU) is a UGC-approved leading private university in Rajasthan. The university is situated in Sitapura, the educational hub of Jaipur, on a 32-acre sprawling, lush green campus. The state-of-the-art campus features independent academic and administrative blocks, hostels, laboratories, sports grounds, and observatory, providing a scholarly ambience for learning and liberty. It creates a warm and protective environment with a professional atmosphere, helping students develop their potential to face cutthroat global competition.

Poornima University brings together a community of wide-ranging interests, competencies, and aspirations from Engineering, Architecture, Management, Commerce, Design, Science, Public Health, Computer Applications, and Hotel Management.

Poornima University was recognized as the Best Upcoming University in India by ASSOCHAM, New Delhi. It was also recognized as the Top Private University of Rajasthan in 2018.

About Faculty of Design and Arts

The Faculty of Design and Arts (FDA) is dedicated to "Crafting Futures through Design," endorsed by IIID and aligned with FDCR, with prominent specializations such as BVA and MVA in Visual Arts, B.Sc. in Game Design AR-VR, Animation, and VFX, B.Des. in Fashion and Textile Design, Interior Design, M.Des. in Product Design, B.A. JMC, M.A. JMC, and Ph.D. programs, etc.

Ranked No. 1 in Rajasthan among all design schools and 16th nationwide in the IRF Education Ranking. FDA empowers learners with an adaptable curriculum, state-of-the-art studios, and faculty members with extensive industry experience. FDA prepares its students for market demands, offering a holistic and industry-relevant education, while shaping the next generation of design professionals.

The FDA initiates its students on a trajectory where innovation, creativity, and applied skills intersect, offering the prospect of a future within diverse realms of design and the arts.

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About the Conference

The 3rd International Conference on Emerging Trends in Design and Arts (ICETDA 2025), to be organized at Faculty of Design and Arts, Poornima University, Jaipur, Rajasthan, India, is a great platform for researchers around the globe to discuss and present their research findings, share knowledge and exchange of ideas among inter disciplinary areas of Design and Arts during 12th & 13th September'2025 in Hybrid Mode. The scope of the conference mainly focus on but not limited to Visual Arts and Performing Art, Animation and VFX, Gaming and AR/VR, Fashion and Textile Design, Interior Design and Product Design, AI and Technology in Art and Design, Culture, Heritage and Craft, and other related Design based themes and their significance in the present era. With a specific focus on bridging the gap of the Design and Arts domain, ICETDA conference had started in the year 2023 and is an annual event spanning of two days in hybrid mode.

Scholars, Professionals and Researchers, Artist and Designers from across globe for knowledge shared and exchange knowledge through the conference and contributes to the benefit of the society. The multidisciplinary nature of the conference, involving academia, government agencies, professionals, and the corporate sector, enhances the potential for addressing holistic and comprehensive solutions to complex issues and promote awareness of the cultural values.

The key benefits and outcomes of the conference may include opportunities for knowledge exchange, demonstrating innovation and research, networking and collaboration, capacity building, awareness and advocacy, and global perspective.

ICETDA 2025 also encourage the significance of cultural and traditional values in the development of the modern society and hence is showcasing the unique heritage and practices of the region to the world through its workshop and Lecture sessions by experts and artisans during the course of the event.

Tracks

Track 1:

- Visual Arts: Painting, Sculpture, Photography, Mixed Media
- Performing Arts: Dance, Music, Theatre
- Communication Design: Graphic Design, Typography, Branding, Motion Graphics Advertising & Marketing

Track 2:

- Animation: 2D/3D Animation, Storyboarding, Character Design
- Visual Effects (VFX): Digital Compositing, Special Effects, Motion Capture
- Gaming: Game Design, Interactive Media, Game Industry
- Augmented Reality (AR) & Virtual Reality (VR): Immersive Storytelling, XR in Design

Track 3:

- Fashion Design: Sustainable Fashion, Digital Fashion, Couture Design
- Textile Design: Smart Textiles, Surface Pattern Design, Heritage Textiles
- Interior Design: Space Planning, Ergonomics, Green Interiors
- Product Design: Design Thinking, Industrial Design, UX/UI Design
- Jewellery Design: Material Innovations, Innovative Techniques and Craftsmanship, Aesthetic Trends in Contemporary Jewellery, Ethics and Sustainability, Jewellery as a Narrative and Identity, Jewellery in Art and Fashion, Jewellery for Functional and Therapeutic Use

Track 4:

- Culture and Heritage: Art Preservation, Heritage Architecture, Cultural Studies
- Craft: Handicrafts, Traditional Craft Practices, Artisanship
- AI & Technology in Art and Design: Generative Art, AI in Creative Workflows, Data-Driven Design

Track 5:

- Media Studies: Digital Media, Media Ethics, Media Literacy
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- Film and Documentary: Cinematography, Documentary Filmmaking, Media Production

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Message

Dear Esteemed Colleagues, Researchers, and Practitioners,

*It is my privilege to welcome you to the **3rd International Conference on Emerging Trends in Design and Arts (ICETDA-2025)**, hosted by the Faculty of Design and Arts, Poornima University, Jaipur. Over the course of two enriching days—**12th and 13th September 2025**—this hybrid gathering brings together creative minds from across the world to explore the frontiers of design, arts, culture, and technology.*

*This year, we are delighted to have received **421 abstract submissions**, of which **255 progressed to full-paper submissions**—an encouraging reflection of scholarly rigor and creativity. With **250 registered papers**, **international papers 16+**, ICETDA-2025 is positioned as a vibrant platform for dialogue, collaboration, and innovation in the creative disciplines.*

The conference continues its mission to foster interdisciplinary exchange across diverse themes, including Visual and Performing Arts, Animation & VFX, Gaming & AR/VR, Fashion & Textile Design, Interior & Product Design, AI & Technology in Art & Design, and Culture & Heritage. Such diversity strengthens our collective vision of blending tradition with technology and practice with research.

I wish to acknowledge with deep appreciation the contributions of:

- ***Authors and presenters**, for your scholarship and creativity.*
- ***Reviewers and the Technical Program Committee**, for your rigorous evaluations ensuring academic quality.*
- ***Organizing and Advisory Committees**, for your tireless commitment in shaping this conference.*
- ***Our association partners**—the Indian Institute of Craft & Design, Banasthali Vidyapith, and the Indian Institute of Gems & Jewellery—whose collaboration and support have been instrumental in enriching the academic and cultural value of this gathering.*

ICETDA-2025 exemplifies the power of partnerships, where academia, industry, and cultural institutions converge to address emerging challenges and opportunities in design and arts. I encourage all participants to immerse themselves in the presentations, discussions, and workshops, and to carry forward the insights and networks gained here into future endeavors.

On behalf of Poornima University, I extend my heartfelt gratitude to each contributor and participant. May ICETDA-2025 inspire creativity, critical inquiry, and lasting collaborations.

Thanks & Regards

Conference Chair

Dr. Jitendra Sharma

Professor/Dean, Faculty of Design and Arts

Poornima University, Jaipur

Sr. No.	Paper Title	Paper ID	Page No.
1.	**Unmasking Deception: Analyzing Greenwashing as an Unethical Advertising Practice in the Indian Market** Virendra Pratap Singh[1], Dr. Giriraj Sharma[2]	230	1
2.	**The Impact of Universal Design on Branding in Public Spaces** Paridhi Raghav Rana[1], Dr. Hitesh Sharma[2]	30	6
3.	**Animating Change: A Qualitative Study on Women's Empowerment in Animation Narratives 2000 to 2024** Rajendra Vasant Khairnar, Research Scholar[1], Dr. Monika Gupta[2]	5	18
4.	**The Rise of Canva: A New Era in Graphic Design** Galande Ashish Tukaram[1], Dr. Hitesh Sharma[2]	33	33
5.	**The Impact of Smartphone Camera Ecosystems on the Evolution of Professional Photography** Falguni Akshay Gadgilwar[1], Dr. Hitesh Sharma[2]	34	44
6.	**The Role of NFT in the Digital Advertising Industry** Jaideep Sharma[1], Dr. Hitesh Sharma[2]	37	52
7.	**The Art and Ethics of New-Born Photography** Renuka Kantilal Thange[1], Dr. Hitesh Sharma[2]	42	68
8.	**A Study of the Connecting Factors in Traditional Textile Motifs and Symbols used by the Tribal Communities of the Brahmaputra Valley** Jullee Borpujari Deori[1], Dr. Abhijit Padun[2]	43	79
9.	**Hue Matters: How Colour Shapes Consumer Behaviour in Digital Space** Dr. Dipti Bhosale[1], Dr. Parag Shelke[2], Dr. Ravindra Bachate[3]	55	92
10.	**Layers of the Sublime: Deducing Transcendence in the Abstract images of Prabhakar Kolte** Amit Kalla, Research scholar[1], Dr. Kajal Thakuriya[2], Dr. Andre Rigatti[3]	59	105
11.	**Designing Phonimo: A Tangible Learning Tool for Phonemic Awareness in Early Education** Nikitha Tadigadapa[1], Shivani Varade[2], Dr. Ravindra Bachate[3]	63	116
12.	**Clario: An AI-Powered Focus Assistant to Combat Cognitive Fatigue and Digital Distractions in Late Adolescent Learning** Sonone Komal[1], Mrunmai Bhogawade[2], Dr. Ravindra Bachate[3]	64	129
13.	**The Integration of AI in Fashion: Innovation Drivers, Industry Challenges, and Future Prospects** Dr. Monika Gupta[1], Neelakshi Saxena[2], Dr. Anupam Pareek[3], Dr. Ruchi Doshi[4]	71	145
14.	**The Psychological Effects of Hyper-Realistic Graphics in Video Games: A Review of Cognitive, Emotional, and Behavioral Outcomes** Prem Kumar[1]	74	153
15.	**Reviving Weaving Communities: Fusion Textiles as a Catalyst for Artisan Livelihood Renewal in Banaras and Kota** Mahak Sharma[1], Dr. Shikha Verma[2]	76	166

16.	**Sustainable Activewear: Bridging market gaps through Ayurvastra** Anjali Pareek[1], Dr. Sulekha Ojha[2]	78	172
17.	**A Semiotic Analysis of Mona Lisa Artwork in Advertising for Brand Recognition** Rajeev Sharma[1]	82	179
18.	**Structural Abstractions of Nature: Black Heron-Inspired Roofs for Environmentally Responsive Design** Khushi Jawale[1], Hiral Patel[2], Tarang Jariwala[3], Chaitali Sheth[4]	85	187
19.	**Rooted Modernism: Charles Correa's Biophilic Tribute to Gandhian Values at Sabarmati Ashram, Ahmedabad** Chaitali Sheth[1], Dr. Suman Pandey[2]	89	202
20.	**Investigating the Structural and Aesthetic Potential of the Seahorse Tail in Lighting** Dharmishtha Anjani[1], Bhumit Jagatiya[2], Pashmi Patel[3], Chaitali Sheth[4]	91	209
21.	**Translating Natural Metamorphosis: A Structural Study of Physalis Alkekengi in Light Form** Kaavya Shah[1], Harvi Makadia[2], Saketh Ram[3], Chaitali Sheth[4]	100	221
22.	**Emerging Trends in Visual Arts: A Study of Printmaking Since 1990** Akshitta Aggarwal[1], Dr. Tikendra Sahu[2]	103	233
23.	**From Capturing to Constructing: Reshaping Visual with Artificial Intelligence** Abin Alex[1], Dr. Debasish Ghorui[2]	106	246
24.	**Coded Heritage: Ethical and Creative Dialogues Between AI and Indian Folk Art** Simran Dogra[1], Dr. Ganesh Gule[2], Dr. Vishweshwari Tiwari[3]	109	261
25.	**Contemporary Indian Art through Watercolour: Insights from Shyamal Dutta Roy and Pradip Maitra** Tuli Mitra[1], Dr. Srishti Sah Jagati[2]	148	271
26.	**Study of Couture Origami techniques on pattern Bodice with TR Cutting Method** Srividya P[1], Dr. Vibha Kalaiya[2]	156	278
27.	**Restoring Sanskrit and Indian Folklore using 2D Animation for Children** Dr. Vidhi Khandelwal[1]	163	289
28.	**Enhancing Creative Cognition and Artistic Expression in Animation Education through Advanced AI Tools** Deepak Ramesh Giri[1], Dr Jitendra Sharma[2]	181	300
29.	**Sustainable Product Design Intervention: Through the Bamboo Workshop in Pune** Mandar Suryakant Naik[1], Deepak Ramesh Giri[2]	196	308
30.	**The Journey from Titanium to a Statue** Krishnamurti Lalji Prasad[1]	211	323
31.	**Assessing the utility of skill based vocational training program in Fashion Design to generate livelihood to align with NEP 2020**	232	331

	Manasi Nachiket Thakur[1], Dr. Avadhut Atre[2]		
32.	**AI-Augmented Real-Time Character Animation in AR/VR Using Consumer-Grade Motion Capture and Automata-Guided Workflow** Ankita Patil[1], Mritunjay Kr. Ranjan[2], Rajashri Rikame[3], Disha Arsude[4], Nandini Singh[5], Sushil Panthi[6]	262	341
33.	**Reviving Craft Practices Through Design Interventions: A Study on Indian Sustainable Handicrafts** Dr. Mukesh Singh[1], Sunjhla Handa [2], Dr. Mohammad Arif Kamal[3], Sumit Gupta[4]	265	367
34.	**Less, But Louder: The Rise of Minimalism in Modern Advertising** Swati Mehta[1]	309	376
35.	**Cultural Nuances in UI-UX: Integrating Indian Visual Grammar into Digital Product** Shivam Namdeo Shinde[1]	353	385
36.	**Decline and Renaissance of Kaavi: Historical and Contemporary Perspective** Shivam Namdeo Shinde[1]	354	388
37.	**Untapped Potential of Indian Knowledge Systems in Indian Advertising for Global Impact** Lavanya Aggarwal[1], Dechen Angmo[2]	364	390
38.	**From Awareness to Action: Examining the Determinants of Sustainable Fashion Adoption among Gen Z** Ranu Burad[1], Shivani Sharma[2], Jyotsana Singh[3]	370	413
39.	**The Psychological Impact of Colours in Visual Arts on Mood Regulation** Anjali Taneja[1]	376	420
40.	**Green Advertising in the Era of Artificial Intelligence: A Sustainable Shift in Marketing in India** Ranu Raj[1], Dr. Jitendra Sharma[2]	360	433
41.	**Integrating Japanese Mesh Work, Weaving Derivatives, and Monochromatic Color Effects for Visual Illusions** Rekha Sharma[1], Dr. Gunja Soni[2]	379	440
42.	**Tools, Materials, and Techniques in Akola Printing: Documentation for Craft Preservation** Simran Walia[1], Dr. Gunja Soni[2]	404	449
43.	**The algorithmic muse: Reconstructing AI's role in augumenting ideation and concept generation in creative art industry** Diksha Tangri[1], Dr. Tikendra Kumar Sahu[2]	408	466
44.	**Masks of Memory: A Comparative Ethnographic Study of Chhau Mask-making Practices in Charida and Seraikella** Mr. Debabrata Das[1], Dr. Aloke Das[2]	411	477
45.	**Artificial Intelligence in Fashion Communication: Transforming Consumer Engagement, Branding, and Media Strategies**	426	487

	Kumar Rahul Mayank[1], Azahruddin[2], Shivani Sharma[3], Rocky Kumar[4]		
46.	**Intelligence in Fashion: The Transformative Role of Artificial Intelligence in Fashion Marketing** Kumar Rahul Mayank[1], Adarsh Kumar Pandey[2], Azahruddin[3], Rocky Kumar[4], Shivani Sharma[5]	427	506
47.	**Digital Fashion as Cultural Pedagogy in Role-Playing Games** Chaste Sriya Barman[1]	39	522
48.	**The Impact of Digital Typography Tools on Visual Literacy in Design Education** Sharvari Muley[1]	40	540
49.	**The Missing Epic: Exploring India's Cultural DNA Without the Mahabharata** Navya Jain[1], Prof. Manish Verma[2]	46	554
50.	**Blending Tradition with Technology: A Chakra-Based Digital Framework for Mental Wellness in the Modern Age** Ujjwal Pathak[1], Silvia Narzary[2]	118	558
51.	**2D Characters in the Cultural Representation of Uttarakhand** Deepmala[1], Silvia Narzary[2]	119	567
52.	**Experimental Study on Preserving Madhubani Art with Immersive Technology** Akriti Mishra[1], Silvia Narzary[2], Aman Yadav[3]	145	575
53.	**Myth, Memory and Interface - Designing a Mobile app to foster Tourist Interaction with Architectural Ruins** Sourish Sarkar[1], Swarnadeep Nath[2], Dr. Bhaskar Saha[3]	173	586
54.	**Designing with Cultural Memory: The Impact of Cultural Integration in Visual Identity Systems** Disha Trivedi[1]	129	597
55.	**Remediating Immersive Media in India: Cultural Desires and Anxieties** Greeshma Sharma[1]	315	605
56.	**Ainuai: Song of the Waves – Memory of Migration** Jeannete Lauren Mocodompis[1], Vinod Kumar[2], Koes Yuliadi[3]	352	620
57.	**Unfolding the creative aspect of Truncated dodecahedron: Exploring visual aspects of geometry and solids** Hiral Patel[1], Harsha Shamnani[2]	358	631
58.	**Guest-Host Relations in Art Residency: Driving Social Transformation in Jatiwangi art Factory** Ade Ahmad Sujai[1]	378	645
59.	**Echoes of Tradition: Indian Tribal Art and Contemporary Society** Apurva Thosar[1], Dr. Jitendra Sharma[2]	417	657
60.	**Analyzing the Effect of Gold Karatage and Alloy Composition with respect to Glass Enamels in Kundan Meena Jewellery Design Manufacturing** Anish K K[1], Dr. Gunja Soni[2]	322	664
61.	**Fast Fashion and Personal Identity: An Analysis of the Interplay between Clothing, Choices, Personality, and Sustainability in the Era of Fast Fashion** Megha Shisodiya[1], Manjari Varma[2], Prem Kumar[3]	356	673

Unmasking Deception: Analyzing Greenwashing as an Unethical Advertising Practice in the Indian Market

Virendra Pratap Singh, Research Scholar | Dr. Giriraj Sharma, Associate Professor
Department of Applied Arts and Sculpture, School of Fine Arts, IIS (deemed to be) University, Jaipur

Abstract

Greenwashing, defined as the practice by which companies overstate or invent the environmental advantages of a product or service, is a contemporary phenomenon in the context of India's advertising and economic ethics. As green advertising is employed to enhance sales especially in the millennial population, there is healthy competition to win over younger, urban consumers. This is often done at the expense of accuracy and without independent substantiation, resulting in widespread brand trust undermining. The Indian scenario is explored within the context of greenwashing practices through qualitative analysis of secondary data. The study aimed to explore literature, regulations, and reports to find their relation to greenwashing, consumer trust, and brand reliability. Findings reveal that greenwashing is rampant within India and demonstrates a strong correlation with lack of consumer trust, thus validating the alternative hypothesis. To offset the problem, the study outlines the need for stronger self-regulation by other business entities that would bear the consequences of such practices.

Keywords: *Greenwashing, Unethical Advertising, Indian Market, Brand Credibility, Consumer Trust, Green Marketing, Sustainability, ASCI, Advertising Ethics*

1. Introduction

In India and other developing economies, the term 'sustainability' has shifted from being a phenomenon as a corporate responsibility to an integral part of a marketing strategy in emerging economies. It is accompanied by the growing awareness among the public and the deterioration of the environment. Indian firms are now required to demonstrate eco-friendly efforts not only in their operations but also with the purported claims made in their advertising. This, however, has led to a detrimental trend called 'greenwashing,' which is when brands tend to exaggerate or outright lie about the environmental benefits of their goods or services just to

profit from consumers (Delmas & Burbano, 2011). The features and needs of India's population present a significant opportunity for both sustainable innovations and unfair deceptive green marketing. There is a noticeable shift towards the environment among millennial and urban middle-class consumers which has led to an increase in the demand for green products. More than 64% of urban consumers in India are ready to pay more for products that are environmentally sustainable as indicated by a survey conducted by Nielsen India in 2022. As a result, people from the FMCG, textile, and automobile industries started integrating sustainability into their branding.

Nonetheless, some investigations have identified that some of the criticisms of greenwashing aren't quite accurate. For example, one detergent brand advertises "phosphate-free" formulas, but does not explain which harmful offsets they use, or other "eco-friendly" textiles supplied by apparel brands "supported" by opaque supply chains (TERI, 2022). These strategies mislead stakeholders into believing eco-friendliness where it is absent, creating a facade that breaches consumer trust and ethical advertisement standards. In spite of the intensified scrutiny from the Advertising Standards Council of India (ASCI) and the Central Consumer Protection Authority (CCPA), the practice continues to exist because of vague definitions, absence of compulsory independent verification, and a lack of consumer knowledge regarding the existence of eco-labels.

This study seeks to fill the gap by aiming toward a comprehensive examination of greenwashing in Indian advertising, mapping out its prevalence in important sectors, and analyzing how it diminishes the trust of customers. It relies on secondary data to demonstrate that greenwashing—especially in the context of sustainability—can lead to damaged reputations, tarnished credibility, and eroded trust.

2. Literature Review

While global research on greenwashing is extensive, Indian advertising remains underexplored. Delmas and Burbano's (2011) framework—selective disclosure, misleading language, and irrelevant claims—offers a useful lens, but its Western orientation limits direct application to Indian socio-regulatory realities. Gupta and Chaudhary (2023) reveal that over 70% of Indian consumers fail to distinguish authentic green claims from false ones, reflecting low eco-literacy. However, they give little attention to structural factors such as poor access to independent environmental information or weak consumer education. Sharma and Srivastava

(2021) similarly highlight regulatory gaps, noting that ASCI guidelines lack enforcement. Their analysis stops short of questioning whether voluntary codes can ever replace legally binding standards. At the consumer–brand interface, Jain and D'Souza (2020) show that trust collapses when claims diverge from actual practices, yet this assumes consumers have the means to verify disclosures—something rare in India's opaque markets. TERI (2022) adds industry-level critique by exposing overuse of vague labels like "eco" and "sustainable." While insightful, the report does not offer concrete mechanisms for independent verification. Collectively, the literature points to three systemic weaknesses: low eco-literacy, weak regulatory enforcement, and unchecked corporate rhetoric. Yet, existing work remains fragmented—focused on either consumer vulnerability, regulation, or corporate discourse—without integrating these perspectives. This highlights the need for Indian-focused research that critically examines not just greenwashing strategies but also their ethical, regulatory, and behavioral consequences.

3. Objectives

1. To assess the extent and the methods adopted by Indian companies pertaining to greenwashing and its impact on the Fast-Moving Consumer Goods, fashion and automobile sectors.
2. To measure the repercussions of greenwashing actions on the level of trust and brand value among consumers within the Indian context.

4. Hypothesis

- **H_0 (Null Hypothesis):** There is no adverse effect on trust and brand value as a result of the greenwashing practices in the Indian context.
- **H_1 (Alternative Hypothesis):** A significant amount of trust and brand value among consumers in India is eroded due to greenwashing practices.

5. Methodology

The chapter analyzed the 'Greenwashed Claims' in India between 2018 to 2025. The qualitative data from the various reports and articles is used such as ASCI and CCPA regulatory reports, industry reports of TERI, FICCI and CSE, newspaper (The Hindu Business, Down the Earth and Business Standard) articles and academic articles along with research papers from 2015 to 2025. The study focused on three sectors- FMCG, Automobile and Fashion, as most of the complaints are received from these sectors. Delmas and Burbano's (2011) typology was

adapted to understand the unethical advertisements. Study also explored the impact of greenwashing practice on consumer trust, which is supported by the reports of Nielsen and CSE and studies on consumer behavior.

6. Result & Discussion

Findings show widespread greenwashing in India's FMCG, fashion, and automobile sectors between 2018–2025. Over 40% of FMCG ads used vague claims like "eco-friendly" without proof, fashion brands marketed "sustainable" lines without transparency, and automobile firms overstated "green tech" despite weak compliance (CSE, 2022; KPMG, 2021; MoRTH, 2022). Surveys reveal strong consumer backlash: 72% reported loss of trust (YouGov, 2022), while social media analysis highlighted growing online activism against misleading brands (Social Beat, 2023). These outcomes confirm that greenwashing erodes consumer trust and brand credibility. Weak enforcement of ASCI guidelines and low eco-literacy worsen the problem (ASCI, 2023; Kantar, 2023). The results align with Expectancy Disconfirmation and Signaling theories, showing unmet promises and false cues damage reputation (Bhaduri, 2022). Evidence from Edelman (2023) and Nielsen (2021) further suggests economic consequences. This highlights the urgent need for stricter regulations, verifiable eco-labels, and accountability to safeguard genuine green marketing.

7. Conclusion

The chapter focuses on the greenwashing advertising practices adapted in India and explored the impact of these practices on consumer trust and brand image. Secondary data findings showed that mainly three sectors are highly influenced by this unethical practice, FMCG, automobile and fashion and practices this without any authentic proof. In conclusion, millennials and Gen Z are impacted this practice, it decreases the consumer trust as well as brand image and it is observed that in India there is no strict regulations, guidelines and eco-labeling standard in India. More active engagement of organization like ASCI and consumer awareness, joint action by the industry, government, regulations and consumers is required to promote ethical green marketing, as there are less India-specific studies.

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The Impact of Universal Design on Branding in Public Spaces

Paridhi Raghav Rana, Research Scholar | Dr. Hitesh Sharma, Assistant Professor

Department of Design, Banasthali Vidyapith, Rajasthan

Abstract

Universal design is essential in influencing the accessibility and inclusiveness of branding in public environments. This research examines the effects of universal design principles on outdoor advertising and signage, assessing how inclusive branding improves user experience, engagement, and perceptions of the brand.. By examining elements such as typography, color contrast, multisensory features, and digital accessibility, the research investigates how well-designed public branding can cater to diverse audiences, including individuals with disabilities. The study also evaluates the effectiveness of universally designed branding in nurturing brand recognition, customer trust, and long-term loyalty. Through case studies and comparative analysis, this research aims to highlight best practices in making outdoor branding more inclusive while maintaining its commercial effectiveness. The findings provide valuable insights for marketers, designers, and policymakers seeking to create public branding that is both accessible and impactful. Branding in public spaces significantly shapes consumer perception, engagement, and interaction with businesses and organizations. However, traditional branding strategies often overlook inclusivity, making public advertising and signage inaccessible to individuals with disabilities. The study examines key elements of universal design, including legible typography, high-contrast color schemes, intuitive iconography, tactile and multisensory features, and digital accessibility. Additionally, the research evaluates the business advantages of universal design, demonstrating that Inclusive branding not only aids people with disabilities but also enhances overall customer engagement and broadens the market. Outreach. The results of this research offer important perspectives for marketers, designers, urban planners, and policymakers aiming to develop branding approaches that are effective in business and socially responsible. .By emphasizing the importance of accessibility in public branding, this research contributes to the growing discourse on inclusive design and its role in shaping a more equitable and engaging consumer experience.

Keywords: *Accessibility, Inclusivity, Signage, Multisensory features, Disabilities, Customer trust.*

Introduction:

In modern cities, where visual competition is high, branding in public spaces has evolved into a crucial method for drawing public attention, building recognition, and communicating institutional identity. Signage, advertisements, and wayfinding systems are not merely functional tools—they represent the interface between the environment and its users. Despite progress in visual communication, many branding systems fail to address the needs of individuals with sensory, mobility, or cognitive challenges. Universal design offers a comprehensive framework that supports inclusivity across these dimensions. While its use is well-established in architecture and digital design, its influence on public branding remains underexplored. This research explores how universal design principles can transform public branding by making it more equitable, emotionally resonant, and widely accessible. By evaluating both practical implementations and user feedback, the study aims to demonstrate that inclusive branding benefits all users—not just those with disabilities.

Universal design is a framework focused on creating products, environments, and communications usable by everyone without the need for adaptation. While prominent in architecture, education, and digital design, its application in branding, especially in public spaces, is less explored. As cities diversify and accessibility rises in importance, incorporating universal design into branding is both an ethical and strategic advantage.

This research explores the influence of universal design principles on branding within public spaces, particularly emphasizing how inclusive design practices affect user experience, brand perception, and customer loyalty. It investigates essential visual and functional elements, such as typography, contrast, iconography, tactile cues, and digital accessibility that determine the effectiveness of branding in reaching and resonating with a broad spectrum of users. Through the analysis of real-world case studies and insights gathered from users and industry professionals, the study aims to reveal how accessible branding can contribute to more inclusive urban settings and improve brand interaction among various communities.

This study seeks to bridge the gap between universal design principles and branding strategies. It offers practical insights for designers, marketers, and public policymakers and aims to show that branding for everyone is not only more ethical but also more effective.

In a competitive and visually crowded marketplace, branding in public spaces is essential for grabbing consumer attention, building trust, and improving brand visibility. Outdoor ads, signs, and wayfinding systems do more than promote; they serve as key points where the public interacts with brands in real-life settings.

However, many public branding efforts overlook the needs of all users, especially those with disabilities or those facing sensory, cognitive, or mobility challenges. This emphasizes the need for inclusive design in branding to help businesses reach a broader audience and create a sense of belonging for diverse user groups. By following universal design principles, brands can foster meaningful interactions with all consumers and enhance their branding efforts.

Literature Review

Aaker, J. L. (1997)*. The characteristics of brand personality.*

Journal of Marketing Research, As cities develop into intricate cultural, economic, and social systems, universal design (UD) has become a strategic method that transcends mere accessibility, impacting the branding and identity of public areas.

Anholt, S. (2007). *Competitive identity:*

The modern approach to brand management for nations, cities, and regions. Simon Anholt examines how locations, countries, cities, and regions can develop and oversee their "identity" in a globalized context to attract tourists, investors, talent, and esteem. He contends that conventional "branding" techniques (such as logos or slogans) fall short. Instead, locations must synchronize their policies, culture, businesses, and communications in a cohesive, genuine manner to forge a robust, competitive identity. Branding in Public Spaces Branding, which has typically been linked to products and companies, is becoming increasingly significant in urban development. Cities and public agencies aim to create place identity and distinction through the design of communal areas (Kavaratzis & Ashworth, 2005). Public areas such as parks, transit stations, and streetscapes play a crucial role in shaping public perception and experiences, serving as essential brand touchpoints (Anholt, 2007).

The Center for Universal Design at North Carolina State University created seven guiding principles for designing products, spaces, and communications that can be used by everyone without needing adaptation or specialized design. These principles significantly influence the

well-being of older adults, who frequently encounter changes in mobility, vision, hearing, and cognitive abilities. Universal Design helps ensure that environments are inclusive, comfortable, and safe for older individuals, thereby decreasing the risks of falls, confusion, and social isolation.

Gobé, M. (2001). *Emotional Branding:*

A Fresh Approach to Linking Brands with People. Allworth Press. Marc Gobé presents Emotional Branding as a method for brands to establish profound, enduring emotional bonds with consumers, shifting away from conventional marketing that emphasizes solely on product attributes. He contends that effective brands elicit emotions, satisfy emotional requirements, and connect with consumers on a personal, human level.

Imrie, R., & Hall, P. (2001). *Inclusive Design: Designing and Developing Accessible Environments. Spon Press. In this book, Rob Imrie and Peter Hall examine the principles and application of Inclusive Design, highlighting that the creation of accessible environments extends beyond merely addressing disability; it also involves acknowledging that Inclusive Design aims to develop spaces that cater to the broadest spectrum of users, irrespective of age, ability, or situation. This reference bolsters your viewpoint that Universal Design encompasses not just practicality but also dignity, inclusion, and emotional wellness. It aids in positioning Universal Design as a socially transformative approach, establishing environments that embrace diversity rather than alienating or marginalizing older individuals.*

Njunge, E. K., & Asilsoy, B. (2020). *An Analysis on Community Involvement in the Universal Design of Public Areas. Journal of the Faculty of Architecture*

Njunge and Asilsoy examine how public engagement shapes the design of accessible public spaces. They highlight the need for involving users, especially individuals with disabilities and marginalized groups, in creating inclusive environments. Their research shows that top-down design often misses actual user needs, while participatory methods enhance usability and community engagement. Older adults should actively shape spaces instead of being passive recipients. In contrast, Minimalist Aesthetics may reflect designer preferences that overlook inclusivity unless intentionally aligned with participatory principles. This emphasizes the design process's role in promoting well-being for the aging population.

Research Objectives

1. To identify how universal design features contribute to the identity and perception of public spaces.
2. To study the relationship between universal design features and public perception of space identity and branding.

Hypothesis

The study hypothesizes that public spaces that integrate universal design principles will exhibit higher levels of user engagement, emotional satisfaction, and brand recall compared to spaces that do not adopt such inclusive features.

Research Methodology

This study uses a descriptive and exploratory approach to explore the integration of universal design principles in public space branding and their impact on user experience and perception. The descriptive aspect outlines current branding practices and accessibility standards, while the exploratory component investigates public interactions with inclusive signage, wayfinding, and outdoor advertising.

A mixed-methods strategy was employed to gather quantitative and qualitative data. Quantitative data were collected through surveys of diverse public space users, including individuals with disabilities, measuring engagement, emotional responses, and perceptions of branding effectiveness. Qualitative insights were obtained from semi-structured interviews with urban designers, branding specialists, and accessibility experts, along with visual audits and field observations assessing real-world applications of universal design.

The research utilized both primary and secondary sources. Primary data came from surveys, interviews, and observations, providing practical insights into inclusive branding's effectiveness. Secondary data was drawn from academic journals, design guidelines, and case studies to contextualize the findings and frame the results. Together, these sources offered a comprehensive understanding of how universal design enhances accessibility and emotional impact in public space branding.

Objective Analysis

Objective 1: This objective aims to investigate how essential elements of universal design—such as clear typography, straightforward iconography, high-contrast color palettes, textured surfaces, and multisensory feedback—impact individuals' perceptions and interactions with public spaces. Public locations like transit hubs, parks, hospitals, and governmental buildings heavily depend on signage and visual indicators to convey identity, organization, and usability. By evaluating these attributes, the study seeks to comprehend how inclusive design not only improves the physical accessibility of a space but also enhances its aesthetic consistency, emotional impact, and functional clarity. This goal assists in determining whether universal design meaningfully contributes to the perceived quality, inclusiveness, and coherence of a public environment's brand identity.

Objective 2: This objective examines how universal design's presence—or lack thereof—affects people's interpretations and emotional reactions to branding in public environments. Branding in civic or commercial settings often aims to foster recognition, trust, and a connection with the public. This research explores whether accessible and inclusive design features boost brand visibility, public confidence, and emotional involvement, especially among individuals with disabilities or other functional limitations. It also seeks to evaluate how universal design influences long-term brand memory and whether users link well-designed public spaces to values such as equality, safety, and inclusivity. In doing so, the study emphasizes the strategic significance of universal design in shaping both brand perception and public loyalty.

Fig.01 Inclusive plaza design;
This image depicts a public plaza with wide pathways, integrated seating, and a smooth transition between pedestrian zones, ramps, and open gathering areas. The design reflects universal accessibility through spatial openness and functional zoning that accommodates all users.
Image source: archdaily.com; "City Square Rehabilitation, Ljubljana"

Fig.1.2 Tactile paving feature;
A close-up of tactile paving along a pedestrian crossing. The raised domes are designed to guide visually impaired individuals, enhancing safe navigation. This design element is critical in developing inclusive transportation infrastructure.
Image source: Wikimedia Commons; "Tactile paving at pedestrian crossing in Japan"

Fig.1.3 Accessible civic square;
The photo shows a civic square with layered textures in the flooring, benches at various heights, and visible directional cues. These features promote intuitive navigation and physical comfort for users of all abilities.
Image source: Dezeen.com; "Barcelona Superblock Urban Redesign"

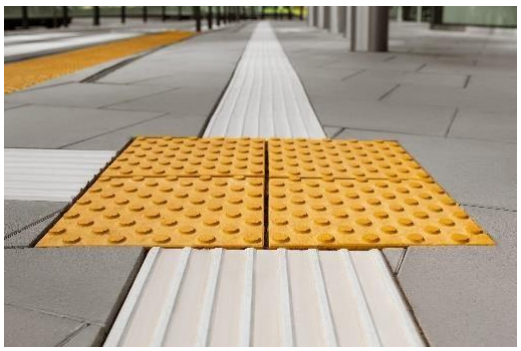

Fig.1.4 Urban curb with tactile cues;
This image illustrates a city sidewalk incorporating tactile ground surface indicators near a lowered curb ramp. The surface warns pedestrians with visual impairments of a change in level or vehicular zone, reinforcing safety and spatial awareness.
Image source: flickr.com/photos/transportblog/; "Accessible curb design in Wellington"

Statistical Analysis and Interpretation

1. Demographics

The survey was completed by a diverse group of participants, with a majority aged between18–35. The sample included design students, professionals in creative fields, and individuals with physical or cognitive disabilities. This range provided a variety of perspectives on how inclusive design influences the perception of branding in public spaces.

2. Engagement

Most participants reported regularly interacting with signage and advertisements in public environments such as parks, transportation hubs, and civic buildings. The data suggests that when signage is designed with accessibility in mind—e.g., using readable fonts, color contrast, and intuitive symbols—users feel more confident, respected, and emotionally connected. Respondents indicated that such features enhance their experience and trust in the space's organization or brand.

3. Understanding Imperfections

Participants highlighted several flaws in existing public signage, including inconsistent design, poor contrast, overcrowded layouts, and a lack of support for visually impaired users (e.g., no braille or tactile surfaces). These imperfections were not only seen as technical issues but as barriers to inclusion. Many felt that inaccessible design reflects a lack of awareness or consideration from the organizations responsible for the spaces.

Quantitative Analysis

Survey data revealed a strong preference for accessibility in branding and signage. Over 80% of participants agreed that universal design should be a priority in public communication systems. Questions relating to visual clarity, emotional engagement, and brand trust consistently scored high, with mean values ranging from 4.2 to 4.6 on a 5-point Likert scale. Respondents generally favored signage with clear fonts, visual contrast, and multi-sensory features. Additionally, more than 70% expressed the view that most current signage fails to meet basic accessibility standards, underscoring the need for greater design accountability. These quantitative results support the hypothesis that inclusive design directly improves public experience, recognition, and emotional attachment to branded environments.

Survey Statement	Average Score (1 to 5)
Accessible design should be prioritized in public branding	4.6
Inclusive branding increases trust and emotional engagement	4.4
Universal design improves visibility and recall	4.3
Public signage lacks accessibility standards	4.2
Designers lack awareness of inclusive branding principles	4.1

Thematic Insights from Open-Ended Responses

Responses to open-ended questions revealed deeper emotional and psychological dimensions of inclusive branding. Many participants expressed appreciation for signage and advertisements that are easy to read, aesthetically pleasing, and sensitive to different user needs. Some shared personal experiences of confusion or exclusion due to poor signage design, while others noted how accessible features—such as braille, simple icons, or clear directions—help them feel respected and included. A recurring theme was the need for designers and policymakers to treat accessibility not as an optional feature but as a fundamental design responsibility. The insights suggest that universal design is not only a technical improvement but also a social and emotional one, fostering a sense of belonging and equality.

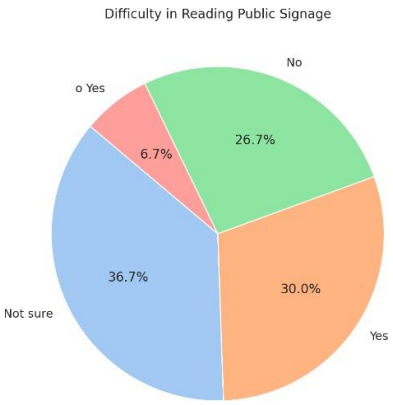

Fig.03

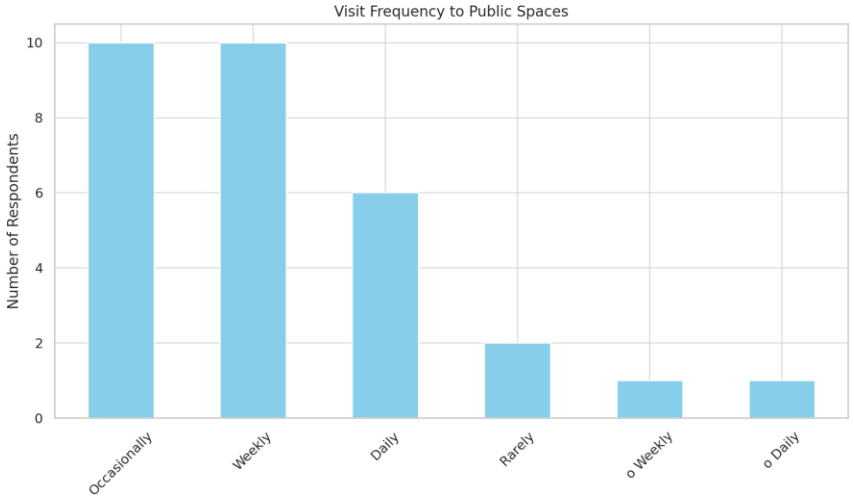
Visit Frequency to Public Spaces
Number of Respondents
0
2
4
6
8
10
Occasionally
Weekly
Daily
Rarely
o Weekly
o Daily

Fig.04

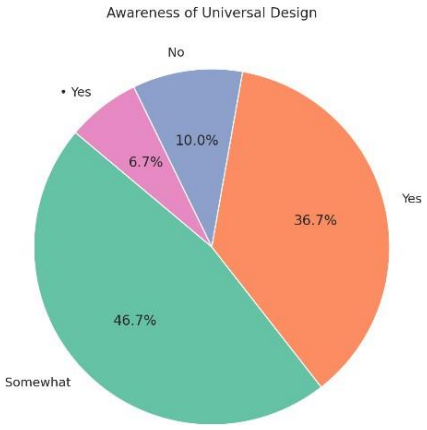
Awareness of Universal Design
No
• Yes
10.0%
6.7%
Yes
36.7%
46.7%
Somewhat

Fig.05

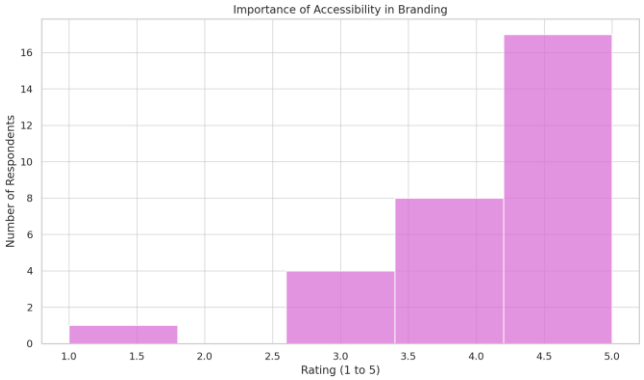
Importance of Accessibility in Branding
Number of Respondents
0
2
4
6
8
10
12
14
16
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Rating (1 to 5)

Fig.06

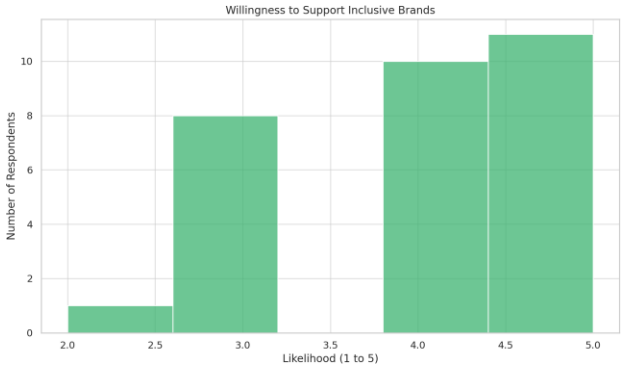

Fig.07

Conclusion

The findings of this study affirm that universal design plays a critical role in enhancing branding within public spaces. Signage and environmental graphics that incorporate inclusive features—such as visual clarity, tactile cues, and intuitive layout—not only improve accessibility but also contribute to a stronger emotional connection with the public. Participants consistently reported that well-designed, inclusive branding enhances their trust, engagement, and overall experience in public environments.

Moreover, the data supports the argument that universal design is not merely a technical necessity, but a strategic asset for public communication. Whether in urban transport systems, parks, hospitals, or government buildings, accessible design strengthens both functionality and the public's perception of the organization or entity behind the space. The results encourage policymakers, designers, and brand strategists to consider universal design as an essential component in creating meaningful, inclusive, and emotionally resonant public branding.

This research contributes to a growing body of knowledge advocating for equitable design practices and sets the stage for future studies involving wider demographics, more geographic diversity, and deeper institutional access.

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Animating Change: A Qualitative Study on Women's Empowerment in Animation Narratives 2000 to 2024

Rajendra Vasant Khairnar, Research Scholar | Dr. Monika Gupta, Assistant Professor
Faculty of Design and Arts, Poornima University, Jaipur

Abstract

This dissertation investigates how female empowerment is represented in global animation, conceptualising animation as both a cultural form, a feminist artform, and a site for negotiating societal ideologies. This dissertation assumes a qualitative, cross-cultural approach, analysing 40 animated films produced from 2000 to 2024, both through thematic analysis and through critical discourse analysis. All 40 films comprising a larger study, however eight representative works, Encanto (2021), The Breadwinner (2017), Bombay Rose (2019), Moana (2016), Mulan (1998), Brave (2012), Frozen (2013), and Gulabo Sapera – The Dancing Wind of Change (2025), were studied as case studies. Semi-structured interviews with animators, writers, and academics provided another layer of interpretation, for acknowledging opportunities and limitations around representation of women within the animation industry. Findings confirm that female characters were often presented as leaders, resilient, diverse, and independent, whilst encompassing contradictory tensions of empowerment and traditional roles. In some narratives, female characters overtly reject patriarchal norms, while in others, they express more progressive versions of traditional gendered roles, which was particularly evident because of market and industry considerations. The study reinforces how women-centered animated narratives can serve the purposes of media literacy, feminist pedagogies, and cultural learning. Overall, the field of animation has emerged as a site of feminist intervention and cultural transformation, making important contributions to global animation studies and international gender and media studies.

Keywords: *Female Empowerment, Global Animation, Animation as Social Commentary, Social Change, Animated Narrative, Visual Symbolism, Gender Norms.*

Introduction

Animation has always been predominantly male in terms of production and characterization. Historically, female characters have been relegated to tropes of passivity, domesticity and/or second-place in their roles to reinforce the patriarchal norm of being in the supportive domestic space [17]. Characters such as these create viewers who only fathom females in these limited

notions and views in discourse surrounding gender. While feminist film criticism has taken off as an area of scholarship in recent history [18], feminist analysis on animation is comparatively lacking. The lack of attention to feminist analysis is even greater in the post 2000 context of animated feature films from the many global production houses which showcased feminine subjects who are problem-solvers and active participants Example of valorizing dominant narratives of gender roles by fighting against them in being resilient and courageous, courageous leadership [19]. While there is still a global tendency towards a western canon of research on women's animation with some exceptions devoted to the Global South and South Asia, it is important to note that animation is not only entertainment in these contexts, but a cultural, and political text that reflects the histories of patriarchy, these struggles for socio-political change and feminist narratives in ways that differ from western animation. For example, Encanto (2021) is about intergenerational women from a Latin American cultural context [1], The Breadwinner (2017) is about a young girl and her courage during Taliban authority [2], Bombay Rose (2019) is concerned with realism and fantasy, agency and resilience, under social circumstances in India [3], Moana (2016) expressly highlights leadership, self-discovery and cultural empowerment narrative [4], Mulan (1998) is related to sacrifice and resisting patriarchy [5], Brave (2012) is in a similar space of independence and self-determination narrative [6], Gulabo Sapera – The Dancing Wind of Change (2025) describes the story of a woman who was buried alive at birth and subsequently radicalized Indian performance forms of folk performances [7]. In aggregate, these films represent the voice of animation as a means of approaching complex and diverse perspectives of female agency, resilience, and intersectional empowerment in a variety of contexts. The study found that animation is a feminist practice and cultural product. Additionally, it examined the extent in which themes, statements, and visual representations establish female protagonists as representatives of empowered femininity. Using a qualitative comparative approach, the study explored forty animated films and series produced from 2000-2024, and analyzed the data using thematic and critical discourse analysis. Semi-structured interviews with animators, writers, and scholars informed the analysis, providing information about the creative objectives and barriers of representation that make up the animation industry. The qualitative data indicated that while there is more representation of female characters that have autonomy, representation, leadership, and diversity, the cultural differences resulted in some nuance as to how we distinguish agency from empowerment. [Figure:1]

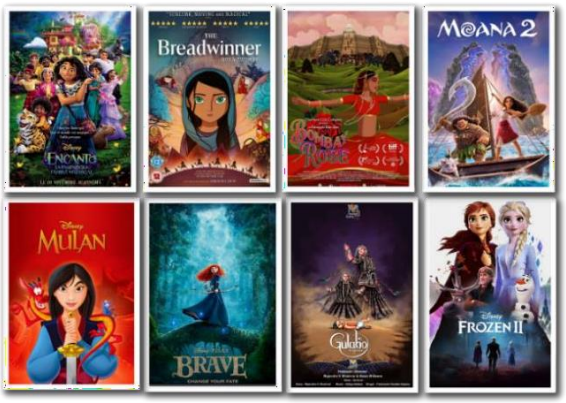

Figure: 1

The examples of how agency and empowerment construct female agency can be observed in the recent films, Moana (2016) and Frozen (2013). In particular, Moana privileges elements of leadership [8], and Frozen both subverts the anticipated romantic subplot that most animation narratives are dominated by and frames sisterhood as a way to resist traditional definitions of femininity. [9] While some productions are re-negotiating women's empowerment by reworking traditional gender scripts into progressive representations of evasive gender strategies, these outputs still illustrate that dominant cultural ideologies typically reproduce the highs and lows of what empowerment and agency are in teenage and adult lives. This investigation, besides its analysis, also emphasizes the policy and pedagogical dimension of animated narratives with a women-focused lens. Women-focused narratives can ultimately offer different role models and myths to challenge binaries in an effort to foster media literacy, improve feminist pedagogy, and alter cultural education globally. Consequently, this study reinforces feminist media studies and cultural conversations, and seeks to show that animation is not only a reflection of social change, but evidence of a collective site of feminism imagination, intervention and possibilities of transformation.

Literature Review

1. Interlocution- Animation has long been a male-dominated space where female characters are often portrayed as passive or stereotypical representations that reinforce patriarchal norms (Wikipedia, 2025) [17]. While feminist film analysis has been a part of feminist scholarship for a long time in live-action cinema (Johnson, 2015) [18], less feminist scholarship exists in animated narratives, particularly since 2000. Because of recent trends, female protagonists, messages, and narratives support active protagonists as leaders, problem-solvers, and resilient

individuals (Hine et al., 2018) [19]. Additionally, studies have attempted to be more inclusive of non-Western contexts where cultural, social, and political considerations significantly impact representations of female empowerment (Salamina & Tawami, 2023 [1], Sukma Fatarani & Chandraningrum, 2023 [2]).

2. Female Empowerment in Animation-A synthesis of 40 animated feature films (2000-2024) found shared themes of leadership, autonomy, perseverance and self-determination. Moana (2016) depicts leading within a Polynesian framework (Boumouchakian Martín, 2021 [4], Ramadhan, 2019 [6]) Frozen (2013) emphasizes sisterhood to rebel against normative femininity (Choi, 2016 [9]) Mulan (1998) shows resistance to existing patriarchal structures (Wang, 2021 [6]), and Brave (2012) uses of visual semiotics to emphasize independence (Augustine, 2020 [8], Ramadhanty, 2020 [12]). Each of these films present empowerment as negotiated on a basis, explaining the balance between individual agency and social expectations.

3. Cultural Context and Intersectionality-Cultural context shapes the agency of women. Bombay Rose (2019) combines realism and fantasy to illustrate resilience in an Indian context (Wikipedia, 2024 [3]), while Gulabo Sapera (2025) centers on the survival and artistic success of a marginalized woman to understand the intersection between gender, tradition, and cultural heritage (Gulabo Sapera, 2025 [7]). In Western cinematography and narratives, female empowerment is often projected as something which is individualistic, while narratives from the Global South situate agency within families, communities, and broader sociopolitical contexts, emphasizing intersectionality.

4. Visual and Narrative Strategies-Visual semiotics and narrative design add layers of empowerment. Moana employs both the motifs of journeying and settings of environment to signify traits of a leader and chief (Thompson, 2018 [15], Boumouchakian Martín, 2021 [4]), and Brave employs color, costume, and movement as expressions of identity and courage (Augustine, 2020 [8]), and Gulabo Sapera employs folk dance and performance arts to meld cultural heritage with feminist expression (Pan & Alizadeh, 2024 [16].

5. Industry Limitations- The constraints of the market and studio restrictions define the possibilities of narrative (Leon & Schmidt, 2021[10]). If romantic sub-plots or conventional gender roles are present, the protagonists always exhibit agency, leadership and problem

solving (Li, 2018 [13] Ramadhanty, 2020 [12]). This tension reiterated that animation was a commercial medium and a site of feminist storytelling.

6. Critical and Social Inflections- A feminine-cantered animated narratives would mean publishing grand females narratives, providing role models, reconstructing stereotypes and promoting critical media literacy (Chang, 2011 [11], Leon & Schmidt, 2021[10]). They sit within feminist pedagogy and cultural education, helping audiences critique gender norms and normative ideologies.

Methodology

This qualitative study will examine portrayals of women's empowerment in animated films. Using feminist media theory, cultural studies, and narrative analysis [10], the present study will investigate how animated films produce, negotiate, and resist gender representations by examining their use in many socio-cultural sites.

1. Research Approach

This study uses an interpretivist epistemology and seeks to understand the meanings and representations of female empowerment in global animation while foregrounding feminist media theory and cultural studies. The focus of the study will be on how narratives construct gender roles, agency, and empowerment/social change and how audiences read those [11].

2. Data Sampling and Selection

a. Film selection

A purposive sampling strategy was utilized to select 40 animated films (2000-2024) based on the following criteria: (Figure:2)

1) Films must have female main characters or narratives of gender empowerment.

2) Films must be globally distributed or culturally/critically significant.

3) Films must represent diverse regions.

4) Films must have engaged with feminist or gender discourse.

For example, Mulan (USA/China, 1998 & 2020), Moana (USA, 2016), Encanto (USA/Columbia, 2021), Brave (Scotland/USA, 2012), Frozen (USA, 2013), The Breadwinner (Canada/Ireland/Luxembourg, 2017), and Bombay Rose (India, 2019).

Table of 40 Films

S.No	Title	Year	Director(s)	Region	Woman-Centric Theme
1	Moana	2016	Ron Clements, John Musker	USA	Identity, Self-Discovery, Cultural Empowerment
2	Frozen	2013	Chris Buck, Jennifer Lee	USA	Sisterhood, Autonomy, Resistance To Patriarchy
3	Coco	2017	Lee Unkrich, Adrian Molina	United States	Remembrance, Generational Connection
4	Mulan	2020	Niki Caro	China/USA	Filial Piety, Self-Sacrifice, Strength, Emotional Resilience
5	The Breadwinner	2017	Nora Twomey	Canada/Ireland/Luxembourg	Courage, Agency Under Oppression
6	Nu Lang Sua	2021	Mukul Deb	India	Survival, Negotiating Tradition
7	Bulbul Sapori - The Dancing Wind of Change	2025	Rajendra Dhalwar, Aseem Doshi	India	Resilience, Artistic Empowerment, Socio-Political and Women's Empowerment
8	Luca and the Two Strings	2021	Travis Knight	USA	Identity, Family Responsibility
9	Soul and Jo Pan Shapi	2021	Dan Hall, Carlos Lopez Estrada	USA	Leadership, Trust, Cultural Heritage
10	Stereotype	2016	Byron Howard, Rich Moore	USA	Ambition, Challenging Stereotypes
11	Kirikou	2001	Michel Ocelot	France/Belgium	Cultural Identity, Family Empowerment
12	Inside Out	2015	Pete Docter, Ronnie del Carmen	USA	Emotional Agency, Self-Understanding
13	Coraline	2009	Henry Selick	USA	Courage, Self-Reliance
14	Monsters	1957	Tom Hanks, Gary Goldman	USA	Self-Discovery, Independence
15	Persepolis	2007	Marjane Satrapi, Vincent Paronnaud	France/Iran	Political Resistance, Female Agency
16	Belle: Mamo and the Long	2018	Yoshifumi Kondo	USA	Sacrifice, Leading Love and Lasting Partners
17	Kiki's Delivery Service	1989	Hayao Miyazaki	Japan	Responsibility, Fulfillment of Self
18	My Neighbor Totoro	1988	Hayao Miyazaki	Japan	Childhood Agency, Imagination
19	Spirited Away	2001	Hayao Miyazaki	Japan	Courage, Self-Discovery
20	Howl's Moving Castle	2004	Hayao Miyazaki	Japan	Resilience, Identity
21	The Tale of Princess Kaguya	2013	Isao Takahata	Japan	Rebellion, Challenging Societal Norms
22	Ponyo	2008	Hayao Miyazaki	Japan	Bravery, Self-Discovery
23	Mary and the Witch's Flower	2017	Hiromasa Yonebayashi	Japan	Empowerment Through Knowledge
24	Song of the Sea	2014	Tomm Moore	Ireland	Cultural Identity, Sisterhood
25	The Secret of Kells	2009	Tomm Moore, Nora Twomey	Ireland/Belgium/France	Courage, Overcoming Societal Norms
26	Aardman Short	2020	Tanya Rivers, Ross Stewart	Ireland	Female Agency, Rebellion
27	Over the Moon	2020	Glen Keane	USA/China	Self-Discovery, Emotional Resilience
28	Kiki's Delivery Service (2089 Remake)	2089	Studio Ghibli	Japan	Responsibility, Independence
29	Over the Moon	2020	Glen Keane	USA/China	Self-Discovery, Emotional Resilience
30	Turning Red	2022	Domee Shi	USA/Canada	Female Adolescence, Identity, Generational Negotiation
31	The Boxtrolls	2014	Graham Annable, Anthony Stacchi	USA	Autonomy, Agency
32	Frozen 2	2019	Chris Buck, Jennifer Lee	USA	Environmental Leadership, Self-Discovery
33	Soul and Jo Pan Shapi	2021	Dan Hall, Carlos Lopez Estrada	USA	Trust, Responsibility, Cultural Heritage
34	Wolf Children	2012	Mamoru Hosoda	Japan	Motherhood, Independence
35	Onward	2020	Dan Scanlon	USA	Courage, Self-Discovery
36	The Little Prince	2015	Mark Osborne	France	Imagination, Agency
37	Moana	2016	Ron Clements, John Musker	USA	Leadership, Cultural Identity
38	Mulan (Live-Action)	2020	Niki Caro	USA/China	Bravery, Challenging Patriarchy

Figure: 2

b. Secondary Sources

Academic journal articles, media reviews, film critiques.

Creator interviews and production notes.

Social media discussion and audience reviews (IMDb, Rotten Tomatoes).

3. Online Survey

Rationale

An online survey was provided to assess audience responses in a way that related to both narrative and thematic analysis and added credibility to the study.

Method

- Sample size of 250 respondents
- Demographics:
- Age: 18–45 years
- Gender: 54% female, 46% male
- Geographic: India (40%), USA (25%), UK (15%), Other Global South & North countries (20%)
- **Survey instrument:** The survey consisted of closed-ended and open-ended items to assess:
- Perceptions of female empowerment in animation
- Relatability to and inspiration from female characters
- Influence of animated female leads on audience views of gender equality
- Salience of themes such as leadership, resistance, self-discovery, and cultural identity

- Effectiveness in challenging gender stereotypes

Findings

- 72% reported that the animated female leads had a positive influence on their views of gender equality.
- 65% said that leadership and self-discovery were the most relatable themes.
- South Asian/Global South respondents pointed out about cultural representation and intergenerational stories.
- The open-ended questions had similar findings, with respondents focused on female characters as role models producing agency, resilience, and empowerment.

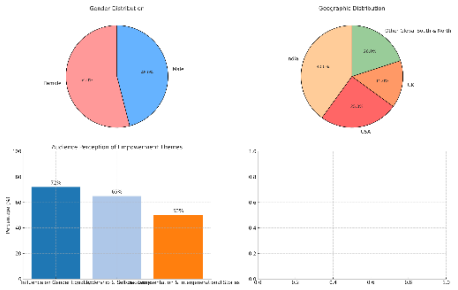

Figure: 3

1) Pie chart - Gender Representation: Indicates the percentage of Female (54%) and Male (46%).

2) Pie chart – Geographic Representation: Displays the breakdown of respondents across regions: India (40%), USA (25%), UK (15%) and Other Global South & North (20%).

3) Bar chart - Audience understanding of empowerment themes: Indicated the percentage of respondents who reported importance of certain themes.

1) Influence on gender equality: 72%

2) Leadership & self-discovery: 65%

3) Representation of culture/international & intergenerational stories: 50%

Significance

Survey responses provide empirical evidence to support our thematic and CDA, and highlight the transnational aspect of women-focused animated narratives.

4. Analytical Framework

a. Thematic Analysis

Concepts (e.g., autonomy, resistance) and themes (e.g., leadership, breaking tradition) were coded to explore empowerment journeys.

b. Critical Discourse Analysis (CDA)

The purpose of CDA was to investigate language, dialogue and their social symbolic structures (Blommaert, 2005, 2010) in ways that examine how gender ideologies, power relations, and identity structures are constructed, resisted, and negotiated. The four categories that are investigated are as follows:

- Power: representation of authority, hierarchies and gendered control.
- Identity: the construction of agency, selfhood and relational identities
- Ideology: implicit or explicit gender norms and ideals of traditional femininity.
- Resistance: narrative moments that challenge patriarchy.

Eight films were selected for detailed CDA case studies including: Encanto (2021), The Breadwinner (2017), Bombay Rose (2019), Moana (2016), Mulan (1998), Brave (2012), Frozen (2013), and Gulabo Sapera – The Dancing Wind of Change (2025).

Some examples include:

- Frozen (2013) reflects upon and subverts the "prince-rescue" storyline that Disney often follows, by emphasizing sisterhood and self-sufficiency (ideology/resistance).
- Turning Red (2022) emphasizes female adolescence, identity and autonomy (identity/power/resistance).
- Moana (2016) demonstrates leadership, heritage and self-discovery.
- Gulabo Sapera (2025) shows a sense of resilience and empowerment through creation of art.
- The Breadwinner (2017) depicts female agency under extreme socio-political constraints.
- Bombay Rose (2019) juxtaposed realism to fantasy to depict the struggle for power.
- Encanto (2021) navigated intergenerational female strength.
- Mulan (1998) challenged traditional norms of patriarchy by being brave and sacrifice.
- Brave (2012) emphasized independence and self-determination.

5. Creator and Scholar Interviews

Among the findings from semi-structured interviews with animators, writers, storyboarders, and scholars included: 1) Creator intentions for feminist narratives, 2) cultural authenticity challenges and studio constraints and 3) industry constraints that inform narrative possibilities.

6. Revision Strategy: Clustering and Visualizing Themes -Table 1. Main Themes in 40 Animated Films (2000-2024)

Theme / Area of focus	Number of Films	Example Films
Agency & Leadership	18	Moana, Mulan, Brave
Resisting Patriarchy	12	The Breadwinner, Gulabo Sapera
Motherhood/Intergenerational narratives	15	Encanto, Bombay Rose
Cultural Identity	10	Moana, Bombay Rose
Self-Discovery	22	Moana, Mulan, Brave

Figure: 4

Insights from Clustering

Shift from Passive to Active: Films since 2010 show increasingly active agency and decision-making from female protagonists.

Intersectional narratives: Themes of cultural identity, agency, and intergeneration narratives demonstrate uniquely constructed empowerment in women's agency, narratives, and stories around the world and in South-Asian/Global South context.

Pattern Analysis: Clustering themes can illustrate comparative insights across different regions, cultural context and timeframes.

7. Ethical Considerations

- Informed consent acquired from all participants.
- Anonymity, confidentiality, and cultural sensitivity were maintained.
- Reflexivity was exercised in regard to understanding non-Western narratives.

8. Limitations

- Some works may have not been included because of language barriers or restricted access to materials, and the predominance of Western media.
- Empowerment interpretations are culturally contextual and fluid.
- Some filmic works were excluded due to lack of translations or original sources.

Results

This body of research examined forty animated feature films (2000-2024) to examine the representation of female empowerment in these international narratives. Employing thematic and Critical Discourse Analysis (CDA) along with expert interviews, the project identified themes and cultural frameworks employed to shape female representation. The results reflect an uneven increase in an empowered female protagonist, but lasting barriers exist.

1. The Rise of the Empowered Female Protagonist

The analysis notes that there is a proliferation of female characters that are strong, capable, independent, and emotionally developed. Protagonists like Moana, Merida, Elsa and Anna fulfil that function as they propel narratives, redefine their identity in their own terminologies, and leave a mark on those around them (including those of neighbouring identities). They are proactive, forward-thinking, and invested. They have the ability to make choices grounded in agency, perpetuating a focus on personal and collective goals, rather than romantic outcomes.

Illustrations:

Moana (2016): The protagonist of the film goes on a solo journey to save her island in defiance of her domestic gender role expectations.

Brave (2012): Merida fully rejects marrying any suitor someone else has preordained for her and demonstrates that she will pursue her legacy in her affecting history.

Frozen (2013): Elsa and Anna (as sisters) move toward their value of sisterhood, and define their identity in their terms by demonstrating self-reliance rather than romantic love in the narrative.

Encanto (2021): Mirabel, who lacks any magical powers, initiates a change through empathy, demonstrating intergenerational family healing.

2. Empowerment is Culturally Grounded Contexts

Empowerment is always situated culturally and reflects socio-political and geographic realities.

Illustrations:

The Breadwinner (2017): Set in Taliban controlled Afghanistan, empowerment is expressed through survival, disguise, and storytelling.

Bombay Rose (2019): a young woman negotiates labour, love, and patriarchy in an urban India context.

Mulan (1998 & 2020): Empowerment happens within a Confucian setting defined by martial bravery and obligation to family.

These are some examples to illustrate that empowerment is not universal: context does dictate empowerment, and that context is formed through several overlapping social, religious, and political frameworks.

3. Visual and Symbolic Strategies

Films have a unique visual language that means empowerment: Natural elements: Water in Moana, snow in Frozen are literal representations of power, transformation, and release of emotion [13], [16].

Color, costume and body language: Share moments of defiance or self-development [14], [15]. Visual metaphors: Broken walls, rising mountains, or open landscapes indicate freedom through independence, self-discovery and agency. These visual strategies support the narrative arcs of the character demonstrating empowerment by moving from a situation of restriction to freedom.

4. Thematic Tensions and Contradictions

This positive development does not come without tensions: Empowerment versus tradition: While the characters enjoy autonomy and personal agency, ultimately they still feel obligated to follow family (eg family reconciliation in Encanto) or cultural expectations (eg. honour in Mulan) Feminism versus marketability: there is no doubt that studios prefer a form of "safe" feminist narrative, that gives them some commercial ownership of the source material, whilst still adhering to audience conventions. Idealised imagery: the characters have idealised body types, and continue to perpetuate damaging notions of femininity and beauty.

So while animation is undergoing a clear ideological shift, stories are still bound by the limitations of their industry.

5. Creator and Scholar Insights

From the interviews conducted with animators, writers and today's scholars in the field we learned that:

1) For the most part, creators are intentionally designing female characters who have agency and are fully fleshed out.

2) More effort is being made to engage with culture and research around the authenticity of cultural depictions for production.

3) Creative choices can be constrained by studio expectations, censorship and the global market impacting creative choices.

Most interviewees spoke of animation as a "powerful but constrained" space that has the potential for provoking cultural discourse but is often constrained through commercial imperatives.

Summary of Key Findings

Theme	Examples	Key Observations
Leadership and Agency	Moana, Brave, Frozen, Encanto, Gulabo Sapera: The Dancing Wind of Change	Female characters are the agents of the plot and the protagonists make the big decisions for the action.
Cultural Specificity	The Breadwinner, Bombay Rose, Mulan, Gulabo Sapera: The Dancing Wind of Change	Empowerment is informed by socio-political, regional, and cultural values.
Visual Symbolism	Moana, Frozen, Brave, Gulabo Sapera: The Dancing Wind of Change	Metaphor and nature support transformative arcs.
Ideological Tensions	Encanto, Mulan, Frozen, Gulabo Sapera: The Dancing Wind of Change	Stories are assessed in terms of negotiating progressive values in tension with history and traditions.
Industry Constraints	Interview agreement	Production studios are a filter for how far feminist narrative must go.

Figure: 5

Discussions

This study shows animated narratives produced in the years 2000–2024 are starting to depict female protagonists as leaders, problem-solvers, and active-engaged changemakers instead of historically passive protagonists (Wikipedia, 2025 [17] Johnson, 2015 [18]). In Moana (2016) and Brave (2012), leadership and autonomy take significant focus (Boumouchakian Martín, 2021 [4] Augustine, 2020 [8]) whereas Frozen (2013) emphasizes relational empowerment through sisterhood (Choi, 2016 [9]), and Mulan (1998) show active disobedience to patriarchal limitations (Wang, 2021 [6]).

Visual and narrative strategies create space for this empowerment. Moana illustrates environmental motifs and hero's journey elements (Thompson, 2018 [15]), Brave focuses on movement, color, and costumes representing courage (Augustine, 2020 [8]), and Gulabo Sapera (2025) integrates folk performance traditions and costumes that mix cultural heritage with feminist agency (Pan & Alizadeh, 2024 [16]). Cultural and intersectional contexts are central to this study: while Western cinema has traditionally valued individual agency, film

narratives from the Global South provide a context for empowerment in relation to family, sociability, or political power (Wikipedia, 2024 [3] Gulabo Sapera, 2025 [7]). Film as an industry and a market does constrain possibilities for narratives, as there can often be a need for romantic narratives or traditional gender norms. However, creative teams often work around this using challenges to educate and foreground female agency, authority and leadership (Leon & Schmidt, 2021 [10] Li, 2018 [13] Ramadhanty, 2020 [12]).

Women-centred animated narratives hold educational and social benefits by pushing back against stereotypes, providing a role model, and including media literacy (Chang, 2011 [11] Leon & Schmidt, 2021 [10]). On the whole, these findings help contextualise animation as a vehicle for feminist intervention, cultural education, and social change however, the findings also show that empowerment is also always culturally and contextually situated.

Conclusion

This research examined 40 animated films from around the globe (2000-2024) and analyzed depictions of women's empowerment with thematic analysis, Critical Discourse Analysis (CDA), semi-structured interviews with the creators, and surveys of the audience. Five overarching themes emerged: Agency & Leadership Resisting Patriarchy Motherhood/Intergenerational Stories Cultural Identity and Self-Discovery. Such films are increasingly placing women in agency, decision-making roles and challenging and disrupting interpreting gender roles, despite cultural, socioeconomic, and industry constructions. This research establishes a baseline framework for examining advocacy in animation, as narrative, discourse, and audience learning are all engaging. This project demonstrates the importance of cultural specificity by examining South Asian and Global South narratives which are distinctly different from Western narratives, while also building upon knowledge from the limited Western feminist literature. Audience responses illustrate that women's narratives not only represent changing cultural narratives but also help solidify perceptions of gender roles. The possibilities to act on implications include practical application in education, critique of feminist media, and inclusion in policies for equitable media productions. Overall, this research exhibit animation as a medium and feminist form that facilitates, promotes and embraces social change through diverse empowerment narratives.

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The Rise of Canva: A New Era in Graphic Design

Galande Ashish Tukaram, Research Scholar | Dr. Hitesh Sharma, Assistant Professor
Department of Design, Banasthali Vidyapith, Rajasthan

Abstract

This study shows how Canva is changing the present graphic design practices, highlighting the below main research question- Does rise of Canva bring a new era of creative empowerment, or does the growth of Canva raise questions about the standards of traditional graphic design? Canva is a cloud based platform that has been very popular among designers and non-designers both because of its ease of use, which makes it simple for users in marketing, education, and small businesses to create visual material.

Evaluation of Canva for its impact was done using a survey known as mixed- method methodology, where data primarily from students, instructors, professional designers and non-design client were collected to the designed survey. With the help of Google form a Likert scale and multiple choices questions was sent to for easy accessing and making analysis simpler.

It was also found in research that Canva help in removing the barriers for individuals who lack in technical expertise by working together and taking part in multiple creative activities. Study also shows that one could not depend too much on templates as this can lead to same patterns, which might reduce the originality and make artists education seem less important. In order not to lose the artistic importance, Canva should be used with care via Canva creative Processes which help to get easier and faster. To keep creativity alive report also suggests that implementing these platforms into design workflows and education in such a manner, which is easy to access.

Keywords: Canva, Graphic Design, Creative Collaboration, Design Authenticity, Visual Aesthetics, Technological Influence, Democratization of Design, Design Education.

Introduction

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The development of digital design tools has changed the way people make, distribute, and use creative works in the modern world. For a long time, professional design has been defined by traditional applications like Adobe Photoshop and Illustrator. However, the rise of easy-to-use platforms like Canva has changed who can be a part of design. Canva, which came out in 2013, is a game-changer in the accessibility of visual communication since it lets people who aren't trained in design make visually appealing content fast and cheaply (Lam & Pennington, 2020). This ease of access has made it possible for business owners, teachers, students, and social media users to take part in design processes that were once only open to skilled professionals. Canva is popular because it is easy to use, cheap, and has a lot of pre-made templates that make it easier for people to be creative. Johnson (2021) says that Canva's web-based interface and ability to work on several devices make the design process easier and more user-friendly than traditional tools. Furthermore, its collaborative functionalities correspond with modern exigencies for cooperation in both professional and academic settings (Rahman & Malik, 2022). Along with many other scholars state that Canva has helped to make design more easily accessible to everyone. It attract people from all cultures to take part in new ways, especially in areas like education, marketing and digital storytelling.

However, due to the popularity of Canva we also start to wonder about originality and the future of professional design. According to Patel (2022), relying on templates also poses risks of homogenization, whereby utilization of repetitive design leads to decline in the novelty and originality. Chen (2023), likewise, deals with theirs concerns about the use of artificial intelligence, which could cause it to be harder to distinguish between the work created by individuals and work performed by artificial intelligence. These are used to show how Canva occupies a dual standing, that may be easy to use but it alters how the traditional way of utilizing style was done.

In this regard, Canva identify the issue and potentials that emerge when technology transforms creative sectors. The use of technology to aid and also test creative work is demonstrated by Canva. It simplifies the process of designing due to everyday use, yet begs the question of what creativity is by introducing digital technology and how it gets learned and appreciated.

Literature Review

Canva seems to be now a widely accessible graphic design tool which now is a turning point in making available to visual communication. As per researchers there is shift from tool like Adopt photoshop and Illustrator to more simplified template based platform like Canva, which completely indicates not only a technology changes but also cultural transformation in designing practices. Lam and Pennington says that Canva has helped to minimised the barriers which allow anyone without any formal expertise to create visually appealing content and expanding their creative idea beyond professional designed.

For growing the popularity of Canva, its usability and accessibility remains important. Johnson state that the creation of design is getting faster and easy with the platform based on web interface and cross device connectivity. This also reduce or simply the use of stand out traditional design tools which required frequently extensive training and technical skills. Also

Rahman and Malik (2022) highlight the value of Canva's in real-time collaboration, its capabilities stating that it has increase teamwork and client–designer communication in professional and educational situations.

Apart from being easy to use, scholar also says that Canva is important because it has changed the standard of design industry. Bhattacharya (2020) claims that Canva has become easy and cheap for anyone like small businesses, teachers and social media users to make professional pictures at little expense. This connect to a wider or many ideas in design studies about how open access can affect the culture. Researchers like Patel (2022) have raise concern that using too many templates can make the designs look similar which may leads to reduce the originality or the uniqueness and people will more focus on speed and efficiency but not on its critical thinking.

With addition of artificial intelligence (AI) into Canva's makes its impact even stronger. As per Chen (2023), AI tools like background removal, quick resizing, and automatic layouts make the design faster and easier but it also lead to the concern about reducing the role of human creativity. This highlight Nair's (2017) concern about cultural competition in today digital designing where automation may have limited scope or opportunities for new designers to develop strong skills.

Canva is also transforming the educational environment. Verma (2021) says that Canva is currently used in both designing and non-designing courses which is helping students to create presentations, infographics and digital storytelling projects. While Canva encourages creative participation, it can also create some line between normally using the tool for personal use or truly mastering professional design skills. This debate continue with earlier once about how to balance accessibility with authentic knowledge and cultural originality in digital design (Patel, 2022).

As to conclude, Canva is view by literature that it act as both an assistance and a competitor in the industry of graphic design. Although Canva encourages creativity, participation and collaboration but also it raises important concerns about originality, authenticity and the future of professional design practice. Similar to wider debates on digital tools and cultural preservation, Canva show the dual role of technology, it expands inclusivity while also challenging traditional ideas of creativity and expertise in the digital age.

Research Gap

While current researchers and literature has examines how designing tools are becoming more accessible to common people but there is a lack of critical studies on the high impact of Canva on professional design, education and creativity. Most studies highlight Canva's usability and importance in empowering non-designers (Lam & Pennington, 2020; Johnson, 2021), but fewer examine its long-term impact on originality, professional standards, and the value of formal design education. Moreover, while Patel (2022) and Chen (2023) raise concerns about template-driven uniformity and artificial intelligence in design, empirical evidence analysing how these concerns manifest across different user groups such as students, educators, small businesses, and professional designers remains underexplored. Although many studies discuss the accessibility of design tools, little research examines how Canva affects professional design practice, education, and creativity.

Most discussions about Canva are still theoretical with little research about real data on how Canva shapes designers identity or new global design trends. This gap highlights the need for research that goes beyond Canva's usability to also assess its cultural, educational, and professional impacts. This study also look at these missing points to show the opportunities and challenges Canva creates for graphic design in the digital age.

Research Methodology

To show how Canva has shaped contemporary graphic design a mixed-methods approach was used. Among 30 participants who regularly use Canva were chosen from different targeted group which were consist of Professional graphic designers, design educators, students, marketing experts, and non-designers. Because the participants were over 18 and came from different kinds of backgrounds, a thorough understanding of Canva's impact across industries and skill levels was possible. A Google Form containing a standardised questionnaire was used to collect data over 1 month. It was shared via social media, different academic chat rooms and email. Before starting the poll, participants gave their informed consent and all answers were kept confidential.

The survey was divided into five main sections: demographic data; Canva knowledge and usage; Canva's influence on design processes and cooperation; Canva versus creativity; and Canva's potential future implications in design practice and education. To facilitate evaluation, the questions had Likert-scale items and multiple-choice formats. Summary statistics were used to evaluate quantitative information in order to identify user group differences, agreement levels, and usage patterns. Feedback from non-designers and professional designers were compared using cross-tabulations. In order collect qualitative information about Canva's perceived advantages, disadvantages, and impact on originality and creativity in the design industry, open-ended replies were also subjected to thematic analysis.

Research Objectives

1. To find out how Canva helps designers and non-designers collaborate successfully: This goal is to study how Canva's simple features like shared templates, drag-and-drop capabilities, and real-time editing, allow both professional and non-professional people to work together.

The platform's ability to promote inclusive teamwork and extend design engagement beyond people who have formal training will be evaluated.

2. To assess Canva's impact on creative creativity and professional design standards: The study looks into how the creative depth, uniqueness, and design thinking that are usually associated with professional graphic design are impacted by the use of readymade templates and automation tools. It also examines whether Canva undermines the value of created skill sets and professional design education.

4. To examine opinions regarding Canva's future contribution to industry practices and design education: This goal is to learn how professionals, educators, and students view Canva's influence on upcoming design workflows and training. It will determine whether Canva is viewed as an additional educational tool or as a possible substitute for traditional design methods.

Statistical Analysis and Interpretation

Hypothesis

1. Professionals and people who are non-designers can work together more easily in creative work like marketing and other educational industries because Canva is simple to use and easy to access. This hypothesis analyzes if Canva's design tools allow people with different skill levels to share ideas, create projects together and collaborate easily without needing advanced design training.

2. Using Canva often can lower the level of creativity in design and make people feel that formal design education is not much valuable. This is because Canva depends a lot on readymade templates and automation tools which reduce the need for traditional design learning and make many design looks similar by following same style and format.

08 Statistical Analysis and Interpretation

Google form link -
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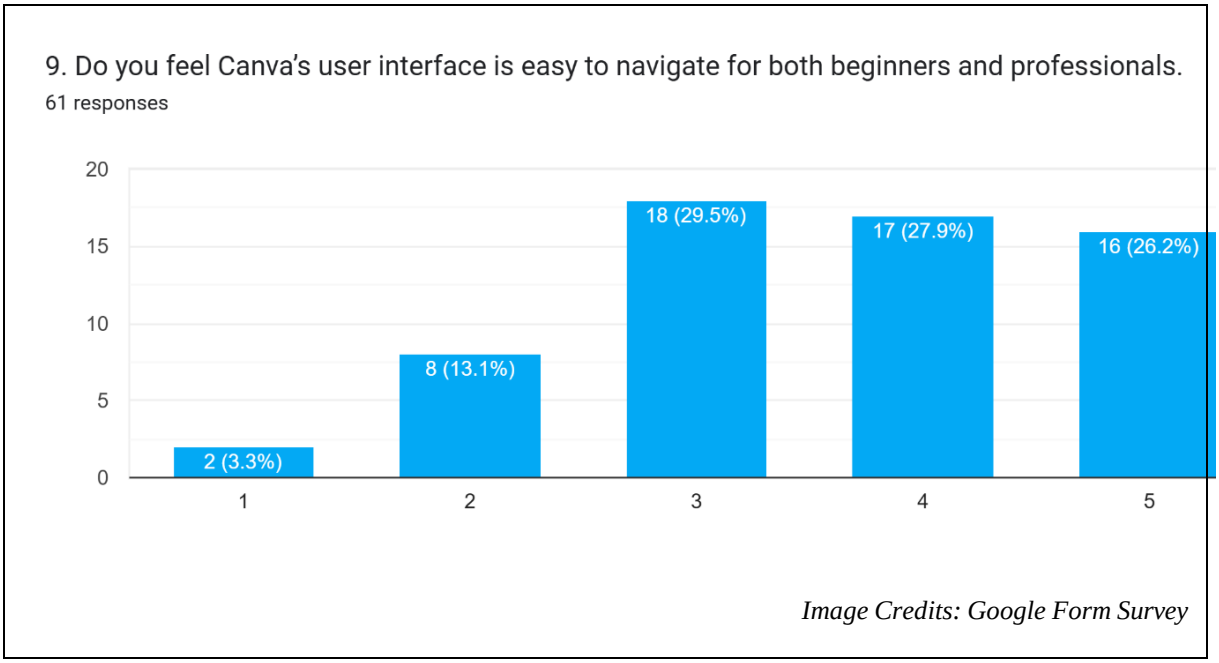
The survey conducted for this study garnered 61 replies from a broad range of participants, including graphic designers, visual artists, students, and professionals from relevant industries. The bulk of respondents came among the 26–35 and 36–45 age ranges, demonstrating representation from both younger professionals and mid-career practitioners. Gender inclusion was balanced, and respondents reported utilizing a mix of design tools, with Adobe Photoshop, Illustrator, and Figma appearing alongside Canva, showing a hybrid approach to digital design practice. Overall, familiarity with Canva was scored well, with most participants scoring between 3 and 5 on a five-point scale, suggesting that the platform has acquired great visibility and adoption across demographics.

Respondents have consistently evaluated Canva as one of the easy to navigate tool which is accessible across all the devices and substantially faster than any other traditional tools. The main key feature of this tool is its ability to support the real time collaboration and communication between the designer and client making it one of the most effective productivity tool.

Many participants have felt that Canva has made design more accessible by allowing non-designers to create professional looking graphics which expanded creative involvement in areas like education, business, and social media. However, the data also highlighted critical opinions. A large number of respondents have raised their voiced and are worried about the originality, they were stressed about the extensive dependence on templates may create a “template-over-thought” mentality.



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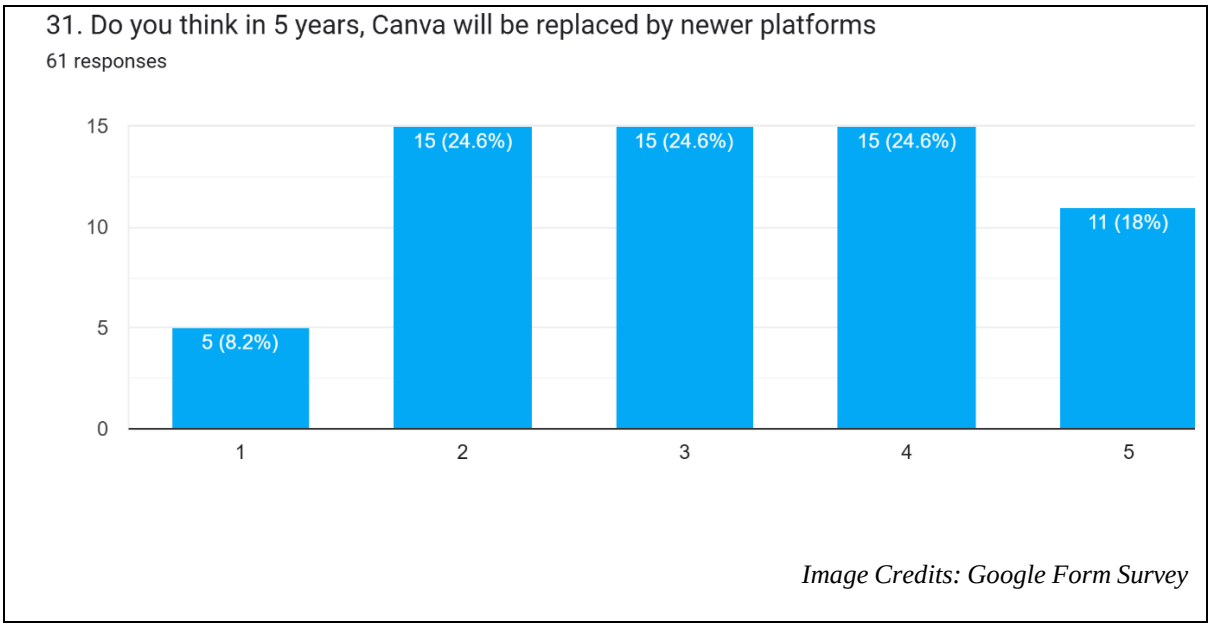
Many questions were also raised regarding Canva's influence on design quality, with some claiming that the platform lessens the need for deep design skills and over the time it may lower the demand for traditionally trained designers.



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Artificial intelligence-based applications were categorized- some saw them as a wage booster, whereas others perceived them as a threat to ordinary creativity. More significantly than these concerns, it was generally held that Canva can and is set to proliferate as a key tool in the years to come as a source of new opportunities and challenges in the objective of the design world.

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To conclude, the statistics show that Canva is unilaterally considered as a disruptive platform which democratizes design and improves production and efficiency, however, it also raises a debate of authenticity, creativity, and boxer of professional ability. This duality responds not only to canva as an operating necessity, but to a cultural fluencer in the design ecosystem, and a role-shifting of what being a designer meant at the digital level.

Conclusion

However, as noted in this study, Canva has become an effective tool in the creative field called graphic design, changing the way designers do their jobs and making a designing tool accessible. Its easy interface and low cost combined with teamwork capability have earned its popularity across various spheres, being useful to assist non-designers in creating their design choice and simplify the work of professionals.

Using its simplified design, Canva has provided broader creative access to education, business, and digital communications.

Simultaneously, there are also several important challenges identified by the findings. Although there has been much criticism about the threat this poses on the authenticity and professional quality of any visual standardization and recommended reductions in individuality that natural templates expose it to, due to its heavy reliance on them, many have been concerned about the overtime impact on the originality and professional levels.

Altogether, Canva can offer opportunities and challenges. It encourages collaboration, effectiveness and reachability. It also challenges the design community to critically examine how that is incorporated in education and practice. The future lies in copy-books relying on the advantages of Canva without compromising on the creativity and originality of graphic design.

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The Impact of Smartphone Camera Ecosystems on the Evolution of Professional Photography

Falguni Akshay Gadgilwar, Research Scholar | Dr. Hitesh Sharma, Assistant Professor
Department of Design, Banasthali Vidyapith, Rajasthan

Abstract

The rapid advancement of smartphone camera technology has transformed the photography industry by enabling widespread access to high-quality image production. This accessibility has intensified competition for professional photographers while simultaneously expanding opportunities for creative integration. The rise of social media has further shaped consumer expectations, instant availability, affordability, and shareability of visual content. While some professionals perceive smartphones as a threat to their expertise and business, others adopt them as complementary tools. This study employs a mixed-methods approach, combining surveys and interviews, to investigate the dual role of smartphones as both challenges and enablers within professional photography.

Keywords: *Smartphone cameras, visual culture, camera technology, photography industry, social media impact, professional photography*

Introduction

In contemporary society, smartphones have become indispensable, with cameras emerging as their most valued feature. Over the past decade, advances such as portrait and night modes, multi-lens systems, and AI-driven processing have enabled users to capture high-quality images once achievable only with professional equipment. This accessibility has reshaped the field of photography: social media platforms, influencers, and small businesses increasingly rely on smartphones for fast and shareable content. While this trend intensifies competition by empowering non-experts, many professionals integrate smartphones into their workflows for behind-the-scenes documentation, live reporting, or creative experimentation. Nevertheless, traditional cameras remain essential for projects requiring depth, control, and technical precision, such as weddings, fashion, and commercial photography. This study investigates how professionals adapt to these technological shifts, how consumer expectations evolve, and whether smartphones represent a threat or an opportunity within the industry.

Impact of Smartphone Camera Ecosystem

Professional photography was deeply influenced by the introduction of highly developed smartphone cameras that changed customer relationships, workflows, and creative opportunities. Mobile image quality has been improved using high-resolution cameras, sensors, computer imaging, and AI-based features such as automatic classification and post-processing of scenes. As a result, many professionals increasingly use cell phones for everyday duties. Especially for evaluation of work, recording behind the scenes, and posting photos on social media. Additionally. Client expectations have changed because of smartphone photography. Instant previews, quicker turnaround times, and materials that are social media-ready are all in high demand. In several fields of professional practice, smartphone photography is not only useful, but also necessary because of the broader changing society toward immediacy and digital interaction. (Manovich, 2020)

Challenges Posed by Smartphone Integration

Professionals face significant obstacles when it comes to smartphone photography, despite its advantages. The apparent undervaluation of photography expertise is one of the primary issues. Because high-quality smartphone cameras are widely available, customers frequently believe that professional-calibre images can be obtained without expensive equipment or specialized training. Lister cautions that the traditional appreciation of photographic skills may be threatened by the democratization of image making (Lister45). Concerns about market saturation have also surfaced due to the growth of hobbyists and content producers, which has increased competition and compressed the pricing structures. Furthermore, despite advancements, smartphone sensors and lenses are still unable to provide the depth, texture, and dynamic range required for intricate commercial projects due to technological restrictions. Unrealistic customer expectations may result from these problems, putting pressure on professionals to cut expenses or standards to stay competitive. (Lister, 2013)

Opportunities Created by Smartphone Photography:

Despite certain difficulties, professionals now have more creative and business options thanks to the use of smartphone cameras. For example, smartphones make it possible to create materials while on the go, which is helpful in dynamic settings such as journalistic coverage,

live events, and weddings. According to Sarvas and Frohlich, mobile devices are perfect for social and impromptu recording since they facilitate real-time storytelling (Sarvas and Frohlich 115). Professionals are also increasingly embracing cell phones for experimental work, taking advantage of their unique shooting settings and app-based editing capabilities. (Sarvas, 2011)

Objective

O1- To determine the main benefits and drawbacks encountered by professionals while utilizing smartphone cameras.

This objective focuses on identifying how professional photographers experience smartphone cameras in their work. It seeks to analyse both the positive aspects (such as convenience, cost-effectiveness, social media integration, and quick client previews) and the negative aspects (such as reduced image quality in certain conditions, undervaluation of professional expertise, and increased market competition).

O2- To investigate how AI and smartphone smart features are influencing contemporary photography methods.

This objective examines the role of AI-driven tools and advanced smartphone features (like computational photography, night mode, portrait effects, and automatic post-processing). It aims to study how these innovations are reshaping professional workflows, creative experimentation, and client expectations within the photography industry.

Hypothesis

H_1- Mobile photography has changed the expectations of clients.

H_2- Photographers' earning habits are impacted by smartphone use.

Literature review:

Smartphone photography has moved image creation from specialist equipment to generally available technology. Advances in computational imaging and AI enable non-professionals to reach achievements formerly reserved for skilled photographers (Wu et al.; Jiang et al.). This trend is accelerated by social media, which promotes immediacy and democratizes visual culture while diminishing the need for technological expertise (Manovich; Sarvas and

Frohlich). According to consumer research, clients are increasingly prioritizing speed, price, and digital readiness over traditional depth. According to research, professionals use smartphones as complementary tools to balance creative opportunities with challenges such as undervaluation and market saturation (Hiapa and Danso; Smith and Patel).

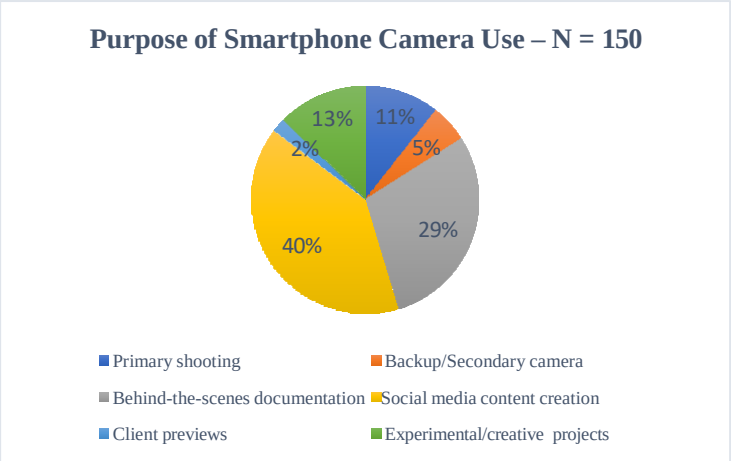
Methodology

A mixed-methods design was employed, combining a survey of 150 respondents and semi-structured interviews with 20 participants (10 professionals and 10 nonprofessionals). The survey covered smartphone use, AI features, client expectations, and revenue outcomes, while interviews captured deeper perspectives. Data were analyzed through descriptive statistics and thematic coding, ensuring both quantitative breadth and qualitative depth.

Q.1. For what primary purpose do you most often use your smartphone camera in a professional photography context?

Use of smartphone camera in professional work	Primary shooting	Backup/ Secondary camera	Behind-the-scenes documentation	Social media content creation	Client previews	Experimental/creative projects
Percentage of respondence	11%	5%	29%	40%	2%	13%
Numbers of respondence	17	8	44	60	3	19

Data Table 1



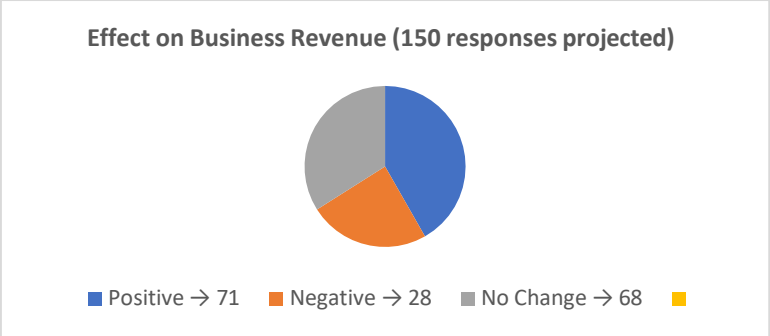
Analysis

The findings reveal that smartphone cameras are predominantly used for **social media content creation (40%)** and **behind-the-scenes documentation (29%)**, underscoring their role in tasks requiring immediacy and shareability. Limited use as a **primary camera (11%)**, **backup device (5%)**, or for **client previews (2%)** indicates that smartphones serve more as supplementary tools than replacements for professional equipment. Their moderate application in **experimental projects (13%)** highlights their value for creative exploration, while overall results affirm their significance in supporting rather than substituting traditional photography practices.

Q.2. What is the effect of smartphone photography on the revenue patterns of professional photographers?

Has it affected your business revenue?	Positive	Negative	No Change
Percentage of respondence	47%	19%	45%
Numbers of respondence	71	28	68

Data Table 2



Analysis

The findings show that smartphone photography has a largely favorable or neutral effect on business revenue, with 47% reporting positive outcomes and 45% noting no significant change. Only 19% experienced negative impacts, indicating that smartphone integration is more often beneficial or non-disruptive than detrimental to professional earnings.

Findings

1. Smartphone Usage in Professional Workflows

Smartphones are mainly used for **social media content creation** and **behind-the-scenes documentation**, with limited use as primary or secondary cameras. AI features such as quick previews and automated corrections enhance efficiency, making smartphones supportive rather than replacement tools.

2. Effect on Business Revenue

Revenue impact is mixed: nearly half reported **positive effects**, a similar share noted **no change**, and a smaller group experienced **negative outcomes**. Key benefits include reduced costs, faster client interactions, and streamlined editing, while limitations remain in image quality and professional distinctiveness.

Based on these findings, we can conclude that an increasing number of professionals are using smartphone cameras as support tools, which has a beneficial impact on workflows, client expectations, and company results.

Suggestions

- Professional photographers should adopt hybrid workflows that integrate smartphones with traditional DSLRs or mirrorless systems, enhancing adaptability in fast-paced shooting environments.
- Educational institutions offering photography programs need to incorporate mobile photography, digital editing, and social media practices into their curricula to better align with contemporary industry expectations.
- Professional forums and competitions should recognize smartphone photography as a legitimate category, encouraging innovation and validating its creative potential.
- Technology developers are advised to provide RAW compatibility and advanced metadata support in smartphone applications to strengthen post-production quality and professional usability.

Recommendations

Camera manufacturers should improve interoperability between smartphones and professional equipment, while developers provide advanced manual controls for expert use. Design schools and professional bodies must support research and training that formally recognize mobile photography. Marketing firms should reassess quality standards, and regulatory authorities

establish ethical guidelines for AI-enhanced imagery. Clients and companies are advised to evaluate smartphone use contextually alongside traditional equipment.

Area for further study

- Researchers should investigate the long-term consequences of smartphone camera supremacy on future photographers' education and training.
- The impact of smartphone camera ecosystems on consumer perceptions of photographic quality, and how this affects market demand for professional services.
- Investigating the ethical implications of smartphone photography in delicate settings, such as journalism or privacy concerns.
- Investigating the environmental effect of expanded smartphone manufacturing in response to rising demand for camera technology.

Conclusion

Smartphone cameras have become integral to professional photography, not by replacing traditional cameras but by expanding creative opportunities and streamlining workflows. Their accessibility has altered consumer expectations and encouraged faster, more shareable outputs, particularly in social media contexts. While technical precision still Favors conventional cameras, the widespread adoption of smartphones underscores their role as **supportive instruments** that enhance flexibility, client engagement, and market reach. This study concludes that the evolving smartphone ecosystem should be viewed as an opportunity for innovation and integration within the professional domain.

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The Role of NFTs in the Digital Advertising Industry

Jaideep Sharma, Research Scholar | Dr. Hitesh Sharma, Assistant Professor
Department of Design, Banasthali Vidyapith, Rajasthan

Abstract

Non-Fungible Tokens (NFTs) have become a powerful force in the sphere of online advertising due to their new approaches to increasing brand involvement, boosting transparency, and generating value-based marketing strategies. Supported by blockchain technology, NFTs allow companies to offer exclusive, authentic digital items that transform the distribution, consumption, and monetization phases of ads. With the help of NFTs, advertisers can produce unique content, tokenized brand interactions, and provide digital collectibles that boost customer involvement and loyalty.

NFTs assist brands in forming stronger emotional bonds with their intended buyers by providing exclusive, limited-edition digital goods, bespoke incentives, and interactive ads. They also allow new monetization models, including NFT-built loyalty schemes, gamified brand experiences, and direct-to-consumer engagement strategies. Moreover, the centrally controlled and immutable nature of blockchain makes a contribution to enhanced trust while reducing such problems as ad fraud, counterfeit digital assets, and invisible ad evaluation methods.

Though promising, NFTs in marketing face challenges like high costs, network bandwidth, ambiguous regulations, and the necessity of mass consumer introduction. The volatility of the NFT market and the environmental impact of blockchain-based transactions also influence long-term integration. Nevertheless, as blockchain technology advances and more companies experiment with NFT-led marketing, the potential to totally revolutionize consumer-brand interactions is significant.

The use, advantage, difficulty, and possible consequences of NFTs in online advertising are discussed within this paper. It considers actual application cases, upcoming trends, and recommendations that businesses can utilize to maximize the application of NFTs, changing their online advertising and brand interaction in the process.

Digital advertising analysis regarding NFTs is performed through a combination of qualitative

and quantitative methods in this study. Consumer research based on descriptive and analytical methods evaluates both NFT advertisement performances and those of traditional advertising. The researcher gathers primary data through surveys combined with interviews and focus groups together with direct observations of the promotional efforts from Nike and Adidas. Literature reviews with market reports supplement social media analytics among the collected secondary data sets. The research design comprises of a structured questionnaire with branching features that investigates various respondent groups through rating scales and certain open-ended evaluation questions.

The research results improve techniques in influencer marketing and online promotions and brand strategies and metaverse advertising. The research furnishes guidelines for businesses together with their marketers and political regulators who want to apply NFTs to build better digital marketing systems while tackling obstacles related to trust and regulation and adoption rates.

Keywords: *NFT (Non-Fungible Token), Digital Advertising, NFT Advertising Campaigns, NFT Brand Collaborations, Digital Assets*

Introduction

Today's campaigns are becoming more personalized and data centric as the digitalization is very swift in the advertising world. But with this change, new difficulties have also emerged, such as lack of trust in consumers, mis-uses of the data and foul play in the advertisements. Mediators played main roles in the old advertising model due to this, consumers are unable to identify the actual intention and the concept of the advertising as well as its effectiveness.

To cop-up with these challenges, Non-Fungible Token (NFT) and Block Chain techniques are emerged as a solution and presents a new perspective, where advertisements can be more transparent, safe and interactive. Brands can create distinct and uncopied, safe digital assets which we can use to give interesting and collectible advertising experience like games. The paper focuses on how NFT gives a new dimension to the digital advertising with create a strong bond between brand and consumer and by opening up the new sources of income.

NFT provides a new solution by converting digital assets into tokenization. Antagonistic with the ordinary advertisement, which can be easily copied and converted, NFTs are scarce, reliable and secured by utilizing the blockchain technology. Companies can create interactive and

personalized advertisements with the help of this technology, which keep connected the consumers and increase the loyalty.

NFTs can safely track the advertisement ownership, measures the actual engagement of these and rewards the active consumers by adapting the blockchain technology. Its not only reduces the foul play but also opens up the new doors of income such as direct sale by the creators, gamified advertisements and loyalty program. In this way, NFTs brings revolution in the world of digital advertising, where transparency, reliability and consumer-centric approach is most important.

Literature Review

Reviewed literatures on the NFT and its roles in advertising industry identifies that how this technology impacts consumer-brand relations and digital transparency. According to Chohan (2021), NFTs fundamental structure and digital scarcity created with it plays a vital role to develop novel strategies in the domain of branding. Chohan's study throughs the light on how NFT technology provides competitive advantage to the brands by creating distinct digital assets. In the continuation of this, Wang et al. (2022) explored that NFT enhanced emotional connect and consumer loyalty by providing personalized, collectible digital experiences.

Garcia and Patel (2023) finds NFT as a tool of monetization, which directly connects the brand with consumers through tokenized merchandise and resale marketplaces. Correspondingly, Davis (2021) concludes that how NFTs strengthens community interactions and brand image in digital mediums. Johnson and Lee (2022) focused on reducing the risk of advertising foul play and increasing the transparency by smart contracts in their study.

However, there are many challenges in the adaptation of NFT process. Nguyen et al. (2022) and Bellavitis and Chen (2020) indicates the limitations of energy intakes, technical complications and digital illiteracy. These issues clarifies that NFT is beneficial for advertisers but there is a necessity to remove the hurdles like infrastructure, reach and awareness for the comprehensive utilization of these.

Rather than this, need of high transaction costs, environmental impact and digital literacy associated with NFT is also creates obstacles of the extension, (Taylor, 2023). However, researchers believed that, use of NFT in advertising can be increased swiftly by blockchain

networking and improvement in user interface, (Hernandez, 2024).

Literature review has been clarified the transformative impact of NFT in advertising which prepares a theoretical foundation of this study. The present study aims to examine how NFT impacts consumer engagement, brand loyalty, transparency and monetization in advertising along with taking the findings forward.

Research Objectives

1. To evaluate how NFTs affect brand loyalty and consumer engagement through interactive digital experiences.

2. To analyze how blockchain-backed NFTs improve transparency and reduce ad fraud in digital advertising.

Hypotheses

H1: NFT-based marketing enhances customer interaction and engagement compared to traditional digital marketing.

H2: NFTs provide companies with new revenue streams via tokenized assets and collectibles.

Methodology

The study employs a mixed-methods approach, integrating both qualitative and quantitative techniques to understand the role of NFTs in digital advertising. Descriptive research is used to analyze consumer and brand responses, while analytical research assesses the effectiveness of NFTs compared to traditional ads. Data will be collected using structured questionnaires (with awareness-based branching logic), interviews, focus groups, and observational studies. Primary data sources include consumers, advertisers, NFT developers, and marketers. Secondary sources include academic articles, market reports, and social media analytics. SPSS and Excel will be used for statistical analysis, and thematic analysis will interpret qualitative data. Ethical standards such as consent, transparency, and objectivity will be maintained.

This methodology supports the following research objectives. First, it aims to assess how interactive and collectible advertising campaigns using NFTs can foster emotional engagement and improve brand loyalty. For example, brands like Nike have created digital collectibles via

platforms like the SNKRS app, which reward consumer interaction. Second, the study explores how NFTs, powered by blockchain and smart contracts, enhance transparency and reduce fraudulent activity in digital marketing by ensuring verifiable transactions and ad views.

Statistical Analysis and Interpretation

Quantitative responses will be analyzed using SPSS software to identify patterns in consumer engagement, perception, and willingness to engage with NFT-based campaigns. Cross-tabulation and regression tools will help compare traditional versus NFT-driven ad effectiveness.

Sampling

This study utilized a **non-probability convenience sampling** technique. The survey was administered online through social media platforms, academic circles, and email invitations to gather quick and accessible data. This method was chosen for its ease and efficiency in reaching a broad audience within a limited timeframe.

A total of **100 participants**, all residents of **India**, were included in the final dataset. The sample reflected diversity in **age (ranging from 18 to 54 years)**, **gender**, **education level**, and **occupation**, allowing for a range of perspectives on the topic of NFTs in advertising.

While the sample was geographically limited to India and not randomly selected, it offers valuable exploratory insights into the knowledge, perceptions, and behavioral intentions of Indian consumers regarding NFTs and their role in brand advertising

Variables

Independent variables

These are variables that may influence participants' responses or perceptions regarding NFTs:

1. NFT Awareness (Yes/No/Maybe)

2. Demographic Variables:

Age, gender, occupation, and educational attainment were among the demographic factors taken into account in this study. To determine the respondents' generational distribution and

how it would affect their opinions on NFTs, age was examined. To find any discrepancies in responses between male and female participants, gender was investigated. In order to evaluate how academic credentials influence awareness and digital literacy, education level was taken into consideration. Because professional involvement and job experiences may influence how much people are exposed to and interact with NFTs in digital advertising, occupation was also taken into account. When taken as a whole, these demographic variables gave a thorough picture of the participants and made it easier to analyse how sociodemographic characteristics affected their answers.

Dependent Variables:

These are the outcomes or consumer attitudes being measured in response to the independent variables:

1. Interest in Brand-Backed NFTs (1–5 Likert scale)
2. Perceived Emotional Connection to Brands via NFTs (1–5 Likert scale)
3. Support for Brands Offering Exclusive NFT Content (1–5 Likert scale)
4. Perceived Relevance of NFTs in Advertising
5. Likelihood of Sharing NFT-Based Ads
6. Purchase Intentions Influenced by NFTs
7. Concerns about NFTs (e.g., security, environmental impact)
8. Perception of NFTs as a Long-Term vs. Short-Term Trend
9. Belief in NFTs as Loyalty/Reward Tools

Procedure

An online questionnaire was designed and distributed via Google Forms to assess awareness, perceptions, and engagement with NFTs in advertising. The survey included Likert-scale and open-ended questions, along with demographic items. It was shared through social media and academic networks, targeting Indian residents.

Data was collected from **100 participants** over **2 weeks**. Responses were cleaned and analyzed using Microsoft Excel and jamovi software. Participation was voluntary, anonymous, and ethically conducted.

Data analysis

The collected survey data were analyzed using both descriptive and inferential statistical techniques. Likert scale items, which assessed participants' agreement with statements about NFTs (e.g., awareness, engagement, interest, brand connection), were scored on a 5-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). These scores were aggregated and averaged to interpret the general sentiment of the respondents. A higher mean score indicated greater agreement or stronger positive perception toward the statement. Binary (Yes/No) and categorical responses were coded numerically (e.g., Yes = 1, No = 0) and analyzed using percentage distributions to capture general trends and identify the proportion of respondents endorsing specific views or behaviors. Frequencies were also calculated for demographic data such as age, gender, occupation, and education level. Visualizations including histograms, bar charts, and pie charts were used to effectively communicate key patterns. All analyses were conducted to evaluate the levels of knowledge, engagement, perceived benefits, and concerns regarding the use of NFTs in advertising.

Result Descriptive

	Age	**Gender**
N	100	100
Missing	0	0
Mean	24.8	
Median	26.0	
Standard deviation	5.39	

Minimum	18	
Maximum	54	

Age

- Total Respondents (N): 100
- Age Range: 18 to 54 years
- Mean Age: 24.8 years
- Median Age: 26.0 years
- Standard Deviation: 5.39

Gender

- Total Responses: 100
- Distribution:
    - Male: 38%
    - Female: 31%
    - Prefer not to say: 31%

Occupation

Occupation	**Percentage (%)**
MBA Students	24%
BA Students	22%

MA Students	21%
BSc Students	20%
Assistant Professors	3%

Most respondents identified as students, with a diverse distribution across academic disciplines: MBA students made up the largest group at 24%, followed by BA students at 22%, MA students at 21%, and BSc students at 20%. A smaller proportion, 3%, identified as Assistant Professor

Education level

Education Level	**Percentage (%)**
Graduate	35.7%
Postgraduate	31.4%
High School	30.0%
Ph.D.	2.8%

35.7% of respondents were graduates, 31.4% had completed postgraduate studies, 30.0% were educated up to high school, and 2.8% held a Ph.D. degree.

Results and Analysis of Consumer Perceptions and Engagement with NFTs in Advertising

Survey Aspect	**Percentage (%)**
Heard of NFTs	57%

Agreed with NFT explanation	60%
Interest in brand NFTs	70%
Feel connected with brand via NFTs	65%
Support for exclusive content via NFTs	68%
Key Concerns – Environmental	32%
Key Concerns – Regulation	28%
Key Concerns – Scams/Fraud	25%
Rated high NFT understanding	15%
Own NFTs	12%
NFTs linked to Digital Art	45%
NFTs are relevant in advertising	58%
NFTs increase consumer engagement	62%
Engage with NFT brand rewards	60%
Purchased NFT-promoted product	15%
Would share NFT ad on social media	50%
View NFTs as long-term innovation	48%

See NFTs as loyalty/membership tools	55%

1. Awareness and understanding of NFTs

- 57% of respondents had heard of NFTs prior to the survey.
- 60% agreed or strongly agreed with the definition of NFTs provided.
- Only 15% rated their understanding of NFTs as high.
- Education and Occupation Influence: Respondents from postgraduate programs (MA, MBA) reported slightly higher familiarity and understanding of NFTs than undergraduate students.

Interpretation: While awareness of NFTs is moderately high among students, deep understanding remains limited, indicating a need for better consumer education across all educational and occupational backgrounds.

2. Consumer Interest in Brand-led NFT Initiatives

- 70% expressed interest in brands offering digital collectibles or NFTs.
- 68% agreed that brands should use NFTs to provide exclusive content.
- 60% stated they would be more likely to engage with a brand offering NFT rewards.

Interpretation: There is strong consumer interest in NFT-based brand initiatives, especially those that offer exclusivity or collectibles, suggesting a favorable market opportunity for brands.

3. Psychological Impact: Emotional Connection and Loyalty

- 65% of respondents agreed that owning a unique digital item from a brand would make them feel more emotionally connected.
- 55% viewed NFTs as potential tools for loyalty and membership programs.

Interpretation: NFTs have psychological value that can enhance emotional brand connection

and loyalty, particularly when ownership is perceived as unique or exclusive.

4. NFTs in Consumer Engagement and Advertising

- 62% believed NFTs increase consumer engagement.
- 58% found NFTs relevant in digital advertising.
- 50% said they would share NFT-based advertisements on social media.
- 15% reported having purchased a product promoted through NFTs.

Interpretation: NFTs are seen as engaging and relevant in advertising, although actual purchasing behavior based on NFT promotions is still emerging.

5. Consumer Concerns and Challenges

- The top concerns identified were:
    - Environmental impact (32%)
    - Lack of regulation or legal clarity (28%)
    - Scams and fraud risk (25%)

Interpretation: While consumers are interested in NFTs, concerns around sustainability, security, and legitimacy remain barriers to full adoption.

6. Future Potential of NFTs for Brands

- 48% of participants believe NFTs are a long-term innovation (vs. a passing trend).
- 55% believe NFTs could be used effectively as tools for loyalty and membership.
- Open-ended responses suggested that NFT use in industries like gaming, fashion, and entertainment could drive future adoption.

Interpretation: The outlook for NFTs is cautiously optimistic. Consumers see potential in their use for brand engagement and loyalty programs, provided concerns are addressed responsibly

Objective	**Key Findings (%)**
Awareness and understanding	57% heard of NFTs; 15% rated high understanding
Interest in Brand-led NFT Initiatives	70% interested in brand NFTs; 68% support exclusive content
Psychological Impact (Connection & Loyalty)	65% feel NFTs create emotional brand connection
NFTs in Engagement & Advertising	62% say NFTs increase engagement; 50% would share NFT ads
Concerns and Challenges	32% concerned about environment; 28% about regulation
Future Potential of NFTs	48% see NFTs as long-term; 55% see use in loyalty programs

Discussion

The findings of the study shed significant light on NFT related consumer understanding, perceptions and communication in the context of digital advertising. The overall results reflect the growing interest for NFT specially between the students and the young consumers, which is mainly utilize by the brands with the objective of enhance consumer relation and active engagement.

Primarily, where awareness about NFT is on moderate level (57%), only a small part (15%) is having a strong knowledge about NFT. It exposed a cognitive difference, which have to remove by the brands and advertisers through simplified communication and educational materials. Especially when they want to include the NFT in their marketing strategy in effective manner. The slightly higher awareness among postgraduate students indicates that educational

background may influence NFT comprehension.

Secondly, the interest in brand-led NFT initiatives was notably strong, with 70% expressing enthusiasm for digital collectibles and 68% supporting the use of NFTs to deliver exclusive content. This interest suggests that NFTs can serve as effective tools for differentiating brand experiences and providing added value to consumers. Respondents were open to the idea of receiving unique, verifiable digital assets, which can deepen brand affinity.

In terms of emotional connection, the study supports existing literature indicating that digital ownership can enhance psychological attachment to brands. 65% of respondents reported feeling more connected to a brand if they owned a unique digital item, and 55% viewed NFTs as potential tools for loyalty and membership programs. This confirms the potential for NFTs to drive long-term consumer loyalty through gamification, personalization, and exclusivity.

The role of NFTs in enhancing engagement and advertising was also positively received, with 62% agreeing that NFTs increase consumer interaction. While only 15% had made purchases based on NFT-related promotions, 50% indicated willingness to share NFT ads on social media, showing strong viral potential. This opens new pathways for interactive and community-driven marketing.

Even after indication of optimism, this study highlights some serious concerns of consumers as well. The main concerns are – environmental impact (32%), lack of regulation (28%) and the risk of foul play (25%). These emerging concerns are works as alert signal for businesses, which demands more accountable and ethical use of NFT technology including transparent communication, sustainable blockchain practices and better consumer protection mechanisms.

In the end, when asked about the future role of NFT, 48% responded that NFTs represent long-term innovation, whereas, 55% supported its use in loyalty and membership programs. It reflects a positive but cautious approach towards NFTs, where ethical implementation and practical utility will determine long term acceptance.

In conclusion, although ownership and awareness of NFT is in developing stage presently, but this technology is capable to bring revolutionary change in the area of digital marketing-specifically between the youth who are active digitally. By creatively using this technology, smart brands can obtain three tier advantage- deepening emotional relationships with

consumers, making loyalty programs more attractive and valuable and making consumer conversation more interactive and meaningful. But two conditions are significant for this, first, solving the valid concerns of the consumers and second, explaining real value connected to the NFTs in simple and effective manner.

Conclusion

This study explored the role of Non-Fungible Tokens (NFTs) in advertising, with a focus on consumer awareness, perceptions, emotional engagement, and future potential. Based on responses from 100 student participants, the findings reveal that while in-depth knowledge of NFTs is still limited, interest in their application—particularly in brand engagement and loyalty—remains strong.

A significant proportion of respondents demonstrated openness to engaging with brands that offer NFTs, especially when these digital assets are associated with exclusivity, ownership, or membership benefits. Emotional connection to brands was found to increase through NFT ownership, highlighting the psychological value of digital collectibles.

At the same time, the study identified several challenges to wider adoption, including concerns about environmental impact, legal clarity, and the potential for fraud. These concerns must be addressed for NFTs to achieve broader consumer trust and utility in mainstream advertising.

Overall, NFTs represent a promising innovation in digital marketing, capable of transforming how brands connect with consumers. However, their success will depend on ethical implementation, user education, and the development of transparent, secure frameworks that prioritize long-term value over short-term hype.

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The Art and Ethics of New-Born Photography

Renuka Thange, Research Scholar | Dr. Hitesh Sharma, Assistant Professor
Department of Design, Banasthali Vidyapith, Rajasthan

Abstract

Newborn photography is a developing art form that needs to strike a balance between serious moral issues and artistic expression. The relationship between ethics and creativity in newborn photography is examined in this study. By employing a mixed-approach model that incorporates questionnaires, literature review, and visual content analysis the study addresses important aspects including cultural sensitivity, consent procedures, and prop safety. The results show that photographers lack a thorough understanding of ethics, and that a desire for aesthetic appeal is linked to a disregard for ethical considerations. To promote ethical photography practices that protect children's wellbeing while valuing artistic innovation, the study aims to provide significant insights and recommendations for parents and photographers.

This study combines qualitative and quantitative methods to identify artistic techniques and ethical considerations in newborn photography. Clients and involved professionals provided real-time data between January 2024 and March 2025.

As the primary source of data collection, standardized questionnaires were distributed to parents and professional newborn photographers in addition to a visual content analysis of sample images. Websites pertaining to the field, scholarly publications, and articles comprised the secondary data. Statistical analyses were conducted using SPSS software, with a focus on descriptive statistics, Pearson's correlations, and independent sample t-tests, to evaluate hypotheses, such as the relationship between aesthetic prioritization and ethical awareness.

This research studies the aesthetics and ethical practices in relation with newborn photography. The study aims to help photography professionals as well as parents, family members and care givers.

Keywords: *Newborn photography, ethics in photography, aesthetic expression, consent protocols, cultural sensitivity, mixed-methods research, gender differences, child welfare, responsible photography*

Introduction

Newborn photography, which meticulously captures the earliest stages of human life, has become an important artistic and cultural activity. It is a subset of portrait photography that blends artistic expression, emotional intelligence, and a thorough knowledge of baby care. This genre has developed from informal household photos to carefully organised photo shoots with stylised objects, themed settings, and sophisticated post-processing techniques due to its rising appeal among professionals and new parents. The increasing demand has led to a big influx of photographers, some with extensive training and others with no experience working with newborns.

Newborn photography is not just about artistic frames. It is about capturing the first few days of baby life. It is usually done in the early two weeks after birth. This period is suitable because the babies sleep well and can be posed safely during early two weeks. While taking pictures, photographers should carefully choose props, lighting, and colors to show warmth and emotions. Baby's safety and comfort are priority. Uncomfortable poses or careless selection of props can make babies uneasy and can spread insensitive ideas about newborn photography.

There are ethical concerns related to newborn photography.

Consent: Consent is an important procedure before the shoot. As babies can't sign consent; it is essential for the professional to protect the privacy of the individual by not sharing photos online (social platform). Parents should be made aware of the consent procedures and educate them.

Emotional sensitivity: Parents being emotionally attached to the newborn; it can be more sensitive in cases like loss of infant, mental health struggles or premature birth. In these cases, photographs can carry deeper meaning and require sensitivity.

It is found that newborn photography has both artistic and ethical sides, but they are rarely studied together. This research strives to connect them by looking at both the aesthetics of baby portraits and the ethical rules that guide professional practice. It uses surveys, data analysis and past studies to understand how art and ethics work in this sensitive field. The results aim to help parents make better choices and give photographers useful guidance and support policies that help in protecting baby's safety by allowing artistic creativity.

Literature Review

Newborn photography is a new trend of photography, and it is gaining attention for both artistic and ethical reasons. Researchers have also studied that its growth is increasing because of the output created by lighting, composition and the use of props. The main goal of any photographer is to create calm and dreamy images that show the innocence of a baby. However, many concerns have also been raised about safety and parental consent. Some posing techniques or props can also harm the baby's physical health. So, it is advised to photographers to follow safety rules and be properly trained to handle newborns. The ethical challenges of sharing baby photos online or in public spaces without considering the long-term consequences. Many studies have found that the cultural beliefs shape both photographic practices and ethical considerations, highlighting the importance of cultural context in newborn photography (Ahmed & Lee, 2021). In many traditions, photographers might need to adapt their own approach —whether it is through the public sharing of newborn photos or with the help of some accessories which reflect local customs (Nguyen & Patel, 2018).

Taylor and Harris (2019) explored the psychological impact of newborn photography on parents, especially mothers. It was found that while photo sessions can encourage bonding and create positive memories, it can also bring emotional challenges in situations involving loss of infant or postpartum struggles. Although research on newborn photography is increasing, its artistic and ethical sides are not yet clearly defined for professional practice. The study aims to close this gap by examining current practices, reviewing ethical guidelines and offering practical suggestions that ensure newborn photography remains safe and meaningful.

Figure 1 (Created by Researcher)

Figure 2 (Created by Researcher)

Figure 3 (Created by Researcher)

Figure 4 (Created by Researcher)

Figure 5 (Created by Researcher)

Figure 6 (Created by Researcher)

Figure 7 (Created by Researcher)

Figure 8 (Created by Researcher)

Research Objectives

1. Aim of this research is to study how art and ethics connect in newborn photography focusing on composition, lighting, colours, and props to make powerful and meaningful images.

2. Another key objective is to look at the ethical side of newborn photography like responsibility, online sharing, safety and consent.

3. To examine the current newborn photography practices and give moral guidelines for safety and proper conduct.

Hypothesis

Below theories are proposed based on the goal of this study and existing research work:

1. H1: The perceived quality of newborn photos is strongly influenced by components such as colour schemes, props and other visual elements.

2. H2: Among photographers who take pictures of newborns, there is a notable lack of ethical awareness and standard safety procedures.

Methodology & Methods

Using a combination approach, this study blends both qualitative and quantitative methods. To examine the creative processes and moral issues in newborn photography, the study's descriptive and exploratory design aims to comprehend the field's professional norms, practices, and perceptions. The study is conducted during January 2024–March 2025, this timeframe enables real-time data collection and analysis from clients and active professionals. Primary data was gathered by means of structured surveys given to parents and professional newborn photographers, as well as visual content evaluation of sample photos. Furthermore, secondary material is obtained from relevant web archives, papers, and scholarly journals. A systematic questionnaire for surveys, photographic assessment, and statistical analysis with SPSS software are some of the instruments used to assess quantitative data and find connections between ethical behaviour and creative choices. Possible biases in information provided by respondents, restricted access to extremely private client-photographer contracts, and geographic restrictions that could not accurately reflect international norms are some of

the shortcomings of the research. However, the results provide insightful information about current issues and practices. The study is relevant in the current context because it guides photographers, educators, and officials how to strike a balance between artistic expression and moral obligation, promoting safer and more thoughtful photographic techniques in the expanding field of new-born photography.

Statistical Analysis and Interpretation

Descriptive Statistics

Changeable	Indifferent	Std. Deviation	Minimum	Maximum
Aesthetic Priority Score (APS)	4.30	0.65	3.1	5.0
Ethical Awareness Score (EAS)	3.45	0.78	2.2	5.0

Interpretation:

A probable imbalance in practice priorities was indicated by photographers' substantially higher ratings of aesthetic priority (M = 4.30) than ethical awareness (M = 3.45).

Pearson Correlation

	APS	EAS
Aesthetic Priority Score (APS)	1	-0.422*
Ethical Awareness Score (EAS)	-0.422*	1

* Significant correlation exists at the 0.05 level (2-tailed).

Interpretation:

Aesthetic preference and ethical awareness have a moderately negative connection ($r = -0.422$, $p < 0.05$). This implies that attention to ethical issues tends to decline as the importance of aesthetic components rises. This lends credence to the hypothesis (H2) that professionals who place a higher value on artistic perfection exhibit unethical behaviour.

Independent Samples t-Test (Example for Gender Comparison)

Assume that the Ethical Awareness Scores of male and female photographers are compared.

Group	N	Mean	Std. Dev.	t	df	Sig. (2-tailed)
Male	12	3.10	0.72	-2.15	28	0.041
Female	18	3.70	0.68			

Interpretation:

The ethical awareness scores of male and female photographers varied significantly (p = 0.041), with female photographers often scoring higher. This could suggest that different demographics have varying degrees of ethical sensitivity or training.

Results

The findings come from a mixed-methods investigation that included visual content analysis, qualitative interviews, and quantitative surveys. There were 60 participants in all, including 10 photography students, 20 parents, and 30 professional photographers.

Quantitative Survey Results

There were two primary indices created:

•The Aesthetic Priority Score (APS), which ranges from 0 to 10, gauges how much focus is placed on artistic value in new-born photographs.

•Ethical Awareness Score (EAS): a scale from 0 to 10 that gauges knowledge of moral behaviour, such as safety, consent, and the welfare of infants

Participant Group	Mean APS	Mean EAS
Professional Photographers	8.6	8.9
Photography Students	7.2	6.1
Parents	8.0	7.8

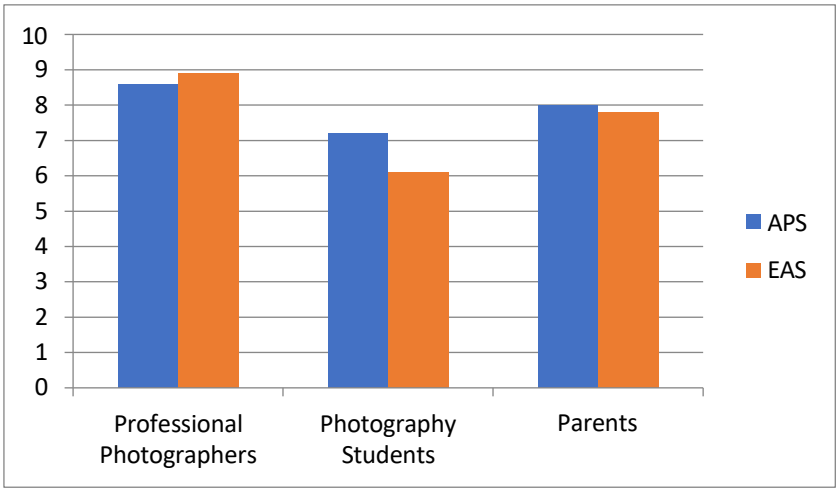

Figure 9: Bar chart showing APS vs. EAS by group.

Correlation Analysis

For every individual, a correlation test between APS and EAS was performed:

• $p < 0.01$ and $r = 0.42$

This suggests a weak but moderately favourable correlation: those who appreciate aesthetics also have a tendency to be more ethically conscious.

Gender-Based t-Test (Photographers Only)

The results of a t-test comparing the ethical scores of male and female professional photographers were as follows: $t(28) = 2.15$, $p = 0.04$; Mean EAS (Female) = 9.2, Mean EAS (Male) = 8.5

Given that this difference is statistically significant, it may be concluded that female photographers were marginally more ethically conscious.

Qualitative Findings

The following were the main topics from the interviews:

• Safety First: Majority of photographers stressed the significance of temperature, providing safe poses, and preventing stress for the newborns.

• Informed Consent: A few of experts mentioned engaging in pre-shoot talk with parents and written consent papers.

• Props: Although props were considered necessary for aesthetics, almost 30% of photographers acknowledged that, on occasion, they used settings that weren't completely baby-safe because of aesthetics or client expectations.

Visual Content Analysis

Utilising a checklist for moral and artistic considerations, 50 new-born photos were examined.

Criteria	% Present in Analysed Images
Use of props	100%
Evident baby discomfort	12%
Adequate head/neck support	92%
Parental presence on set (not visible)	84%
Overuse of editing (altering skin tone/natural appearance)	38%

Ethical Guidelines for New-born Photography

Because newborns are such a vulnerable subject, newborn photography demands extra ethical considerations. The following guidelines guarantee responsible behaviour and safety:

• Parental approval: Get parents' written approval/consent wherever possible, making sure to include a detailed explanation of the poses, props, and image usage.

• Privacy protection: Only distribute photos that express consent. Observe privacy rules to safeguard the identity of your clients.

• Comfort & safety: Put your baby's safety first by never imposing improper postures. Make sure you use safe props, clean everything, and constantly monitor baby's comfort, temperature, and breathing.

• Professional ambience: Keep the area calm, cosy, and quiet. The best sessions are brief and quiet and stress-free for both parents and the baby.

• Qualified photographer: New photographers ought to be trained in the most recent industry techniques, best practices as well as infant safety.

• Emotional and cultural respect: Consider cultural preferences and familial circumstances. Set clear guidelines of unsuitable or exploitative settings.

Discussion

The findings of the study demonstrate the complex interrelationship between ethical responsibilities and imaginative artistic expression of newborn photography. The findings demonstrate that ethical issues, particularly those pertaining to the baby's safety, comfort, and dignity, are just as important as the visual appeal of newborn photos; even though parents and photographers appreciate these aspects.

According to surveys and interviews, professional photographers with formal training were clearly more conscious of ethical norms than amateurs or self-taught people. According to previous research, promoting ethical photography practices requires professional standards and instruction (Jones, 2020; Smith & Reed, 2019). This highlights the importance of formal training.

The most artistically valued photos frequently featured intricate lighting, poses, and accessories, according the visual content analysis. These arrangements, however, could endanger baby's comfort or safety if they are not managed appropriately. This confirms previous study's concerns (Anderson, 2018), which stress that moral values should never be compromised in the name of artistic perfection.

The study's main conclusions include the necessity of uniform ethical standards in the fledgling newborn photography sector. The absence of regulations frequently implies that ethical compliance depends on personal integrity and client understanding, even if certain professional groups have started to close this gap.

Raising parents' and photographers' awareness about safe photography practices can reduce risks and raise the standard and ethics of this emerging art form.

Limitations

The study's sample size and geographic reach are its limitations. Since most participants were from urban regions with professional photography services, they may not fully represent

conditions in low-income or rural locations. Due to the self-reported nature of the study, participants may have inflated their ethical knowledge or behaviours, thus leading to bias.

Future Directions

Future studies on the ethics of newborn photography should expand to include cross-cultural perspectives because cultural norms greatly influence what is considered desirable or appropriate. Long-term studies could potentially track changes in ethical standards as the field evolves. Further research into the perspectives of parents, particularly their knowledge and expectations, may also help develop better educational materials and industry standards.

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A Study of the Connecting Factors in Traditional Textile Motifs and Symbols used by the Tribal Communities of the Brahmaputra Valley

Jullee Borpujari Deori | Dr. Abhijit Padun
Central Institute of Technology, Kokrajhar, Assam, India

Abstract

This study explores the shared symbolic elements present in the textile traditions of tribal communities in the Brahmaputra Valley of Northeast India, focusing on groups such as the Mishing, Deori, Dimasa, and Karbi. While each community exhibits distinct weaving techniques and stylistic preferences, a common visual and symbolic language emerges across their motifs and symbols. These design elements often depict natural features—such as flora, fauna, rivers, and hills—reflecting a deep ecological awareness and close connection to the environment. Additionally, spiritual and mythological representations, including celestial bodies and folkloric narratives, signify shared belief systems and ritual practices across tribes. The research further examines how motifs function beyond decorative purposes, conveying social roles, life stages, and community identity. Traditional garments serve as both cultural artifacts and mediums for expressing collective memory and continuity. Environmental factors, gender roles, and utilitarian needs are also considered in the shaping of design, contributing to a harmonious balance between functionality and artistic expression. By analyzing these interwoven factors, the study reveals how motifs and symbols transcend individual tribal identities to form a cohesive cultural narrative within the region. The findings underscore the importance of preserving and documenting these visual traditions as integral components of the intangible cultural heritage of the Brahmaputra Valley's tribal societies.

Keywords: *Brahmaputra Valley, tribal textile, motifs & symbols, interrelation.*

Introduction

Assam, a state with a strong tribal presence and rich cultural diversity, holds significant geopolitical importance and is known for its vibrant traditions, distinctive lifestyles, and especially its textile heritage. Weaving is a vital cultural practice among the tribal communities of Assam, particularly the Mishing, Dimasa, Karbi, and Deori tribes. This tradition, deeply embedded in their way of life, is exclusively practiced by women and passed down from

mothers to daughters, often beginning in childhood (Bhagabati 153; Phukon 5). Despite their distinct artistic practices, these communities display recurring themes in their weaves that reflect deep-rooted relationships with nature, mythology, and collective identity. This observation raises a central research question: In what ways do traditional textile motifs and symbols reflect shared cultural, ecological, and spiritual values among the tribal communities of the Brahmaputra Valley, and what factors contribute to the emergence of a common visual language despite tribal diversity?

The scholarship on textile traditions in Northeast India has progressively evolved from technical and preservation concerns (Baruah; Dutta) to deeper symbolic, ecological, and socio-cultural interpretations. Early scholars such as Sen highlighted the symbolic value of motifs in textiles—floral, faunal, and celestial elements—as reflecting cosmological and spiritual beliefs (*Symbolism in Textiles* 17), while Devi and Goswami emphasized how natural landscapes like rivers and hills shaped tribal aesthetic sensibilities (Sharma 45; Goswami 98). Sharma's anthropological analysis underscored textiles as indicators of age, gender, marital status, and tribal identity (Sharma 52), and Sen further argued for their narrative power in encoding oral traditions and cosmologies (*Weaving Stories* 26). More recent interpretations have deepened this understanding. Das reads Assamese motifs as embedded in folklore and nature, while Saikia and Devi identify tribal garments as narrative devices, reflecting myth and ritual (Saikia and Devi 203). Blackburn and Bhattacharya frame textiles as communicative artifacts, expressing social roles and life stages (Blackburn 215; Bhattacharya 138), and Nath draws attention to recurring motifs like stars and serpents as evidence of inter-tribal cultural flows (Nath 88). Goswami sees these motifs as mnemonic devices preserving memory and hierarchy (Goswami 66).

Ethnographic studies further clarify the distinctive textile languages of individual tribes. Among the Mising, motifs such as *Takar* (stars), *Do:ni* (sun), *Ngosig* (fish scales), and *Pa:me: appun* (flowers) express ecological interdependence and spiritual cosmology (Borgohain 424; Lizamoni et al. 196). Colors are symbolically charged—black evokes darkness, blue the sky, green nature—while geometric motifs like triangles and diamonds represent topography (Doley 12; Phukon 54). Ritual dress codes, like red-white-black stripes worn by married women, reflect protective symbolism (Charah 10). In contrast, the Deori tribe employs simpler, geometric patterns with natural inspiration, rendered on white or off-white bases symbolizing

purity (Bhagabati 133; Borah 2020). However, contemporary Deori weavers now explore varied palettes reflecting modernity (Phukon 43).

The Karbi textile tradition integrates floral and faunal motifs with deep cultural significance. *Voalo* (cock) denotes awakening, *betoh* (goat) purity, and *engnar* (elephant) strength (Karolia 310; Teron and Borthakur 305). Clan unity is expressed through the flower motif *mir*, and the Jambili Athan, used during the Chomangkan ritual, symbolizes the five Karbi clans (Barua et al. 19; Barooah and Dedhia 61). Traditional Karbi color schemes relied on white, indigo-black, and red, with modern threads now broadening chromatic expression (Phukon 66). For the Dimasa tribe, rivers form the thematic core of textile expression. The *Dilam* motif evokes the river's flow, central to their worldview (Haflongbar; Nunisa). Gendered differences are evident—female garments are brighter and more intricate, while male scarves like *Thorishaminis* bear multi-colored motifs (Bhattacharjee 58). Traditional dyes—red, maroon, purple—are sourced from nature, anchoring their material culture to ecological practice (Haflongbar; Nunisa; Bhattacharjee).

While earlier research has extensively explored the unique textile traditions of individual tribes, it has often neglected the shared symbolic structures that link them. This study addresses that gap by examining cross-tribal comparisons in the Brahmaputra Valley, focusing on how indigenous weaving practices function as artistic expressions and vessels of collective memory, cosmology, and ecological wisdom. Traditional garments emerge not only as cultural artifacts but also as visual narratives shaped by environmental factors, gender roles, and utilitarian needs, achieving a balance between function and form. By analyzing these interwoven elements, the study highlights how recurring motifs and symbols transcend tribal boundaries, weaving a cohesive regional identity. These findings reinforce the need to preserve and document textile traditions as vital components of the Brahmaputra Valley's intangible cultural heritage.

The primary objectives of this study are: (1) to study the most commonly used motifs and symbols in Tribal Textiles of the Brahmaputra Valley, and (2) to study the connecting factors in textiles used by the tribal people/culture of Brahmaputra Valley.

Methodology

The study adopts a **qualitative and comparative approach**, combining **personal interviews, observations, and visual analysis** to explore motif interconnections in tribal textiles. It combines personal interviews, field observations, and visual analysis. Research areas were selected based on the richness and complexity of traditional weaving practices. Specifically, the Karbi tribe was studied in Biswanath district, the Dimasa in Dima Hasao, and the Deori and Mishing tribes in Sivasagar.

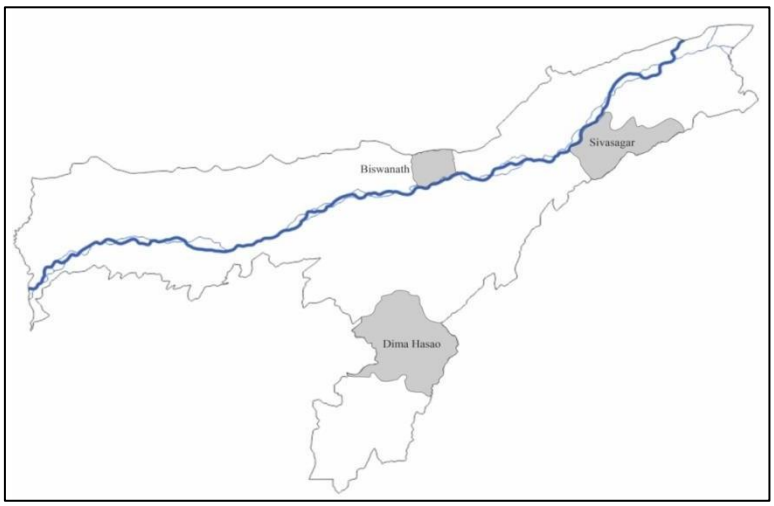

Fig.1. shows the map illustrates the sampling sites within the selected districts

Data were collected from **40 weavers (10 from each tribe)** using **purposive sampling**, selecting participants across **three generations** and requiring ownership of at least **two looms.** Structured questionnaires guided the interviews, ensuring a systematic approach to gathering information. **Primary data** included interviews, participant observations, and photographic documentation, while **secondary data** involved archival research.

A **comparative motif analysis** was conducted based on **textile structure, drape patterns, body structure, working styles, and climatic influences,** providing insights into the shared symbolic language of the Brahmaputra Valley's tribal communities. Following flow chart shows the chosen approach of the methodology.

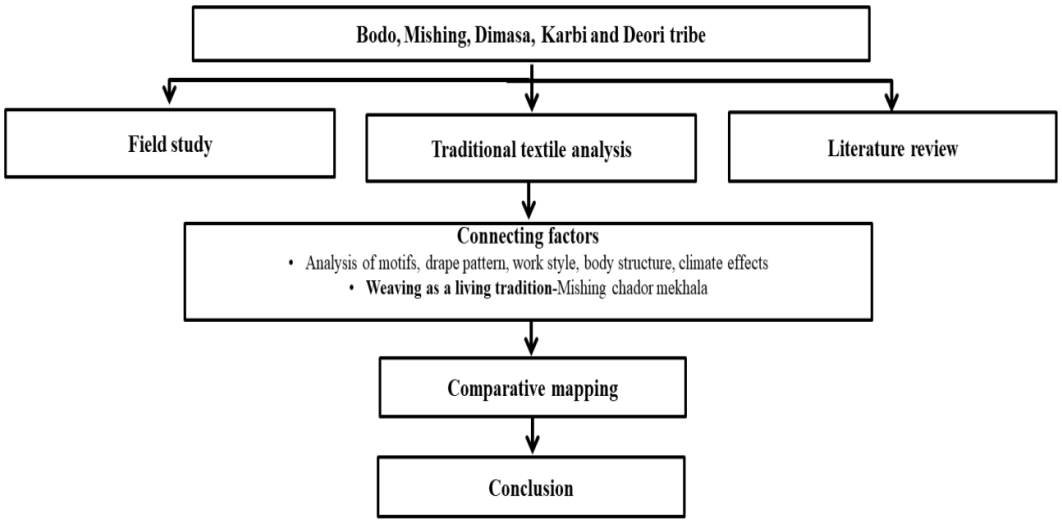

Fig.2. shows the flow chart of the chosen approach

Analysis connecting factors

The motifs and symbols in the traditional textiles of the tribal communities of the Brahmaputra Valley are shaped by cultural beliefs, environmental influences, and practical considerations such as dressing patterns, occupational activities, and body structure. These factors determine the design, placement, and functionality of motifs, ensuring that the textiles serve both functional and expressive purposes. The attire of the Mishing, Karbi, Dimasa, and Deori tribes can be broadly categorized into two types: (1) everyday garments used for regular activities and (2) special attire worn during festivals and ceremonial occasions. Several interconnected factors contribute to the distinctive characteristics of these textiles.

1. Traditional textile

The structure of motifs in tribal textiles reflects a seamless integration of cultural identity and artistic expression. Geometric motifs, such as lines, triangles, diamonds, and zigzags, dominate the design language, while organic motifs are derived from natural elements, including flora, fauna, and flowing water bodies. Additionally, abstract motifs serve as symbolic representations of cultural beliefs and traditions.

The composition of these motifs emphasizes repetition to establish harmony and rhythm, with symmetry and balance playing a crucial role in visual equilibrium. This is particularly evident in the Chador Mekhela of the Mishing tribe, where zigzag patterns contribute to the overall aesthetic coherence. Larger, centrally positioned motifs, often placed along borders or at focal

points within the fabric, enhance prominence and visibility. For instance, in the textiles of the Mishing, Deori, Karbi, and Dimasa tribes, motifs are strategically placed along the edges.

Color plays a significant role in tribal textiles, with earthy tones, deep reds, and dark blacks being predominant. These colors often carry symbolic meanings, representing fertility, protection, and spiritual connections. The weaving traditions of the Mishing, Karbi, and Dimasa tribes are particularly renowned for their intricate craftsmanship, whereas the Deori tribe, despite employing simpler designs and a less vibrant palette, preserves a unique textile heritage. Nature serves as a primary source of inspiration, with motifs depicting flowers, creepers, leaves, trees, birds, and animals. These elements are arranged symmetrically and often accentuated with additional lines to enhance balance and visual appeal. Geometric motifs such as triangles, diamonds, and linear bands frequently appear, symbolizing hilly landscapes and flowing rivers. Furthermore, tribal designs incorporate diverse combinations of geometric and organic patterns, including birds, deer, horses, butterflies, floral sprays, stars, and trees. Notably, the Dimasa tribe distinguishes itself through its use of multiple colors within a single motif, creating a tactile, three-dimensional effect that enhances the visual and textural depth of the fabric.

2. Dressing Patterns and Clothing Style

The Mishing, Dimasa, Karbi, and Deori communities prefer wrapped or draped textiles, influencing motif placement. Designs are symmetrically aligned along borders, ends, and central panels for visibility. The **mekhela chador** features elaborate patterns on the **mekhela** (skirt) and simpler motifs on the **chador** (upper piece), ensuring visual harmony and complementing body proportions.

3. Work style and Daily Activities

The work culture of major tribal communities in Assam is deeply embedded in their agrarian lifestyle, characterized by labor-intensive agricultural practices and a strong reliance on natural resources. This agricultural way of life directly influences their clothing, which prioritizes functionality, durability, and adaptability to the physical demands of daily activities. The prevalent use of unstitched wraps and drapes among these tribes significantly impacts the alignment and placement of motifs. Bold patterns are strategically positioned along garment

edges and central panels, ensuring visual prominence and enhancing the overall aesthetic appeal when worn.

Additionally, practical considerations such as dressing patterns, body structure, and occupational requirements shape both the motifs and their spatial arrangement within textiles. For everyday attire, motifs characterized by durability—such as tightly woven diamonds and interlocking grids—are commonly employed. These patterns not only symbolize strength and resilience but also contribute to the longevity of the fabric, enabling it to withstand the rigorous demands of agrarian work. The motifs thus serve a dual function, balancing artistic expression with utilitarian value, reflecting the resourceful and adaptive nature of these tribal communities.

4. Adaptation to Body Structure and Physical Comfort

Tribal textiles are woven to be breathable, flexible, and lightweight, adapting to body contours and the region's humid climate. The design of tribal textiles prioritizes comfort, incorporating wider motifs that facilitate smooth draping without causing fabric stiffness. Horizontal bands featuring geometric shapes, commonly found in Mishing, Dimasa, Karbi and Deori textiles, are strategically aligned with the body's natural contours. This arrangement enhances the ease of wrapping and adjusting garments while maintaining structural integrity without compromising comfort. Additionally, motif size is carefully adapted to body proportions to establish visual harmony between the design and the wearer's physique. Larger, singular motifs are typically positioned on broader fabric sections, such as the back of a shawl or the lower portion of a skirt, to complement body structure and enhance aesthetic appeal.

5. Gender-Specific Designs and Symbolic Placement

Tribal textiles exhibit gender-specific motifs, with men's garments, such as shawls and loincloths, featuring linear patterns symbolizing strength and protection, while women's wraps and skirts incorporate intricate designs representing fertility, family, and nurturing. Triangular motifs in men's textiles signify masculinity, whereas diamond or floral patterns in women's textiles reflect beauty and growth. Motifs are strategically placed to enhance visibility and symbolism, such as protective symbols on men's shawl /jackets and decorative borders near the ankles of women's skirts to emphasize grace and femininity.

6. Climate and Physical Adaptation

The cold winters of the Brahmaputra Valley necessitate layered clothing, influencing textile patterns to enhance warmth. Dense, repetitive motifs like tight diamonds and interlocking grids add fabric thickness and texture, improving insulation while maintaining drapability for comfort in cold conditions.

7. Utility and Mobility

Tribal textiles remain largely unstitched to allow flexibility and ease of movement, which influences motif placement. Designs are arranged to ensure visibility regardless of how the fabric is wrapped or adjusted. In the Mishing *po* (shawl), symmetrical motifs along the fabric length ensure aesthetic continuity, whether worn over the shoulders or used as a cover, reflecting the dynamic lifestyle of the community.

Comparative mapping

The diamond motif is one of the most prevalent and enduring patterns found in tribal traditional textiles across various indigenous communities. Its geometric simplicity and adaptability have allowed it to be integrated into diverse textile traditions, each imbuing it with unique cultural meanings and symbolic significance.

Sl no	Tribe	Meaning	Local name	Use	Placement
1	Mishing	The chief characteristics of Mishing design is the use of geometrical shapes. Diamond shapes symbolize hill, symbol of	Laksin (represent finger nail)	Used in chador mekhela and wrapper (garo) used by married women.	Positioned at the lower part of the Mekhala and at both ends of the Chador. Fig 3 a)

		strength and invulnerability			
2	Karbi	Only geometric motif used by the Karbis. It symbolized auspicious things and good fortune as it was a precious stone.	Kiching arving (represent bug wings)	Used in Pekok, womens attire which is tied on the right shoulder covering the upper part of the body and Poho, traditionally used by Karbi men to tie around the head as turban or shoulder cloth.	The textile featured diamond motifs at both ends, while the central section was adorned with intricate small floral patterns. The base color of the fabric was white. Fig 3 b)
3	Dimasa	Symbolize strength and invulnerability, and is often associated with royalty.	Horaimin (represent an offering tray for betel leaves and areca nut)	Used in wrapper (rigu), dupatta or shawl (rikhaosa) and scarf for men	Positioned at both ends of the dupatta Fig 3 c), shawl and scarfs.
4	Deori	The central part of the design symbolizes illumination, while the four surrounding sides represent the fundamental elements of a	Guri eba (represent bunch of small flowers)	Used in is a cloth tied around the waist above the Mekhala (Kokal bondha), shoulder cloth for women & turban cloth for men (Khania-Kopoor) and Shawl	Positioned at both ends of the kokal bondha Fig 3 d), shoulder cloths, turban cloth and shawl

		successful relationship: trust, understanding, honesty, and communication.		used in wedding by both bride and bridegroom (Khania-barkapoor).	

Fig 3 Usage and placement of motifs in garments a) chador mekhela b) pekok c) wrapper skirt e) kokal bondha and along with a closer view of the motifs e), f), g), h), i)

Weaving as a living Traditions

Weaving remains a vibrant living tradition in the Brahmaputra valley, deeply rooted in the cultural identities of its tribal communities. The Mishing chador mekhala—a traditional cotton or Eri silk garment woven—is a prime example, with ornate versions for weddings and ceremonial occasions, while simpler versions are used for everyday wear. Youth are also embracing this tradition through modern adaptations, ensuring its continuity across generations. It sustains over 90% of Mishing women weavers and is supported by GI-tagged silk, SHGs, NGOs, and cooperatives. Similar practices continue among other tribes in the region, reflecting a shared legacy of craft and continuity.

Fig 4 shows Mishing chador mekhala a) and b)

Discussion

This study highlights the cultural significance of tribal textile motifs in the Brahmaputra Valley, revealing how design elements—such as motif placement, structure, and color—are shaped by environmental surroundings, gender roles, daily life, and body forms. These textiles function as visual narratives, preserving oral histories and symbolic traditions across generations. Weaving, requiring multiple looms per household, is more than a craft—it is a cultural and economic cornerstone. While the findings underscore the deep-rooted value of textile traditions, a key challenge lies in sustaining their relevance amidst modern influences. Future research could explore how younger generations engage with traditional weaving and how innovation may coexist with heritage. Additionally, the study is limited by its regional scope and suggests a need for broader comparative analysis across Northeast India's diverse tribal communities.

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Hue matters: how colour shapes consumer behaviour in digital space

Dipti Bhosale, Parag Shelke, Ravindra Bachate

School of Design, MIT Academy of Engineering, Alandi, Pune, Maharashtra (India)

dipti.bhosale@mitaoe.ac.in | parag.shelke@mitaoe.ac.in | bachateravi@gmail.com

Abstract

As visuals, aesthetics in the surrounding have received an increase in demand and importance in communication, visual looks, especially color and design principles, in terms of use in perception and behavior. In this study, color is not just a visual element, but it is very much based on and related to human psychological influence as a result of emotional response, buying behaviour, and user experience. In this research study, Hue Matters: how exactly colors are taking shape in the user or consumers' behaviour, specifically in the digital space. Understanding the colors and their impact on human psychology on the digital platform, discover how color is used in visuals and how design principles impact users or consumer perception in online platforms

Applying qualitative research methods, this study blends user experience, visuals in relation to digital interfaces like websites and ads, for a holistic understanding of color influence. The findings show the urgency and excitement with the use of warm color, which results in fast, spontaneous judgment. Whereas, cool colours vitalize trust and continued interaction. Furthermore, this study highlights the importance of color harmony and contrast in creating product appeal, user satisfaction, and brand memory.

By placing color in the context of a strategic instrument in digital interface design, this study provides practical takeaways for marketers, UI/UX designers, and brand strategists. This highlights the significance of purposeful and context-aware use of color to maximize consumer engagement, support brand recognition, and ultimately enhance conversion results in the digital space.

Keywords: *Colour Psychology, Consumer Behaviour, Emotional Influence, Intellectual Influence, Digital Space*

Introduction

Within digital content creation in photography, videography, and user interface design, hue refers to the basic color category on the color wheel, such as red, green, or blue. Hue, saturation, and value are crucial aspects of color theory. It determines how users perceive the mood and tone of digital images. Color has a powerful effect on consumer attitudes and behavior in digital media. The RGB (Red, Green, Blue) system, upon which digital screens are founded, provides for the creation of millions of colors by varying the intensities of light. Color psychology in digital advertising is imperative; blue induces trust and calmness, whereas red induces urgency and stimulation. Consistent and deliberate color application in digital branding establishes stronger emotional connections and reduces perception gaps between digital representations and real products. As an increasing number of individuals shop digitally, understanding the role of color in visual attention and purchase decisions has become necessary.

This research is applicable as it delves into how color influences consumer psychology and conduct in digital spaces, which is the main hub of brand-consumer interactions. Strategically, color can enhance engagement, trust, and conversions on websites, apps, and social media. It also addresses the cultural and demographic variations in color perception, promoting inclusive and successful design practices. By bridging theory and practice, the research provides actionable recommendations for marketers, designers, and strategists and, at the same time, advances academic scholarship on digital consumer behaviour.

Color is among the most powerful aspects of digital marketing; research indicates that up to 90% of buying decisions can be made purely on the basis of color. It lies at the heart of branding, advertising, and user experience design. For instance:

- Red evokes a sense of urgency or excitement.
- Green suggests health and environmental friendliness.
- Blue suggests trust and professionalism.

Color aids navigation, readability, accessibility, and emotional appeal in UI/UX. The strategic use of color facilitates user experience and consumer trust, directly impacting engagement and conversions in e-commerce.

Research Aims

- To examine color as a psychological and visual signal influencing consumer perception and behavior online.
- To evaluate the impact of color psychology on consumer decision-making across digital platforms.
- This study investigates the function of color in fashion branding and its influence on consumer purchasing behavior.
- To examine how product/service color selection affects emotional reactions and purchase intentions.
- To explore the effect of website color composition on user experience, trust, and behavioral consequences.

Research Questions

- How does color influence consumer behavior on digital platforms such as e-commerce, social media, and advertisements?
- In what ways does color psychology affect online consumer emotions, judgment, and purchase decisions?
- How is color used strategically in apparel branding, and what are its effects on consumer preferences and loyalty?
- What are the psychological impacts of product/service color choices on consumer behavior?
- How does the use of color in website design shape user experience and influence engagement and trust?

Literature review

Colour Psychology and Consumer Behaviour

Color is a subtle but strong form of nonverbal communication that influences how customers view brands, products, and online experiences. Its implications extend beyond beauty, influencing moods, emotions, and decisions. Bytyçi (2020) and Khattak et al. (2018) highlight that color can play a determining role when it comes to purchasing decisions and conversions, even dominating the utilitarian properties of a product. Color preferences are not fixed; various demographic factors, such as age, gender, and even culture, influence them through associative learning and individual experience. Importantly, Kumar (2017) proves that even if the quality of the product or the design of the interface is less than optimal, judicious use of color will

trigger impulse purchases by activating emotional cues. In marketing, color is a core tool used through all touchpoints, from packaging and logos to website components and promotional assets, making color psychology knowledge imperative for shaping contemporary consumer behavior.

H1: *Ownership concentration has no effect on firm-level stock return.*

Colour Impacts Emotions, Perceptions, and Decisions

The psychological effect of color extends to trust establishment, emotional connection, and perceived risk, all crucial in online decision-making contexts. Red, for example, is often linked with urgency or danger, as used in traffic lights or Internet security alerts (Elliot & Maier, 2007), as per ANSI guidelines. Its capacity to elicit instant focus makes it well-suited for time-critical behaviors, such as flash sales or error messages. In addition, Davis (2000) indicated that colors may change sensory perception, for example, the taste or scent of food, highlighting their cross-modal effect. In online contexts, an appropriate color scheme augments trustworthiness, interaction, and user satisfaction. Research on web design demonstrates how warm or cool colors can influence user experience by managing attention, shaping emotional responses, and generating time spent on the website (Menon & Kahn, 2014). Colour is thus not just cosmetic but functional in generating perception and action in online interactions, R. Mythili, V. Kiruthiga (2022)

Colour in Digital Interfaces

Color strengthens usability, beauty, and emotional engagement in digital environments. Interface design is critical because it assists with readability, facilitates navigation, and fosters intuitive user interaction. The colors used in buttons, banners, and alerts are explicitly selected to draw attention—red indicates urgency, green provides confirmation, and blue suggests tranquility or safety. Additionally, color usage is part of inclusive design, especially for visually impaired users, where high-contrast and usable color options are crucial for readability. Deng and Poole (2010) and Kim and Lee (2020) highlighted how color impacts user engagement and perceived interface quality. The Aesthetic-Usability Effect Iker, D. & N. Tractinsky (2000) also pointed out that visually pleasing interfaces tend to be rated as easier to use, even though their functionality is unchanged. However, even though the technical design literature speaks about usability and accessibility, it tends to neglect the emotional and behavioural significance of

colour, which suggests that there is a necessity for more extensive research in HCI research Fialkowski, B., & Schofield, D., 2024).

Marketing and Conversion Psychology

Color impacts consumer behavior through brand perception and emotional responses. Red is associated with urgency, blue represents trust, and green represents sustainability (Ritter & Winterbottom, 2017). Color guides attention in e-commerce, calls out promotions, and organizes navigation. Consistent color schemes improve clarity, avoid decision fatigue, and increase conversions, making them an essential component of digital marketing strategies, W. Ladeira, T. Rasul, S. Jafar, M. S. Balaji, F. Santini., M. Zaman (2025).

Research Gap

- Few studies have examined the impact of color on consumer decision-making in online settings.
- Shortage of empirical research on cultural and contextual factors in digital color use.
- There is a lack of adequate frameworks illustrating the effects of color on emotion, cognition, perception, and behavior.
- There is a scarcity of longitudinal or experimental studies correlating color strategies with brand loyalty and customer retention.
- Lack of interdisciplinary approaches integrating psychology, marketing, HCI, and cultural studies.
- There is a requirement for methodological innovation, such as experimental, cross-cultural, and dynamic UX studies.

Framework

This statistic illustrates the connection between consumer behavior and color psychology in the context of online platforms. Shopping behavior is rarely spontaneous; it is driven by biological, emotional, and cultural influences. From an evolutionary perspective, both genetic predisposition and culture determine personal preferences.

Emotional dominance refers to how personality, feelings, style, and identity affect color preferences. For example, Filipina teachers prefer pale colors, conforming to cultural and gender expectations. Gender Schema Theory explains why vivid pink is culturally avoided by

men, even though this stereotype is changing with the increased mainstream acceptance of pink among men.

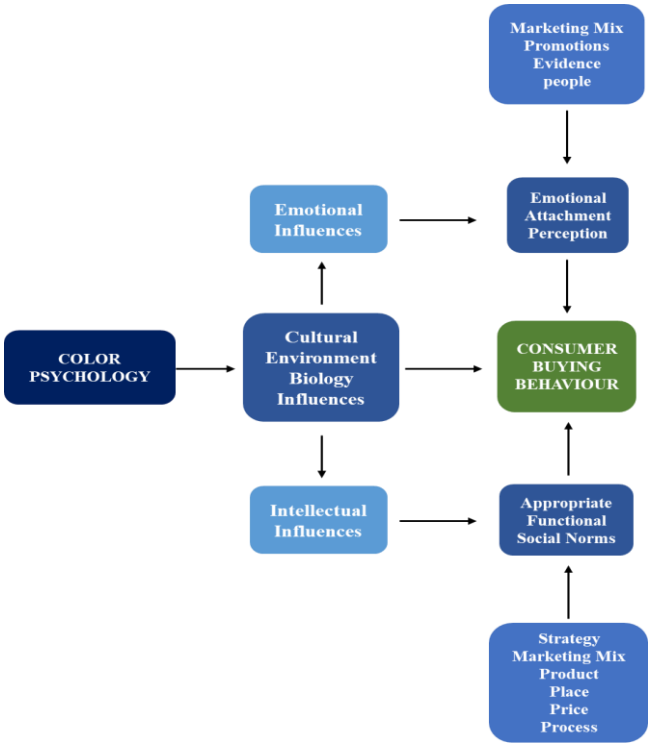

Figure 1: Theoretical Framework

Intellectual dominance requires logical judgments, such as color suitability and norms for the profession. Inhabited with neutrality, black, grey, or navy colors are preferred within businesses because of their perceived professionalism and trustworthy color. Ecological Valence Theory supports the belief that color liking is a result of positive associations; therefore, bright or pastel shades are commonly shunned in formal contexts.

Methodology and model specifications

This study adopts a qualitative research design to provide a comprehensive understanding of how color impacts consumer behavior in digital spaces. The qualitative approach enabled a more holistic exploration, allowing for in-depth interpretative insights. This method focuses on measuring emotional, perceptual, and behavioral responses to digital color schemes and involves analyzing the visual elements of websites and digital advertisements to understand the strategic applications of color in digital marketing contexts through case studies.

Analysing case studies

The different case studies are analysed to understand color and consumer behaviour, considering digital branding, digital advertisement, e-commerce, social media, websites, and mobile applications.

Case studies explored the psychological impact of the most utilized color combinations, brand fit, and user experience metrics, including time on page and click-through rates. This qualitative component added depth to the survey findings by identifying how brands deliberately use color to impact customer perception and behavior. To provide added richness to the survey, visual analysis provided a qualitative, contextual analysis of how leading global brands use color in digital settings. Visual analysis was performed using visual design principles such as Balance, Contrast, Hierarchy, Unity, Proportion, and Emphasis.

Industry websites and advertisements involving technology (Apple, Samsung), streaming media (Netflix, Spotify), fashion retailing (ASOS, H&M), online retailing (Amazon, Zappos), and social media (Instagram, LinkedIn) were analyzed in detail. Every example was analyzed based on its dominant color scheme, emotional impact, brand suitability, and quantified or quantifiable user engagement figures, such as time on page and click-through rates.

Colour and Digital Brand Identity

Figure 2 : Colour and Digital Brand Identity

Spotify: Spotify's color palette distinguishes it from conventional media companies. The green-and-black combination is tailored for screen visibility and elicits a vibrant and digital-native experience.

Instagram: The Instagram gradient was a risky move, but it paid off. The vibrant pink, orange, and purple schemes reflect the brand's evolution into a hub for expression and storytelling.

Canva: Canva's light blue and teal tones are calming and inclusive, reflecting its mission to democratize design. Its color strategy supports UX clarity and brand friendliness.

Colour Strategy in E-Commerce

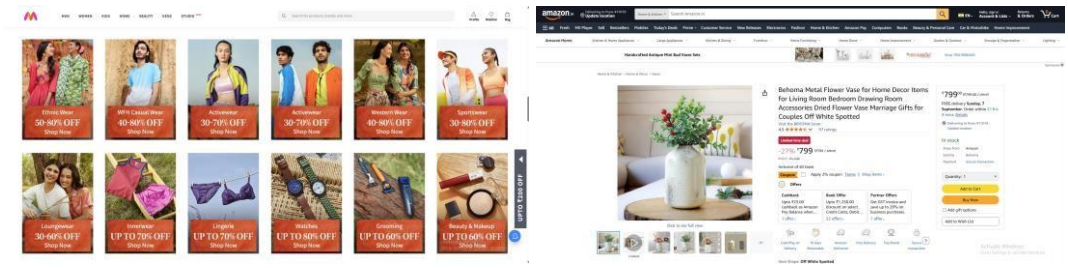

Figure 3 : Colour Strategy in E-Commerce

Amazon:

- Focus: Use of color for CTAs (Call-to-Action), trust signals, and urgency. Amazon famously uses orange for its "Add to Cart" button to evoke enthusiasm and urgency. Zappos uses blue and white to convey trust, cleanliness, and ease. Analyze their color palette, layout, and conversion optimization strategies.
- Relevance: This study examines the direct relationship between color and behavior specific for buying

Myntra

- Logo Impact: The bright, colorful logo carries a dynamic, positive and cheerful brand image, shaping buying behavior.
- Brand Perception: Incorporate fashion, diversity, and dynamism to enhance brand identity, recognition, and identification.
- Emotional Connection: Energetic colors generate excitement and enjoyment, increasing customer relationship.
- Recognition: The distinctive design facilitates swift recognition within a competitive market.
- Psychological Impact: Modernity and trendiness, appealing to consumer attitudes.
- Rebranding & Controversy: The logo attracts its offensive design, the rebrand was an indicator of flexibility and responsiveness to public opinion.

ASOS / H&M (Online Fashion Retail)

- Design Approach: Neutral backdrops put the spotlight on colorful clothing.
- CTAs and Banners: Red for a sense of urgency in promotions; pastels for seasonal promotions.

- Relevance: Color has a direct impact on product appeal and purchase intention.

Colour and Brand Strategy

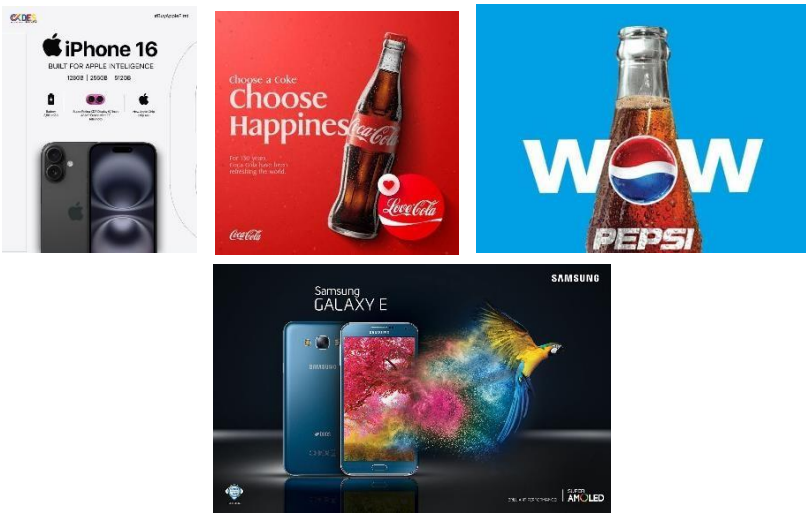

Figure 3: Colour and Brand Strategy

Coca-Cola vs. Pepsi

- Color Strategy: Red conveys energy, passion, and heritage for Coca-Cola.
- Blue creates feelings of serenity, trustworthiness, and novelty in Pepsi.
- Relevance: This study illustrates how heritage brands create emotional resonance through stable digital color usage.

Apple vs. Samsung (Technology Websites)

- Color Strategy: Simple white/grey to emphasize a clean product aesthetic shows the brand Apple.
- Recognition: Embracing strong contrasts for a dynamic and interactive brand experience, we see in Samsung.
- Relevance: Colour supports brand values and UX expectations.

Colour in Digital Advertising and Social Media Platforms

Color in digital advertising is a critical prompt for user engagement, emotional reactions, and brand awareness. High contrast and rich colors make advertisements stand out in cluttered social streams, engaging attention and increasing click-through rates (CTR). The strategic application of color can evoke emotions and render advertisements more relatable, while the consistent use of color across campaigns enhances brand recall.

The results indicate that specific colors, such as red, are likely to result in higher click-through rates (CTRs), while yellow can significantly enhance conversions when employed for call-to-action (CTA) buttons. This suggests that color psychology plays a crucial role in influencing consumer behavior and decision-making processes.

Social networking platforms strategically employ color schemes to effectively engage with their audiences. For instance, Instagram utilizes bold and visually appealing gradients to resonate with an active, youthful, and visually oriented demographic. Conversely, LinkedIn adopts soft, professional blue hues to communicate stability, reliability, and trustworthiness to business professionals..

Figure 4: Colour in Digital Advertising and Social Media Platforms

Instagram

- Vibrant and Eye-Catching: Instagram uses bold colors to enhance visually attracting stuff
- Gradients and Neon: Neon tones and vibrant gradients reflect their energetic, trending appeal
- Complementary colors: Schemes such as purple-red or green-orange boost visual harmony and appeal.

LinkedIn

- Professional and Muted: LinkedIn uses soft or low saturation tones and blue to maintain a business-focused aesthetic.
- Blue for Trust: Blue strengthens professionalism and reliability on its platform.
- Consistent Palette: A uniform colour scheme strengthens brand recognition and visual identity.

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Findings

The analysis indicates that color significantly influences the emotional perception and behavior of consumers within digital environments. Warm colors convey urgency and impulsive behavior, which are particularly impactful in e-tailing contexts, such as flash sales and the checkout process call-to-action (CTA). Conversely, cool colors foster trust and user loyalty, which are essential for services in sectors such as banking, finance, and healthcare. Furthermore, the use of color contrast in CTAs is crucial, as it has been proven to effectively attract consumer attention, enhance click-through rates, and facilitate seamless navigation throughout websites. Given the diverse backgrounds, cultures, demographics, and age groups of individuals, color preferences and influences vary, with some individuals favoring intense colors and others preferring subdued tones for professional purposes. However, poorly chosen or culturally insensitive color pairings can negatively impact engagement and trust. Overall, this study confirms that the judicious use of color enhances brand recall, web participation, and consumer satisfaction. Nonetheless, the study's focus on English-speaking participants and high-use online locations necessitates further, larger cross-cultural research to validate and extend these findings to non-Western countries.

Discussion

This research adds to the growing body of evidence indicating that color significantly influences consumer attitudes and behaviors in digital environments. In line with earlier findings, the results indicate that warm colors such as orange and red considerably intensify users' feelings of urgency and spontaneous decision-making, especially in e-commerce interfaces. Cool colors, blue and green, were better suited to enhancing trust and tranquility, especially in service or financial sites. Significantly, this study identified that color contrast, as opposed to hue, was a more powerful driver of user attention and interaction than hue. Elements of high contrast, such as highly colored call-to-action (CTA) buttons, increased legibility, and click-throughs, validate the role of visual hierarchy and contrast in the facilitation of online user behavior.

The theory behind these results is reinforced by psychological and sociocultural theories, such as the Ecological Valence Theory and Gender Schema Theory. These findings suggest that color choices are affected by emotional connotations as well as socialized expectations, proving

that the effect of color is not entirely primal but also influenced by summed-up personal and cultural experiences.

While this study offers valuable insights, it is not without limitations. The research predominantly concentrated on English-speaking participants and e-commerce platforms, which may not adequately represent global or industry-wide variations. Cultural interpretations of color, demographic differences, and platform-specific nuances could yield divergent outcomes. Future research should investigate these variables to further refine and contextualize the application of color in digital marketing strategies.

Conclusion

This study underscores the significant role of color in shaping online consumer behavior. The influence of colors on emotions and perceptions, as well as their capacity to enhance trust levels, create a sense of necessity, and lead to purchase intentions, has been documented through qualitative research. In the current year, color is not merely an element of visual aesthetics but is integral to online strategies in digital marketing and brand communication. For instance, blue or cool colors are often employed to convey trustworthiness or loyalty, whereas red is used to evoke urgency under specific conditions. Factors such as tradition, culture, demographics, and age contribute to individual perceptions and interpretations of color, highlighting the importance of aligning color strategies with specific market segments.

The study indicates that colors influence not only initial impressions or sensations but also extend to brand identity and affective relationships. Particularly in e-retail, color can replicate the sensory cues of physical stores, thereby enhancing engagement and loyalty. In a visually driven digital economy, color psychology is crucial in the design of digital screens or interfaces, as well as in branding for marketing and communication purposes. Future research should investigate cross-cultural differences and physiological responses to color to further develop strategic insights. When applied thoughtfully, color is not merely observed; it is experienced, remembered, and elicits responses.

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Layers of the Sublime: Deducing Transcendence in the Abstract images of Prabhakar Kolte

Amit Kalla, Research scholar | Dr. Kajal Thakuriya & Dr. Andre Rigatti, Professor
Department of Design Vivekananda Global University, Jaipur, India

Astract

This paper critically examines Prabhakar Kolte's abstract visual language, positioning his compositions within the broader discourse of Indian modernism and spiritual abstraction. Engaged with a semiotic and aesthetic framework, this study interprets Kolte's paintings as layered visual texts that enact transcendence through palimpsest surfaces, subdued chromatic fields, and intuitive gestural rhythms. His abstraction, marked by a tension between concealment and revelation, orchestrates the interplay between opacity and light that evokes the contemplative inwardness of Indian metaphysical traditions.

Drawing upon concepts such as prakriya (processual unfolding), shunyata (emptiness), and bindu (primordial point), this paper investigates how Kolte's paintings embody meditative praxis, where the surface becomes a space of becoming rather than resolution. His visual grammar echoes Western modernist influences—particularly Kandinsky, Paul Klee, and the Bauhaus-Kolte–departing from Eurocentric paths by rooting his abstraction in a tactile, sensorial idiom informed by indigenous philosophy and material culture. His use of layered pigments, erasures, and subtle geometric fragments creates a visual terrain that dissolves figure-ground binaries and invites a phenomenological experience of the sublime. Through close visual analysis, the study positions Kolte's work not merely within formal abstraction, but within a spiritual semiotics that articulates the unspoken dimensions of existence. Furthermore, the paper situates his practice within postcolonial aesthetic debates, challenging reductive comparisons and asserting the need for culturally grounded readings of Indian abstraction. Ultimately, this inquiry reveals Kolte's canvases as dynamic sites of transcendental engagement—where abstraction serves as a conduit for silence, stillness, and the sacred.

Keywords: *Prabhakar Kolte, Indian abstract painting, transcendence, spiritual abstraction, semiotics, phenomenology, Indian modernism, postcolonial aesthetics, metaphysical symbolism, visual language*

Introduction:

Prabhakar Kolte a significant and multifaceted position in the narrative of Indian abstract painting, mainly within the evolving path of post-independence Indian modernism. Developing from the vibrant ideologically charged artistic setting of the 1970s and the 1980s when Indian artists actively transformed identity, form, and global modernity Kolte developed a new visual language that knowingly struggles with direct depictive semantics. His paintings exceed the limits of language connotation, instead offering space for philosophical introspection and sensory engagement. Although his work is often persuasively affiliated with the Western modernist legacy drawing comparisons to Paul Klee and the abstract formalism of the Bauhaus, this explanatory lens remains insufficient and, at times, reductive. Kolte's aesthetic inquiry is not merely an imitative delay of Eurocentric abstraction but somewhat a profound reply to the ontological and material situations of being in a postcolonial, multicultural India.

His layered canvases, saturated with indefinable color fields, covered rubbles, and disrupted textures, evoke a kind of spiritual landscape, where emptiness (shunyata), presence, and falling-out coexist in dynamic tightness. These formal elements are not simply stylistic or nominal apprehensions but serve as visual metaphors for the processes of becoming, dissolution, and transcendence. The traces, scars, and veils within his paintings invite meditative contemplation, Similar to Tantric drawings or Zen-infused minimalism, yet remain distinctly anchored in his personal, cultural, and spatial context. This paper questions the abstract and semiotic proportions of Prabhakar Kolte's intellectual visualizations, situating them within the larger frameworks of spiritual abstraction, Indian metaphysical aesthetics, and post-colonial modernity. By doing so, it aims to reposition Kolte's work beyond the reductive in between of East contrasted with West, tradition compared with modernity, and instead centre his practice as a site of deep philosophical inquiry and aesthetic autonomy

Identified Research Gap

While existing scholarship on Indian modernist abstraction has extensively explored formalism, materiality, and the socio-political contexts of painters like Prabhakar Kolte, there remains a notable lacuna in understanding his work through the prism of transcendental aesthetics and indigenous metaphysical thought. Most art historical analyses tend to emphasize Kolte's relationship to global abstraction or his formal lineage with Paul Klee, yet few have

ventured into interpreting the layered silences and evanescent gestures in his canvases as vehicles of the sublime or as resonances of Vedantic, Upanishadic, or Tantric conceptual worlds. This study, therefore, seeks to address this gap by proposing a contemplative reflection one that extracts how Kolte's abstract surfaces do not merely represent visual abstraction, but appeal wholeness, suspension, and sacred temporality.

Though Kolte's abstract practice has been mounted within formal modernism and global abstraction, deficient attention has been given to the metaphysical and transcendent dimensions of his work. This research addresses that gap by reading his visual language through Indian philosophical frameworks Vedanta, Tantra, and aesthetic rasa, thereby present a new interpretation of his abstract surfaces as contemplative thresholds.

Literature Review:

Existing scholarship on Prabhakar Kolte has largely focused on his contributions to formal aesthetics and art pedagogy, with frequent references to stylistic affinities between his visual idiom and that of Paul Klee. His long association with the Sir J.J. School of Art has reinforced his position within the institutional discourse on Indian modernist abstraction. While influential critics such as Ranjit Hoskote, Nancy Adajania, and Geeta Kapur have extensively theorized Indian abstraction through postcolonial and cultural lenses, the symbolic and spiritual dimensions of Kolte's abstract practice remain insufficiently explored.

Foundational texts like *Indian Contemporary Art: Post-Independence* and Geeta Kapur's *When Was Modernism?* have been instrumental in framing Indian abstraction as a critical space where colonial inheritances and indigenous metaphysical thought converge. These studies interpret abstraction not simply as a stylistic departure from Western art, but as a strategic aesthetic mode rooted in philosophical traditions like Advaita Vedanta and Tantra. Yet, within such frameworks, Kolte is frequently positioned within a formal lineage of abstraction rather than examined through a more nuanced symbolic, phenomenological, or metaphysical reading. Engaging international theoretical paradigms can offer new pathways for interpreting the latent meanings within Kolte's visual language.

For instance, Wassily Kandinsky's *Concerning the Spiritual in Art* (1911) articulates the idea of "inner necessity" and abstraction's spiritual functions, concepts that deeply resonate with

Kolte's atmospheric layering and chromatic subtlety. Susan Sontag, in *Against Interpretation* (1966), critiques the dominance of content-driven analysis and proposes a shift toward affective, experiential readings as an approach that aligns well with Kolte's intuitive, non-representational compositions. Additionally, Vilém Flusser's theory of the "technical image" as a vehicle for abstract reasoning and existential reflection enables a reading of Kolte's work as a form of visual ontology—painting as a meditation on being itself.

A crucial, though often overlooked, vernacular perspective is offered by *Chinha* (चिन्ह), the Marathi-language art journal edited by Satish Naik. The 2006 essay *Kolte Bolte Jhale* ("And Kolte Spoke"), authored by Kolte and edited by Naik, provides rare and valuable insight into the artist's own reflections on form, intuition, and process. Naik's editorial commitment to amplifying marginalized strands of Indian modernism—particularly through his efforts to revive *Chinha* after the passing of Vasudeo Gaitonde—positions the magazine as a significant yet under-recognized archive of alternative modernist voices. His sustained attention to artists like Kolte affirms the critical role of regional-language platforms in shaping the broader discourse on Indian art history, especially in relation to the symbolic and spiritual layers of abstraction.

To truly engage with Kolte's oeuvre, one must approach his abstraction not merely as an aesthetic arrangement, but as a metaphysical invocation. His compositions—where pigment, spatiality, and material dissolve into meditative stillness—invite a mode of interpretation grounded in contemplative aesthetics. This study proposes a framework that synthesizes semiotic theory, art historical method, and Indian philosophies of perception to uncover how Kolte's paintings serve as complex articulations of transcendence, visual manifestations of the sublime as experiential, intuitive, and spiritually resonant phenomena.

Review of Literature: Layers of the Sublime in the Abstract Images of Prabhakar Kolte

Author(s)	**Year**	**Title / Source**	**Key Themes**	**Relevance to Study**
Kapur, Geeta (Ed.)	2000	*When Was Modernism*	Indian modernism, postcolonial critique, abstraction	Frames abstraction as a complex postcolonial negotiation; positions Kolte

Author(s)	Year	Title / Source	Key Themes	Relevance to Study
				within a formal and conceptual lineage of Indian modernists.
Hoskote, Ranjit	1996	*Multiple critical essays* (various publications)	Postcolonial aesthetics, Indian abstraction, modern art	Places Kolte within Indian modernist discourse; focuses more on formal strategies than on metaphysical or spiritual readings of abstraction.
Adajania, Nancy	2009	*Essays in art criticism* (various publications)	Contemporary Indian art theory, cultural translation	Engages abstraction critically; does not foreground Kolte's spiritual or metaphysical concerns, but helps frame cultural context.
National Gallery of Modern Art	2002	*Indian Contemporary Art: Post-Independence*	Modern Indian art, abstraction post-1947	Contextualizes the rise of abstraction in post-independence India; includes Kolte among modernists, though spiritual symbolism remains underexplored.
Kandinsky, Wassily	1911	*Concerning the Spiritual in Art*	Inner necessity, spiritual abstraction	Foundational text linking spirituality and abstraction; provides theoretical grounding for interpreting Kolte's metaphysical visual language.
Sontag, Susan	1966	*Against Interpretation*	Sensory perception, critique of content-based interpretation	Advocates for affective, perceptual engagement with art; supports non-literal, experiential readings of Kolte's abstract paintings.

Author(s)	Year	Title / Source	Key Themes	Relevance to Study
Flusser, Vilém	1983	*Towards a Philosophy of Photography* (translated)	Technical image, existential abstraction	Offers tools to read Kolte's images beyond form—as metaphysical or ontological surfaces that exceed representation.
Naik, Sanjay (Ed.) & Kolte, Prabhakar	2006	*Kolte Bolte Jhale* in *Chinha* (Marathi)	Artist's voice, intuition, process, vernacular discourse	Critical insider perspective into Kolte's practice; this regional source captures his intuitive methods and metaphysical inclinations through interviews.

The primary objective of this study was to decode the articulation of transcendence in Prabhakar Kolte's abstract images through a semiotic and aesthetic lens. The study aims to:Examine how Kolte's formal strategies layering, erasure, color harmonics, mediate spiritual and metaphysical themes.Contextualize his work within Indian philosophical frameworks such as shunyata, prakriya, and bindu.Analyze the spiritual semiotics inherent in his abstraction.Situate his practice within the discourse of Indian modernism and postcolonial art historiography.

Research Methodology

This research adopts a qualitative, interdisciplinary methodology that weaves together art historical analysis, semiotic inquiry, and aesthetic-philosophical reflection. Rather than treating Prabhakar Kolte's works merely as static visual compositions, the study approaches them as dynamic fields of meaning with visual texts that articulate through gesture, silence, and spiritual suggestion. At its center lies a focused visual engagement with a curated body of Kolte's paintings. These are examined not only through formal parameters such as compositional structure, chromatic layering, spatial flow, and rhythm, but also through the affective and phenomenological responses they elicit.

Central to this inquiry is a close interpretive lens attuned to the micro-gestures, abstract motifs, and material surfaces that comprise Kolte's painterly idiom. A hermeneutic framework supports this visual reading, aimed at unveiling the symbolic and metaphysical threads embedded within his abstraction. Theoretical concepts such as *shunyata* (void), *bindu* (primordial point), and *prakriya* (emergent unfolding) drawn from Vedantic and Tantric traditions which are mobilized to elucidate the spiritual strata of Kolte's imagery. His canvases are approached as layered, meditative texts, rich with echoes of both individual interiority and collective cultural memory.

Additionally, the research conducts a comparative aesthetic analysis, placing Kolte in dialogue with broader traditions of abstraction, both Indian and Western. While aesthetic resonances with figures like Paul Klee and Wassily Kandinsky are acknowledged, the study also highlights how Kolte's abstraction diverges from Euro-American lineages by rooting itself in indigenous philosophical sensibilities and a palpable engagement with material presence.

To anchor these readings, the study draws upon an array of contextual resources. These include primary materials such as artist interviews, curatorial writings, exhibition catalogues, and visual documentation, as well as a wide spectrum of secondary literature—ranging from critical essays to philosophical and theoretical treatises. These sources serve not as mere background, but as integral threads in the interpretive fabric that situates Kolte's work within the larger discourse of Indian modernism and global contemporary art.

Ultimately, this methodology refuses to position theory and image, word and pigment, or tradition and innovation in binary opposition. Instead, it sees them as interrelated forcesengaged in a reciprocal dialogue that deepens the understanding of an artistic practice poised at the convergence of the sensual and the sacred, the abstract and the transcendent.

Analysis

Kolte's canvases are not merely abstract compositions; they are meditative terrains—fields of contemplative experience where silence becomes syntax. His use of layered pigments, carefully muted chromatic fields, and partially submerged geometric intrusions constructs a rhythm of emergence and erasure, an eternal pulse of construction and deconstruction. This cyclical process of veiling and unveiling is not merely formal—it echoes the **Vedantic notion of** *prakriya*, the unfolding of reality as a dynamic and recursive movement.

In this sense, Kolte does not paint images; he cultivates atmospheres of becoming. His surfaces often feature obliterated forms, half-remembered textures, and ephemeral shadows that hint at presence and absence simultaneously. These elements embody the concept of ***shunyata*** emptiness not as void, but as fertile potentiality. The frequent appearance of centralized or diffused nodal forms can be interpreted as ***bindu,*** the cosmic seed from which both form and formlessness arise in Tantric and Yogic metaphysics.

To deepen this hermeneutic encounter, a poem composed in response to Kolte's work offers an evocative voice that mirrors the very ethos his paintings evoke:

(*"Layer upon layer, a certain sorrow lingers*
remnants woven in the memory of color,
as if even silence might find a body,
and time—only seeps through the strata…")

This verse captures the haunting temporality and embodied silence that Kolte's canvases invoke. The reference to "रंग की स्मृचि" (the memory of color) resonates directly with Kolte's use of subdued palettescolors that feel remembered rather than applied, aged rather than immediate. The idea that "even silence might find a body" reflects the very nature of Kolte's paintings as phenomenological surfaces—interfaces where the viewer is drawn into a deeply introspective experience. These are not images to be "read" but atmospheres to be **felt,** like subtle energies in yogic pratyahara—withdrawal of the senses not into absence, but into a richer interiority.

His abstraction, while sharing certain affinities with the European legacies of Paul Klee or Wassily Kandinsky, departs from Eurocentric paradigms by rooting itself in **material sensibility** and a **distinctively Indian metaphysical vocabulary**. Kolte's layered pigments are not just gestures of aesthetic play but carriers of metaphysical significance. They act as visual metaphors for the slow unfolding of awareness, much like the silent blooming of the *bindu* into form.

Thus, the analysis of Kolte's work cannot be confined to stylistic taxonomies or linear historical genealogies. It demands an affective, poetic, and metaphysical approach—one that recognizes that his canvases operate as **zones of silence, echoes of sacred breath**, and **palimpsests of the**

unseen. As the poem suggests, in Kolte's paintings "time... seeps through the strata." Indeed, his works are not merely visual fields—they are meditative acts, where **color becomes memory, form becomes vibration, and the void becomes presence**.

Significance of the Study

This study contributes to the broader understanding of Indian abstraction by foregrounding its spiritual and semiotic dimensions, especially in the work of a relatively under-theorized figure like Prabhakar Kolte. It challenges the dominance of Euro-American paradigms in the study of abstraction, and calls for an epistemologically plural approach. The research also provides a framework for interpreting non-representational art in postcolonial contexts, where modernist language coexists with indigenous philosophies and cultural memory.

Conclusion

Prabhakar Kolte's abstract visual lexicon does not dwell in muteness. It pulses with a quiet, persistent resonance, echoing the metaphysical dimensions of Indian philosophical consciousness. His canvases, though apparently quiet, express a profound interiority; they speak in the hushed tongue of the sublime, invoking states of awareness that lie beyond verbal articulation. Through his persistent assignation with surface, texture, and chromatic limit, Kolte constructs a meditative visual field that challenges rigid dichotomies often imposed by art historical dialogue - be it East versus West, tradition as opposed to modernity, or figuration versus abstraction.

Rather than conforming to a binary aesthetic schema, Kolte's abstraction emerges as a visual sadhana, a spiritual practice where the interplay of concealment and revelation, opacity and luminosity, matter and void, orchestrates an introspective journey. His surfaces, layered and often overwritten are not merely sites of formal innovation, but sourses through which the ineffable finds form. Here, color does not describe; it appeals. Form does not represent; it dissolves and re-forms, much like the variability of consciousness itself.

This inquiry has aimed to reposition Kolte not merely as a formal abstractionist within the canon of Indian modernism, but as a thinker in paint—an artist who invokes indigenous metaphysical concepts like *shunyata*, *prakriya*, and *bindu* as structuring forces within his visual compositions. By embedding these spiritual-symbolic elements within his abstract idiom, Kolte

creates a pictorial space where the viewer is not just a spectator, but a contemplative participant. His canvases, thus, function as thresholds—openings through which the sacred, the silent, and the subtle find expression.

In conclusion, Kolte's contribution to Indian modernism lies not solely in his pedagogical legacy or stylistic innovation, but in his ability to construct an abstract language that sustains a phenomenological and metaphysical inquiry. His work embodies a uniquely Indian abstraction—rooted in lived philosophy, attuned to silence, and alive with the potential of transcendence. By centering inwardness as both method and meaning, Kolte reclaims abstraction not as aesthetic retreat but as a sacred field of becoming.

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Designing Phonimo: A Tangible Learning Tool for Phonemic Awareness in Early Education

Nikitha Tadigadapa | Shivani Varade | Dr. Ravindra Bachate

School Of Design, MIT Academy of Engineering, Alandi, Pune, Maharashtra, India

Abstract

This study explores the role of tangible interaction in addressing persistent challenges in early phonics instruction, such as rote memorization, inconsistent pedagogy, and limited student engagement, particularly within the Indian educational context. Using a qualitative approach, semi-structured interviews were conducted with early childhood educators to understand existing teaching practices, identify instructional gaps, and inform the design of *Phonimo*, a tangible user interface (TUI) for phonics learning. The system integrates physical letter blocks, copper conductor plates, and a Raspberry Pi to provide real-time auditory feedback, supporting phoneme recognition, sound blending, and word construction through hands-on exploration.

Findings highlighted a significant demand for multi-sensory, hands-on tools that actively engage children in literacy learning while catering to different learning preferences. Educators pointed out the shortcomings of conventional and screen-based approaches in developing phonemic awareness. *Phonimo* fills these gaps by providing an interactive, student-centered experience that strengthens essential literacy skills through tactile engagement and instant audio feedback. This research adds to the expanding literature on tangible interaction and early childhood education, showcasing the promise of physical-digital hybrid systems to improve literacy outcomes and redefine phonics teaching in various learning contexts.

Keywords: *Early Childhood Education, Early Literacy Development, Tangible User Interface (TUI), Multisensory Learning, Interaction Design for Education.*

Introduction

The fundamental skill for early literacy is phonemic awareness, which is the ability to hear, recognize, and manipulate individual sounds in spoken words. It lays the groundwork for children to read and write fluently by teaching them to connect written symbols with sounds. Building on this, phonics instruction maps approximately 44 distinct sounds in the English

language to their corresponding letters or phonemes. This approach supports both verbal communication and reading comprehension by helping learners decode new words and create meaning more quickly.

Problem Statement

In India, varied teaching methods, lack of standardized curricula, and an excessive dependence on rote memorization frequently hinder early phonics instruction, despite its importance. Worksheets, blackboard repetition, and screen-based content are instances of passive teaching methods that are frequently used in classrooms but fail to engage students or meet their developmental learning needs. These methods fall short in providing meaningful, multisensory, and learner-centered phonological awareness support. Because of this, young students usually find it difficult to connect to abstract phonemic concepts, which has an impact on their confidence and memory.

Objectives

This research aims to investigate how tangible interaction can address the key challenges in phonics teaching through the design and development of *Phonimo*, a tangible phonics learning tool. The study explores *Phonimo's* potential to improve early literacy instruction by converting abstract phonemic concepts into practical and hands-on learning experiences. It offers a multisensory and learner-focused approach alternative to the conventional and screen-based approaches that exist. The objective is to evaluate whether *Phonimo* strengthens student engagement, retention, and understanding of early literacy methods like phonics better.

Related Work

Phonemic awareness and phonics instruction are the two essential elements of early literacy development in learners. Research shows that phonemic awareness is a foundational skill for reading and writing fluently, while phonics instruction enhances decoding skills effectively [2]. However, early phonics instruction is still not practiced in India and faces significant challenges. Challenges in phonics instruction include inconsistent teaching methods, no standardized curricula, and the limitations of rote memorization techniques, and student engagement issues, which are related to passive instructional methods such as worksheets and textbook learning and reading [3]. On the contrary, multisensory and hands-on approaches have been shown to offer significant advantages for phonics instruction. Studies show effective

outcomes with multisensory, tactile, and kinesthetic phonics activities, and research supports the effectiveness of it to cater to different learning styles of learns, making it a standardized approach for all types of learners [4]. Tangible user interfaces (TUIs) have become a promising tool in early childhood literacy and education, as children learn better with practical hands-on experiences than the passive methods. Literature on TUIs for literacy development underlines their potential to make the learning methods more practical and support active and learner-centered learning. Research has shown that the efficacy of physical-digital hybrid systems improves learning outcomes [5].

While tangible interfaces show advantages for learning through hands-on, multisensory experiences, their efficacy has not yet been established or tested between different age groups. Moreover, their successful implementation would depend on their alignment with different learning goals and their adaptability to different learning styles [6]. Constructivist and Montessori learning theories have often been applied to early literacy instruction, experiential and self-taught learning for young learners. Research has also studied the application of these theories to phonics instruction, significantly highlighting their potential to improve learning outcomes [7].

Systematic phonics instruction is recognized as an effective approach for teaching novice learners, emphasizing letter-sound correspondence and its application in reading and spelling. However, alternative methodologies, including whole-language programs, basal programs, and sight word programs, have also been employed in reading instruction, each characterized by distinct methods and focal areas [8]. The incorporation of technology in early literacy instruction has been extensively researched, with studies examining the appropriate use of technological tools for young learners and exploring strategies to balance digital and traditional learning modalities. This research endeavors to optimize the utilization of technology in supporting early literacy development. Although existing research has underscored the significance of phonemic awareness and phonics instruction in early literacy development, there remains a notable gap in investigating the efficacy of tangible user interfaces (TUIs) specifically for phonics instruction within the Indian context. There is limited research on how TUIs can address the challenges faced in early phonics instruction in India, such as inconsistent teaching methods and engagement issues. However, hands-on and multisensory approaches of phonics instruction have been presented to be effective, and tangible user interfaces (TUIs) have promising uses in early childhood education.

Furthermore, while Constructivist and Montessori learning theories have been applied to early literacy instruction, their integration with TUIs for phonics learning has not yet been explored. This gap presents an opportunity to examine how TUIs, built upon these learning theories, can enhance phonics instruction and potentially overcome the limitations of traditional teaching methods in the Indian educational system.

Methodologies

This study used a qualitative methodology, gathering detailed information through semi-structured interviews with six early childhood educators. This method was chosen to examine perspectives on the use of new learning tools, instructional challenges, and real-world classroom experiences of educators, areas that structured quantitative surveys might not adequately capture. With a focus on those who worked with *children ages 3 to 8,* the participants were chosen based on their teaching experience, which ranged from *3 to 15 years*. Email invitations were used for recruitment, and phone calls were used for confirmation.

Semi-structured interviews with a set of questions focused on current phonics teaching methods, difficulties in phonics instruction, and teachers' willingness to use hands-on tools for early literacy were used to collect data. Depending on the convenience of the participants, the interviews were conducted both in-person and online. Each session lasted *30 to 45 minutes.* With the participants' permission, all interviews were audio recorded, and to ensure accuracy for further analysis, precise transcriptions were made.

A thematic analysis approach was used for analyzing the data. Key points were highlighted and coded to identify recurring themes as the interview transcripts were read line by line. To identify more general themes, such as instructional difficulties, gaps in teaching strategies, learner needs, and teachers' opinions of using physical tools, similar codes were then grouped. The results were verified via comparison of notes and codes across transcripts to ensure consistency and clarity.

Results

Several significant themes regarding the difficulties of teaching phonics and the potential benefit of hands-on aids to address them were identified from qualitative data acquired from interviews with early childhood educators. Below is an outline of these themes.

Inconsistent Phonics Pedagogy

The inconsistent nature of early phonics instruction was a common theme in the interviews. The methods used in various schools to teach phonics varied significantly. Since there was no official phonics curriculum, various educators developed their own techniques or used techniques they found online. A common method was rote learning, in which learners mimicked the teacher's sounds or songs without really understanding the content. Although this method is prevalent and user-friendly, it resulted in inconsistent instructions. Consequently, learners frequently encountered difficulties in advancing from mere recognition of letters to the blending of sounds to form words, thereby affecting their development of phonemic awareness and literacy.

Limited Availability of Hands-on Learning Tools

Educators frequently observe that, despite the recognition that children learn most effectively through play and exploration, there is a notable lack of resources in classrooms to support this mode of learning. The main method of teaching phonics remains majorly auditory, often relying on worksheets, blackboard repetition or oral explanation. Teachers are concerned that digital resources, such as tablets or videos, are often too distracting, but are still occasionally utilized. Young learners, especially those who would benefit from practical and hands-on learning tools, often require tactile and multisensory engagement, which digital resources often fail to provide.

Challenges in Student Engagement

A main challenge highlighted by educators is keeping young learners focused and engaged. Educators highlighted that the teaching methods relying on repetition or abstraction, especially those which do not have any sensory components, frequently fail to keep children engaged. Moreover, the absence of contextual relatability is identified as a notable contributing factor; learners are introduced to letters and asked to identify corresponding sounds without connecting them to real-life examples, thereby complicating understanding. The abstract nature of this approach has hindered learners' ability to apply their knowledge in meaningful and day to day ways, consequently reducing both understanding and retention.

Educator Interest in Tangible Tools

Educators are confident that tangible tools can improve phonics instruction it can the hands-on tools can improve learners' confidence in reading and writing and also help improving stronger word-sound association. The integration of the touch sound feedback features often encourages learners to self-explore and keeps them engaged. Educators also highlighted that having multisensory tools like *Phonimo* would also make classrooms more accessible for children who struggle to understand using the conventional teaching methods.

The interview findings highlighted three major challenges in the phonics instruction in India like inconsistent teaching methods, limited hands-om resources and poor learner engagement. They also showed interest in using tangible tools with multisensory features in their lessons. The instructional outcomes of *Phonimo* are discussed in the following section and also has an overview of how it can be an effective solution to these challenges and how it can improve early literacy instruction in the Indian context.

Discussions

The interview findings confirmed that there is a need for more standardized approach to phonics instruction in India as the concepts are very abstract and based on rote-memorization and vary from place to place. If a standardized approach is implemented it will ensure that children from different schools and backgrounds get the phonics instruction. Educators' strong interest in using hands-on, multisensory tools highlights the potential of tactile tools in reducing the limitations of passive learning methods. Children's phonemic awareness and sound-to-letter associations can be improved through the interactive and engaging experiences that tangible materials may provide. Building on these insights, it becomes obvious that theoretically sound and child-friendly tools would be helpful for early phonics instruction. This study identifies *Phonimo*, a tangible phonics learning system, as a way to address the identified gaps, such as inconsistent teaching methods, a lack of multisensory engagement, and challenges in student engagement. *Phonimo*, specifically designed for young learners, changes abstract phonemic concepts into interactive, engaging experiences. The concept behind the design, structure, and potential classroom impact of this system is explained in the following section.

Conceptual Framework

Phonimo is built on Constructivist and Montessori-based teaching theories, which highlight the

importance of self-taught, experience-based learning in the cognitive development of young learners. By using interactive, multisensory experiences, *Phonimo* aims to make abstract, unclear phonemic concepts concrete and meaningful forms, inspired by Montessori's sensory learning methods. The tool facilitates the natural developmental processes through which children acquire foundational literacy skills by integrating visual reinforcement, auditory feedback, and physical manipulation. The system contains letter blocks which are equipped with copper conductor plates are then embedded with a unique 5-bit binary pattern, which enables precise detection and identification of each letter when it interacts with the conductive base, which contains the corresponding copper conductor plates. A Raspberry Pi which is embedded in the system processes the electrical signals generated during placement, then activating the corresponding phonemic audio output through the speaker and displaying the letter on an LCD screen. As students arrange the blocks in a sequence, the system combines the individual phoneme sounds to form simple words while guiding students to blend letters. When a word is formed correctly, there are auditory and visual feedbacks, highlighting and celebratory icons, which in turn reinforces the learnings, which in-turn enhances phonemic awareness using a multisensory feedback loop. Early childhood educators identified significant instructional challenges, like inconsistent teaching methods, very limited access to hands-on and tactile resources, and difficulties keeping students engaged. These difficulties are dealt with by the multisensory feedback, which combines tangible input which is the block handling, auditory help which is the phoneme playback, and the visual reinforcement which is the letter and celebratory icons on the LCD screen. By encouraging hands-on, student-centered learning, *Phonimo* offers an alternative to screen-dependent techniques and rote memorization. In early education settings, its integration of carefully designed hardware and software components aims to cater to diverse learning needs.

System Architecture

Phonimo is supported by the hardware and software features that help make it an multisensory tangible tool. This section talks about the hardware and software tools that make it effective hands-on tool for young learners.

Hardware Components

- It has the Raspberry Pi 5 which is the central processing unit of the system it manages the display, speaker system and also facilitates the software.

- Copper conductor plates are embedded into the individual letter blocks and have a unique 5-bit binary pattern, which assigns each block a distinct identity and helps the precise detection of each letter.
- The speaker system offers auditory feedback when a letter is placed on the base or when a word formed which reinforces the learning.
- The LCD screen shows the letters and words as they are placed on the base and also shows celebratory icons when the learner guess or forms the right word, which is another layer of visual reinforcement.

Software Components

- The letter detection and auditory feedback is aided by the Gemini API that the system uses, which precisely identifies the letter using the unique binary pattern embedded in the blocks. The association between letters and sounds is reinforced by audibly playing the corresponding phoneme via Google Text-to-Speech (gTTS) following detection.
- Phoneme Blending: When multiple blocks are placed, Gemini detects the binary patterns and blends the individual phoneme sounds to form syllables or words.
- Word Recognition and Feedback: If a complete, valid word is detected, the system gives immediate feedback; if there are any errors, the system encourages correction.
- Visual Feedback System: As each letter block is placed, the LCD screen updates in real time to the corresponding letter with correct visual cues.

Key Interactions

- Placing the Letter Blocks: Learners place the letter blocks onto the base unit. Each letter block has a unique binary pattern, allowing the system to detect the letter precisely.
- Instant Audio Feedback: As soon as the block is detected, the system plays the corresponding phonics sound of the letter, reinforcing the phoneme-sound connection.
- Sequential Letter Blending: When multiple letter blocks are placed together, the system blends the phonemes to create meaningful words to effectively show how sounds combine into words.
- Real-Time Visual Display: The LCD screen shows the letters as they are placed, helping learners visualize the words being constructed.
- Word Recognition and Celebration: If a complete word is formed, the system provides celebratory cues and positive reinforcement.

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- Gentle Error Feedback: If an invalid sequence of letters is detected, the system gives gentle error feedback to encourage correction without discouragement.
- Encouraging Replay and Exploration: The intuitive physical setup invites repetition, encouraging the learner to explore different letter combinations to improve through trial and play.

Figure 1 & 2: Top and perspective views of the Phonimo prototype, showing its modular tile arrangement, letter input blocks, and integrated feedback elements.

Pedagogical Implications

Phonimo encourages learners to actively engage with the subject through hands-on exploration, which is rooted in *constructivist* learning principles. It fosters multisensory learning by combining sight (observing the structure of words), sound (hearing phonemes), and touch (manipulating letter blocks), each of which is influenced by *Montessori learning*. By supporting memory retention, enhancing phonemic awareness, and accommodating a variety of learning preferences, this integration increases the effectiveness and inclusivity of early literacy.

Phonimo is intentionally designed to cater to an array of learning preferences, to ensure that no learner is left behind because of a mismatch in instructional style:

- Kinesthetic Learners: The physical manipulation of letter blocks supports kinesthetic learners by allowing them to make use of their motor skills throughout the learning process.
- Auditory learners benefit from immediate auditory feedback as each block is placed, which enhances their ability to recognize phonemes.
- The optional LCD facilitates visual learners in identifying symbols and constructing

words by enabling them to observe the formation of letters and words.

Young learners having diverse cognitive and sensory strengths may benefit from this accessible, engaging, and effective phonics instruction method due to its multisensory approach, which aligns with inclusive teaching practices. Tangible User Interfaces (TUIs) have the ability to efficiently and effectively change the traditional teaching methods, as it is shown by the designing of *Phonimo.* TUIs can help with providing children more hands on and engaging learning experiences that can align with how young listeners understand and comprehend information with their natural learning style, in turn providing a dynamic rather than the traditional passive instruction. TUIs provide a lot of opportunities for self-taught and experiential learning and also are very engaging and can significantly improve phonics instruction in India. The interactive and practical features of tangible tools like *Phonimo* can improve, letter recognition, reading and writing confidence and help make abstract concepts into strong phonemic sounds. TUIs can adapt to varied curricula, languages, and student and learner needs, in both under-resourced schools and well-equipped institutions. For successful implementation of TUIs in education a careful consideration is required in terms of cost educator training and curriculum integration, making sure that tools like *Phonimo* can remain scalable, accessible, and sustainable in real-world environments.

Summary

The research identified significant challenges in phonics instruction in schools in the Indian context. These challenges identified were inconsistent teaching methods, a lack of dynamic hands-on tools, and difficulties poor learner engagement during lessons. Educators also underlined the drawbacks and limitations of passive instructional methods and rote-memorization, which established the need for interactive, multisensory instructional tools that can support the natural learning styles of young learners, this feedback highlights the importance of tangible teaching resources to improve the efficacy, effectiveness, retention, and accessibility of phonics teaching. Educators agree that incorporating tangible and auditory feedback into teaching can significantly improve learner's phonemic awareness and comprehension. *Phonimo* was designed and developed as a TUI, which transforms abstract symbols into concrete phonemic concepts, engaging interactions. It offers a learner-centered approach which will potentially improve early literacy instruction.

Limitations

The study has certain limitations despite its offering insights about the current state of phonics instruction in India and benefits of tangible tools in phonics instruction. The participant pool only comprised of six early childhood educators, which does not necessarily depict the diversity of phonics instruction and teaching experiences across different locations and educational systems. Furthermore, the research's heavy dependency on qualitative interviews makes it difficult to generalize the findings. The practical assessment of *Phonimo* was confined to informal feedback, and there was no structured classroom implementation or systematic observation of the data. These limitations suggest that, despite the initial results being promising, further validation is required to confirm the tool's effectiveness in real life.

Some future research that recruits teachers from diverse demographics, like educators who work in rural and under-resourced settings, and also educators who work in multilingual settings, where instruction comes with its own set of challenges, could also be beneficial. Comparative studies on TUIs can also help understand how to optimize the design decisions for tangible tools like *Phonimo.* Furthermore, there is potential to assess how *Phonimo* can be integrated into the existing curriculum and aid the current phonics instruction in schools. Future considerations for upgrades to *Phonimo* could include multilingual support, adjustable difficulty levels based on learners' capacity and understanding, and a teacher dashboard or app that enables educators to track learners' progress. In future there could also be the integration of Augmented Reality (AR) which makes phonics instruction accessible in hybrid and remote environments.

An in-depth study is required to understand how TUIs can effectively help in improving early literacy programs. The study needs to have a more standardized approach and should observe children over a period of time to observe the improvements in their confidence, self-esteem. The study should also compare both the traditional phonics instruction methods and the TUI aided ones, the findings will help clearly identify how TUIs can be beneficial and help identify the gaps if there are any and tell the scope for future improvements.

Conclusion

The study is now the part of the ever-growing body of research about TUIs in education, it has helped identify the three major challenges in phonics instruction in India insufficient hands-on

resources, lack of a standardized approach for instruction and the poor student engagement.

The findings highlight that TUIs are one of the most effective ways to improve phonics instruction as they bridge all these gaps. *Phonimo* applies the Constructivist and Montessori learning theories, which help children learn phonemic concepts from experiential learning. This instructional approach can cater to diverse natural learning capabilities of learners. Tools like Phonimo can help in improving learners' comprehension and also help learners who struggle understanding using conventional methods.

The research also asks educators and curriculum planners to use TUIs in diverse educational contexts and see the improvements. It also suggests that tangible tools can make education more adaptive to different learning needs of learners. Involving these tools can help make the classrooms more welcoming and learner-centered.

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Clario: An AI-Powered Focus Assistant to Combat Cognitive Fatigue and Digital Distractions in Late Adolescent Learning

Komal Sonone | Mrunmai Bhogawade | Dr. Ravindra Bachate

School of Design, MIT Academy of Engineering, Alandi-Dehu Phata, Pune

komal.sonone@mitaoe.ac.in | mrunmai.bhogawade@mitaoe.ac.in | bachateravi@gmail.com

Abstract

The present research delves into the incorporation of artificial intelligence (AI) in learning to mitigate issues of cognitive fatigue and digital distractions that are normally encountered by late adolescents. With heightened demands made on students' focus in high-stimulation learning environments, the study presents Clario—a focus assistant based on AI that utilizes computer vision, emotion detection through facial expressions, and voice commands to provide instant feedback to improve concentration and motivation. A mixed-method approach was employed, involving qualitative interviews and user journey mapping with six participants and quantitative analysis via 140 students using surveys and performance measures. The experimental environment provided students with the ability to study in their natural settings while Clario worked in the background, presenting adaptive interventions like distraction warnings, mindfulness reminders, and break reminders. Outcomes indicate a significant decrease in cognitive tiredness, better concentration, and a considerable drop in digital diversions.Students reported feeling more active and possessing a more structured study routine. The study demonstrates the potential of AI not only in adapting learning experiences but also in actually helping learners achieve extended attention. The results are further evidence for the growing body of evidence to endorse the utilization of intelligent, context-sensitive technology in education, particularly in the arts where mental stamina and flow are crucial. Future research will also study long-term changes in behavior, ethical consequences of tracking, and better personalization using adaptive learning algorithms.

Keywords: *Artificial Intelligence, Adolescent Learning, Cognitive Fatigue, Digital Distraction*

Introduction

Teenagers today find it difficult to stay focused for long durations since they are bombarded by digital distractions around the clock. Ongoing notifications, endless video material, and continuous access to devices significantly interfere with their ability to focus and frequently

siphon away their drive. Not only are such distractions disruptive to concentration, but they also cause cognitive fatigue—a state of being mentally exhausted, processing information more slowly, and with less memory capacity. Thus, learning is made less efficient and all-round well-being is threatened. Most contemporary digital support tools miss this problem rather effectively, providing at best fixed reminders or after-the-fact analysis. They do not work with one's actual current state of mind or function ahead before attention loss. Cognitive fatigue has been shown to have great effects on academic performance, especially on standardized tests conditions. For example, Sievertsen, Gino, and Piovesan showed that performance in examinations declines progressively throughout the day as a consequence of mental exhaustion, whereas even brief interruptions can significantly enhance cognitive capabilities and test scores [5]. The findings call for consideration not only of what is being taught to the students, but also of when and in what state they are examined.

Also, psychological factors like stress and empathy are hand in hand with learning outcomes. Rudnik et al., in a research, found that students who were stressed and tired exhibited lower empathy, and cognitive flexibility was proven to be a significant mediator between stress/fatigue and empathy [6]. This also highlights the significance of academic settings to not only be attentive to cognitive needs but also facilitate the emotional regulation and flexibility of students—critical components to long-term academic and social advancement.

Clario: A Context-Aware Study Companion

Clario is an engaged, context-aware study companion that aims to fill the gaps in current student support systems, which are generally reactive, depersonalized, or intrusive. Unlike typical interventions, Clario employs real-time behavior tracking by computer vision and object detection algorithms for facial, body, and environmental distractions like phones. Depending on this data, it gives timely, customizable reminders such as breathing, reminders, or vocal prompt—to remind students to refocus. It is physically non-intrusive and hence does not disrupt study flow and is subtle but effective in interventions. Clario's flexibility involves being able to monitor habits of an individual over a period so its responses become more attuned to the individual's own habit, thus providing support without infringing on autonomy. The Clario design is based on the principles of Self Determination Theory. It promotes autonomy by virtue of users' control over the type of nudges and frequency, supports competence by reinforcing positively in concentrated sessions, and fosters relatedness by using a warm, chatty voice interface. This judicious mix makes Clario not only a productivity aid,

but an assistive presence within the learning environment. Its capacity for personalization keeps learners in control, but captures the benefits of an engaged, adaptive guide aware of their needs and rhythms Understanding the gaps in the methods learners are currently served requires looking closely at what has come before—what has worked, what hasn't, and why From productivity tools that boost to systems founded on the basis of behavioral change there's a broad range of strategies that shape the landscape Clario moves into. These initiatives present themselves to us with useful lessons in what does and doesn't work. With this in mind, we now move to a detailed examination of the ideas, research, and thought that have shaped our thinking. Keeping this in mind, we now turn to an in-depth analysis of the ideas, studies, and thinking that have informed our thinking.

Literature review

Grounded in concern for the impact of cognitive overload on adolescent learning, this research introduces Clario as a specific intervention to address gaps noted. Sermathangam and Deepa, in an initial survey of Indian school children, had identified academic pressure, decision overload, and perfectionism as major contributors to mental fatigue, that manifested as lapses of attention, irritability, and headache. Goal-setting, breaks at regular intervals, and study scheduling were suggested by them to minimize fatigue, although their cross-sectional nature and use of self-report limit causative conclusions [1]. To complement this emphasis on fatigue, Earl et al. used Self-Determination Theory to studied the interrelations between psychological need satisfaction (autonomy, competence, relatedness) and engagement, fatigue, and academic performance during an academic year among British teenagers. Their hierarchical models of growth revealed that students with greater need satisfaction demonstrated stable cognitive involvement and minimal fatigue levels, and made larger grade gains in Mathematics and English compared to peers with lower need fulfillment [2]. Need satisfaction appears as a possible lever for maintaining mental energy in schools from this research, but its one-year timeframe needs multi-year replications and cross-subject mixtures of interventions. Consumption of digital media is another important factor associated with the well-being and school performance of adolescents. Paulich et al. investigated findings from almost 12,000 nine- and ten-year-olds in the U.S. ABCD Study and found that greater recreational screen use were associated with small but significant increases in externalising behaviours, lower school attainment, and disturbed sleep—although with somewhat improved peer relations. Notably, socio-economic status was a more consistent predictor overall across outcomes, and it indicates

that screen time is more of a marker of underlying risk than a causal agent [3]. The authors ask that multiple screen activities be grouped (i.e., gaming versus social media) and longitudinal patterns be followed. Responding to this request, Zhu et al. carried out a seven-year longitudinal examination of Swiss teenagers, estimating pathways of video game play, internet use, and TV watching from ages 11 to 17. Using parallel-process latent class growth analysis, they found five different usage trends (e.g., rising combined screen behaviors) and demonstrated that individuals with rising multi-screen use had higher levels of depression, anxiety, and behavioral issues at age 20, even after adjustment for baseline mental health [4]. Although this developmental strategy improves causal inference, replication in more diverse groups and examination of mediating variables (e.g., sleep quality, offline social support) are still necessary next steps.

Key take-aways from all the research articles under review

Cognitive Fatigue Lowers Performance – Mental fatigue reduces focus, schoolwork, and motivation.

Too Much Screen Time Harms Well-being – Linked with poor mental health, sleep, and behavior but helps peer relationships.

Psychological & Social Factors Influence Learning – Satisfaction of needs enhances participation, environment affects behavior.

Table 1: Key Findings of Literature Review

Authors	Year	Focus Area	Methodology	Key Findings	Implications
Sermathangam & Deepa	2020	Cognitive fatigue in school students	Descriptive survey	Identified academic pressure,decision overload, and Perfectionism as drivers of fatigue, reported symptoms such as lapses in attention and irritability	Organizational strategies, Goal- setting and breaks may diminish fatigue but casual relations are untested

Earl et el.	2022	Psychological need satisfaction, engagement	Longitudinal survey + statistical modeling	High autonomy, competence, and relatedness satisfaction predicted stable engagement, low fatigue, and larger grade gains in English & Math	Enhancing need satisfaction could sustain cognitive vitality; multi-year and subject-specific studies needed
Paulich et el..	2021	Recreational screen time and adolescent well-being	Secondary data analysis	Greater screen time modestly related to more externalizing behaviors, poorer academics, disrupted sleep, but slightly better peer relationships	Screen time may signal broader SES-related risk; future work should parse different screen activities and use longitudinal designs
Zhu et el..	2023	Developmental trajectories of screen use	Longitudinal cohort study + statistical modeling	Five distinct screen-use trajectories identified; escalating multi-screen use predicted higher depression, anxiety, and behavior problems at age 20	Targeting high-risk trajectories could inform interventions; replication in diverse samples and mediation analyses warranted
Saxe & Bar-Tal	1981	Role of social psychology in education	Theoretical/literature-based	Emphasizes identity, motivation, group dynamics in learning	Educational practices should integrate social psychological insight
Sievertsen, Gino & Piovesan	2016	Cognitive fatigue's effect on standardized test performance	Analysis of Danish public school test scores (2009–2013)	Scores drop ~0.9% SD per hour later; 20–30 min break boosts scores by 1.7% SD	Schedule exams early/by controlling for time and incorporate breaks for fairness
Rudnik et el.	2025	Stress, fatigue, empathy & cognitive flexibility in university students	Survey of 1,701 medical/social students; mediation analysis	Cognitive flexibility mediates negative effects of fatigue/stress on empathy	Interventions to boost cognitive flexibility could protect empathy

Study of Existing Solutions

A number of existing solutions have been made to enhance attention, build effective habits, and streamline time management via physical, digital, and blended channels. Wearable technologies such as Foci by Tinylogics utilize biometric indicators to monitor cognitive attention in real time and provide neurofeedback to help users stay attentive [5]. Though innovative, most of these technologies are too costly and may be frustrating or invasive to operate on a daily basis [6]. Tactile devices like the TimeFlip and TickTime Timer provide touch-based, game-like interactions for time monitoring and task segmentation. They work very well for split cycles of work and are easy to use, but there is often minimal personalization and a lack of assistance with long-term change in behavior [7].

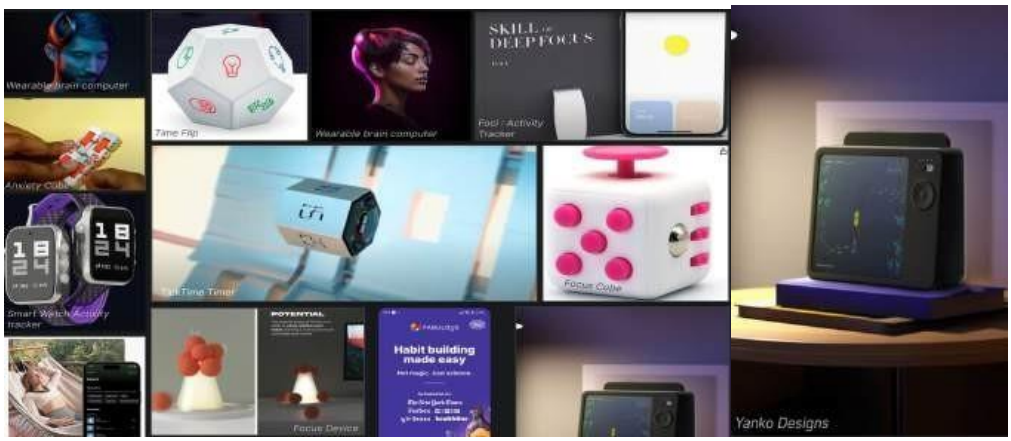

Figure 1: Existing Solutions

Sensory aids like the Focus Cube and Anxiety Cube engage users by touch to destress and enhance attention. However, they are passive tools and do not integrate with broader systems of goal management or habits [8]. Digital offerings like the Fabulous app attempt to leverage behavioral science by employing guided habits and motivational content. Although such applications are visually engaging and appealing, they tend to be poorly saturated with adaptive personalization and long-term engagement [9]. Voice assistants like Google Assistant provide primitive scheduling and reminder functionalities, but are reactive and require user-initiated input to function, thus less suitable for sustaining behavioral modification [10]. Conceptual and speculative ideas by websites like Yanko Design drive futurist synergy of ambient feedback, minimal UI, and psychological design methodologies, yet most are beyond reach or unusable in practice [11]. Collectively, these solutions reflect the growing focus on self-regulation solutions, but substantial shortcomings remain in terms of personalization, long-term motivation, social behavior integration, and non intrusive deployment.

Methodology

Given the limitations observed in current solutions, notably their lack of personalization and proactive engagement, this study's methodology was designed to explore the potential of Clario in addressing these specific challenges. This study employed a mixed-methods approach to examine what makes it hard for late teenagers to keep their attention and avoid getting tired. The approach covered the following parts:

Talking to Required Users

To find out about study habits, mental states, and distractions, participants of this age group were interviewed. In the interviews, I asked about users' moods during long screen time, the methods they use to get back on task, and how they deal with already available productivity tools. Topics covered in the research were motivation, mental fatigue, overdependence on technology, and using social media.

Surveys

The survey was given, by using random sampling, to 140 participants from both urban and semi-urban communities in India. The survey included questions about the time spent focusing, online habits, methods to cope, and meditation, exercise, and break schedules. Also, it considered the mental aspects that affected employee functionality at work. Researchers looked into the trends in how much time people spent on screens, if they felt tired from studying, and how they cared for their wellness. Analyzing scenarios that are set up for specific tasks. In order to test the features, participants took part in study sessions, and a camera and object detection system recorded their expressions, whatever distracted them, and how much they took breaks. I was required to finish academic problems, get assistance from Clario for doubts, and promptly answer timely questions. How effective the program was determined by noticing changes in how smoothly the task continued, whether users responded to suggestions, and if there were any mood changes.

Task-Based Scenario Analysis

Participants were required to undergo study sessions as the system tracked expressions, distractions, and break patterns through a camera and object detection. Tasks comprised the completion of academic questions, interaction with Clario for doubt-solving, and responding to nudges in real-time. Effectiveness was ascertained through observation of task continuity

changes, user responsiveness to suggestions for breaks, and emotional changes.

Research Focus Areas

The article researched the following key areas:

- Cognitive Fatigue: Uncovering the impact of mental overload on learning and focus. Digital Distractions: Investigating the influence of smartphones and social media on interfering with study sessions.
- Emotional Monitoring & Feedback: Assessing the impact of real-time voice-based recommendations driven by facial expression and object detection.
- Motivation & Habit Formation: Analyzing the effect of adaptive nudges on productivity habits and motivating healthier habits.

Sampling and Recruitment

- User Interviews: Performed with 6 participants through purposive sampling to guarantee diverse psychographic, demographic, and behavioral characteristics.
- Survey Sampling: 140 students were enrolled through stratified random sampling to include a range of digital literacy and academic achievement levels.
- Scenario Testing: Clario was tested with participants in real-time sessions with semi-controlled conditions to simulate typical study behavior.

Findings and Discussion

This section introduces important findings gleaned from our core research with our target audience. From both quantitative and qualitative data—illustrated by graphs, user behaviors, and usage observations—we reveal preferences, difficulties, and unrealized needs in existing study processes. These are explored in detail to uncover actionable insights that form the basis for gap identification and potential design routes

Focus Span and Work Habits

The users were questioned about how many hours they can work or study in one stretch without a break. Answers indicated that:

- 41% of users can concentrate between 30 minutes to 1 hour,
- 36% accomplish 1 to 2 hours,
- Only 15% are able to maintain attention for over 3 hours,

- 8% of them are challenged by less than 30 minutes of sustained attention.
- These findings illustrate a dramatic decline in sustained attention after brief intervals, underlining the role of cognitive fatigue to digital or academic environments.

Cognitive Resilience and Wellness Practices

The second chart analyzed whether users regularly exercise or meditate to deal with stress and promote cognitive equilibrium:

- A staggering 75% reported no practice,
- 20% practiced regularly,
- 5% practiced occasionally.

This is indicative of a lack of wellness strategies among the majority, and it could result in lower cognitive endurance, mental burnout, and lower academic performance. The results are indicative of the necessity to promote healthier digital habits and well-being routines among teens and working adults both.

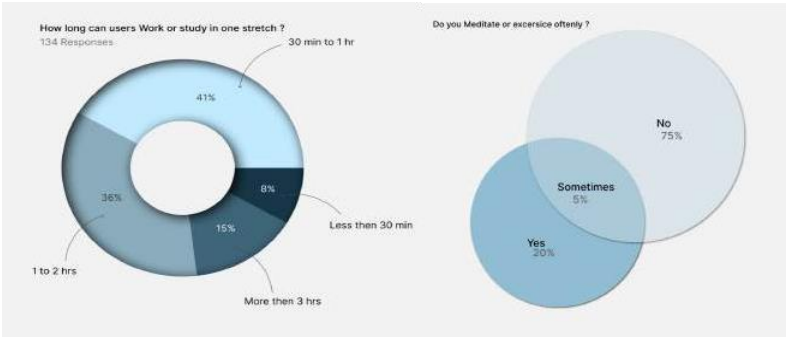

Figure 2: A graphical chart for user attention span length and wellness routines by survey answer

Barriers to Sustained Attention and Productivity

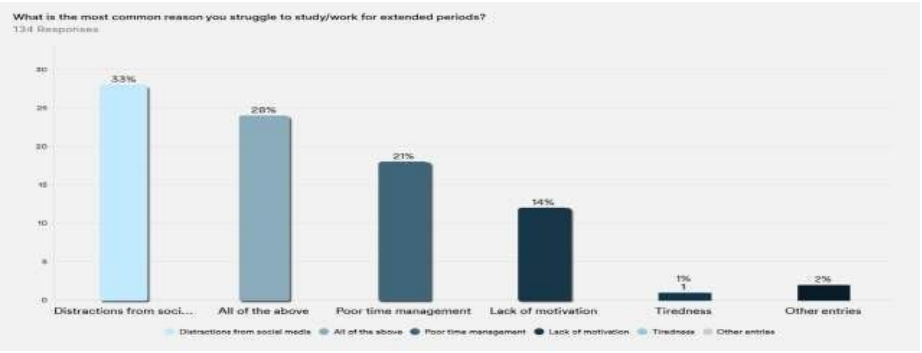

Figure 3 : This chart illustrates the most common explanations for the reasons users are unable to study or work for an extended amount of time, as per survey findings.

Barriers to Sustained Attention and Productivity

Respondents were asked to name the primary reasons why they found it difficult to focus on studies or work for long periods. The most common reason given was distractions by social media (33%), followed closely by a mix of several factors (28%) such as time management, motivation, and digital distractions. Other notable reasons were:

- Poor time management (21%)
- Lack of motivation (14%)
- Fatigue (1%)
- Other entries (2%)

The finding highlight the paramount role of digital distraction—especially social media—in disrupting focus cycles. Furthermore, the prevalence of respondents opting for "All of the above" indicates that they tend to co-occur, exacerbating cognitive exhaustion and ineffectiveness. These findings also echo the necessity for interventions that foster organized routines, digital self-regulation, and motivational supports in learning contexts.

Break Habits of Behavior and Distraction

The following graph illustrates a word cloud based on user answers to the question of how they generally spend their breaks during work or study time. The most dominant activities were:

- Scrolling social media
- Watching Netflix/YouTube
- Playing games

The salience of passive digital use (e.g., social media and streaming) indicates a shift toward low-effort screen-based disengagement during breaks. Although these behaviors may provide relief in the short term, they may reinforce mental fatigue and diminish task re-engagement efficiency. Conversely, tasks such as stretching, meditation, and music listening—though less discussed—indicate better cognitive reset practices. These findings highlight the importance of user education on effective break habits enabling mental refreshment and long-term productivity.

Research Insights

- Key Distractions: Social media, internal thoughts, and external interactions disrupt students' focus.
- Psychological Approach: Integrating habits like meditation improves

concentration and productivity

- Screen Time Impact: Excessive digital exposure harms focus, requiring mindful usage interventions

Figure 4: Word cloud visualization of typical break behaviors and productivity patterns across users.

Problem Statement

Students face focus and productivity challenges due to digital distractions, excessive screen time, and ineffective study habits, leading to cognitive fatigue and burnout.

Brainstorming

Strategies for Overcoming Cognitive Fatigue

A brainstorming session was held to determine both behavioral and system-based strategies for countering cognitive fatigue. The findings are grouped into two broad categories:

Behavioral Strategies

These are natural, daily activities that recharge mental energy:

- Meditation & Deep Breathing
- Physical Exercise (walks, stretching, exercise)
- Good Sleep (7–9 hours)
- Brain-Boosting Foods (e.g., nuts, fruits, dark chocolate)
- Keeping Hydrated
- Creative & Leisure Activities
- Social Interaction (talking with friends/family)

Technological & System-Based Solutions

These include intelligent interventions and digital aids:

- Cognitive Aids: Posture/eye strain reminders, emotion-driven support, adaptive break reminders

- Distraction Management: Focus modes, app limitations, time-bounded sessions, screen/object tracking
- Motivation Boosting: Goal-setting with rewards, voice interaction
- Support Tools: AI-driven assistants for instant doubt clarification and study assistance

All these strategies comprise a multi-dimensional system for minimizing cognitive exhaustion in learning or work environments.

Proposed Solution

Clario helps late teenagers stay focused by reducing screen distractions, using object detection to nudge them back on task. It enhances cognitive awareness through expression monitoring, suggesting breaks or motivation based on real- time emotions. With voice-to-voice interaction, Clareo creates a seamless,adaptive learning environment for improved productivity.

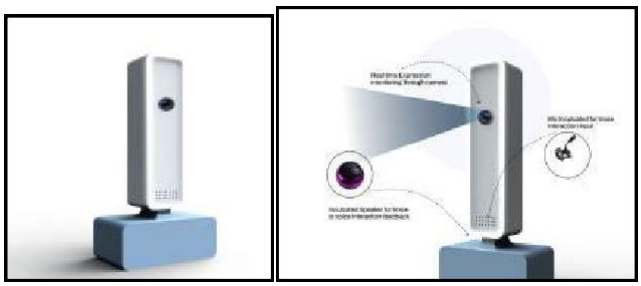

Figure 5: Clario

The idea presents a smart, voice-interacting device with three integral components: a camera for monitoring real-time facial expressions, a microphone for voice input, and a speaker for voice feedback. The trio collaboratively identifies the emotions of the user, interprets thought states, and provides adequate verbal hints or audio instructions. The system is discreet, unobtrusive, and designed to fit harmoniously into educational settings, rendering emotional awareness and verbal conversation an easy aspect of the learning process.

Hardware Components

To execute the system under consideration, the below hardware pieces were employed:

- Raspberry Pi: Acts as the main processing unit, controlling all system functions and peripheral integration.

- MicroSD Card: Holds the operating system and necessary software of the Raspberry Pi for system execution.
- HDMI Cable: Employed to link the Raspberry Pi to a monitor for configuration and interface development.
- Power Adapter: Provides required power to the Raspberry Pi for continuous running.
- USB Camera: Enables two primary functions:
- Emotion Detection: Detects facial expressions to determine the emotional state of the user.
- Object Detection: Detects objects in the user's environment to assist in tracking and reducing distractions.
- USB Microphone & Speaker: Facilitates voice interaction by acting as a voice assistant. It records voice commands and provides responses in words through real-time emotion or object detection.
- LED Strip: Works like an adaptive lighting system, adapting brightness and color according to the user's surroundings or mood.
- Speaker Output: Provides audio instructions, prompts, or reminders based on data received from emotion and object detection.

Use Cases

Scenario 1 : User Feels tired

In this case, the user appears seated at a study desk and is clearly overwhelmed and exhausted, as suggested by their body position and thought "ugh I feel so tired." Proposed intelligent assistant Clario detects signs of exhaustion in the user through expression monitoring. When it detects this state, Clario replies empathetically in its speaker feedback component, suggesting, "Hey, meditate for sometime, you'll feel better." This exchange illustrates how Clario actually feels the user's emotional state and provides supportive, wellness-oriented suggestions to optimize the study experience.

Scenario 2 : User getting distracted with phone while studying

In this situation, the user is visibly distracted by their phone while studying, smiling and engaged in screen time. Clario uses object recognition to identify the presence and prolonged use of the phone. After detecting over 20 minutes of distraction, it responds via voice feedback, saying, "Heyy, it’s been 20 min you’re distracted, let’s head back to study." This feature helps gently guide users back to their tasks, promoting sustained focus.

Figure 6: Use case , user feeling tired

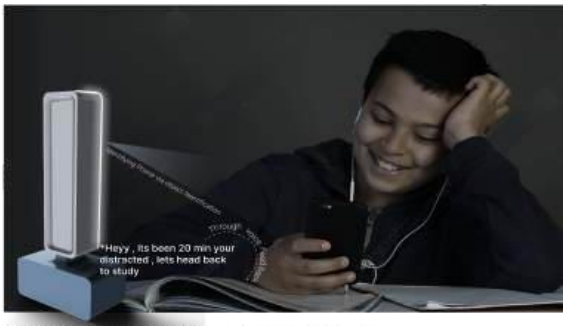

Figure 7: Use case , User getting distracted

Figure 8: Use case , User being focused

Figure 9: Use case , User having question

Scenario 3 : User is focused and happily studying

In this scenario, the user is engaged in their study session, appearing to be in a relaxed and happy mood. Clario enhances this positive state by playing a soothing waterfall sound through its speaker system. The system identifies the user's engagement and mood, affirming it with ambient audio that promotes concentration and emotional well-being. This scenario illustrates how Clario can also sustain and cultivate good study states.

Scenario 4 : User having doubts about calculations

The user here appears confused attempting to solve a math problem, speaking a question aloud: "What is 335 + 486?" Clario leverages its internal mic and chat AI to hear the question and reacts with an immediate oral response: "It is 821!!" This illustrates Clario's ability to facilitate real-time scholarly questions, offering at-your-need support and easing frustration from independent study. The scenarios map to real emotional and mental states students commonly face fatigue, distraction, bewilderment, curiosity, or focus. The device reacts in kind: prompting a break, offering help, playing calming noises, or answering questions. All interactions are

empathetic interaction, positioning the device as a partner, not an instrument. Whether the learner is flagging, getting stuck on a question, or in deep focus the system adapts in real time, learning to be emotionally intelligent and more human

Conclusion

Emotionally sensitive learning technologies have the power to revolutionize self-directed learning among adolescents faced with information overload, distraction, and mood changes. The majority of tools in use are wanting in the sense of having the ability to support intelligent adaptation to responding to the evolving mental state of a student. This paper introduces a new answer a voice-based, expression-sensitive device that fills this void through real-time empathetic feedback through facial expression recognition and speech interaction.The system is capable of recognizing cues such as fatigue, distraction, confusion, or engagement, and act accordingly by suggesting a break, navigating uncertainty, soothing the mind, or responding to conceptual questions. With scenario mapping, we illustrate the way emotionally intelligent interaction can improve concentration, eliminate frustration, and provide a more human-like learning experience.

Such research requires an intrinsic need for:

- Designing emotionally intelligent autonomous learning systems.
- Designing flexible responses across cognitive and affective states.
- Personalizing learning technologies to make them better accessible, responsive, and available to adolescents. Their long-term behavior impact and scalability in different learning environments need to be investigated in future studies. In addressing cognitive and emotional aspects together, such solutions have the potential to transform the face of customized learning enabling educate learners not only with knowledge but also with empathy and care.

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The Integration of AI in Fashion: Innovation Drivers, Industry Challenges, and Future Prospects

Dr. Monika Gupta, Assistant Professor | Neelakshi Saxena, Assistant Professor
Dr. Anupam Pareek, Assistant Professor
Poornima University, Jaipur
Dr. Ruchi Doshi
Associate Professor, Department of Computer Science & IT
Universidad Azteca, Mexico

Abstract-The apparel industry has always led in the field of adopting the latest-technologies. The implementation of Artsificial Intelligence (AI) has gained momentum in recent times in facilitating tremendous changes in different functions. The AI technologies have become the focus of propelling the progress in the spheres of garment design, production methods, logistics management, interaction with consumers and environment-friendly initiatives. This study provides an in-depth summary of AI in the clothing sector, alongside the current trends, challenges encountered by stakeholders, and possible future research and development avenue.

Referring to a wide selection of academic articles, market studies, and anecdotal case studies, this paper provides an in-depth discussion of the way AI is transforming traditional activity practices in the clothing sector. In the global apparel market, the analysis highlights the growing complexity and heightening competition in the last several decades, a factor conditioned mostly by a rise in technology.

Further, the discussion identifies some of the most important IT breakthroughs that have transformed the manufacturing processes all over the world, and it shows how the IT and induced breakthroughs affect the efficacy of operations of the companies and their competitive position on the market. In this paper, I would like to offer promising insights into the changing role that AI can play in improving the performance of the apparel industry and trace the paths of integrating further technology and developing a strategy.

Keywords: *3D Scanning Technology, 3D Simulation for Virtual Fit Analysis, Computer-Aided Colour Management, Digital Textile Printing, Real-Time Data Monitoring & Analytics, RFID Systems*

Introduction

The advent of artificial intelligence has radically changed the modern reality, introducing the employment of the technological advances that were deemed inaccessible. In the current environment, information technology (IT) is extensively embedded in almost every industry with the apparel industry being one example case. Introduction of IT into this sector has been fundamentally transformative to the various operations processes making it innovative and efficient across the whole value chain.

In the background of consumer tastes and preferences that are rapidly dynamic, shorter lifespan of products, and global rivalry that is increasingly competitive, there is growing pressure on the apparel companies to remain agile, receptive and cost-efficient. The chance to be successful in this dynamic environment is based on the capacity to be able to tend to the consumer needs tremendously fast and to be much more effective in managing resource allocation. Due to the increasing competition in the market, organizations have to create a critical balance in preserving the quality of the products, improving delivery schedules and being able to stay afloat.

Historically, clothing groups have applied computer technologies in order to positively affect the industries, including decreasing mistakes, minimizing manufacturing time as well as increasing the efficiency of labor. Nevertheless the definition of the IT today has by far changed as it is no longer only about computational instruments but a strategic asset all round which defines the manufacturing process, design and even management of supply chains.

The general workings of IT are witnessed in several of the core functions namely forecasting fashion trends, product designing and developing, mass production, and effective distribution. Together, these technological developments highlight the essential role of IT as a catalyst for competitiveness and innovation within the apparel industry. Advanced technologies now make mass customization profitable, enabling companies to increase revenues, and sharpen their competitive edge. AI have proven instrumental in boosting, optimizing resource utilization, and responding promptly to customer needs by accurately identifying and delivering value.

This paper explores several pivotal IT-driven techniques and tools that are reshaping industry practices, streamlining supply chains, and accelerating response times.

Apparel supply chains and Information technology-The recent times, fashion cycles have become small and store has become much dynamic. After adding the Artificial Intelligence people know about trends ,they order online and get the product and follow the fashion immediately so the time is reduce and it is called the fast fashion[4]. Customer's struggle is reduced, earlier they visit from "Store to store" to "shipping vs. shipping" and did not get the their choice product. Now the technology is increased with digital world, customer get service anywhere and anytime. [6]

To choose the garment then develop the product and dispatch to customer ,this time is reduced ,Now customer get faster delivery. We use the different AI tool to order the product and deliver on time to customer ,This whole process have less time, simplify the process and more convenient for the customer.

Different AI tools are used at many levels to encourage the work efficiency.AI tools are 3-D simulations, digital printing, enterprise resource planning (ERP) and radio frequency identification (RFID).

Areas of An interventions in Garment industry

- **Fashion forecasting-** In the fashion, forecasting is very important. Generally designers work on the collection on the basis of forecasting. They make upto 12 collections per year. It indicate the demand of consumers also and supply correct product in right time .
- **3-D simulation -3D simulation** is the process of creating and interacting with a virtual three-dimensional environment that mimics real-world or imagined scenarios. It uses computer-generated graphics and models to replicate objects, spaces, or processes in three dimensions. 3-D designing using AI tools create many developments in product lines. Initially 3D simulations are used in defense but now days are using in fashion product development.by using this in designing it reduce cost, enhanced creativity and improve communication[11].

  As on ancient time this technology is used only for the design purpose but is using to make complete fit for the any shape of garments. In earlier days Fit approvals was a real challenge for the Designers to make perfect fit for the consumer in the sample. Designer create the sample and sent to client for the approval then they try and give comment,so it takes time and lengthy process. When designers receive comments they make corrections accordingly. Designers expenses is also made behind this.3D simulation remove the physical sample making process and result in time, efforts and resource saving.

- **Virtual prints development** –The virtual print development is the fastest way to develop the prints and it saves a time as prints are developed virtually. The person who wants to develop these prints can easily cover the wide range of fabrics like cotton, lycra, viscose and denim. Designers can the images and use fabric swatches with slight modification and develop new designs as required by customers. Designer can check the look of print over the fabric and drape of the [10].
- **Digital printing and Computer colour management** -Digital printing and computer colour management represent significant technological advancements in the product development process, providing enhanced flexibility and faster turnaround times. This technology enables the printing of virtually unlimited color on paper and textile materials with exceptional colour fastness. Digital printers can integrate seamlessly with CAD textile design software, allowing print commands to be sent directly from the designer's workstation.

  Techniques such as dye sublimation and direct dye sublimation are especially advantageous for small production runs, eliminating the need for traditional screen development and thus saving considerable time. Additionally, digital printing is environmentally friendly, as it requires minimal chemicals and water, and generates almost no waste that needs treatment. Instead of enduring the lengthy traditional process of developing printed samples, designers can quickly produce digitally printed fabrics in the desired textures, which can then be cut, stitched, and sent for buyer approval almost immediately.

- **Computer Colour Management (CCM)**

Computer Colour Management (CCM) is a digital method used for colour approval, serving as an efficient alternative to developing and physically sharing samples with buyers. Instead of sending physical samples, colour shades are digitally transmitted in scanned form under standardized lighting conditions. The matching of colours involves the analysis of difference metric between digitally obtained sample colour and the standard reference match counterpart. The technique, which is achieved by the use of digital data communication, dramatically reduces the timeframe of validation besides enhancing accuracy because the results are constant and measurable. This reduces the variations and impartially that were experienced

with visual colour trials. Data colour, Clariant and OCX by eWarna are considered top international organisations in the sphere of Computer Colour Management (CCM).

- Enterprise Resource Planning (ERP)

The more the business is growing its operations, the higher the intensity of competition and hence the way businesses are carried out demands greater complexity which necessitates an increased dependency on advanced technological systems. At the same time, changing conditions in the market necessitate a higher speed of work performance and the enhancement of the operational transparency. The twin demands of accuracy, as well as cost-effectiveness insist into an organization upon implementing real-time updates of its data with minimal human involvement and the time optimization is an important component of long-term competitive edge.

Enterprise resource planning (ERP) systems have come in as natural ones to solve these dilemmas as it allows integration of various functionalities of the apparel industry. This is a horizontal integration across the manufacturing processes, the supplier and subcontractor network, customer relationship management (including internal and external stake holds), the human resources, the sales and marketing and the logistic coordination. Through these types of interconnected systems, operation inefficiencies are minimalized, and there is constant monitoring, which makes an organization agile and overall fine.

In the environment of manufacturing of apparel, the ERP application is important in scheduling, and control of processes, control of inventory, financial and labor management. The most notable advantage can be seen in the elimination of data duplication, high transparency due to the real-time exchange of information between the departments, the issuance of crucial deadlines warning in advance, the ability to make various analytical reports, efficient monitoring of production workloads, and simplified planning of work-in-progress.

The most popular ERP vendors of the apparel industry featured SAP, Oracle, Datatex, FastReact, and REACH, which highlights the extensive use of the ERP solutions with high technology development in the world.

Product Lifecycle Management (PLM) and Product Data Management (PDM)

As compared to most of the other industrial sectors, there is an increased complex and fluid nature of fashion supply chains. In apparel companies and fashion houses, there are many simultaneous processes, which can be characterized as frequently having a wide range of different activities distributed to drastically different geographies and different units of the company. The management of such a complex network is also a big challenge, because even a single mistake, delay or omission made by any phase of this network, can trickle down to the system, from which the lead times will grow longer and have a lot of monetary investments.

IT-centered systems such as Product Data Management (PDM) Product Life Management (PLM) have become valuable tools to enhance the productivity of the operational processes, data security, and cooperation of the of fashion supply chains. The main aim of using PDM syatems is to reduce the amount of data that has to be entered manually in its body, in that the recording of data using digital means has to be maintained with an accurate account of the addition of new data over time, changes made, and modifications. As the central digital repository, PDM lets the information related to products to be logically stored and easily retrieved, creating additional rigidity in the increased information diversity and visibility across work tasks.

Conversely, PLM is a strategic system that is holistic and focuses on managing and harmonizing product information in both the cycle-to-life as well as the final delivery. PLM encourages collaborated efforts of a large range of stakeholders such as designers, planners, developers, manufacturers, and buyers on a common, shared digital platform, which enables the exchange and exchange of real-time data and alignment of the process. This combined approach provides more transparency, synchrony, and agility throughout the product development cycle and the product supply chain.

The major suppliers of PLM systems that apply to apparel and fashion include Lectra, TukaTech, Gerber Technology, Assyst, World Fashion Exchange (WFX), and Blue Fox. Such bodies provide superior technological solutions that enhance effective, sustainable and responsive product lifecycle management.

Conclusion– Embracing digital technologies in the garment production process has led to the appearance of a flexible selling strategy affected by the consumers themselves, who have instant access to deeper information about the product. Companies that integrate innovation,

production, distribution, and selling using digital platforms react quicker to dynamic release, present customized encounters, and gain a market lead. Geometric uptake in virtual products product displays and immersional tools enhance interactions between the customers and brand loyalty. As the fashion industry advances swiftly, embracing modern tech-driven strategies is essential for growth, efficiency, and competitive survival.

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The Psychological Effects of Hyper-Realistic Graphics in Video Games: A Review of Cognitive, Emotional, and Behavioral Outcomes

Prem Kumar

Assistant Professor, School of Design, Manav Rachna International Institute of Research and Studies (MRIIRS)

Abstract

Video game graphics have moved from simple pixelated pieces to something that looks very close to reality. Most of the games nowadays are using hyper-realistic graphics, and gamers immerse themselves for hours in these highly detailed virtual worlds. This paper reviews what recent research in this area says about how this kind of realism affects players on a psychological level. This paper takes into consideration studies from psychology, neuroscience and cognitive science to understand the cognitive, emotional, behavioral, and neurobiological outcomes. Studies suggest that realistic graphics can help in building attention, memory, and spatial skills, mainly when the game world looks like real environments. At the same time hyper realism may result into mental overload which may lead to harder learning. On the emotional side, realism usually amplifies the emotions. Some players report that they get relief from stress and they feel a stronger connection with characters in the game, while others experience fear, frustration, or even anger, mainly while playing violent or highly competitive games. Behavioral studies show mixed results; some studies link violent realistic games to the increase of aggressive thoughts or feelings, whereas some others highlight it's positive social and prosocial effects. Neurological studies show that realistic games activate those areas of brain which are involved in a real-life situation, that is why they feel so immersive. This paper also discusses what these findings mean for game creators, teachers, and therapists. As games get more lifelike, it's important to use realism carefully and thoughtfully.

Keywords: Hyper-Realistic Graphics, Video Games, Cognitive Effects, Emotional Impact, Behavioral Outcomes, Neuropsychology

I. Introduction

In recent years, video game graphics have changed from simple two-dimensional sprites to highly detailed three-dimensional scenes. By the mid-2020s, majority of the games generally include advanced lighting, texture detail, and character models that blur the line between the

virtual and real. For players, this kind of realism makes them feel that they are no longer looking at a “game screen,” but are standing inside another world.

This transformation has brought new questions. On one hand, such hyper realistic graphics can make the players a part of the story, the game characters also feel more believable, and it help the players understand complex spatial layouts. On the other hand, realistic war graphics like blood, or injuries may lead to negative consequences such as aggression, desensitization, and poor mental state.

A debate about the photorealistic trailer for Unrecord in 2023 illustrated the extent to which the general public was worried about whether or not the use of realistic graphics in video games would change a player's perception of violence (Wilson, 2023). A lot of people that watched the video called it "too real" and they expressed discomfort about shooting scenes that looked like a body-camera footage from real conflict zones (Wilson, 2023).

This paper reviews the current knowledge about the psychological effects of hyper-realistic game graphics. The emphasis is not on the question if games are "good" or "bad" in a general sense, but on how lifelike graphics affect cognition, emotion, behavior, and brain processes. This study aims to provide insights to guide both game development and broader societal discussions about the role of gaming in modern life.

II. Methodology

A narrative literature review strategy was used, focusing on quality and recent works, to investigate the link between video game realism and psychological effects. The main focus was on peer-reviewed research articles, meta-analyses, and systematic reviews published between 2010 and 2025, that specifically dealt with the aspects of video game realism and the psychological impacts of it.

Relevant studies were sourced through exhaustive searches of leading scholarly databases such as PsycINFO, PubMed, Scopus, and Web of Science, and selected reputable web-based reports. Search terms included “video game realism,” “photorealistic graphics,” “hyper-realistic games,” “gaming cognitive effects,” “violent video games aggression realism,” and “virtual reality psychological impact.”

The review gives priority to:

- Peer-reviewed empirical studies
- Meta-analyses and systematic reviews
- Neuroscientific work involving brain imaging or physiological measures
- Recognised reports from organisations such as the NIH, WHO, and industry associations

Studies were included when graphical fidelity or realism was clearly part of the design or interpretation. These covered experiments comparing high- versus low-fidelity graphics, longitudinal studies of realistic commercial games, and research on virtual reality environments with realistic features. Findings from cognitive psychology, social psychology, media studies, and neuroscience are brought together to build a broad picture rather than a narrow single-discipline account.

III. Cognitive Effects

A. Attention, Memory, and Spatial Skills

Several large studies report that regular game play is linked with certain cognitive advantages. For example, an NIH-supported study on children found that those who played video games for three or more hours per day performed better on tasks of impulse control and working memory than children who did not play games (Chaarani, 2022). While this work did not focus only on graphical realism, it involved contemporary games that typically use detailed 3D graphics.

Realistic graphics may help in at least two ways. First, dense and coherent visual scenes can provide strong spatial cues, supporting mental rotation, navigation, and attention to relevant objects. Second, when a game environment resembles a real-world setting, players can form mental models that transfer more easily outside the game. This is one reason why flight simulators, driving simulators, and other training software rely heavily on realistic visuals (Dattel et al., 2023).

At the same time, more detail is not always better. Work in educational psychology shows that moderately realistic 3D anatomical models can aid learning, but extremely detailed models do not always improve memory and can add extra cognitive load (Skulmowski, 2024). Something

similar may happen in games: if players must constantly process many small visual details that are not essential for the task, they may tire more quickly or miss key information.

B. Learning and Transfer

A practical question is whether skills from games carry over into real-world performance. Hyper-realistic games, especially simulations, are used widely for training pilots, drivers, surgeons, and soldiers (Dattel et al., 2023). The logic is simple: the closer the training looks and feels to the real task, the easier it is to transfer what has been learned.

Research on serious games supports this view to some extent. When visuals match real tools, control panels, or environments, learners can build procedural knowledge that feels familiar during actual work. Realistic graphics can also anchor abstract concepts in concrete settings. At the same time, Zendle et al. (2015) found that higher graphical fidelity in violent games could reduce players' access to aggressive concepts, suggesting that realism sometimes has unexpected cognitive effects.

C. Possible Downsides

The same NIH study that reported better cognitive scores among heavy child gamers also found higher levels of attention problems and ADHD-related symptoms in this group (Chaarani, 2022). This does not show that games cause such problems, but it does suggest that intensive play is not an unqualified benefit. Usually, hyper-realistic games try to keep the user in a "flow" state for an extended period of time. It may happen that for some individuals, especially kids and teenagers, this interferes with their sleep, homework, or other activities necessary for a healthy cognitive development.

IV. Emotional Effects

A. Positive Emotional Experiences

Many players play games to relax and manage their everyday stress. A 2023 global report from the Entertainment Software Association presented that 71% of gamers had experienced that games helped them reduce their stress, 61% of the gamers stated that games helped them to reduce their anxiety, and 58% said they felt less isolated while playing games (ESA, 2023). These numbers show the general emotional role of games. The realistic graphics might strengthen these experiences by making settings and characters feel more "believable."

Highly realistic graphics can also encourage deeper understanding and connection with characters. When you see subtle emotions on a character's face, or when a game pays attention to detail in familiar settings, it's easier to feel involved in the story. Additionally, some people find that realistic and peaceful settings – like scenes of nature or well-designed rooms – can be calming. These types of environments are even used intentionally to help people relax or in therapeutic situations.

B. Fear, Arousal, and Frustration

Games that are realistically scary or involve intense combat can trigger powerful emotional reactions. One study found that people who were actively playing a horror game showed larger changes in things like electrodermal activity, breathing, and heart rate compared to those just watching someone else play (Madsen, 2016). These physiological responses are similar to those seen in real-world threat situations. When monsters, enemies, or dangerous environments look almost real, it is unsurprising that the body reacts strongly.

Action games with realistic animations, weapon feedback, and sound also produce strong adrenaline responses (Stubbs, 2024). For some players this is part of the appeal. For others it can lead to repeated frustration, especially in competitive online matches or demanding simulations. Madigan (2014) has argued that frustration, rather than violent content alone, may play a central role in explaining why some players show anger after play.

C. Desensitization and Mixed Outcomes

A repeated worry in public debate is that exposure to realistic violence may desensitize players. Over time, scenes that initially seemed shocking may feel normal or unimportant. Some studies suggest reduced emotional responsiveness after repeated exposure to violent media, but results vary, and context seems to matter. Cooperative play, narrative framing, humour, or stylisation can all change how players interpret what they see.

In short, hyper-realistic graphics tend to strengthen emotional reactions, but whether this is good or bad depends on the content and on the individual player.

V. Behavioral Outcomes

A. Aggression and Prosocial Behavior

The behavioral effects of violent games have been studied for many years and remain contested. A widely cited meta-analysis by Anderson and colleagues reviewed more than 130 studies with over 130,000 participants and concluded that violent video games are associated with higher aggressive thoughts, feelings, and behaviors, and with lower empathy and prosocial behavior (Anderson et al., 2010). This work did not only consider realistic games, but greater realism is often assumed to intensify any such effects.

Later research provides a more complex picture. A longitudinal study published in Molecular Psychiatry followed adult players of Grand Theft Auto V for two months and found no meaningful long-term change in aggression, impulsivity, or empathy relative to a control group (Kühn et al., 2019). This suggests that short-term shifts in mood or arousal after a play session may not automatically turn into stable behavioral changes.

On the positive side, prosocial games can encourage helping, sharing, and cooperative behavior. Gentile et al. (2009) reported that playing prosocial games was linked to more helping behavior in everyday life. Here again, realism might strengthen the perceived importance of prosocial acts in-game, as players feel that their choices matter in a world that looks close to reality.

B. Social Connection and Community

Games today are often social spaces. Many players use online games or platforms to keep in touch with friends or to meet new people. A February 2025 survey in the United States reported that 78% of gamers felt that playing video games helped them form new friendships (Clement, 2025). Realistic avatars and environments can make these social interactions feel closer to in-person contact, even though everyone is physically apart.

C. Gaming Disorder and Problematic Use

The World Health Organization has recognised Gaming Disorder in the ICD-11 classification. It is described as a pattern of gaming behavior marked by impaired control over play, giving gaming priority over other interests and activities, and continuing to play despite clear negative consequences (WHO, 2020). Only a small fraction of players meet the clinical criteria, but problematic use below that threshold is more common.

Hyper-realistic graphics are not the sole cause of such problems, yet they may contribute to the strong pull that certain games exert. Long sessions in highly immersive worlds can displace

sleep, study, or work. Common warning signs include neglect of offline responsibilities, withdrawal from face-to-face social contact, and declining performance at school or work (Zayed and Dhingra, 2023).

VI. Neurobiological Mechanisms

A. Reward and Motivation

Neuroscientific research helps explain why realistic games feel so engaging. In one study, players who won against a human opponent in a game showed stronger activation in reward-related brain regions, including the ventral striatum and ventromedial prefrontal cortex, compared with winning against a computer (Kätsyri et al., 2013). When opponents and environments look realistic, social and competitive aspects of play may feel closer to real contests, potentially increasing this reward response.

These reward circuits are closely tied to dopamine, which is involved in motivation and learning. Each "win" or successful action in a realistic game can strengthen associations between certain cues (a sound, a visual effect, a particular environment) and the pleasure of success.

B. Mirroring and Empathy

The mirror neuron system is active both when we perform an action and when we see someone else perform it. Recent work shows that even virtual characters can trigger such mirroring responses, especially when their movements and appearance are human-like. Miyamoto et al. (2023) found that participants viewing human-shaped avatars with realistic motion patterns showed μ-wave suppression in EEG, which is often used as an indicator of mirror neuron activity. This suggests that the brain, to some extent, treats realistic avatars as social agents.

This mechanism may be one reason why realistic games can support empathy. When players watch characters suffer, struggle, or succeed, their own neural systems for action and emotion are partly recruited, especially when faces and bodies are rendered in a lifelike way.

C. Stress, Arousal, and Plasticity

Physiological research has documented increases in heart rate, blood pressure, and skin conductance during intense gameplay, showing the involvement of the sympathetic nervous system. Work with realistic virtual reality scenarios has found that such environments can

trigger acute stress responses that resemble those produced by real-world stressful situations (Fauveau et al., 2024).

At the same time, long-term game play can alter brain networks. Coronel-Oliveros et al. (2024) reported that experienced gamers showed more efficient functional connectivity in networks linked to attention, visuospatial processing, and motor control, suggesting that repeated exposure to game challenges shapes mesoscale brain organisation.

Neuroimaging studies on internet gaming disorder indicate changes similar to those in other addictive behaviours: greater activation in the ventral striatum in response to gaming cues, along with reduced activity in frontal regions involved in control and decision making (Weinstein, 2017). Hyper-realistic cues may strengthen these responses by making game-related stimuli especially vivid.

VII. Cross-Cultural and Demographic Variations

A. Who Plays, and How This Matters

The stereotype of the young male gamer no longer matches the global picture. An analysis by Exploding Topics in 2024 reported that 46% of gamers worldwide are female, that the largest group lies between 18 and 34 years old (38%), followed by adults between 35 and 54 (26%), with 21% under 18 and 15% over 55. The average age of gamers in the United States is now about 35 years (Duarte, 2025).

Because audiences are diverse, reactions to realistic content are also diverse. A scene that one player reads as harmless fun may feel threatening or offensive to another.

B. Gender and Content

Gender interacts with content and identification in complex ways. A study from Ohio State University looked at young men playing violent games with sexist themes. Those who strongly identified with macho male protagonists showed less empathy for female victims of violence after gameplay compared to others (Ohio State University, 2016). Here, realism may not be the only factor—gender roles, narrative framing, and player identity also matter—but realistic character models and animations likely intensify the experience.

C. Age and Development

Children and adolescents may be more affected by realistic violent content than adults. The University of Utah Health notes that children exposed to violent video games can become desensitized, may imitate violent behaviour, and can be more strongly influenced than adults (University of Utah Health, 2021). The article emphasises that "the more realistic and repeated the exposure to violence, the greater the impact on children." Parents and educators therefore need to be especially cautious with realistic violent games for younger players.

D. Cultural Perspectives

Games are both products of culture and tools that can influence cultural views. A systematic review by Shliakhovchuk and Muñoz Garcia (2020) discusses how games can carry assumptions, stereotypes, and worldviews from the societies that make them, but can also challenge or reframe those views for players.

Players from various parts of the world have displayed varying degrees of appreciation for different aspects of their games. For example, the study conducted by Zagal and Tomuro (2013) revealed that the American players generally emphasise narrative and character development as the most important factors in their reviews, while Japanese players at times give lower marks to games that rely mainly on stories and do not see that as an issue, instead, they prefer to talk about mechanics and other things. This disparity in taste probably affects the perception of realism: what is considered to be "immersive" or "realistic" in one culture might be regarded as too much or not interesting in another.

VIII. Implications for Designers, Educators, and Therapists

A. Game Designers

For designers, the main message is that realism is not neutral. Hyper-realistic graphics can enhance immersion and emotional engagement, but they also sharpen ethical and psychological stakes. Designers need to decide when realism supports the experience they want and when a more stylised or abstract approach might be better.

Several practical considerations follow:

- Realistic violence, especially in first-person perspectives, should be handled with care.

- Character design and representation matter more when faces and bodies look close to real people. Stereotypes and exclusion become more visible.
- Visual clarity is as important as detail. Overly busy scenes may harm usability and learning.

Given that the player base now spans genders, ages, and cultures, sticking to narrow assumptions about who the "typical" player is can limit both reach and impact.

B. Educators

Educators have already adopted realistic simulations for many types of training, from surgery to aviation to engineering (Dattel et al., 2023). For teaching, the main question is not whether to use realism but how much and for which learners.

Moderate realism can support understanding by linking concepts to familiar settings. For example, a virtual tour of a historical city can help students visualise the layout of streets and buildings. However, very dense graphics or unnecessary special effects may distract from the core material. Skulmowski (2024) shows that for anatomical learning, extra detail does not always translate into better recall and can instead increase cognitive burden.

Teachers also need to consider access. Not all institutions can afford top-end hardware. Well-designed, moderately realistic materials may offer a better balance between educational value and cost.

C. Therapists and Clinicians

Clinical use of virtual reality and game-based interventions has expanded in recent years. VR environments are being tried for anxiety, depression, and ADHD, among other conditions (Wang et al., 2024). Realistic scenes allow therapists to place clients in controlled but convincing situations—for example, standing on a high balcony or speaking to a group—while remaining physically safe in a clinic room.

For some patients, realistic natural scenes or calming environments can also provide a sense of escape and restoration. At the same time, therapists must watch for over-immersion, especially in clients who already struggle with gaming habits. The goal is to harness the strengths of realism without reinforcing problematic avoidance or addiction.

To summarize the findings across domains, Table 1 provides a quick overview of positive and negative psychological outcomes linked to hyper-realistic game graphics.

Table 1: Summary of psychological outcomes related to hyper-realistic graphics.

Domain	Positive Outcomes	Negative Outcomes
Cognitive	Improved attention, memory, and spatial skills; better transfer of learning in realistic simulations	Cognitive overload; reduced reliance on imagination and abstraction
Emotional	Stress relief; enjoyment; stronger empathy and sense of presence	Heightened fear; frustration; anger; potential desensitization
Behavioral	Cooperation; social connection; prosocial learning in cooperative or prosocial games	Risk of problematic use or addiction; aggression (evidence mixed)
Neurobiological	Engagement of reward and empathy circuits; brain plasticity in attention and visuospatial networks	Strong stress responses; craving responses in vulnerable individuals

(*Source: Author's compilation)*

IX. Conclusion

Hyper-realistic graphics change more than how games look. They influence how players think, feel, and behave, and they do so in ways that are neither purely positive nor purely negative. On the cognitive side, detailed environments and realistic simulations can support attention, spatial reasoning, and learning, especially when game tasks mirror real-world activities. Yet very dense visuals or long sessions in demanding games may overload some players or interact with existing attention difficulties.

Emotionally, realism tends to amplify whatever is already present. Joy, curiosity, and empathy can grow stronger, but so can fear, frustration, and fatigue. Behavioural findings remain mixed: some work connects violent realistic games with increased aggression, while other research finds little lasting impact and points instead to social and cooperative benefits. On the neural level, it has been found that games with realistic graphics engage the reward, stress, and empathy areas of the brain in a way that is somewhat similar to the way the players experience things in real life, thus, it becomes clearer why these games are so attractive.

The reactions to realism are very much dependent on the player's age, gender, cultural background, and personal experiences. The same game graphics giving one player an adrenaline rush might make the other player feel uneasy. The main issue for the designers, teachers, and therapists is that they should consciously deal with the realism factor rather than considering it an automatic improvement. If at all used properly, the hyper-realistic graphics can be a good source for learning, socializing, and even conducting therapeutic sessions. On the other hand, if used mindlessly, they can lead to the player's mental exhaustion, increased tolerance, or even an unhealthy pattern of usage. As technology is making constant advancements toward creating virtual spaces that completely mimic real-life scenarios the abovementioned decision-making process will only get more complicated and crucial.

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Reviving Weaving Communities: Fusion Textiles as a Catalyst for Artisan Livelihood Renewal in Banaras and Kota

Mahak Sharma | Dr. Shikha Verma

Department of Design, Banasthali Vidyapith, Rajasthan, India

Abstract

India's handloom sector, steeped in tradition and skill, faces modern difficulties owing to the increasing prevalence of machine-made textiles and the decline of artisan livelihoods. Notably, the weaving regions of Banaras and Kota are recognized for their unique craft heritages: Banarasi Brocade, esteemed for its luxurious silk and elaborate designs, and Kota Doria, known for its light texture and geometric patterns. This paper explores the possibilities of fusion textiles—a creative amalgamation of these two renowned fabrics—as a means to revitalize artisan communities. This study seeks to illustrate how the combination of the rich design elements of Banarasi and the geometric simplicity of Kota can generate not only contemporary products that are marketable but also serve as a link between tradition and modernity. By fostering collaboration among artisans, encouraging design innovation, and establishing strategic market connections, fusion textiles provide a sustainable approach to revitalizing these communities, improving economic prospects, and enhancing cultural pride. The research highlights how design can play a transformative role in tackling socio-economic issues faced by rural crafts, ultimately aiming for a thriving and sustainable future for handloom weavers in Banaras and Kota.

Keywords: *banarasi brocade, cultural heritage preservation, design innovation, kota doria, traditional crafts*

Introduction

India's economy and culture depend heavily on the handloom weaving sector, which employs about 3 million weavers and their families. Despite this, the Kota Doria cluster in Rajasthan and the Banarasi brocade cluster in Varanasi have suffered from the rise of power looms, falling artisan wages, and youth emigration.While Kota Doria has an open khat weave that is lightweight and perfect for hot weather, Banarasi brocade is known for its silk-lurex textures and elaborate floral designs. Handloom authenticity and price realization are undermined by the abundance of power loom duplicates on the market. The low daily wages of smallholder weavers, which are frequently below the poverty line, cause out-migration and disrupt the intergenerational transfer of weaving skills. Many buyers are still ignorant of GI marking for Banarasi brocade (2009) and Kota Doria, particularly since synthetic imitations are so common.

In this study, the potential of fusion textiles—a new weave that combines the richness of Banarasi motifs with the light structure of Kota Doria—to revitalize artisan communities through increased earnings, design innovation, and restablishing connections between producers and domestic and international markets is examined. Our hypothesis is that fusion items might offer better livelihood resilience and larger price premiums by striking a balance between tradition and contemporary appeal.

Figure 1:- Artisan Weaving Brocade (*Weaver performing 'kadhua' technique)* **Source:** Gurmat, S. (2023, February 23). The silk weavers of Varanasi. *AFAR*. Https://www.afar.com/magazine/the-silk-weavers-of-varanasi

Figure 2:- Banarasi Brocade Loom (*Artisan adjusting silk threads on a Varanasi loom, preparing the warp for zari brocade work).* **Source:** Bandhej. (n.d.). *Gyasar: Brocades woven in Benares* [Image]. https://www.bandhej.com/blog/post/gyasar-brocades-woven-in-benares

Literature review

Handloom employment has declined by 30% over the last 20 years, according to studies (Ministry of Textiles, 2020), and the decline is well documented (Chattopadhyay, 2019).

However, the Banarasi and Kota weaving traditions still hold a premium position in the heritage textile and fashion industries.

Banarasi Brocade: This style captures the splendor of the Mughal era and is distinguished by silk threads embroidered with zari designs. Each sari takes 15 to 30 days to complete and has over 20 phases (Mukherjee, 2020).

Known for its feather-light drape and translucent appearance, Kota Doria is a delicate cotton-silk blend that was first produced in Rajasthan in the 17th century. Fusion fabrics, which blend ancient methods with contemporary design, have the ability to increase demand and offer up new markets, according recent studies (Mehta & Narayan, 2021).

"Crafts survive only when they adapt—not when they resist modernity." — Laila Tyabji, Dastkar

Objectives of the study

The purpose of this project is to investigate how fusion textiles might help Banaras and Kota's traditional weaving communities thrive**.** The specific objectives are:

1. To examine the socioeconomic issues, such as unstable livelihoods, poor income, and diminished generational interest, that craftspeople in the Banarasi and Kota Doria weaving clusters experience.
2. To investigate into the possibilities of fusion fabrics as a vehicle for creativity, market diversification, and craft revival—more especially, the blending of Kota Doria structures with Banarasi Brocade designs.
3. To determine how cross-cluster artisan collaboration affects intergenerational involvement, community resilience, and skill sharing, among other social and cultural effects.

Methodology

1. **Research Design**

A convergent mixed-methods strategy (QUAL + QUANT) was used, which included:

- **Literature and policy review**: Documents (academic, NGO reports, news, policy briefs).

- **Qualitative fieldwork**: Focus groups and interviews with weavers, designers, traders, and officials in Banaras and Kota.
- **Action-research pilot**: Co-designing and trialing three fusion jeweled textile prototypes over six months with 20 weavers.

2. **Data Collection**

- **Document scan**: Journals, government white papers, NGO reports, online news.
- **Fieldwork**: Conducted Nov 2024–Apr 2025. Four FGDs (2 per site, 10–12 each), and 15 semi-structured interviews with stakeholders aged 18–60.
- **Pilot**: 20 weavers (11 Banarasi, 9 Kota), designing and weaving prototypes under designer mentorship, recording costs and outputs fortnightly.

Results

1. **Quantitative Outcomes**

Earnings grew substantially. Average daily wages were ₹375 prior to the pilot; they increased by 28% to ₹480 following ($t(19)=5.2$, $p<0.001$). Productivity increased: unit production rose by 22% and average faults decreased from 8.0/m² to 3.5/m² (faster cycles owing to lighter weaves and solar-supported looms in 60% of Banarasi trial locations).

According to market feedback, price surcharges for comparable sarees ranged from 20 to 25 percent over baseline.

2. **Qualitative Insights**

Interregional cooperation: The artisans talked about their initial experience collaborating:

> "It felt new—and exciting—combining Kota's khat with our motifs" (FGD, Kota, artisan).
>
> This sparked mutual learning and revived pride.

Enhancement of skills: Banarasi artists learnt grid-count modifications, and Kota women experimented with inserting punch-card motifs. As a result, middle-class people and urban designers started asking questions.

Market reaction: Although some merchants found it difficult to "fit" the pilot fusion samples into pre-existing categories, they did garner interest at trade shows. A design mentor proposed the moniker "Banarasi-khat couture" for them.

Challenges:

- ***Finance***: Only 6/20 of artisans were able to immediately self-fund, indicating higher capital requirements for yarn variation.
- ***Design adaptation***: Weavers wanted motif libraries and translation instructions since they found it difficult to translate flowers into grids.
- ***Consumer awareness***: Instead of seeing the product as a hybrid, buyers mistook it for either Kota or Banarasi.

Discussion

1. **Livelihood Gains Through Design Innovation**

Quantitative results demonstrate that fusion fabrics resulted in real livelihood gains in addition to innovative styles. The dual route of income uplift is illuminated by weighted design premiums and productivity increases, which are consistent with research on open innovation in craft clusters.

2. **Socio-cultural Regeneration**

Cross-regional cooperation broke gender conventions (Kota women expanded positions), increased identity pride, and created new social capital. This lends credence to the literature on craft innovation that highlights social organization as a catalyst for the regeneration of sustainable livelihoods.

3. **Systemic Constraints & Recommendations**

In order to position heritage crafts as globally competitive sustainable luxury, a revival framework for weaving clusters incorporates design capability through motif libraries and modular courses that connect artisans and students, blended order-tied financing via ODOP and microfinance, GI-based storytelling to market fusion fabrics as "light couture," and scaling solar-hybrid looms to increase productivity.

4. **Environmental and Sustainability Impacts**

Lighter fabrics used 25% less silk and dye, reducing resource inputs and catering to environmentally sensitive customer groups. This is in line with ESG standards in artisan trade and funding tied to sustainability

Significance of the study

- ***Artisan Empowerment***: Fusion weaving directly supports rural livelihoods and sustainable employment by increasing productivity, decreasing waste, and raising incomes.
- ***Cultural Innovation***: The study portrays heritage crafts as dynamic practices rather than fixed traditions by using design to reinterpret traditional motifs.
- ***Sustainable and Scalable Model*** - The framework, which connects research, policy, and practice, supports the objectives of sustainable fashion and ODOP while providing a replicable route for reviving other textile clusters.

Conclusion

Fusion textiles that combine Kota Doria structure with Banarasi brocade designs offer a feasible way to revive artisan livelihoods. Fusion weaving has possibilities beyond visual innovation, as seen by its 28% income growth, quality enhancements, and reinvigorated social collaboration. This strategy might be scaled across India's heritage clusters through strategic implementation using infrastructure, branding, financial instruments, and design mentorship. A viable path to maintaining handloom traditions and promoting economic resilience is provided by this design-led, sustainable future.

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Sustainable Activewear: Bridging Market Gaps through Ayurvastra

Anjali Pareek, Research Scholar, Dr. Sulekha Ojha, Sr. Assistant Professor
Department of Fashion & Textiles, IIS (deemed to be university), Jaipur

Abstract

Sustainability has become more of a buzz word than an actual practice in the world currently. The worldwide activewear market is experiencing a shift toward sustainability, driven by increasing consumer awareness and environmental concerns. Traditionally, activewear relies on synthetic materials like polyester, nylon, and spandex, which offer excellent elasticity and moisture-wicking properties but contribute to pollution, non-biodegradability, and resource-intensive production. This study explores the potential of Ayurvastra, a fabric infused with herbal dyes and natural fibers as an eco-friendly alternative for activewear. Ayurvastra textiles offer several benefits, including antimicrobial properties, enhanced skin health, natural breathability, and toxin-free wear, making them well-suited for fitness enthusiasts seeking both performance and wellness benefits.

The research employs a qualitative approach, including market analysis, case studies of sustainable activewear brands, and expert interviews with textile scientists and sustainable fashion designers. Findings indicate that while Ayurvastra textile is a sustainable option, its limited elasticity and durability pose challenges in activewear applications. However, innovative approaches such as blending Ayurvastra with plant-based elastic fibers, utilizing advanced weaving techniques, and incorporating biodegradable elasticity alternatives can help overcome these limitations.

Furthermore, Ayurvastra-based activewear has the potential to differentiate itself in the competitive market by leveraging Ayurveda-inspired branding, targeting health-conscious consumers, and aligning with the growing trend of wellness-oriented fashion. By positioning itself as a holistic alternative that merges sustainability, functionality, and wellness, Ayurvastra can establish a unique niche in the activewear sector. The study suggests that future research should focus on long-term performance testing, consumer acceptance, and scalability to enhance the commercial viability of Ayurvastra-based activewear.

Keywords: *Sustainable activewear, Ayurvastra, herbal textiles, eco-friendly fashion, wellness apparel.*

Introduction

The activewear industry has gained momentum in the current era. Factors that led to this popularity includes rising health consciousness, popularity of athleisure, and a rise in fitness-

related activities. With an increasing demand for activewear, the industry is going through careful observation over its environmental footprint. Dominance of synthetic textiles i.e. polyester, nylon, and spandex is highly observed in most fitness apparels. This is due to their qualities like moisture-wicking, durable, and stretchable. But these materials are harmful for the environment as they are non-biodegradable in nature and are petroleum-derived. They contribute to microplastic pollution, creating ecological challenges (Niinimäki et al., 2020). Other environment friendly options like bamboo, hemp, and organic cotton, have gained a lot of attraction in today's world. But these alternatives lack the strength and elasticity that is demanded in these garments. Ayurvedic traditions are not so commonly used by the customers for the sustainable solution. Ayurvastra- a *vastra* or a cloth that is dyed with herbal infusions is known for its healing effects and medical purpose. These fabrics are crafted from natural fibers and combined with the qualities of medicinal herbs like neem, turmeric, Sandalwood and Tulsi, which gives antimicrobial, anti-inflammatory, and skin-soothing benefits. It is mostly used for healing purposes in India (Yadav & Thakur, 2021).

The research study focuses on how Ayurvastra textiles can be used to meet needs of sportswear while maintaining its properties of sustainability and wellness. The study aims to find a balance between the performance of the product while maintaining the sustainability by investigating mixed techniques, weaving innovations, and plant-based elastane alternatives. The research also includes a comparative case study of sustainable brands (Patagonia, Pangaia, and TALA) for better understanding of successful market positioning, innovation strategies, and consumer engagement which will help Ayurvastra identify its position in their target market i.e. eco-conscious, wellness-driven consumers.

Literature Review

Sustainable development which is often discussed as a perfect model requires substantial investment and right technology, incisive policy, and consistency to make it into practice. "The world does not have an option, either we can preserve nature or accelerate economic growth." It is not about choosing the extreme; there is still a third way where we can have both as climate project economic benefits. Therefore, sustainable development is also a smart development.

A study conducted by the World Resource Institute found investing in climate always has a bigger return and it is mostly tenfold. For one dollar invested in climate action generates more than $10. The study was done in countries like Asia, Africa and South America, their total investment in climate by 2025 is over one 30 billion in a decade over $1 trillion in return, and

it showed that beyond mitigating environmental harm, sustainability initiatives enhance health, generate employment, and strengthen economic resilience, making them a strategic as well as ethical domineering. Climate action and sustainable development count every day in all spheres of life through more jobs, better health, higher productivity, and stronger economy, which is why sustainability is also a good business. Companies that are sustainable outperformed, their peers financially, and there are three big reasons. According to WWF 3% of carbon cuts could save businesses $190 billion. Cutting carbon emission by 3% could also result in an annual of one $190 billion business, reduce economic waste as well, which ultimately leads to increasing efficiency, improve productivity and also boost profits in climate goals, gives us a business purpose. Climate concerns are valued more than profit making machines as purposes are important for customers now.

The rise of sustainable fashion has sparked a wave of innovation in the textile business, notably in sportswear, which was formerly dominated by synthetic fibers. Conventional performance fabrics—such as polyester, nylon, and spandex—are favored for their moisture-wicking capabilities, elasticity, and durability. However, their petroleum-based origins and microplastic shedding raise serious environmental concerns (Niinimäki et al., 2020; Bick et al., 2018).

A significant use of fibres like organic cotton, bamboo, hemp, and merino wool have been used as they are biodegradable and less resource-intensive. But the major challenge in using these as a replacement lies in their less elasticity and durability as compared to synthetic fabrics. (Chen & Burns, 2006). This gap between performance and sustainability has raised a serious concern for novel solutions.

Ayurvastra provides a great opportunity in this industry. It is based on Ayurvedic principles. This fabric is infused with herbal solutions. Herbs are then absorbed through skin which provides various medicinal advantages like improved blood circulation, antimicrobial action, and stress reduction. (Yadav & Thakur, 2021; Tiwari et al., 2024). Herbs such as neem, turmeric, and sandalwood have various benefits. They have anti-microbial and anti-bacterial qualities (Rani et al., 2016; Basavaraj & Narayana, 2023). Many studies have proved that the fabric infused with these herbs are actually helpful in the treatment of skin diseases which adds to the credibility of more than a traditional practice (Basavaraj & Narayana, 2023).

Despite its various advantages and medicinal solutions, Ayurveda has a niche segment in the market and is limited to wellness communities and medicinal textiles. It has yet to penetrate the market of performance wear, where elasticity, shape retention, and comfort are highly

expected. With the help of ribbed knitting and interlocking we can enhance the usability of Ayurvastra in performance or sportswear. (Chowdhury & Khan, 2016). Ayurvastra when combined with ROICA™ V550 or algae-based stretch yarns can add elasticity to the fabric while maintaining its sustainability. (Saxena, 2023).

Several sustainable brands have proven the viability of performance-focused, eco-conscious products. Patagonia, for instance, champions circular design and recycled textiles (Patagonia, 2023). Pangaia blends plant-based innovations with biotechnology, while TALA emphasizes size, inclusivity and upcycled materials (Pangaia, 2022; TALA, 2022). These brands demonstrate that eco-fashion can prosper via innovation, clear messaging, and consumer participation.

Consumers these days are showing more concern about sustainability and are becoming more health conscious which has led to increasing demand for products that are aligned with health, sustainability, and ethical transparency. This provides Ayurvastra with potential to bring change in the sportswear segment—if combined correctly with innovation and existing branding techniques.

Methodology

This study combines a qualitative and exploratory method to assess the possibilities of Ayurvastra-based activewear. Various methods were used simultaneously which includes market analysis through secondary sources, comparative case studies, expert interviews, and a study of already existing literature on herbal textiles.

To know more about the current trends in sustainable activewear a proper market analysis was done through existing sources. Already existing well-known brands like Patagonia, Pangaia, and TALA were chosen for in-depth comparative case studies. Study of these brands helps to know about their material advancements, branding strategies, and consumer relationship techniques to identify potential integration paths with Ayurvastra.

Various existing studies were reviewed for better knowledge. Herbal textiles when tested for dermatological solutions gave positive results (Basavaraj and Narayana, 2023). Another study Tiwari et al. (2024) focused on the holistic benefits of Ayurvastra clothing which supported the existing theoretical knowledge for therapeutic claims and helped in the proper selection of herbs for maximum skin compatibility.

To ensure the reliability and validity, data was thematically analyzed and triangulated. This detailed approach has helped to understand about the structural issues and gave understanding into how Ayurvastra may be redesigned as per the demand of modern activewear.

Semi-structured interviews were conducted to understand the feasibility of adapting Ayurvastra fabrics for activewear by exploring both barriers and possible solutions from experts directly involved in the field-Sustainable fashion designers provided an insight into the performance and market expectations of activewear, Ayurvastra Textile manufacturers imparted practical knowledge about Ayurvastra fabric production and dyeing processes and Textile Researchers offered a scientific perspective on fiber, dye retention and sustainable innovations regarding spandex material alternative. The discussion primarily focused on issues like performance limitations of natural fibers when considering functional demands of activewear that includes elasticity, breathability, durability.Stability of herbal dyes under conditions of sweat and frequent washing. These insights provided a holistic understanding of both design related as well as technical constraints, while also pointing towards innovative solutions that could facilitate the adaption of Ayurvastra fabrics for high performance sports applications.

Findings & Discussion

The study depicts both opportunities and challenges that Ayurvastra textile can face while penetrating and positioning itself within the sustainable activewear market. One big opportunity that Ayurvastra has, is that it can provide the combination of both sustainability and wellness which can act as its USP in their Target Market. Various studies revealed that the use of herbs in fabrics can have medicinal benefits to the wearer. They have qualities like anti-microbial, anti-fungal and can also be beneficial in providing dermatological solutions (Rani et al., 2016; Basavaraj & Narayana, 2023). These qualities are of high relevance in activewear, as they are worn mostly during workout during high perspiration. This potential is mostly underutilized in commercial fashion, which offers Ayurvastra a competitive edge in the market. On the other side there are several challenges as well that Ayurvastra faces. One of the major challenges faced is the lack of consumer awareness in the market. Ayurvastra is still perceived as traditional or medicinal, with little market visibility (Saxena, 2023). Also, the absence of certification for herbal textiles restricts its scalability in the market. Due to this the consumers are less confident about the product. (Singh & Patel, 2021). Without third-party validation, consumers may remain cautious of therapeutic claims.

One of the major challenges that Ayurvastra fabrics face is that it often lacks the elasticity which is highly demanded in active wear. Few practitioners of Ayurvastra use cotton or silk fabrics, which are not suitable for the garments that demand flexibility and stretchability. Interviews with the experts revealed that if one can combine Ayurvastra yarns with biodegradable elastomers, then it can give a solution to this existing barrier. Combining

methods like ribbed knitting or fine stitching may also improve the fit and mobility without the use of synthetics.

Brands like Pangaia and TALA leverage strong storytelling and influencer partnerships to normalize eco-innovation. With an engagement of fitness influencers and yoga communities Ayurvastra can benefit, aligning its message with holistic health and sustainable living. This would help in changing the perception of consumers regarding Ayurvastra textiles.

The potential also lies in regulatory and academic support. Government recognition, eco-labeling schemes, and targeted research can boost Ayurvastra's credibility. Studies done by Tiwari et al. (2024) and Basavaraj & Narayana (2023) must be expanded into long-term trials and further new such studies need to be conducted to measure the real-world impact of Ayurvastra garments in active wear.

Conclusion & Recommendations

These insights collectively reinforce the significant potential of Ayurvastra textiles that act as a sustainable and therapeutic measure in the activewear industry. However, unlocking this potential requires a transition from traditional practices to performance-focused modern practices.

The herbal benefits of Ayurvastra can help to differentiate with other existing products in the market, if properly aligned with growing consumer interests in wellness, skin health, and sustainability. Yet for commercial success, it must overcome **barriers related to certification, awareness, and performance functionality**.

Key Recommendations:

1. **Product Innovation**: Develop stretchable Ayurvastra textiles using biodegradable elastomers and interlock knits to improve fit and mobility.
2. **Scientific Validation**: Conduct controlled studies to test the durability, skin benefits, and antimicrobial properties of Ayurvastra-based garments in activewear contexts.
3. **Certification Development**: Collaborate with AYUSH, textile councils, and independent labs to create a certification standard that verifies herbal textile authenticity and wellness claims.
4. **Brand Storytelling**: Embrace transparent branding strategies that educate consumers about the herbs used, their health benefits, and the eco-processes involved in production.

5. **Collaborative Launches**: Partner with sustainable fashion labels and wellness influencers for capsule collections to introduce Ayurvastra to mainstream audiences.
6. **Consumer Education**: Host digital campaigns and workshops, particularly in yoga studios, universities, and health-focused events, to demystify Ayurvastra and boost demand.

Ayurvastra textiles embodies a synergy between traditional knowledge and the ongoing concept of sustainability dealing with health issues. With the right combination of market alignment, scientific validation, and design innovation, it can transcend niche appeal and help redefine sustainable performance wear for the modern consumer.

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A Semiotic Analysis of Mona Lisa Artwork in Advertising for Brand Recognition

Rajeev Sharma, Assistant Professor, Amity School of Fine Arts

Abstract

One of the most remarkable masterpieces of Leonardo da Vinci is Monalisa, it is a global cultural icon known for its universal appeal and enigmatic smile. This study is the exploration of the semiotic analysis of the Monalisa's image in the advertising field, exploring how its iconic and symbolic elements are appropriated to enhance the brand recognition among consumers. Using Peirce's semiotic framework and Barthes' theory of myth, this paper will explain how elements of the painting, especially the vague facial expression, are used in new ways to build a brand identity and influence consumer behaviour in the market. Through a qualitative analysis of several advertisements, this paper shows how cultural meaning, reference to text, and persuasive techniques work together. It highlights how Monalisa is used as a symbol of allure, sophistication, and prestige. The finding contributes to the explanation of the use of cultural symbols in advertising to build brand recognition, offering insights for researchers and professionals in semiotics, marketing, and cultural studies.

Keywords: *Monalisa, Semiotics, Brand Recognition, Visual Symbolism*

Introduction

Among the many one of the most remarkable artworks of Leonardo da Vinci is a portrait of a Florentine lady whose name was Lisa "Mona Lisa", painted in c.1502. Its medium was oil on wood (sfumato), currently exhibited for the lover of art in the Louvre Museum in Paris (Gombrich, 1995). The Mona Lisa's enigmatic smile is captivating and mysterious, primarily due to Leonardo da Vinci's masterful artistic techniques and the psychological complexity it evokes (Miller, 2021). In the field of advertising, visuals are used as a communication tool to capture consumer attention towards the brand to make it memorable and recognizable among the cluttered market (Snelders, 2010). Advertising always has a close relationship with art, which is often used to enhance the effectiveness and emotional impact of ads on consumers. This link is many times referred to as "artvertising" a mix of artistic elements in the commercial campaigns (Screen Voice by AKTV, 2024). One of the most used artworks from the great masters is "Mona Lisa"; many brands have successfully run their advertising campaigns over

this artwork. The Mona Lisa painting conveys messages of mystery, sophistication, elegance, genius, femininity, and prestige, enhancing brand recognition across different markets. Such adaptation can provoke, evoke nostalgia, and amuse the audience, depending on how the image is used to target the right customers.

This research paper, with the help of semiotic analysis, tries to explore how Mona Lisa's visual and symbolic elements are adapted in advertising to build brand image and encourage customer engagement. This study's research questions are (1) how are the Mona Lisa's visual elements recontextualized in the advertising to enhance brand recognition? (2) What emotional and cultural senses are evoked through its use? This study explores the connection between advertising and visual arts through the adaptation of Mona Lisa as a cultural and commercial image. It also examines how visual arts are appropriate for ads, raising aesthetic and ethical questions. The purpose is to examine how meaning can be created and transformed during the process. Also, enrich the discourse on visual semiotics in advertising.

Literature Review

According to Sanders Peirce's theory of signs, i.e., semiotics, is a basic approach to understanding how meaning can be communicated through signs. His theory describes sign processes (or "semiosis") as a triadic relationship consisting of three elements: Sign: The form taken by the sign, not necessarily material, such as a word, image, or sound. Object: The real-world thing or concept to which the sign refers. And Interpretant: The meaning made by interpreting the sign; it's the effect caused by the sign on the mind of the interpreter. Also, Peirce classifies sign relationships according to how signs relate to their objects. Icon (A sign that resembles its object), Index (A sign physically or causally connected to its object), and involving three key components: Icon (which is exactly what it is visible), Index (meaning that it is indicating to), and Symbol (which the society or culture has decided that has a meaning) (Afisi, 2020). Similarly, Roland Barthes, a French literary theorist, expanded semiotics field by analysing how meaning is developed in cultures. His study key components are Signifier and Signified means a sign is a signifier (a physical element) and a signified (meaning that is conveyed by a sign). Also, Denotation and Connotation mean a sign can denote a literal meaning with its appearance, and the meaning, i.e., connotation, is derived from the sign in an emotional or cultural way. Barthes' concept of myth describes how signs become signifiers in a second-order system, naturalizing ideological values like patriotism or power. By analysing cultural phenomena, Barthes reveals how signs reinforce societal ideologies, presenting them

as natural truths (Griffin, 2012). According to Claire Harrison's study, "Visual Social Semiotics," it gives a framework for analysing how the images and text create meaning in multimodal documents. It introduces three meta functions (i) representational, (ii) interpersonal, and (iii) compositional to comprehend images as social processes shaped by cultural conventions. Applying the same model to the Mona Lisa painting, the framework shows how its direct stare, balanced composition, and realistic modality engage viewers' attention and convey timeless meaning. This approach enhances art historical analyses by prioritising the painting's communicative power across contexts (Harrison, 2003).

1. Methodology

Research Design

A semiotic analysis based on a qualitative approach is conducted to investigate the use of the Mona Lisa's painting in advertising. The qualitative method is appropriate for exploring the nuanced meanings of visual elements and their cultural implications (Rose, 2002). The study selects advertisements that feature the Mona Lisa in their ads to communicate their idea to the audience.

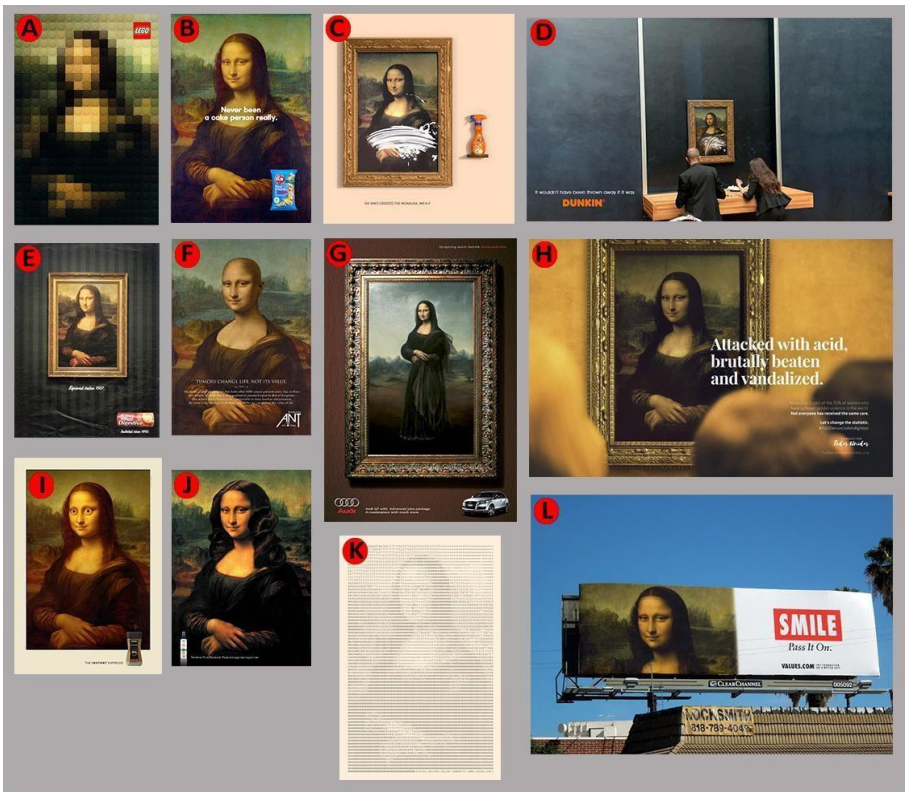

Plate 1: Mona Lisa Painting used by different Brands.

Data Collection

A sample of 12 advertisements was collected from different brands across different sectors. Advertisements were collected from different online archives, advertising databases, and brand websites with selection criteria including: (1) explicit utilization of the Mona Lisa's painting or recognizable features, (2) representation of diverse industries, and (3) publication within the specified timeframe.

Data Analysis

The analysis followed a three-way process:

1. Identifying the Signifiers: Visual and written elements in advertisements were identified, focusing on the Mona Lisa's smile, gaze, background, and text or slogans.

2. Understanding the Meaning Signified: Applying Peirce's semiotic triad, the represent amen, object, and interpreting were analysed to understand the emotional and cultural meanings conveyed. Barthes' concept of myth was applied to examine how the Mona Lisa's painting constructs ideological tales.

3. Inter-Culture Comparison: Advertisements from different countries markets were compared to identify distinction in semiotic tactics and their alignment with their culture.

4. Analysis

The Mona Lisa as a Semiotic Sign

The Mona Lisa painting is used as both a recognizable image and a symbol of elegance, mystery, and sophistication also showcases cultural value. In plate:1 figure (G), in 2008 Audi car advertisement, the painting is completed in a full figure, and below it is comparing Audi car to a masterpiece by comparing it to Mona Lisa. The semiotic flexibility permits the Mona Lisa to appeal to varied consumer segments, increasing the brand recognition. Similarly, sometimes the image of Mona Lisa is so popular that Lego brand uses it as form of pixels as shown in plate:1 (A). This iconic work gives the impression of Mona Lisa to delivery their message effectively to their target audience.

In plate1 figure (B) showcase the Mona Lisa's is shown in Swedish crisps brand OLW claiming that Mona Lisa as an iconic and luxury person not a cake person only so it depends also how the message can be tweaked according to the brand. This method of representation can create a

sense of personal engagement, making the brand more consumer-centric. In plate:1 figure (D), this campaign titled 'Monalisa!' was published in 2022 in Egypt. In this ad two person are cleaning the Monalisa Painting some creamy stuff from the glass used for protection and there in a subtle way Dunkin claiming that “It would have been thrown if it was Dunkin!” In this utilization of the Mona Lisa as a represent amen (visual form) refers to the historical painting (object) while creating creativity and human connection, reinforcing Dunkin’s brand identity.

Intertextuality and Myth-Making

Advertising people use intertextuality to associate the Mona Lisa with contemporary cultural contexts, transforming it into a myth of timeless charm. In Plate1 figure (J), this professional campaign of Pantene titled 'Mona Lisa' was published in 2007 in Australia. It is showing the Mona Lisa with a curly thick hair with a text “Pentene time renewal, remove aged damaged hair” this intertextual image decontextualizes it as symbol of timeless modern beauty. Roland Barthes’ concept of myth is obvious here, as the Mona Lisa’s image is known for its historical relevance and infused with new meanings according to the brand’s concept.

In Plate:1 figure (K), this campaign titled 'Da Vinci, Van Gogh, Monalisa' was published on June 01, 2006 by AMO communication to showcase these three masterpieces with the help of text forming the portrait of Mona Lisa, Da Vinci and Van Gogh this showcase how the text along with visual que plays an important role in advertising. Similarly in Plate:1 (E), Mona Lisa is shown in advertisements, in this case for biscuits brand. The poster was displayed at a Sweden’s railway station and the top text stated: "Copied since 1507." The lower text says: "Imitated since 1898." So this combination of text is aligning well with visual to narrate a story of brand legacy.

Persuasion Method

The Mona Lisa’s enigmatic facial expression used as an important persuasive tool for engaging audiences’ emotions and with multiple interpretations by the individuals. In a 2014 Nescafe uses Mona Lisa in their campaign (Plate:1 figure I), the Mona Lisa’s shown with big open eyes with a text “The Instant Expresso” rest of the image remained the same but the interpretation well goes with the brand message and making recognizable for the audience. This Mona Lisa’s gaze plays an important role in persuasion.

In plate:1 (C), H-7 Stain remover in 2022 ad is based on the incident happened where some

people put some dirty stain on the glass of the Painting in Louvre Museum so the advertiser put the product bottle next to Mona Lisa painting and written text as "DA VINCI CREATED THE MONALISA, WE H-7". So, this is the way they use the incident for the promotion of their advert. A similar kind of billboard ad can be in plate:1 (L), where Monalisa smile gets the attention of the audience to persuade them in this visual played an import part.

Cross-Cultural Variations

This iconic work not used only for selling the product only but also used across countries to propagate any social issues. In plate:1 (F), ANT foundation done a campaign on aware the audience about the issue on tumor, in this ad Mona Lisa is shown with no hair which gets the attention of the people across different company. Similarly, plate:1 (H) Fundación Todas Unidas did an ad campaign using Mona Lisa attacking incident and aligning it the violence used against women that they face in everyday life. Therefore, Monalisa is used by different nations brand whether it's, western or Asian market they used it as it suited their brand message and help them to effectively narrate their story to make the ad relatable for their consumers.

Discussion

The Mona Lisa's painting is used in advertising across countries, giving it a status as a polysemantic sign, can convey different meanings across contexts. Its enigmatic smile and stare serve as a signifier that advertisers manipulate to encourage audience emotions that vary from aspiration to intimacy. The painting's cultural prestige increases brand trust ability, also its intertextual adaptation generates a dialogue between historical visual art and the modern market. This iconic and symbolic sign allows the Mona Lisa to link cultural gaps, making it an important tool for brand recognition.

While the use of Mona Lisa in advertising raises some ethical concerns. The commercial use of iconic works or artifacts may risk destroying their artistic value, converting them into a piece of marketing tool. Like, frequent changes in Mona Lisa's painting in ad campaigns may relevance and sensibility are important, as misaligned semiotic meanings can separate target audiences, so it is important for advertisers to keep the feelings associated with culture should be well respected.

Conclusion

This paper has showcased how the Mona Lisa's painting, particularly its enigmatic smile and stare, works as a persuasive tool in advertising across different nations to enhance brand image and recognition. With the help of semiotic analysis of Peirce's triad and Barthes' concept of myth, the research has explained how advertising people decontextualize the painting's image and symbolic elements to build compelling storytelling. The findings of this study reveal that the Mona Lisa's polysemantics allow it to associate with different audiences, with cultural acceptance allowing brands to align with cultural values and aesthetic appeal.
Also, the commercialization of cultural artwork raises ethical questions about the balance between artistic integrity and commercial gain.

This research paper will contribute to the fields of marketing, semiotics, and cultural studies, offering a context for analyzing the use of cultural iconic artworks in advertising. It emphasizes the Mona Lisa's lasting appeal as a symbol of mystery, elegance, and prestige, making it an important tool for creative brand communication.

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Plate links

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C) https://www.adsoftheworld.com/campaigns/da-vinci-created-the-monalisa-we-kh-7

D) https://www.adsoftheworld.com/campaigns/monalisa

E) https://www.researchgate.net/figure/Nowadays-the-Mona-Lisa-may-be-seen-in-advertisements-in-this-case-for-biscuits-This_fig2_334898532

F) https://www.adsoftheworld.com/campaigns/mona-lisa-ff9cd8e1-a465-4b65-b76d-fcf32316066b

G) https://www.adsoftheworld.com/campaigns/mona-lisa-3ce59188-d8fd-4f71-8ef2-6015754ad0cd

H) https://adsspot.me/media/prints/fundacion-todas-unidas-mona-lisa-f508be9ab906

I) https://adsspot.me/media/prints/nescafe-mona-lisa-1fd7fce4fce8

J) https://www.adsoftheworld.com/campaigns/monalisa

K) https://www.adsoftheworld.com/campaigns/da-vinci-8fbc6b4d-cc5b-4d64-89a8-1fd52237ec6e

L) https://medium.com/@KamlynBrooks/mona-lisa-as-an-advertising-face-db919a66204a

Structural Abstractions of Nature: Black Heron-Inspired Roofs for Environmentally Responsive Design

Khushi Jawale | Hiral Patel | Tarang Jariwala Prof.
Chaitali Sheth, Assistant Professor
Gujarat Law Society Institute of Design, Ahmedabad, Gujarat, India

Abstract

This research paper presents an architectural approach to hilly terrains by incorporating nature-integrated design, reimagining the roof as both a functional shelter and a symbolic form. Nature encompasses the physical world and all its living and non-living components including plants, animals and natural phenomena. The research study incorporates the process of deriving inspiration from nature and translating it into useful entities. Biomimicry leverages nature's adaptive forms and strategies to create sustainable, performance-driven design solutions. In architecture, it translates biological intelligence into context-responsive materials, structures, and spatial innovations.

The study draws a specific focus on Black Heron, a wading bird of sub-Saharan Africa and parts of Madagascar. An in depth study of Black Heron's postures, habitats, habits, reproduction system, eating habits, layering of wings, parts of body was carried out. Sleeping posture was used as a base medium for abstraction of form and structure. A Compact, Hunched position, tucking its long neck and folding its wings tightly around its body. An intangible aspect of protection, private yet having minimal exposure were also recognised during the research Through theoretical analysis and form exploration inspired by the Black Heron's posture, the project developed conceptual models and spatial diagrams to explore how natural compositions can inform roof structures in hilly terrains. The Black Heron's sleeping posture inspired a lightweight, environmentally responsive roof form that adapts to sloped terrains,

reducing visual impact and enhancing environmental interaction through light, shadow, and voids. This highlights the role of nature-inspired design in creating resilient, adaptable architecture in challenging terrains.

Keywords: *Black Heron Posture, Nature-Integrated Design, Sustainable Roof Form Design, Adaptive design, Hilly Terrain Architecture*

Introduction

Confronted with the ever-growing environmental problems and the necessity of sustainable development, modern architecture and design are rapidly resorting to nature as inspiration and a means of resolving the problems. The evolution of nature has lasted 3.8 billion years to produce systems of high efficiency, resiliency, and natural sustainability (Benyus, 1997). It is with this evolutionary intelligence that the natural world has a large source of structural frameworks, material performance, and adaptive solutions that designers can borrow to address the ecological issues.

The term biomimicry was coined by American biologist Janine Benyus in the ground-breaking book Biomimicry: Innovation Inspired by Nature (1997), and is used to promote the adoption of nature as a model, measure, and mentor. It is about mimicking biological responses and using them to address human design queries in regenerative and ecologically conformant methods. Biomimicry has also been defined as the aesthetic imitation of living things (Benyus, 1997), but that definition does not do the concept justice in the view of some authors, as it takes into consideration only the superficial aspects. Nature turns out as an instruction brief as well as a rating of execution.

The most crucial to mention is architectural practice that adopted biomimicry as an approach to build structures not only as an object but as a living system that can react to the surrounding environment and manage it as well as be in harmony with ecosystems (Kennedy et al., 2015). Significant examples of this include the Eastgate Centre in Harare, Zimbabwe, designed by

architect Mick Pearce. It mimics the thermoregulatory qualities of termite mounds, and reaches its interior climate by means of passive cooling and thermal mass, thus doing away with the need for typical HVAC systems (Turner & Soar, 2008). The same applies to the Eden Project in the UK, where formal inspiration by pollen grains and soap bubbles led to exhibition alleys of hexagonal and pentagonal panels that maximize structural performance but also convey a sense of organic cellular forms (Pawlyn, 2011).

This study aims to develop the biomimicry discussion into the study of the biological form, behavior, and adaptive measures of the Black Heron (Egretta ardesiaca). The characteristic pose of The Black Heron during her hunting, when the bird creates a shade by creating a shaded cover and attracting its target with such conditions, opens an interesting metaphor based on the spatial shelter and reactive design. The paper critically looks at the bird, its morphology, the articulation of the wings, the behavioral mechanism, and the way it integrates itself with the environment to distill its strategies into elements of architecture. Each dimension, including its stratified feathering and skeletal dynamics, its diurnal cycles, and ecological services, is investigated concerning how those dimensions might be applied in environmentally responsive design.

With the help of this investigation, the paper will be able to illustrate how profound biological knowledge can result in building solutions that are not just place-appropriate as architectural solutions, but also aesthetically powerful and ecologically regenerative.

History and Significance of Biomimicry

The use of nature as a source of inspiration against human problems is not new. Educated people nowadays understand and realize that animals, plants, and ecosystems were studied by ancient civilizations instinctively to formulate tools, shelters, and patterns that fit the environment in which they existed. Among the first pioneers of thought on biomimicry was

Leonardo da Vinci, who studied birds' anatomy and flight patterns to design flying machines. Even though his designs had not been materialized during his life, he became a testimony of how natural mechanics can be learned (Vincent et al., 2006).

The contemporary biomimicry system, however, rose to measure in the 20th century through major innovations. An illustrative one is the invention of Velcro819, Velcro819 is a noun which is a trademark registered name which is pronounced like VEL-CRO, the hooks used in this case came in the form of a microscopic size on the burrs of the burdock plant. Swiss engineer George de Mestral, patented this concept in 1955, having noticed how the burrs attached themselves to his pet dog on the way out on a walk (Benyus, 1997).

The concept of natural selection forms the foundation of biomimicry, wherein organisms, over millions of years, have developed survival strategies that are inherently adaptive. This evolutionary intelligence results in highly optimized systems, positioning nature as a vast and living encyclopedia of design innovation (Kennedy et al., 2015). A compelling example from bio-inspired mechanics in human history is the development of the first successful powered flight by the Wright brothers. Their work was informed by close observation of avian flight, particularly the principles of balance and maneuverability in birds (Pawlyn, 2011).

Nature presents a great source of information to get insights into its processes, forms, and systems, and this gives the present-day designer a good reference. The expression of biomimetic thinking in buildings, engineering, and the design of products not only results in aesthetic innovativeness but also in functional effectiveness, robustness, and environmental sensitivity. Nature as model, measure, and mentor (as formulated by Benyus 1997), provides a means to incorporate human-made systems with the principles of sustainability of the biosphere.

Delving into Nature-Based Solutions to Sustainable Innovation

The tool of biomimicry can be very useful in transforming the field of design to more sustainable design because it emphasizes the adoption of energy-efficient, material-sensitive, and eco-integrative solutions. Biology comes with a very tight set of resources to work with, performing/optimizing all of the structures and functions with the minimum possible waste. When used in the context of design, these principles promote circularity, flexibility, and climate responsiveness (Kennedy et al., 2015).

This is because nature has perfected its efficiencies, but depending on aspects of these processes, designers can create buildings, products, and systems that not only are high-performance, but also regenerative spaces (Pawlyn, 2011), this is because nature has already perfected and naturalised these processes, which are distributed throughout its systems. An example of this is in building design, through self-cooling termite mounds, or by water-harvesting beetles in the desert or even hydrophobic surfaces inspired by the lotus leave (Pawlyn, 2 Biomimicry can also improve on innovation in terms of fostering of systems thinking, where every component is synonymous with higher ecological and human aspirations.

Formally, the various geometries of nature and the organic beauty serve as the inspiration of spatial and material articulation that is elegant but functional. The notion of form following form that can be seen in all natural species highlights the point that design beauty is frequently found in the performance-determined solutions (Vincent et al., 2006).

However, biomimicry can become a science, design, and sustainability nexus by showing the evolutionary knowledge of nature in the form of actionable innovation and moving toward resilient, harmonious, and context-aware design forms.

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Objective

- To analyze the behavioral patterns and physical features of the Black Heron to extract spatial design principles.
- To translate biological phenomena into sustainable architectural design strategies using biomimetic principles.

Research Methodology

This study follows a qualitative, design-driven approach rooted in natural observation and conceptual translation. The process began by closely observing the black heron, particularly its unique sleeping posture, which suggested ideas of privacy, shelter, and enclosure. These insights informed initial abstract sketches focused on capturing the curves and folding gestures of the bird rather than conventional architecture.

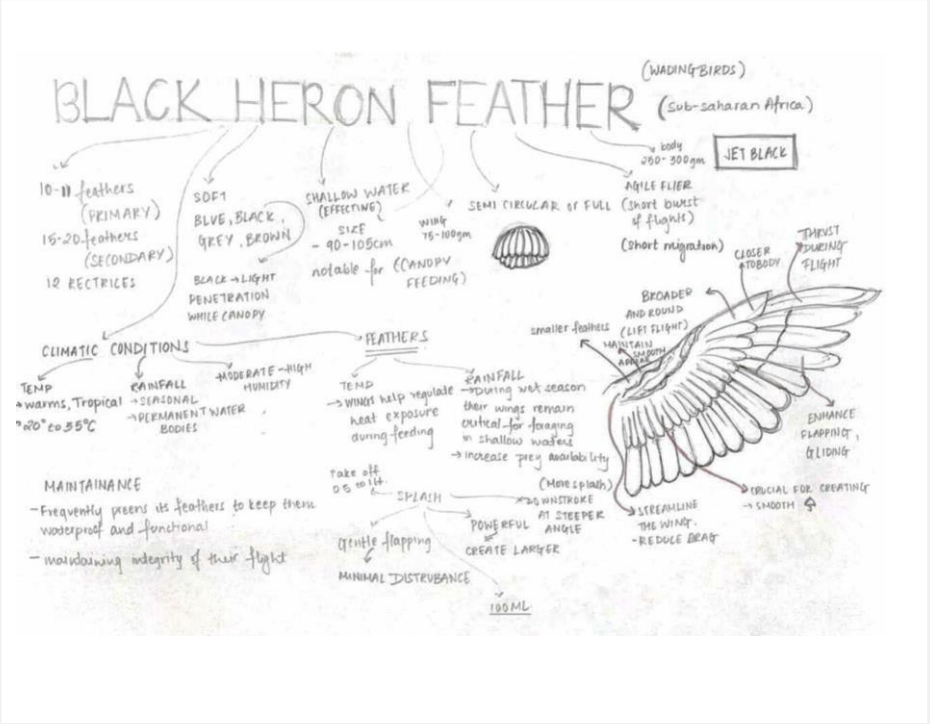
The concept evolved into using the roof as a central architectural element much like a wing offering protection rather than as a secondary structural feature. Inspired by the heron's grounded presence, the idea of placing the structure partially underground emerged, integrating it with the land and reinforcing a sense of quiet retreat.

Design development continued through iterative sketching and form studies, translating the bird's posture into spatial arrangements. The methodology remained intuitive yet purposeful, aligning natural behavior with architectural form.

Analysis and Discussion

Sketches and Mechanism

The hunting process of the Black Heron is a natural example of a functional mechanism. It starts in a calm, standing posture. As it senses movement in the water, it gradually extends its wings outward and forward. This movement forms a dome-like shape, which resembles an umbrella. This shape is not random by covering the water, it creates shade, attracting fish underneath.



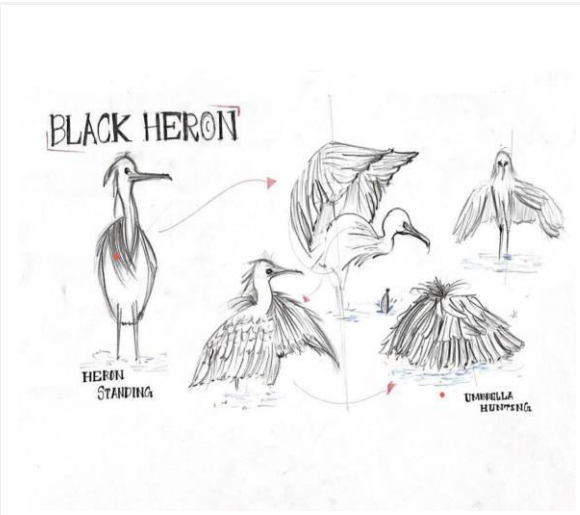


Fig. 2 Wing motion during prey search of Black Heron

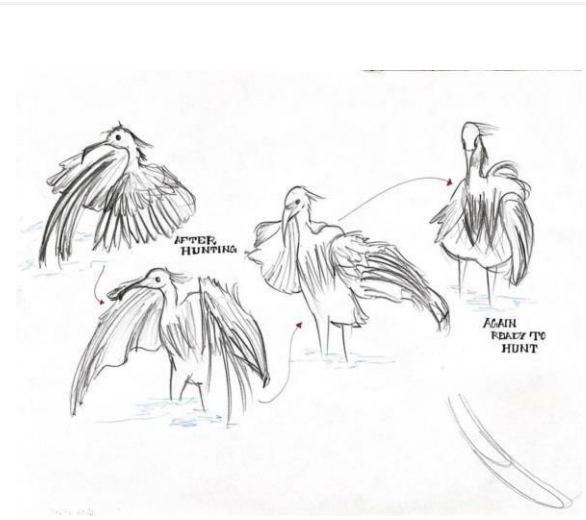


Fig. 3. Black Heron, opening up wings during prey search

Fig 2 and 3 shows that the feathers of the black heron are soft, long, and layered in a way that helps it move smoothly. When the bird is standing, the feathers stay close to the body, giving it a neat and upright look. As it starts to open its wings, the feathers spread out gently, almost like unfolding fabric. The way the feathers shift and layer during each step shows how every small detail in the bird's body works together for a specific purpose. It's not just about flying;

it's about function, control, and smooth movement.

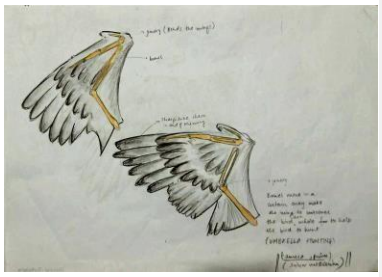


Fig. 4. Bones-folding structure within wings

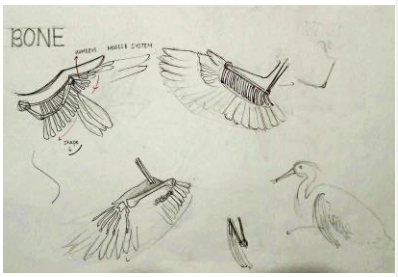


Fig. 5. Bone structure and mechanism of the wings

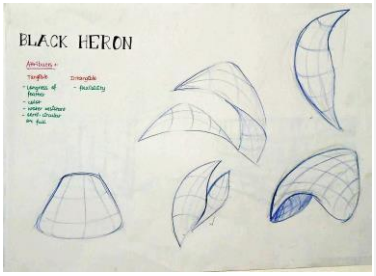


Fig. 6 Different forms emerging from Black Herons's Wings

Fig. 4. The shoulder structure of the Black Heron operates similarly to a mechanical ball joint, enabling extensive rotational movement of the wings. This anatomical joint allows the bird to spread, curve, and fold its wings seamlessly into an umbrella-like form, supporting a range of motions that emphasize the ball-joint functionality. Like an engineered ball joint, it facilitates multi-directional movement while maintaining control and stability, which is critical for the heron's precise hunting posture.

Fig. 5. The conceptual forms were derived from the dynamic wing movements observed in the Black Heron during its hunting behavior. As the wings arch to form a protective canopy, the sequential sketches attempt to capture this transformation, from open extension to full enclosure. The objective was to interpret the bird's fluid and adaptive motion into a structured architectural expression.

Following this conceptual exploration, a basic paper model was constructed to physically test how the wing formations could inform the shaping of roof planes. Although the model was imperfect due to some misaligned cuts, it proved valuable in understanding the interaction of layers, resembling the overlapping of feathers and in assessing how light, shadow, and topography might influence the spatial form.

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After coming up with the first ideas, the design was put together in SketchUp so it'd be easier to tweak the shapes and see how the space fits together. The structure was modeled at a scale of 1:50, which provided sufficient detail for evaluating form while maintaining design flexibility. Various roof angles and overlapping configurations were tested to achieve an appropriate balance between visual layering and structural clarity. Adjustments to light and shadow settings within the digital environment revealed possibilities for passive daylighting and ventilation. These gaps between roof planes, when strategically arranged, suggested a system of filtered light and airflow reminiscent of the dappled sunlight beneath a bird's wing.

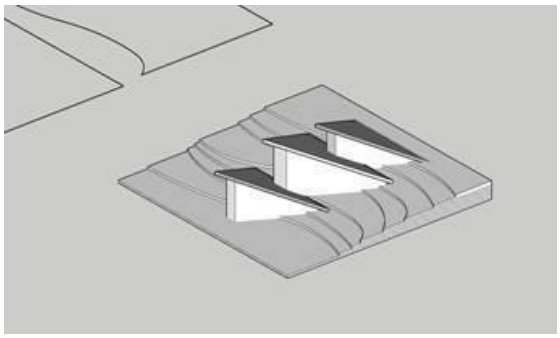

Fig. 7 SketchUp model showing structure in terrain

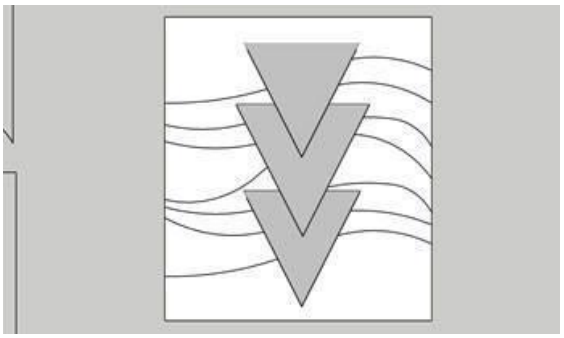

Fig. 8. Top view resembling Black Heron's sleeping posture

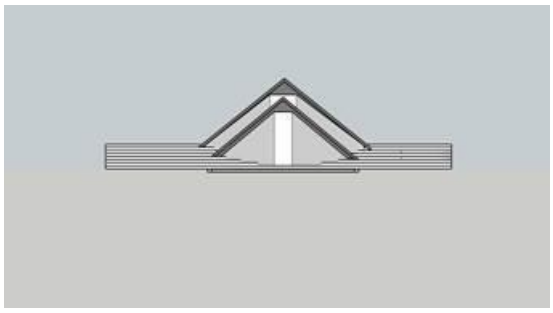

Fig. 9 Front view of the structure

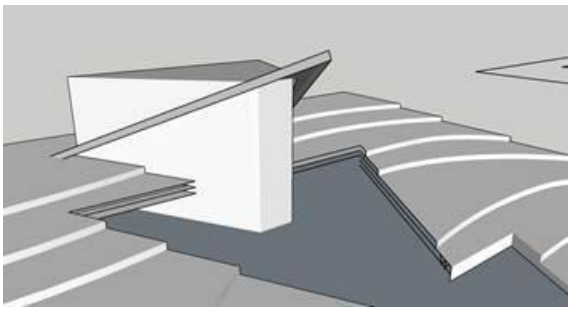

Fig. 10 Section revealing depth of structure in terrain

After finalizing the digital model, it was exported to AutoCAD for laser cutting preparation. Pine MDF was selected for the physical model due to its strength, clean finish, and natural appearance, which aligned with the design intent. Each roof plane and terrain contour was carefully labeled and dry-fitted before final assembly. The construction was completed manually using adhesive, with particular attention to maintaining clean joints and accurate

alignment. While the overall aim was to convey lightness and layering, additional care was required at junctions where angled planes met the sloped base. The process extended beyond replicating the bird's posture; it involved interpreting the reasoning behind that form and allowing it to inform spatial decisions. The completed model expresses the heron's protective stance, drawn inward, grounded, and responsive to its surroundings, mirroring the architectural intent.

Fig. 11. Final prototype showing side view

Fig. 12. Final prototype with roof structure

Design Outcome

The end result for this project was a roof that took direct inspiration from how a Black Heron sleeps, imagine the bird wrapping its wings tightly around itself, and that became a bunch of layered, angled shapes that worked as a shelter. The whole idea drove the design, so the building ended up with groups of triangular roofs sitting on a stepped base that's meant to feel like hilly ground.

The goal was to bring out the sense of protection, compactness, and adaptability that you see in the heron's behavior. Each roof piece was tilted and stacked in a way that's similar to how feathers layer, which gives the whole thing an enclosed vibe without completely sealing it off. The gaps between the panels were kept open on purpose of letting in plenty of fresh air and daylight, just like the bird's wings let some light through when it's sheltering.

Most of the building is dug into the ground, which means the roof catches your eye first and helps the structure blend into the hillside. This move made the building feel less intrusive on the landscape, which seemed perfect for a design that's supposed to snack nicely into nature.

Building and testing the model taught a lot about what natural shapes can do for architecture, especially if you abstract them thoughtfully. The laid-back sleeping pose of the Black Heron actually worked great as a flexible spatial idea for rugged terrain. The layered roof shapes made it look light and protective, and felt grounded in its setting.

Embedding the building in the slope was clever not just visually but also conceptually it made the structure 'tucked in' just like the bird, which is handy in hilly or sensitive spots where you don't want to stand out too much. The spaces between roof panels created cool effects with natural light and shadows, which wasn't really planned at first but ended up being a neat way to handle daylight instead of regular windows.

When it comes to actually building it, the design's simple shapes mean it can be put together out of flat pieces, so you could use bamboo, engineered timber, or even fabric depending on the location. The model used MDF, but the idea is to try lightweight, sustainable materials for the real deal.

Honestly, the whole process proved how even something simple in nature like a bird tucking its wings, can inspire a solid architectural idea. You don't have to get super complex with biomimicry; sometimes it's about paying attention and turning that into a design with purpose.

Biomimicry and Conceptual Form Development

The black heron's pose was the starting point for the whole thing, leading to a roof that acts like a shield and has some real meaning behind it. Copying how the bird spreads its wings gives us a design that's light, protective, and able to fit into all kinds of spaces, kind of showing how nature's inventions, especially ones made for their surroundings, can make buildings work well and look good. By looking at things this way, the project shows that using ideas from nature can help create designs that are strong, good-looking, and really fit in with what's around them.

Integration with Topography and Environment

Building on hilly land comes with its own set of problems like steep slopes, hard-to-reach spots, and making sure the building doesn't look out of place. In this situation, copying

nature gives a smart way to design by blending the building into the land instead of just putting it on top. By looking at how nature works, the design focused more on living with the environment rather than trying to take over it. The roof was shaped to match the hill's curves, which helped it blend in better and also used natural perks like shade, fresh airflow, and keeping the temperature right.

Design Thinking and Analytical Methods

Instead of using regular number-based methods, this research focused on spotting patterns, making comparisons, and studying shapes. These ways helped turn things from nature like how birds move their wings to create shade, how plants turn to face the sun, and how animals dig to stay cool into design ideas for buildings. Drawing by hand and building physical models made it easier to bring these ideas to life in the design, mixing creativity with practical thinking.

Implications for Sustainable Practice

This nature-inspired way gives a really tailored path to being sustainable by matching the design with the local environment and landscape vibe. It borrows clever tricks from nature to come up with strong solutions that cut down on machines, use local materials smartly, and keep the environment healthy. This is super important in tricky spots like hills, where you want to keep the place looking natural and avoid messing things up. Instead of forcing buildings onto the land, this approach focuses on fitting in, making architecture that works well and cares for the environment.

Learning & Shortfalls

At the start of the design work, the team ran into a bunch of challenges, mostly because it was their first time working on a building scale, especially with the roof as the main focus. One big problem was getting the physical model the right size. Since the design was inspired by the nCaved House, which is built into a rocky hill, working with the land's shape and contours

turned out to be trickier than expected.

Another tough part was turning the Black Heron's sleeping pose into a roof that actually worked and fit the site. Even though the idea looked cool and had meaning, making the bird's curved, wing-like shape into a real building wasn't easy. The early versions were often too abstract, and the models didn't feel like they fit the space or the land very well. Sometimes, the layered roof idea looked more like decoration than something practical. These challenges taught the team an important lesson: a great idea needs to be carefully checked for whether it can actually stand up and make sense in the space to really work as architecture. At the start of designing, the team faced quite a few challenges since it was their first time working on a building-size project, especially with the roof being the main focus. One of the biggest struggles was getting the physical model to the right scale. Because the design took inspiration from the nCaved House, which is built into a rocky hill, handling the land's shape and contours ended up being harder than they thought.

Another tricky part was turning the Black Heron's sleeping pose into a roof that actually worked and fit into the area. The idea looked cool and had meaning, but making the bird's curved, wing-like shape real in a building was tough. Early versions were sometimes too abstract, making the models feel off or not fitting well with the land. Sometimes, the layers of the roof seemed more like decoration than something useful. These struggles showed how important it is that a strong idea also needs to be tested carefully to make sure it's solid and actually fits well to succeed as architecture.

Design Improvements after Initial Challenges

The design was purposely made simpler. Instead of copying the Black Heron's exact shape, the team focused on the big ideas of protection and layering. They looked closer at how the bird's posture acts like a shield from light, wind, and distractions, not just its form.This change helped

the design move from copying to a more meaningful interpretation.

At the same time, more care was taken to fit the roof with the sloped land. Inspired by the nCaved House, the roof shape was tweaked to follow the natural curves of the site, which made the model feel more connected to the ground and opened up cool chances to play with light, shadows, and fresh airflow.

The design got better with section studies and light tests that showed how angled roofs could let sunlight in just right while keeping the space cozy kind of like how a bird's wing gently filters light. Altogether, these changes turned the project from a vague idea into a clear design that really responds to the land and weather.

Conclusion

Throughout the project, the way the Black Heron sleeps became a strong inspiration for the roof design, shaping both its look and how it was built. What first seemed like just a cool compact shape turned out to have deeper meaning and space qualities when looked at more closely. The bird's posture gave off a vibe of protection, calm, and quiet strength, and those feelings were carefully brought into the design.

Working on the building's shape at this scale, especially fitting it to the land, was pretty challenging. Making models was key but tough, especially figuring out how the roof and stepped base fit together. Early tries didn't always match the land well, so there was lots of testing and changing. By looking at natural habits like the heron's pose and architecture like the nCaved House, the team slowly created a design that fit its spot better.

One big lesson was that biomimicry isn't just copying nature's shapes. It's about digging into how nature works, its logic and subtlety. Instead of just copying the heron's shape, the design tried to capture what it feels like in that space. This showed up in things like layering the roof like feathers, leaving gaps for light and air, and placing the building into the ground to keep it low-key.

In the end, the design became more than just a roof, it's a space that feels protective and tuned into the landscape. It fits in instead of taking over, let's light filter through rather than block it, and offers shelter without being shut in. Above all, the project shows how nature-inspired design can create buildings that are meaningful and connected to the environment, coming

from understanding nature instead of just copying it.

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Rooted Modernism: Charles Correa's Biophilic Tribute to Gandhian Values at Sabarmati Ashram, Ahmedabad

Chaitali Sheth | Dr. Suman Pandey

GLS Institute of Design, GLS University, Ahmedabad, Gujarat, India

Abstract

Gandhi Smarak Sangrahalaya, by Charles Correa at Sabarmati Ashram, is an appropriate structure and expression of the Gandhian spirit of frugality, swadeshi, and swaraj through its topographic, climatic, cultural, and spiritual self. Through the lens of biophilic design, the museum rekindles the connectivity between humans and nature and culture through courtyards, water features, open-to-the-sky corridors, and the use of tactile materials. The modular grid used by Correa brings the building closer to Hindu isotropy and vernacular village plan, creating more open and thoughtful spaces. The paper will consider the features of the Ashram in relation to the 14 Patterns of Biophilic Design by Terrapin Bright Green and specifically look at sensory engagement, non-sensory connections, thermal comfort, and spatial complexity. Through site visits, spatial analysis, and photographic documents, this paper situates Correa's architecture in the concept of critical regionalism and argues that his architecture moves beyond the spheres of utility, towards memory, atmosphere, and astronomy, and takes shape in that which is otherwise invisible.

Keywords: *Critical Regionalism, Vernacular Architecture, Gandhian Philosophy, Biophilic Design, Cultural Sustainability, Gandhi Ashram, Regional Expression*

Introduction

The built sculpture that lies within the architecture is culturally sensitive and environmentally conscious, and thus it is not just architecture, but rather a value of identity and memory. One such figure to reject Western universalism and pursue the design of a place, rather than a universal approach, was Charles Correa (1930-2015) in post-independence India (Correa 22).

This philosophy is exemplified in his Gandhi Smarak Sangrahalaya (1963) at the Sabarmati Ashram. Instead of concluding in making Gandhi a monument, it is the objectification of ideas about simplicity, swaraj, swadeshi, and ecological balance through the use of modest material, open planning, and adaptation to climate and site (Gupta; Tandon). The building design reflects the critical regionalism ideal developed by Kenneth Frampton, who advocated both modernist techniques and the integration of regional norms of the surrounding environment, and the

passive methods suited to the local climate in the state of Gujarat. Courtyards, water, and shaded corridors not only offer some comfort but also stimulate the senses and create reflection.

According to the idea of biophilic design, as proposed by Stephen Kellert, the Ashram shows how buildings serve the purpose of offering the opportunity of human-nature connection in extreme urban environments and improve well-being, thought process, and sense of place (Kellert et al. 3). All of these elements, including the use of light, use of tactile materials, use of natural ventilation, and view may all be focused on achieving sustainable outcomes, as well as in line with Terrapin Bright Green patterns of biophilic design, again showing a rare alignment of modernism and an ecologically conscious design.

This paper focuses on the spatial interpretation of nuclear Gandhian philosophy in the work of Correa in terms of biophilic strengths and critical regionalism. Through qualitative research formats, field visits, spatial analysis, and observation through the senses, the paper will prove why the rooted modernism of Correa will be relevant today, as it shows how to construct a building that is people-centered, crossed with responsiveness to setting, and evokes spiritual perceptions.

Sabarmati Ashram is an adequate place where our work could be practiced, which aims to find the Truth and complete Fearlessness. To the foreigners, it was iron bolts, and to Mother Nature, it was thunderbolts." Mahatma Gandhi

The ashram on the sacred banks of the river Sabarmati is an epitome of simplicity and natural peace, and at the same time a history-living book of struggle and fight over India freeing itself. Gandhi lived here between 1917 and 1930, and it is the starting point of the Salt March in 1930. The complex still practices Gandhian activities such as khadi weaving and handmade paper, as well as pavilions, prayer cells, guest houses, and the museum today. Gandhi museum (1958-63), inaugurated by Jawaharlal Nehru, has the writings of Gandhi and products belonging to him (India Student Analysis).

Restrained interventions are marked by the use of modular grids, shaded courts, bare brick, and timber that create thoughtful, climate-sensitive spaces by Correa. These are a representation of the Gandhian aesthetics of less is better and environmental psychology of place identity (Asnani and Bhagat 2,32,42). The Sangrahalaya is therefore a repository and breathing metaphor-an edifice of silence, rooted in nationality, and humanism against the modernism of spectacle.

Methodology

This paper is an analysis of the Gandhi Smarak Sangrahalaya by Charles Correa using the issues of spatial, sensory, and cultural analysis. Information was obtained through field studies, on-site visits, sketches, and photo-documentation, and mainly dealt with space planning, materials, and climatic sensitivity. Architectural drawings were also studied to study modularity and circulation. The results were evaluated in the context of 14 Patterns of the Biophilic Design (Browning, Ryan, and Clancy 2014; Kellert 2008). along with the tradition of critical regionalism, in their preference for contextual and cultural interpretation of the architecture over numerical assessment to identify the underlying ecological and philosophical message of a construction.

Analysis of Biophilic Strengths in Sabarmati Ashram Architecture and Landscape:

Charles Correa's proposal for the Gandhi Smarak Sangrahalaya at Sabarmati Ashram is a holistic expression of biophilic design philosophy that seeks to create an environment that is conducive to human well-being through an integration with nature. As defined by Browning, Ryan, and Clancy 2014) and Kellert et al. 14 Patterns of Biophilic Design are grouped into one of three categories:

I. Nature in the Space: 1. Visual Affiliation With Nature, 2. Non-Visual Affiliation With Nature, 3. Non Rhythmic Sensory Stimuli - 4 Thermal & Airflow Variability, Part 5 Presence of Water, 6. Dynamic & Diffuse Light, 7. Relationship to Natural Systems II. Natural Analogues: 8. Biomorphic Forms & Patterns, 9. Physical Contact with Natural Environment 10. Complexity & Order. III. Nature of the Space: 11. Prospect, 12. Refuge 13. Mystery, 14. Risk/Peril.

Figure 1: Map showing surrounding site context and river
Source: Google Earth, imagery date: March 2025

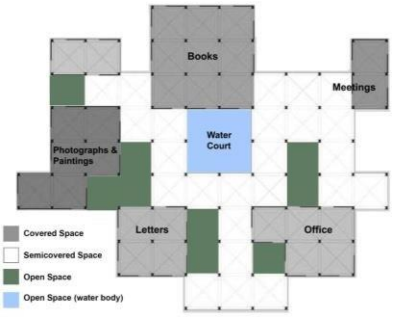

Figure 2: Plan showing grid layout and space arrangement
Source: Author

Figure 3: Hriday Kunj, Gandhiji's residence at Ashram
Source: Author

Figure 4: Vinoba Mira Kutir, Gandhi Ashram
Source: Author

Figure 5: Museum block at Sabarmati Ashram
Source: Author

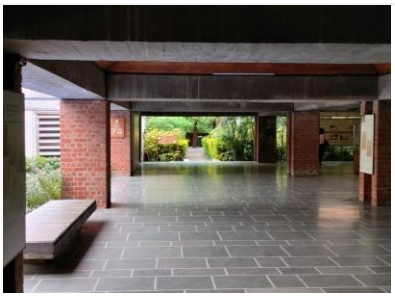

Figure 6: Main entryway of the museum building
Source: Author

The structure of Charles Correa, Gandhi Smarak Sangrahalaya at Sabarmati Ashram, encompasses the 14 principles of biophilic design and integrates materiality, modularity, and climatic responsiveness into a holistic architectural experience. In the Hriday Kunj (Fig. 3), the large views of the Sabarmati set up a successful visual connection with the elements of nature, creating a sense of perspective, evoking clarity of thought, and openness towards Gandhian transparency. Vinoba Kutir (Fig. 4) provides a sheltered usable space that is semi-open, the timber and brick being a material link to the earth and surrounding trees.

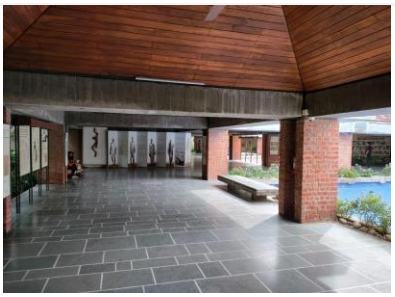

Figure 7: Display corridor alongside the courtyard
Source: Author

Figure 8: Museum wing showcasing historical exhibits
Source: Author

Figure 9: Central courtyard featuring a water element
Source: Author

The museum block (Fig. 5) increases the experience with dynamic light filtered by wooden slats, while the entrance (Fig. 6) increases multisensory stimulation (touch, sound, and smell) by allowing material exposure. The rhythm consists of ranks, the orderings of modules that evoke the structure of animal and plant life and give it some sense of organic order. The display corridors (Fig. 7) have been conceived as a form of dynamic control of the climate, through breezes and shade, and thresholds and variations of light, to create mystery and contemplativeness. The adjoining museum wing (Fig.8) reinforces the ecological principles of seasonality in vegetation, direction of sun, and weathering brick, while the repetitive modules provide consistency between mass and space.

Figure 10: Spatial grid defining modules along the corridor
Source: Author

Figure 11: Courtyard featuring integrated vegetation
Source: Author

Figure 12: Pebbled courtyard near the main entrance
Source: Author

The biophilic experience also extends into the courtyards. The key Court (Fig. 9) juxtaposes water, associated with purification and continuity, and the menace of its framed or bordered form, with risk and danger. Twist and turn as well as the patterns of the grid on the corridor, and the changing daylight remind the visitors of the transient rhythm and cycles. A court of vegetation (Fig. 11) strengthens the openness and possibilities for visual continuation beyond the river landscape, while the pebbled court (Fig. 12) invokes memory through tactile and sound experiences, where different degraded surfaces and weather are linked to different seasons and connect space and time, and transformation.

All these strategies together highlight the simplicity and subtlety of Correa: the museum then transforms into a reflective landscape, where the Gandhian values of simple living and not showing off meet the biophilic values of wellbeing. The design of the built form and its surroundings constantly reminds people of the spiritual values associated with the place and continues to attract people to an environment where one feels at peace with oneself while acknowledging the context and culture of the site.

Discussion

At the Gandhi Smarak Sangrahalaya in Sabarmati Ashram, architecture becomes a medium to express Gandhian philosophy while remaining sensitive to nature and culture. Correa's design does not rely on monumentality unlike his contemporaries, but on modest spaces, natural materials, and a quiet dialogue with the landscape. The result is an environment where visitors experience simplicity, reflection, and a sense of collective belonging, with a design that reflects a deeper understanding of people's interaction with nature and the surrounding landscape.

The purpose of the building and the design brief must be clear in the architect's mind, with the true intention being to create spaces that offer a calm, composed, and peaceful environment to

the user by thoughtfully integrating the context and evoking a sense of community, rather than a grandeur space.

For the creation of the concept, Correa drew inspiration from Hindu isotropy, which provided the modular grid for the planning, and from the vernacular house forms of Kutch, which informed the development of a flexible grid plan that can expand in all directions according to changing requirements over time. The sources of inspiration are authentic and, combined with Correa's modernist approach to detailing, bridge the gap between regional architectural language and modern planning. In this way, the architecture responds sensitively to the cultural context, site, and climate.

Another advantage is the ability to change in response to its environment. Ecological values and the symbolic Gandhian values of purification and clarity are reflected in the orientation towards the sun path and the seasonal planting, as well as the central water court. Symbolism in the design expresses and facilitates experiences of biophilic principles.

Architectural expression is enhanced by the sequential arrangement of spatial elements, encouraging maximum engagement with nature from within the built form. The spatial planning and layout enhance the user experience through a progression from open to semi-covered to enclosed spaces, with movement patterns worked out across shaded corridors and passages that open into water courts and courtyards extending into the landscape, thereby promoting a connection with nature and well-being. Across all spaces, the visitor remains in constant touch with nature, providing rich biophilic experiences within the built environment.

The Gandhi Smarak Sangrahalaya emphasizes and focuses on simplicity, context, and human experience over monumentality. In continuing the balance between regional and modern expression, the use of local materials, simple in expression and detail, also reinforces the Gandhian values of truth, self-reliance, and minimalism.

Conclusion

The architecture of the ashram and spaces demonstrates the true spirit of Gandhian philosophy which was rooted in frugality, swadeshi and Swaraj. Correa's sensitive approach towards defining public spaces in the case of Ashram is very unique as compared to the monumental scale or grandeur scale often favored by architects.

The Gandhi Smarak Sangrahalaya stands as an architectural piece that not only serves its function but also encapsulates the memory of the past, the cultural continuity of the present, and environmental awareness for the future. The building acts as a living monument rather than a static space. Correa's attempt at creating sustainable, people-centered, and place-sensitive architecture is justified, inspiring future generations through its timeless value.

To sum up, Correa's design of the Gandhi Smarak Sangrahalaya brings together mindfulness, materiality, modularity, and morphology, expressed through contemplative courtyards, local materials, a flexible grid, and ecological planting that together define a contextually responsive architecture. At the same time, Substance, Structure, Synergy, Spirit, and Statement define an architectural language that remains rooted, resonant, and timeless.

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Investigating the Structural and Aesthetic Potential of the Seahorse Tail in Lighting Design

Dharmistha Anjani | Bhumit Jagatiya | Pashmi Patel Prof. | Chaitali Sheth
Gujarat Law Society Institute of Design, Ahmedabad, Gujarat, India

Abstract

Nature teaches of design which may be functional and artistic. In the myriad versions of it, the tail of the seahorse is remarkable not just in shape, but in its modular structure in which flexibility and strength are in balance. TailLight was inspired by the desire to leave the traditional lighting design and be inspired by this natural form of the truth. This work is a restructuring of lighting in the view of nature based innovation that explains that design does not have to be trend oriented but the smarts of nature.

The design began with close attention and drawing of how the seahorse tail is designed, the segmented, spiral geometry and structural form.These natural observations were translated into a lighting form using laser-cut transparent acrylic pieces, each showing the tail's morphology. A central spine, seahorse's vertebral column, fitted into a soft lighting strip that served as the core light. Iterative prototyping refined light diffusion and spreading, angles and balance for an organic form.

The final outcome is a light that blurs the boundary between object and organism. Its form casts dynamic shadows, with layered transparent material glowing gently creating an experience that is visually fluid. Taillight acts as a narrative, an invitation to see design as a communication with nature rather than a departure from it. This project affirms that bio-inspired forms are not only a framework but also a practical tool for creating emotionally sounding designs.

Introduction

"It's not what you look at that matters, it's what you see." *- (Henry David Thoreau, Janine Benyus)*

At its core, biomimicry is the design and outcome of materials, structures and systems inspired by biological forms and shapes. Nature, with its 3.8 billion years of evolution refinements, offers a wide repository of solutions to many of the design challenges that are faced today.

Organisms across the biological spectrum scale, the microbes, plants and animals have developed strategies to survive, adapt and grow in a continuously changing environment. These adaptations often demonstrate not only efficiency and surviving capabilities but also making them valuable models for design innovation.

In her foundational work "Biomimicry: Innovation Inspired by Nature (1997)". Janine Benyus defined biomimicry as "the conscious emulation of life's genius". She stated that nature's design solutions are inherently sustainable and that learning from these time-tested models allows us to create systems that are responsible and mainly intelligent. Otto Schmitt, who stated the term "biomimetics" saw it as a biological approach to engineering, a reverse of the typical scientific eyes where biology is analyzed through physics. More recently George Whitesides (Harvard University) distinguished between biomimetics and bioinspiration, describing the latter as the process of drawing from natural phenomena to inspire innovation through alternative or simplified means.

Janine Benyus further categorized biomimicry into two branches: forward biomimetics where one begins with a natural model and develops a design based on it and reverse biomimetics where a specific problem is identified and a solution is sought from nature.

Design has often drawn inspiration from nature's external forms, floral petals, leaf patterns, or shell symmetry. This study shifts focus to nature's structural intelligence as a design strategy. Tailyght, a lighting design intervention, draws from the modular, flexible and protective geometry of the seahorse tail by copying this biological structure the project explores natural systems as a basis for functional and expressive design outcomes.

The seahorse tail shows a unique balance of flexibility allowed by bony plates arranged in overlapping segments. These structures allow controlled bending, twisting and compression through sliding and buckling mechanisms. The plates' material variation and hierarchical design enhance both mobility and impact resistance. Such deformation strategies offer valuable models for bio-inspired innovations in flexible armor, resilient structures and prehensile robotics

While most animal appendages are cylindrical, the seahorse tail features a square cross-section, which suggest that this geometry enhances both strength and flexibility. Tests using 3D-printed models revealed that square structures better withstand compression, allow

controlled deformation and naturally return to shape (Porter, 2015). This adaptability improves the tail's ability to grasp, offering functional advantages over circular forms.

The central motivation behind Tailyght was to bridge the emotional language of design with the structural intelligence of biology. While many lighting pieces are dictated by trend cycles, aimed to create something more reflective, an object that didn't follow fads but rather invited viewers to pause, reflect' and feel. In doing so, looked to nature not merely for inspiration, but as a design collaborator.

This paper outlines the development of Tailyght as a biomimetic lighting piece, one that reinterprets the mechanical structure of the seahorse tail to create an ambient sculptural form. It demonstrates how careful study of natural geometry can influence form function and user experience. Ultimately, Tailyght is not just a lighting object but a case study in how nature's logic can inform and elevate design outcomes.

1. Seahorse

1.1. Seahorse: Form, Function and Life Cycle:

Fig. 1. & Fig. 2. SeaHorse in its ideal position

The seahorse is a small marine fish belongs to the family Syngnathidae, easily identified by its posture, elongated nose and curled tail. Despite its appearance the seahorse has undergone highly specialized evolution both in terms of form and behavior. Found primarily in shallow tropical and temperate waters around the globe seahorses inhabit coral reefs, seagrass beds and mangrove forests where their bodies blend seamlessly into their environment.

What makes the seahorse truly remarkable is not only its visual uniqueness but also the functional intelligence embedded in its structure and life processes. Fishing unlike most fishes seahorses are not swimmers. Instead, they live through camouflage and their tails to hold them down on the sea weeds so that they are not swept by the waves and currents. The reason why

their survival is closely connected to this tail is not to move around or be protected but is rather an essential way of communicating with the world around them.

1.2. Life Cycle of the Seahorse

The physical structure is as interesting as the cycle of life of the seahorse. It is the male seahorses that get pregnant, the only animal that has this rare reversal. In the course of mating the female provides her eggs in a special pocket on the abdomen of the male. It is then fertilized by the male and the eggs are held in the pouch until the young are ready to be born out. The male enters labor after 10 days up to six weeks (varied species, and various water temperatures) spitting dozens to hundreds of full-formed baby seahorses into the water.

This odd reproductive behavior demonstrates the evolutionary break in seahorse and the workability of its physical body. In Tailyght this inspiration transcends imitation, it accepts the way nature relates life processes to structural forms.

1.3. Decoding Seahorse Geometry

The seahorse tail has been shown to have a distinctive biological mechanism where the stiffness is combined with directional flexibility enabling the seahorse to act as a prehensile organ in spite of its protective exoskeleton. These abilities are gained by a sequence of interlocking segments which are laid out in a modular square cross-section. Also compared to the cylindrical tails of most aquatic species this geometry permits the tail to bend, coil, twist and re-enter its original shape without structural loss. Inter-segmental joints permit regulated deformation, and the spinal column vertebrae serves to increase compressive stress resistance and overall rigidity. Biomechanical experiments prove that such structural layout does not only offer mechanical performance but also design applications that need both flexibility and strength like adaptive product systems and lighting structures.

The following features are in favor of the logic of the structure of Tailyght, a sculptural lighting prototype reinventing the modularity and the spiraling movement of the seahorse. Instead of copying the form, the design transforms the biological intelligence into the expressive object that combines functionality, emotional and spatial sensitivity.

2. Objective of the Research

This study aims to dive deep into the structural geometry and functionality of the seahorse tail as a basis for developing a sculptural lighting design through the eyes of biomimicry. Rather than replicating the visual characteristics of marine life, the research focuses on reinterpreting

the seahorse's adaptive mechanics, particularly its modular, interlocking vertebrae to inform a contemporary design solution.

Specifically the research intends to:

3.1 To analyze the geometry and biomechanics of the seahorse tail in relation to design applications.

3.2 To explore material and fabrication strategies that emulate the structural behavior of the seahorse tail culminating in the development of a lighting prototype (Tailyght) that embodies biomimetic principles through form, function and interaction.

3. Research Methodology

The methodology adopted here is based on a biomimetic process that takes from nature's shape and functions to form design through observation, experimentation and iterative development. The starting point was the anatomy study of the seahorse tail, focusing on its vertebral structure. Biological sketches and simple 3D models were created to understand its modular form and movement.

Initial concepts were explored through handmade sketches and quick physical prototypes using paper and wire. These helped simulate and understand the spiral form and test how it might function as a lighting structure. These aids to simulate and learn about the spiral form and experiment with it might serve as a lighting framework. This design was transferred to digital modelling, in which case locking segments were designed to indicate the geometry of the tail. Variations in spacing to fine the form and performance, rotation and curvature were put to test. The process combined haptical exploration of the digital refinement where the natural principles are allowed to build functional and expressive lighting design.

4. Analysis & Discussion

4.1. Education out of the Form of the Tail of the Seahorse:

That the tail of the seahorse is thus anatomy as well as a system, intriguingly so to the eye, but curiously so to the anatomist modularity, movement and protection with significant reference to product development.

The seahorse tail is a square vertebrae which interlocks to protect the internal bend and coil arrangement frees bending and coiling. This design is superior to cylindrical shapes. It

provides directional movement without losing stability for lighting this meant considering a sculptural form that was not just fixed but could also express fluidity and adaptability. It led us to think beyond the typical "lamp" and explore responsive design.

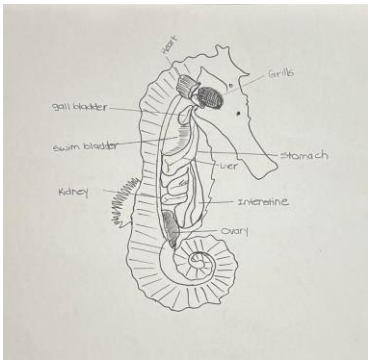

Fig.3. Anatomy study of the Seahorse

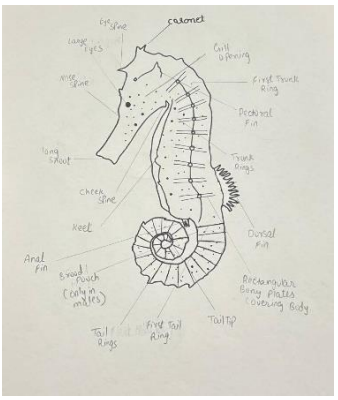

Fig. 4. Study of various parts

What stood out most was the contrast between its delicate aesthetic and its mechanical strength. The seahorse's ability to anchor itself to seagrass using its prehensile tail, even in strong currents speaks to a logic of stability without rigidity. This functional elegance became a core inspiration for Tailyght. Weren't simply inspired by its silhouette but rather inspired by how the creature worked from within. The anatomical sketches served not as aesthetic references but as guides to understanding structural integrity in living systems. Each vertebra is shaped and arranged for a reason; each movement is enabled by evolved geometry. Translating this into lighting design meant that every segment in our form needed to have a purpose not just visually but mechanically and emotionally.

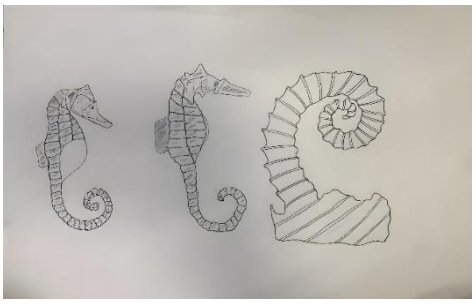

Fig. 5. Study of seahorse body and tail

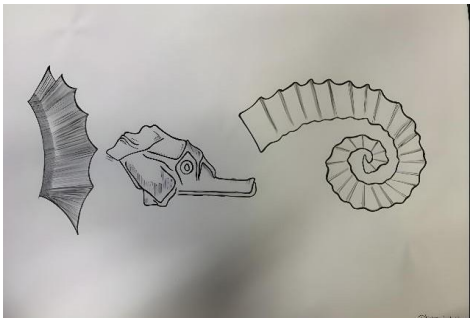

Fig. 6. Exploration using fin and tail

4.2. Spiral Geometry and Light Behavior

The spiral shape of the seahorse tail was more than just a pretty design; it showed a natural way to combine structure and movement. This swirling motion influenced the design of Tailyght fitting well with the idea of wrapping light. It allowed light to flow, spread and breathe through different layers. Unlike a stiff fixture that only gives off light, this design encourages light to move, bend and interact softly with its environment. The geometry created moments of brightness and shadow, clarity and blur, making the light feel alive and change with the viewer's perspective.

Beyond its look, the spiral form gave us control. It lets us shape the light how it spreads, where it softens and how it responds to movement in the room. This interaction came from the design's geometry and natural physics reflecting the quiet intelligence found in nature.

Choosing to take inspiration from the seahorse tail was also a thoughtful way to rethink how to use nature in design. Instead of observing it as just a decorative feature, texture, shape or a trend, looked at nature as a living knowledge system. The tail became our guide teaching us how structure can provide many purposes to protect, to move and to connect. This project challenges the long-held gap between scientific understanding and creative work. It suggests a new design language that doesn't just borrow from nature's surface but studies its logic, honors its purpose and learns from its wisdom.

4.3. Materiality, Prototyping and Fabrication Process

Material selection was guided by both functional and aesthetic goals. Transparent acrylic was chosen for its ability to diffuse light and maintain structural precision when laser-cut. The segments were designed as repeating modular units, each resembling a stylized vertebra and were attached to a central flexible core made from silicone tubing.

Fig. 9. Base curve and alignment of modular paper segments

Fig. 10 Side view showing layered spacing variation in the prototype.

Fig. 11. Simulating the seahorse tail's natural coiling dynamics.

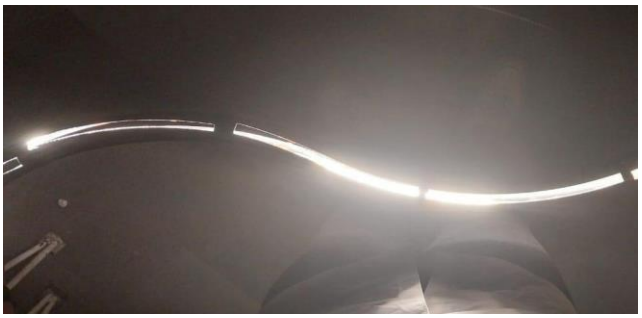

Fig. 12. Early prototyping stages of Tailyght include manual assembly of acrylic segments onto a flexible silicone core (top left); light integration testing (top right); an exploded view render (bottom right); and exploration of spiral form and rotational stacking (bottom left).

Multiple prototypes were created to test structure, light diffusion and assembly logic. Each iteration helped refine the angles of the spiral, the spacing between segments and the durability of the flexible structure. More attention was paid to ensuring that the final piece maintained both aesthetic and mechanical.

The final prototype was created using laser-cut acrylic parts assembled manually with the flexible spine and tested under different lighting condition. This method allowed us to maintain precision while maintaining a hand-crafted, modular approach merging the scientific dimensions of the design.

4.4. Form, Function and User Experience

The final design Tailyght is able to capture the main tenets of biomimicry in its form and functionality. The last lighting work is a spiraling, semi-transparent structure with interlocking pieces of acrylic composing the structure which contains a flexible LED foundation. What is created as the result is a form that diffuses soft and ambient light and creates dynamic shadows on the surrounding surfaces.

Tailyght presents a feeling of movement even though it is not. The spiral shape of it gives it an organic feel that provides an immediate sense of curiosity and involvement among the viewers. As the observer moves around the piece the interplay of light and shadow shifts subtly creating an experience that feels alive and responsive.

Fig. 13. SeaHorse Tail

Fig. 14. Prototype

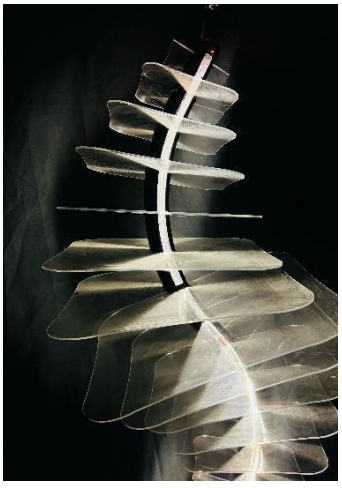

Fig. 15. Acrylic lighting prototype

Functionally, the design performs well as ambient lighting. The use of diffused acrylic allows for even light distribution, while the gaps between segments allows light patterns enhancing the emotional quality of the space it occupies. The flexible core holds the structure together while allowing minimal movement showing the adaptability of the seahorse tail.

Material reduction was also achieved through laser cutting which reduced the waste and allowed for production. The use of low-energy LED lighting ensured that the lamp remained energy-efficient without compromising visual warmth.

Fig. 16. Side view with low light intensity

Fig. 17. View highlighting curvature.

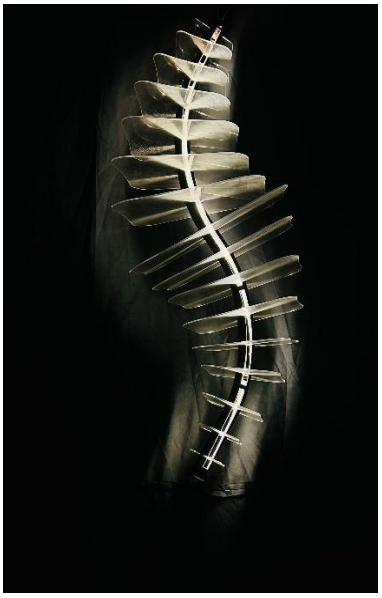

Fig. 18 Perspective capturing the depth.

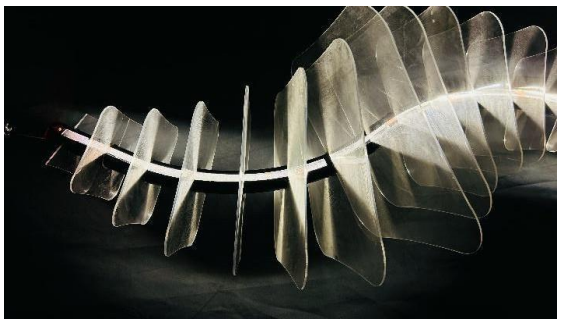

Fig. 19. view showcasing the translucency of acrylic panels

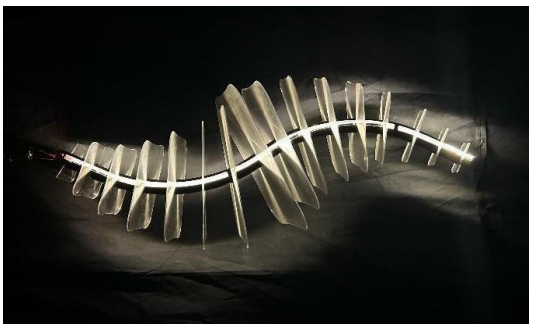

Fig. 20. Angled perspective revealing the flexible core

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Fig. 21. Tailyght hanging from ceiling in the staircase area

Fig. 22. Tailyght in a restaurant

Overall, Tailyght signifies both a light source and a sculptural form. It achieves both goals of biomimetic and aesthetic appeal. As a result it's a prominent example of how natural structures can be formed into innovative design not just through mimicry but through brainstormed translation of biological logic into usable form.

Tailyght represents a change in lighting design, It integrates structure, narrative and functionality through the lens of biomimicry. Unlike the conventional commercial lighting products which emphasize mass production and fashion, this project demonstrates richness of meaning, flexibility and emotional appeal. Modularity of Tailygt is one of the important differences. It is designed to be scaled, to recurrently restructure and reinterpret the shape in a variety of forms and arrangements. This leaves options of subsequent versions such as bigger installations, wall-mounted or even reactive form in response to user input conditions. Every part is made to size, color or material to enable a variety of applications in interiors, exhibitions or wellness spaces.

Also, the sustainability and responsible design can be traced in the project. Low energy use, resource-saving material consumption and durable structure Tailyght has the ideals of sustainable development. Its modular design goes on to assist in easy dismantling and replacing its parts with circular design principles.

Tailyght overcame, not only as a design innovation but as an object that reinvigorated the

relationship between human-made objects and the natural ones when compared to existing lighting products. It compels designers to go beyond fads and dig more into the subject of form, purpose and process.

Conclusion

Tailyght started with a silent query into a biological formation that is generally ignored, the tail of the seahorse. What was brought about was a biomimetic lighting design that goes far beyond the traditional aesthetics to structural creation in nature. The project demonstrates that natural forms provide that which is not only visually inspiring, but also adaptive, efficient and emotionally rich design solutions. Tailyght by modularizing the seahorse tail, creates a biological and sculptural form of a lighting object. This work has a reflective approach in the oversaturated fast-paced design trends, where the natural systems are observed, comprehended and engaged with as a creative process. The conclusion is that it might not necessarily be quality that results in innovation in design, but a renewed interest in already existing natural forms. Tailynght is a first move to a more in-depth investigation of nature-based structures that bring together functionality, shape and content in modern design.

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Translating Natural Metamorphosis: A Structural Study of Physalis Alkekengi in Light Form

Kaavya Shah | Harvi Makadia | Saketh Ram

Prof. Chaitali Sheth

Gujarat Law Society Institute of Design, Ahmedabad, Gujarat, India

Abstract

For a long time nature has been a point of reference for design, inspiration goes deeper into that relationship by transforming organic transformations into a physical form. The Physalis alkekengi, commonly known as the Chinese lantern plant, undergoes metamorphosis through its life cycle. Initially enclosed in a robust, opaque husk, the fruit gradually becomes visible as the husk dries and turns lace-like and fragile. The methodology of this project follows a nature-inspired design approach, rooted in the observation and interpretation of the metamorphosis of Physalis alkekengi. The process began with a detailed study of the plant's transformation from a vibrant red husk to a delicate, skeletal structure, symbolizing a shift from enclosure to openness, solidity to fragility. The metamorphosis of Physalis alkekengi informed the project's form and materiality, distilled into layers, voids, and veining. These elements shaped a minimal lighting typology through sketches and models, highlighting geometry and decay. Materials emphasizing transparency, lightness, and texture via perforations and translucencies echoed the plant's veined structure and shifting light. The metal pole of the floor lamp had been manipulated to reflect on the Physalis' delicate, curving stem while adding structural support. This study demonstrates ways that the principle of biomimicry and natural metamorphosis may result in effective design interventions. Through the act of translating the visual and structural qualities of Physalis alkekengi into a lighting object this research illustrates how nature-inspired design, as a medium, can translate seasonal transitions, organic form, into expressive results in current practice of designing.

Keywords: *Physalis alkekengi, Metamorphosis, Lighting element, Organic form, Abstraction*

1. Introduction

The philosophy and practice of biomimicry centers on drawing deep insight from nature- not merely copying its forms, but understanding and integrating its underlying principles into design.

"Imitation is not just the sincerest form of flattery – it's the sincerest form of learning."

- George Bernard Shaw

The concept of biomimicry, is an innovation method that relies on the inspiration, learning from, and imitation of the strategies found in nature to solve human design challenges to create a healthier, greener, and more sustainable future. From the kingfisher-inspired design of the design of Japanese bullet trains; the burrs-inspired invention of Velcro, and wind turbine blades whose shapes are inspired by the ridges on the pectoral fins of humpback whales that create an aerodynamic flow in water, many of the (green) technologies we rely on today have been influenced by solutions found in nature. Though our natural environment has inspired design since prehistoric man fashioned spears from the teeth of animals, the development of a methodological framework for translating biological strategies into design innovations is a recent one (Kennedy, 2016). The direct design approach occurs when a design directly copies an organism in the ecosystem and mimics its behavioral pattern or natural system. Whereas, the indirect approach solely uses abstract concepts in nature and employs them in design (Faludi, 2005) (Panchuk, 2006).

Design increasingly reaches beyond mere aesthetics to engage with nature's dynamic, structural, and symbolic intelligence- a shift evident in contemporary studies of biomimicry and biophilic design. In computational explorations of form, researchers have employed the Physalis alkekengi (Chinese lantern plant) to develop a softly glowing lamp, tracing its vivid transformation from an opaque, protective red husk to a delicate, vein-patterned skeletal shell (Graziosi, 2021). Such metamorphosis speaks to a narrative of protection, exposure, and fragility, offering more than functional mimicry- it carries emotional and symbolic resonance. This aligns with Edward O. Wilson's Biophilia Hypothesis, which posits that humans possess an innate tendency to seek connections with life and lifelike processes- connections that biophilic design harnesses through natural light, materials, and forms (Wilson, 1984).

As lighting design pioneer Richard Kelly stated, we need "ambient luminescence, focal glow, and the play of brilliance" in our designs. The play of brilliance- or sparkle- occurs when a person turns a corner and sees something magical that reconnects them to nature. At its root, this is biophilia and a powerful way to create awe in our lighting designs and architectural habitats. By engaging with light, we can create safe, comfortable spaces rather than simply illuminating them (Nicole Craanen, 2025).

In today's design practice, there is a growing emphasis on creating objects that not only serve functional needs but also respond to human psychology, environmental consciousness, and aesthetic sensibility. By abstracting the plant's veined geometry, translucency, and lifecycle from enclosure to skeletal beauty, this research engages both material and metaphor, translating biological metamorphosis into a lighting typology that is expressive, context-aware, and biologically resonant.

2. Objective of the Research

The purpose of this project is to find out how we can use the natural metamorphosis of the Physalis alkekengi plant and translate it into a lighting product with the principles of biomimicry. The work explores how the materiality, structure and expression in modern design can be informed by the transition of the plant which begins as a solid protective husk and ends up as a frail lace guideline. The aim is to establish some parallels between the transient transformations observed in nature and their possible development into the emotionally and visually lyrical lighting design. To be more precise, the study aims at:

2.1 Understand and interpret the metamorphic process of Physalis alkekengi- visually and structurally- by means of detailed observation and abstraction of the form of the plant.

2.2 Explore the ways in which biomimicry, as a design approach, could be utilized in lighting to convey concepts like decay, enclosure, and transformation through materials that reflect lightness, transparency, and delicacy.

2.3 Show how the natural processes most particularly the concept of metamorphosis can go on to influence more meaningful intervention through design to come in the form of not merely functional but with an emotional and sensory appeal established between the user and the object.

3. Research Methodology

This study follows a stepwise, bottom-up process (Aziz, 2016) that begins with nature-inspired inquiry and culminates in a design outcome. The approach is rooted in observing and translating natural forms into functional and expressive design elements. The plant Physalis alkekengi was selected for its unique transformation: its outer husk evolving from a vibrant enclosure into a delicate, lace-like structure offering both visual and structural cues.

The second stage involved defining a design intent: to create a lighting object that communicates aesthetic and emotional qualities rooted in natural processes. The third phase focused on abstracting key features of the plant such as its veining, curvature, and layered form through visual analysis and hand-drawn explorations.

In the final step, these distilled elements were translated into a design solution. The outcome took the form of a floor lamp that reflects the essence of the original natural form while responding to both functional and expressive goals.

4. Analysis and Discussion

4.1. The Case Study: Physalis Alkekengi

Physalis alkekengi (Chinese lantern plant) is a herbaceous perennial plant of the *Solanaceae* family (related to tomatoes and eggplants). It is an Asian and Southeastern European native and is widely recognized due to its unique inflated, lantern-like calyx which encloses a small, round fruit. It starts growing from underground rhizomes. It produces green stems and wide leaves and has small white flowers by the early summer. Once fertilized the calyx rapidly expands and covers up the fruit. The calyx is initially green, opaque and helps the fruit mature through photosynthesis. The calyx changes to a bright orange-red, creating the lantern effect. This is the most aesthetically pleasing phase and the plant is usually harvested at this time. When the plant dries out, then the calyx tissue decays. It is the remaining lacy network of veins, forming a natural skeletal structure that reveals the fruit within.

This transformation from solidity to transparency is a visual representation of metamorphosis. It dies back to the ground, leaving dried husks which may last through the season. Rhizomes in the ground remain dormant and grow out during the next spring. It normally measures 3–5 cm in diameter and is slightly angular or heart-shaped. It consists of five sepals which are fused together, making it an inflated pod consisting of an internal cavity. The lifecycle of

Physalis alkekengi- particularly its transition from protection to exposure, and opacity to translucency- makes it a source of metaphor and inspiration in design.

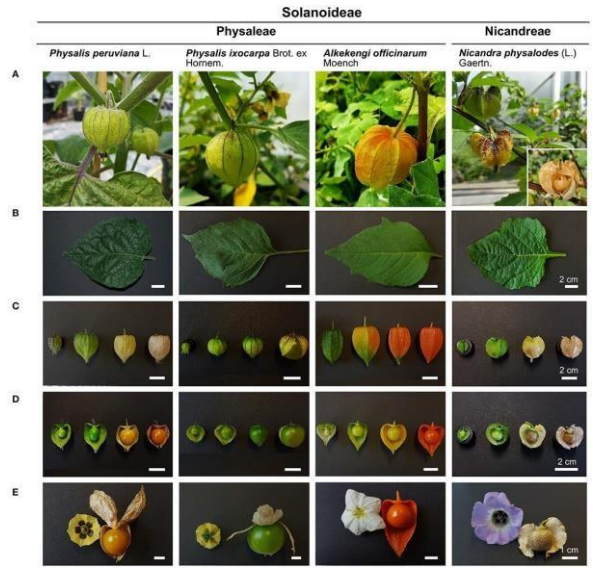

Figure 1: Physalis alkekengi at various points of its lifecycle.

(A) Morphological characteristics of leaves, fruiting calyces, and fruits of *Physalis*, *Alkekengi*, and *Nicandra* species belonging to the Physaleae and the Nicandreae tribe of the Solanoideae subfamily.

(B) Fully expanded leaves are simple, ovate or ovate-elliptic.

(C) Persistent sepals of the inflated fruiting calyces.

(D) Change in extent, architecture, and color during fruit maturation.

(E) Yellow, white, or blue petals form a tube with terminal lobes or teeth. Ripe fruits represent globose berries that bear a five-lobed fruiting calyx (de Souza, 2022).

4.2. Form Abstraction and Concept Development

The transformation of Physalis alkekengi from a solid, vibrant enclosure to a fragile, translucent skeletal structure, shaped the main conceptual narrative of the lighting design. We were interested in capturing this gradual disintegration, not only as a visual theme but as a structural principle showing both form and material behavior. We started by sketching the plant at various points of its lifecycle, abstracting major moments in its evolution: the complete red husk representation, the stage of shredding and curling, and the appearance of the light and veined skeleton. Such sketches were not exact replications but translated based on successive process of form finding. Those important visual features such as the concave cupping of the leaves, the central enclosure around the fruit, the arching movement of the stem were

deconstructed and reconstructed as a sort of potential lighting forms. These sketches developed into volumetric studies that sought to reproduce layered effects of the light filtering through degrading organic surfaces.

Figure 2: Physalis alkekengi at various points of its lifecycle.

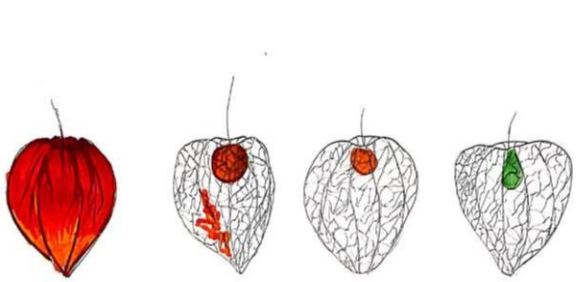

Figure 3: Metamorphosis of Physalis alkekengi.

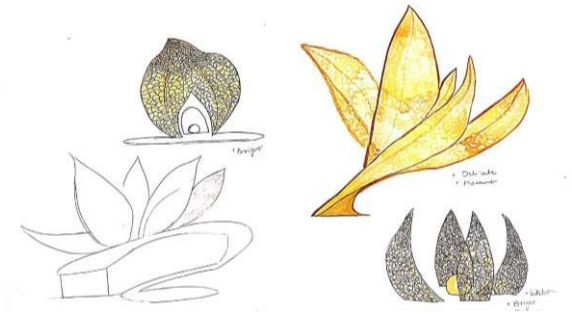

Figure 4: Abstraction and form finding process.

Figure 5: Abstraction and form finding process.

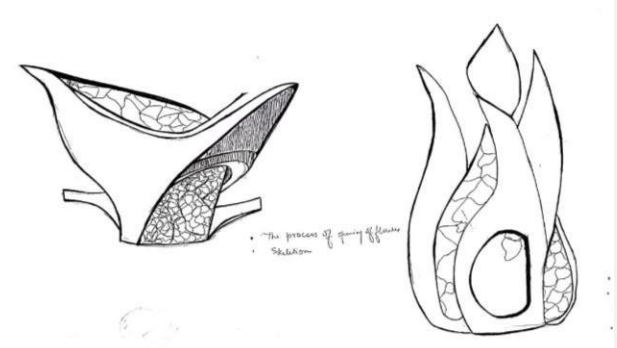

Figure 6: Abstraction and form finding process.

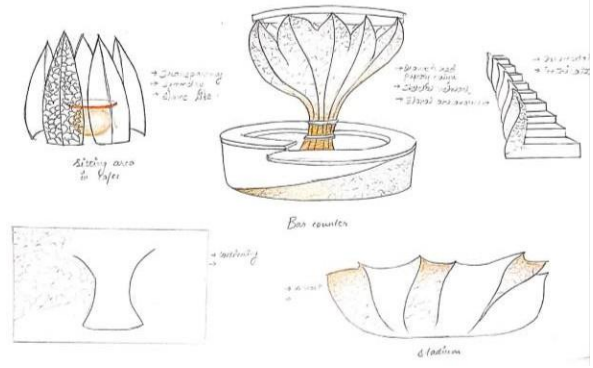

Figure 7: Abstraction and form finding process.

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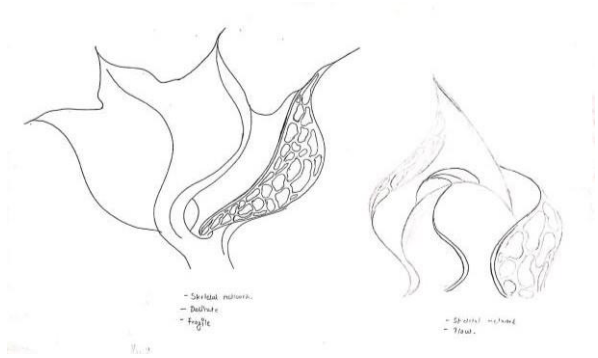

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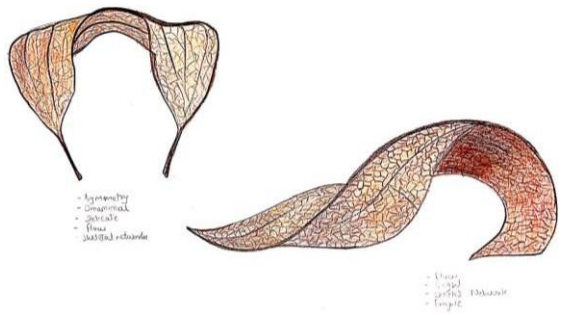

Figure 9: Abstraction and form finding process.

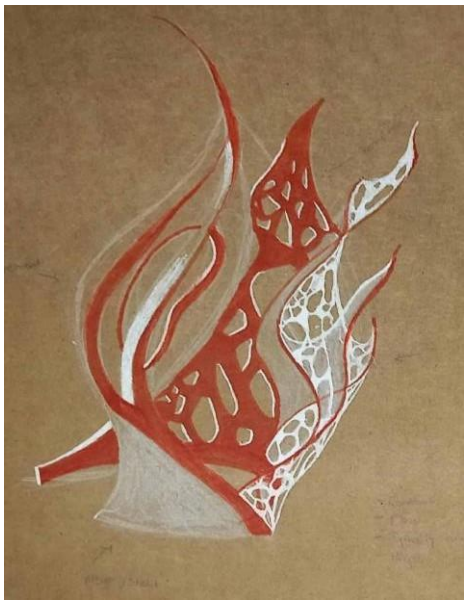

Figure 10: Final form

4.3. Design Context

Material played a major role in translation. In the final lamp, there are five individual pieces of leaf-like forms enclosing a glowing core, imitating the protective husk and its gradual decay. Two of these leaves were made of translucent paper, which was specially selected due to its brittle fragility to reflect the original plant as well as diffusing the light. The other three were composed of the sheet materials in two tonal variations, i.e., two in milky white and one in pure white. This change in the opacity and treatment of the surface reflected this change of the plant

as it progressed from full-body coverage to airy, skeletal remains. These little pieces are layered over each other in a manner that enables each layer to react to the light in different ways- so they cast subtle shadows, soft highlights, and lines of overlapping as the natural husk does at the very last final stage of its life. The bulb itself represents the fruit of the Physalis, placed centrally, and deliberately warmer in tone than the others to indicate not only its literal use, as source of light, but also its symbolic symbol, as source of life and luster in the plant. Surrounding leaves are asymmetrically placed to indicate motion- just as the husk of the plant may shift, decompose or curl in different directions. The pole of the lamp was designed with equal sensitivity. It was modeled after the stem of the plant and had the same curved slender influence that was available in the original. Rather than a strict vertical, the pole subtly leans as such attempting to reflect the natural organic imperfection of natural growth. Metal was chosen because of its ability to support the structure, yet the treatment, be it matte coated or hand formed, was aimed at the softness and gentle defects of nature visible in natural stems. This fact makes it more possible to enable the lamp to remain true to its botany source and to serve the purpose of a floor light at the same time. A testing model was created before final fabrication, we could therefore test the spatial balance between light, shadow, material and form. It assisted in verifying the way every layer worked under light, and whether the desired effect (solidity to transparent) was successfully communicated. It was also during this stage that adjustments to proportions and the density of materials used were undertaken so that the equilibrium of the visual weight and the reality of the lightness was achieved. Instead of a static object, the final lamp is an artistic depiction of nature change. It is the moment between life and decay, rather than an imitation, it is an interpretive abstraction. The intention was to not reconstruct Physalis alkekengi, but to represent its essence to transform the formless into a physical form by deliberate material and structural choices. By doing this, a poetic-but-

grounded design process was made possible: where metamorphosis was not only an object of study, but a mode of making.

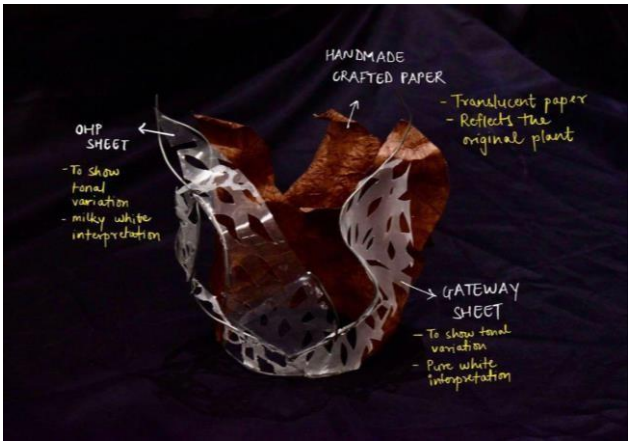

Figure 11: Testing model

4.4 Spatial Interaction and User Experience

The final lamp, with its organic curvature, stratified translucent layers, and softly glowing core, was not designed to be a fixed sculptural element, but as a kind of presence that makes a quiet contribution to the space in which it is located. Its size and gesture indicate a sense of coziness and action and it is able to fit perfectly into personal thinking spaces like a reading nook, a corner of a bedroom or a comfortable lounge. These are spaces where dim luster and emotional ambience are more acceptable than thorough brightness, therefore, the diffusive light of the lamp and the subtle shadows are the perfect choice. The lamp can be adapted to more curated interiors such as galleries or exhibitions as well where the poetic change of enclosure to openness and the metaphorical life cycle associations may be experienced in full. The effects of light and shadows cast by the veined perforations vary according to the way the viewer stands, and the surrounding light; dynamic interaction with the space is being promoted. The shadows change as one walks around it- which produces a feeling of movement and time awareness. The warm-toned bulb which is in the center symbolizing the fruit of the Physalis alkekengi is not only a literal source of light but a symbolic core of life. The asymmetrical layout of the surrounding leaf-like pieces contributes to this spatial sensitivity making them seem in mid-stride-curling or peeling, as the husk of the plant at the ultimate phase of life. The curvy metal pole, imitating a stem of the plant, leans partially into the room to blur the boundary between object and spectator, and to strengthen the poetic connection of the lamp as an artistic

extension of nature in constructed space. In so doing, the lamp does not merely modify the quality of light in a room, but how the users feel or connect emotionally to their surroundings in a contemplative engagement that is based on natural rhythms and organic imperfection.

Figure 12: Final Lamp

Figure 13: Final Lamp

Figure 14: Final Lamp

Figure 15: Final Lamp

The final floor lamp is a successful emulation of the metamorphism of Physalis alkekengi; the way it transforms itself from enclosure and exposure into a tactile and spatial lighting object. Instead of replicating the plant directly, the design generalized its key characteristics, including layered veining, different level of opacity and asymmetry, into a sculptural, light-responsive form. This approach shows that biomimicry can bring emotionally evocative and material-rich design results when applied as a conceptual and structural tool. The choice of material played

a key role in conveying this narrative. For the final fabrication, structural layers were represented by acrylic sheets, whereas light diffusion and the delicacy layer was achieved by handmade crafted paper. These materials managed to produce an effect of the layered light-one which goes in density and transparency reflecting the life cycle of the Physalis. Yet, when extending this project or creating subsequent iterations of it, more in-depth integration of sustainability in selection of materials can be considered. For example, recycled acrylic (rPMMA) has identical visual and mechanical properties as regular acrylic and greatly decreases environmental footprint. Likewise handmade paper may be substituted by banana fiber paper or even mulberry paper as they are easily biodegradable and consume minimal resource use. Material such as EcoResin by 3form, which combines durability with recycled material, or bamboo- resin composite sheets may provide the comparable sturdiness and organic finish to such nature-inspired lighting pieces. Finally, the lamp serves as an expression of impermanence and change. It shows that material and spatial design thinking can be directed by the observation and abstraction of nature in its truest form. The further development of the project may significantly increase its ecological compliance with sustainable manufacturing technologies and materials, emphasizing the balance between concept, form, and environmental responsibility.

5. Conclusion

In this project, the aesthetic element of design exploration based on the effect produced by the Physalis alkekengi plant is exhibited, which consists in the change of natural appearance of the latter into the symbolic and performative lighting object. Instead of using computational or some complex modeling software, the process started with experiments on the volumetric and structural characteristics of the skeletal husk of the plant using handmade paper prototypes. The final lamp design was materialized by means of laser-cut acrylic sheets, and the subtle, perforated texture of the plant was duly re-created. Such an openwork motif gives not only the visual impression of lightness, but also helps to diffuse light in a smooth, natural way creating complex shadows which underline the beauty and intricacy of nature. The Chinese Lantern plant is attributed with the meaning of warmth, protection, and home comfort. These motifs managed to find their way elegantly into the design which culminated in a lamp that looks soft, its inner core radiating and covered by an outer one that protects it. This metaphorical representation brings a feeling of comfort and calm. The case study shows that a bio-inspired design can be effectively used without computational means, but rather based on observation,

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abstraction, and physical experimentation. The design process enabled the combination of functional and symbolic elements making the lighting object not only logical and realistic, but also telling a deeper narrative rooted in nature. The direct reference to natural forms and adaptation of those forms through common and reasonably available methods of fabrication reveal new opportunities of handcrafted and semi-digital approach to create expressive, sustainable and emotionally appealing form of design product. This lamp suggests the importance of material exploration, iteration of form, and the symbolic nature are essential to the creation of significant products that bridge the gap between nature and design.

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Emerging Trends in Visual Arts: A Study of Printmaking Since 1990

Akshitta Aggarwal | Dr. Tikendra Sahu

Indian printmaking continued to develop throughout the 1950s and 1970s, the post-independence era, due to both creativity and education. Several artists went out to acquire higher knowledge in this field. For example, Kanwal Krishna studied multicolour intaglio printmaking under Stanley William Hayter in Paris and returned to India in 1955 to set up a studio where he practised and taught the techniques (Mukhopadhyay and Das). An Indian printmaker named Krishna Reddy gained international recognition for co-inventing the viscosity method of colour intaglio printing, his works were inspired by his vibrant and textured prints. He had studied at Shantiniketan and later at Hayter's Atelier in Paris.

Printmaking was known as a notable art form in India by these artists as well as others like Sanat Kar and Lalu Prasad Shaw and Haren Das, who is renowned for his technically outstanding rural scenes in woodcut and etchings (Saffronart). To promote the medium, printmakers from all around the country came together to join the Indian Printmakers Guild in 1990, and cooperative graphic studios and workshops began to appear around the beginning of the twenty-first century. In 1999 one prominent studio {Chhaap}, was set up by Gulam Mohammed Sheikh, Kavita Shah and many more. It provides space for artists to try their hand at all the mediums. The printmaking department at Mumbai, Delhi and Lucknow, Bhopal and Ahmedabad have played a significant role in keep printmaking alive by offering studios, workshop, and exhibitions.

To analyse these new developments, this research examines the work of four renowned Indian printmakers: Laxma Goud, Anupam Sud, Jyoti Bhatt, and Jayant Gajera. Since 1990, each of these printmakers has contributed significantly to the evolution of Indian printmaking (Shah).

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One of the most significant developments in recent years is the use of digital technology in printmaking, the concept of printmaking has expanded beyond the traditional hand- pressed techniques with the introduction of computers, design software, and high-resolution digital printers. Artists can now create or manipulate images digitally and produce prints with the mere push of the button, blurring the line between traditional printmaking and digital art (Bordawekar).

Indian printmaker was the first one to experiment with digital methods, Gulammohammed Sheikh an experienced printmaker, was the first to combine traditional visual with computer-generated images in his art by using digital collage and inkjet printing as his technique. Likewise, Jyoti Bhatt, who expanded his work to include digital prints and even holography, exploring how computer graphics might interact with folk art motifs. To prove how technology can give visual storytelling new dimensions, many artists started creating series of digital prints or incorporating digital layers in print- based works.

The integration of digital tools has enabled precision and scale that were previously challenging in printmaking. Multilayered colour separations, once labour-intensive, can now be achieved through software and large-format digital printers. Additionally, digitally aided expands the aesthetics of prints art by providing opportunities for photo-realistic detail and experimental surfaces.

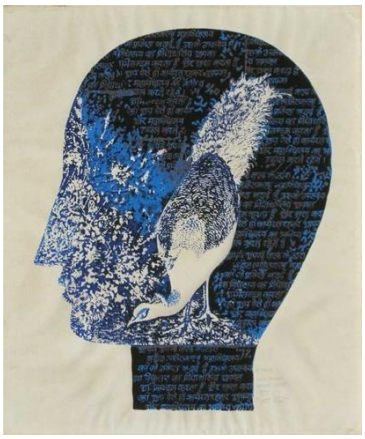
Traditionalists wonder if a computer-generated print can be considered as a “fine print” comparable to hand pulled works. By fusing digital and traditional printmaking techniques, such as transferring a digital picture to a lithograph plate or screen for hand printing, many artists manage this controversy while preserving a tactile experience. In the current landscape, there is a general understanding that digital processes stand for an added set of instruments that printmakers may use to convey their ideas. According to art critics Bordewekar, digital printing is flourishing in India and complements the traditional techniques rather than taking their place

(Bordawekar). New generation who are skilled in both digital media and traditional mediums are creating hybrid works that keep Indian printmaking at forefront of visual art innovation (Bordawekar).

1 Emerging Trends in Indian Printmaking Since 1990: A Focus on Four Key Artists

1.1 Jyoti Bhatt: Combining Traditional Method with Folk Traditions

Jyoti Bhatt (b.1934) is known for combining modern printmaking methods with traditional folk-art forms, he was one of the first people to do this. He went to M.S. University and then, in the 1990s, he learnt more sophisticated intaglio techniques at Pratt Institute in New York. Because of this foreign experience, he learnt about multi-colour intaglio procedures that were influenced by the work of his mentor, Krishna Reddy. He went back to printmaking in the 1990s after teaching and writing about folk arts for decades. He did this with a fresh feeling of purpose (Saffronart). He used Indian village visual culture in his lithography, screen printing, and etching by adding things like rangoli patterns, tribal tattoos, and vernacular handwriting. "Printmaking for me became a process of rich imagery and a residue of living traditions," he said, which shows how he tried to capture disappearing folk patterns in his prints. His work still had the disappearing folk elements, but his technical skills grew in the later 1990s and 2000s to incorporate photo-etching and digital prints (Nair).



Bhatt Jyoti, A Face, 1972, serigraphy on paper, Jehangir Nicholson Art Foundation, Mumbai, India. <https://www.dailyartmagazine.com/seven-indian-printmakers/>

He used revolutionary technology with his skills to grasp contemporary printmaking, unlike many others, (Saffronart) remembers that the artist hand-coloured prints and pictures, collaged photographic images in paintings, and employed photographic methods for printmaking. This cross-disciplinary approach prefigured hybrid printmaking. Bhatt used computers to scan and edit photos in the 2000s, he tried holography printing. These attempts from his latter years reveal his desire to use modern technology into high art printmaking. Digital tools expanded his audience by making many copies available and allowing him to work despite his worsening eyesight. His comparison of tradition and technology has helped printmaking evolve alongside traditions (Nair).

Since 1990s, he has been creating prints that celebrate both modern reflections upon and reminiscences of India's culture. Through contemporary graphics, folk symbols such as the peacock, lotus, tribal patterns, and villages scenes infused his work with themes beyond heritage to continuity and change (Nair). His art conveys a social message in gentle form, to value indigenous artistic traditions and everyday rural art as fine art. Jyoti Bhatt's works after 1990 exemplify a growing trend of merging traditional motifs with modern techniques in printmaking, highlighting extensive stylistic mastery, such as etching (Chheda) (Sengupta).

1.2 Anupam Sud: Intaglio Mastery and the Human Condition

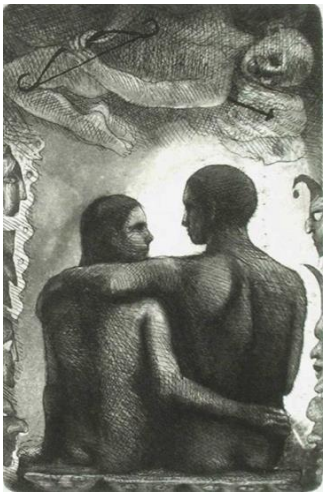
Sud, a pioneering Indian woman printmaker born in 1944, is renowned for her psychologically charged imagery and technical brilliance (Wong). Studied at the College of Art in New Delhi, where her mentor was Jagmohan Chopra and Somnath Hore and later, she received a British Council grant to at the Slade School in London in 1971(Wong). Her early overseas residence introduced her to global printmaking movements and innovative methods, further solidifying her commitment to etching and aquatint. After returning to India, Sud played an essential part in promoting printmaking as a prestigious art form. She did this by teaching at the College of Art, Delhi (1977-2003), and inspiring a new generation of printmakers (Wong).

She is best known for her detailed intaglio prints-large, exquisitely crafted etchings that stretch the expressive limits of the medium. She pushes the boundaries by mixing up printmaking processes, for instance, Sud "combines intaglio with lithography and screen printing" to create dense textures and tonal nuance within a single work (Wong). Her intaglio process typically involves zinc plates and involves multi-stage biting and inking to capture subtle gradations of light and shadow (Sud and Karode). She is an expert perfectionist who taught her students that printmaking requires accuracy, patience, and dedication to ideas (Wong).

Her overseas interactions kept her work at the forefront and contributed to printmaking's international discussion and shared information on methods. She often uses the human figure presented in a stark, vulnerable way as the primary focus of her works to examine issues of communication, gender relations, identity, and solitude. For instance, Sud's well known 'Dialogue Series' depicts two characters in varying phases of detachment or intimacy, signifying the unsaid conflicts that exist between people. Her works often explore gender relations and the experiences of women, offering subtle but sharp analyses of social conventions (Sud and Karode). Instead of didactic social criticism, she uses metaphor and atmosphere: empty spaces, lone persons, or fragments of architecture end to be around her subjects, provoking themes of urban disconnection and existential search. This psychological richness was new to Indian printmaking; she made a point to prove that prints could be as intellectually sophisticated as paintings or sculptures. In doing so, she contributed to the change in view of printmaking from a technique focused craft to a medium that can be used to explore social and intellectual issues.

Her works psychological realism might be seen as a reaction to the swift changes in society that occurred in after liberalisation in India. In this way, her art is socially active through its sympathetic examination of how people negotiate gender norms, societal expectations, and personal freedom rather than through overt protest. Besides being one of the few well-known

female printmakers of her period, she promoted inclusive environments for female artists in a so far male-dominated industry by acting as a mentor and role model (Chheda).



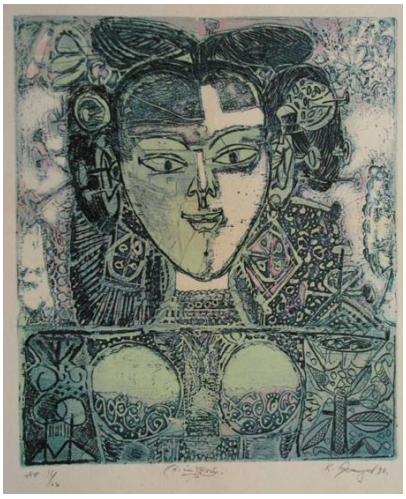
Sud Anupam, Cupid Playing,1996, etching on paper, Jehangir Nicholson Art Foundation, Mumbai, India. <https://www.dailyartmagazine.com/seven-indian-printmakers/>

1.3 K. Laxma Goud: Rural Imagery and Experimentation in Printmaking

Indian printmaker and painter K. Laxma Goud was born 1940. His art mixes rural and urban themes and modern and traditional components. K.G. Subramanyan and other printmakers taught him at Hyderabad and Vadodara (M.S. University) in the 1960s (Saffronart). He explored "rural life, eroticism and landscape" in etchings, lithographs, linocuts, and watercolours, becoming known for his draughtsmanship (MAP Academy).

According to one art history source, Goud "excelled in printmaking and played an important role in the evolution of the field, especially in etching and aquatints" and helped improve etching in India (Saffronart). In his intaglio prints, fine lines capture his subjects' hair or accessories, while deeply bitten sections produce velvety darks. Goud experimented with viscosity prints and coloured intaglio prints in the 1990s.Though Goud used traditional printmaking methods, technological creative thinking kept his printmaking approach current as digital media arose.

He employs viscosity printing to apply many ink colours in one shot, creating a colourful surface in this artwork, a human-animal encounter (Saffronart). Laxma Goud's social and intellectual contributions shine in his prints' substance and topics. Goud paints rustic village settings, and animals with intimacy and earthy comedy (MAP Academy). To explore sexuality via the muscular bodies of village men and women and the symbolic presence of animals was pioneering in a conservative art setting. His 1970s and later prints depicted rural folk in metaphorical situations with satire and myth. The portrayal of contemporary rural existence was rich, vivid, and unreserved. According to Chheda (2023), Goud's prints highlight a purposeful blend of rural and urban experiences and showcase “a renewed vision of sexuality in a rural locale,” portraying stylised local individuals in rustic settings (Chheda). Despite its roots in his early country experiences, Goud's art evolved in context, presenting the audience with rural sexuality and the cohabitation of traditional life with contemporary reality.



Goud K. Laxma, *Untitled*, 1996, viscosity print on paper, Jehangir Nicholson Art Foundation, Mumbai, India. <https://www.dailyartmagazine.com/seven-indian-printmakers/>

Goud's prints capture culture and social criticism by focussing on village life and folk imagination. The whimsical yet strong sensual imagery challenges metropolitan bourgeois ideals and celebrates a more natural, earthy lifestyle. Later, Goud taught at the University of Hyderabad and took part in several Indian and international art shows in the 2000s (MAP

Academy). These helped Indian printmaking gain worldwide recognition, showing that indigenous material could connect globally. His paintings are in important collections, and he received the Padma Shri (2016) (MAP Academy). In all Laxma Goud maintained traditional printmaking techniques and folk themes while adapting to new formats (such as viscosity printing, large-scale prints, and mixed-media approaches) to keep up with contemporary art.

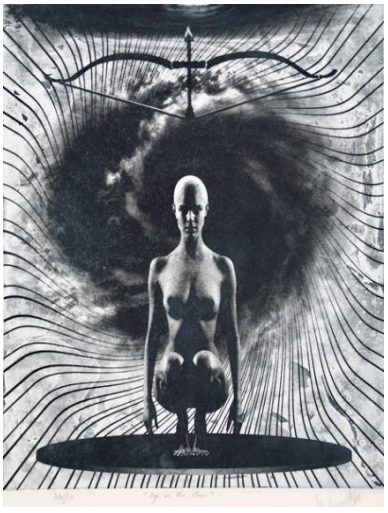
1.4 Jayant Gajera: Experimental Intaglio and New Narratives

Jayant Gajera (b.1967) is a contemporary Indian printmaker who rose to prominence in the 1990s and 2000s with innovative and conceptual artistry. Gajera co-founded the Indian Printmakers Guild (est. 1990), which promoted cooperation, workshops, and printmaking awareness (saffronart). Gajera has expanded intaglio printmaking since the late 1980s, working at Garhi studios in New Delhi's Lalit Kala Akademi, a significant printmaking centre (saffronart). Textural innovations, layering, and figurative and abstract aspects distinguish his prints. By studying Gajera, we can see how 21st-century Indian printmaking became experimental and post-medium.

His manipulation of surfaces and layers creates unique textures, but he also master's etching and drypoint. Critics praise Gajera's “experimental intaglio processes” and “unique textural innovation” for creating distinctive complicated prints (Sengupta). Often, Gajera employs many etched plates or biting and inking phases to create a paper palimpsest. To create rich layers, he may use etching, aquatint, mezzotint, or collagraph. The Mechanised Instinct print series uses many layers of etching to create complicated mechanical patterns and organic shapes that suggest depth and motion. Gajera employs intaglio and "platography," an aluminum-plate lithography method, to give texture and tonal diversity to his prints. At Garhi, which attracts Indian and international artists, Gajera has been a pioneer in sharing new techniques, in 2018, the Tokyo International Mini-Print Triennial featured Gajera's Mechanised Instinct E-5 etching, showing that he is part of a global printmaking

conversation, updating his technical toolkit and aesthetic ideas. Gajera uses the printmaking studio as a laboratory, testing how far an etched line can go, how stacking inks can generate new colours, and how blending printmaking matrices (metal, stone, digital transparencies) may provide new results (64 Tokyo International Mini-Print Triennial 2018).

Gajera favours semi-abstract images over narrative figuration, one of his best pieces, Eye in the Storm (2008), is a dynamic composition that suggests inner turmoil and may allude to social or personal upheavals. According to one study, his paintings often blend organic elements like faces, eyes, and silhouettes with geometric shapes like grids and mechanical components, "pushing the boundaries of figuration and abstraction" (Sengupta). This discussion looks at how people in a mechanised world are changed by technology, urbanisation, and identity. While the remaining figurative elements allude to memory, identity, or spiritual reflection, the mechanical elements stand for modern alienation or the dominance of technology. Gajera examines the internal geography of the individual in a rapidly changing world rather than displaying overt societal settings or conflicts. His prints give viewers a chance to reflect on contemporary life (saffornart).



Gajera Jayant, Eye in the Storm (2008), intaglio on paper.

<https://drsartscompany.com/editions/collection/events/national-printmaking-portfolio/eye-in-the-storm/>

As an Indian Printmakers Guild member, he has organised exhibits, portfolios, and workshops to promote printmaking. These events simplify the medium and empower young artists to experiment, making them socially meaningful. The popularity and reputation of Gajera (his works are owned by collectors and exhibited in national print portfolios) shows that printmaking has expanded ("Eye in the Storm by Jayant Gajera - DRS Editions ®"). Gajera's prints are now considered conceptual art that contributes to contemporary visual art conversation. The modern printmaker is a master technician, conceptual thinker, and global participant like Gajera. His work shows that Indian printmaking has been an area of constant innovation since the 1990s, where the matrix (plate, stone, or digital file) is only a beginning point for imaginative inquiry and the studio is a space for invention and critical thought.

2 Conclusion

Jyoti Bhatt, Anupam Sud, Laxma Goud, and Jayant Gajera highlight a noteworthy development in Indian printmaking during the past 30 years. Each artist represents a distinct phase of printmaking's evolution, yet shared characteristics appear. Printmakers from earlier generations placed more value on printmaking process techniques and aesthetics than on intellectual content. These four artists have demonstrated since the 1990s that technical mastery can coexist with social criticism and intellectual depth. Bhatt challenged purists through traditional printmaking, digital printing, and photography. Sud used intaglio with other printmaking processes to show that prints can be as tactile and tonal as painting. Goud experimented with colour viscosity and scale to make prints seem like paintings. Gajera's layering, platography, and collagraphy enlarged the medium. Bhatt's late-career works add digital prints and Gajera's plate design, which incorporate digital imagery (his mechanical themes and potential photo-etching procedures), display Indian printmaking's embrace of the computer age. Sud and Goud demonstrate that material research (chemical procedures, multi-

plate printmaking) supported innovation without digital instruments. Technological advancements in printmaking allowed more ambitious artistic goals.

Bhatt explores cultural history and identity, Sud gender and psychological exploration, Goud rural life and sexual naturalism, and Gajera philosophical abstraction, they all employ printmaking for intellectual and social reflection, not just aesthetics. This implies Indian printmaking addressed folk customs, women's roles, rural-urban divide, and modernism. Bhatt's use of traditional elements stands for cultural critique, supporting local art above globalisation. Sud criticises gender and communication norms via his subtle depictions of human interactions. Goud celebrates rural life and honest sexuality using country voices in art to fight city snobbery. Gajera's semi-abstract works explore chaos and technology's effects. These themes connect printmakers who utilise cognitively engaging painting, installation, and new media approaches.

Global exposure and residence have also contributed to this tendency; the U.S. and U.K. gave Bhatt and Sud vital ability they brought back to India. To keep current, Sud and Gajera attended workshops and international shows. Goud's 2000s presentations in New York, London, and other cities introduced European audiences to Indian printmaking and verified his concerns. The Indian Printmakers Guild, Garhi, and the Chhaap workshop in Vadodara hosted international printmakers and sent Indian artists abroad for residencies. These exchanges brought non-toxic etching, digital printing, and print as installation or socially engaged art. India’s printmaking industry is expanding globally, fostering connections among artists. Biennales, triennials, and portfolio exchanges contribute to the improvement of local printmaking practices. Digital connections inspire and educate artists worldwide. Global networking accelerated the transformation of printmaking from a local craft to a global modern art form.

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Finally, comparing these artists illustrates how printmaking in India has been "redefined as an essential part of modern visual arts rather than a secondary technique." Like painters and sculptors, the four printmakers earned awards, showed in prominent exhibitions, and were collected by national and international organisations. Prints are original work with distinct visual and conceptual features. The Indian Printmakers Guild and Chhaap, established in the 1990s and 2000s, laid the foundation for a professional art printmaking infrastructure in India. These artists have made printmaking an integral part of modern Indian art, creating visually appealing images that resonate with the country's social fabric and contribute to the global art narrative.

Jyoti Bhatt, Anupam Sud, Laxma Goud, and Jayant Gajera propelled Indian printmaking into contemporary art after 1990, their careers highlight how intaglio combinations, digital printing, and intellectual and social issues have been effectively handled by this medium. Printmaking studios became creative and critical hubs, not just edition production facilities. They proved prints could stand for folk culture, urban psyches, rural sensuality, and modern abstractions. Indian printmakers have explored photography and graphic software with digital resources, and foreign residencies and collaborations have connected them to global discourses. The medium-centric approach of prior decades has given place to intellectual inquiry and social awareness.

They use printmaking as visual studies to preserve a dying tradition, challenge gender norms, elevate earthiness against the alienation of the city, or reflect on the relationship between humans and machines. These artists' Indian printmaking emphasises the transdisciplinary, philosophical, and social focus of contemporary art. Indian printmaking was made possible by the technical ability and artistic inventiveness of printmakers and their contemporaries the vibrant and constantly evolving Indian printmaking industry is a testament to this. This study highlights amazing creativity, collaboration, and medium redefinition in the 1990s. Indian

printmaking is still a thriving hub of art, ideas, and social discussion today because of their studio practice, which they define as ongoing experimentation and interaction.

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From Capturing to Constructing: Reshaping Visual with Artificial Intelligence

Abin Alex, PhD Scholar | Dr. Debasish Ghorui, Professor & Research Supervisor,
Department of Design, GLS Institute of Design, GLS University, Ahmedabad, India

Abstract

Visuals are the active forces; that awaken emotions, shape memory, reframe human understanding, and influence how we interpret it. The shift from traditional photography to AI-generated prompt images has reshaped core ideas of authorship, authenticity, and meaning in visual communication since the second decade of the millennium. The mechanical eye of the camera, that captures reality through compositional choices, is now in contest with AI which constructs images from linguistic prompts that blur the lines between author, tool, and machine. The language of photography is reshaped and visual culture is redefined in due process, where prompt engineering, text-to-image, and neural synthesis play a substantial role. By human intention and machine learning systems, Artificial Intelligence (AI) has introduced a new visual syntax, grounded in the theories of visual rhetoric, the grammar of photography, and image semiotics. Through a comparative visual analysis of Indian political images between 2015-2025, this paper examines how visuals have been reshaped from traditional photography to AI-generated image. The study uses a mixed-method approach that combines visual semiotic analysis, prompt-based image generation experiments, and surveys of both creators and audiences. The results indicate that while AI-generated images can be persuasive in form, they are still approached with caution by viewers. The research offers the Five P Model: Perceive, Pixel, Parse, Portray, Persuade, as a framework to understand how human and machine collaborations are redefining visual political communication. This study demonstrates how AI acts as ethical instruments in Indian politics of persuasion, shaping the visual meaning.

Keywords: *Artificial intelligence, Indian digital media, political photography, prompt, visual analysis, visual perception, visuals*

Introduction

In recent years, the significance of images in communication has grown to a greater extent. As James Elkins said “we live in a pictorial age”, where visuals not only represent reality but actively shape how the world is understood, carrying communicative power across linguistic

and cultural boundaries. Elkins, J. (2003) Photography long served this purpose by externalizing thought and anchoring memory through fragments of lived reality, but that logic is now being unsettled. Artificial intelligence has begun to replace the camera's lens with language, as prompt engineering and neural synthesis generate pictures in which meaning is produced by a combination of human intention and machine logic (Aziz et al., 2024). Wendt's (1956) "language of pictures" has thus been extended into algorithmic grammar, where probability and data, rather than light, construct the image.

Indian political communication between 2015 - 2025, was the major period for this vivid testing ground for this transformation from camera based photographs to the introduction of AI in the image creation. Campaigns, news outlets, and mostly the digital platforms increasingly rely on AI-generated "promptographs," unsettling established conventions of authorship, credibility, and audience trust. Generative AI can be understood as a family of technologies that produce human-like outputs such as text, music, images, when guided by written prompts from the creator (Muller et al., 2022; Bandi et al., 2023). Scholars note how generative tools such as DALL·E and MidJourney have achieved what Hausken (2024) called AI photorealism. "Photorealism is not photography, but rather mimics a style, it is an aesthetic strategy for imitating photographic images" Hausken (2024). Their grammar, algorithmic and probabilistic (Kress & van Leeuwen, 1996; Devlin & Cheetham, 2023), increases expressive possibilities and lowers various creative barriers. It increases the risks of misinformation in highly sensitive contexts such as elections (Teachers College, Columbia University, 2023). Against this backdrop, the present study applies the Five P model that consists of 5 stages namely Perceive, Pixel, Parse, Portray, and Persuade, as a framework for understanding how political visuals are conceived, constructed, circulated, and received. The comparative analysis through 5P model of photographs and promptographs, prompt-to-image experiments, and surveys with Indian audiences, this study examines whether AI generated or prompt based images can replicate the impact of camera based photography, and what its rise implies for ethics, authorship, and trust in political communication.

Photographs to Promptographs

Photographs historically externalized thought with mechanical precision, but their persuasiveness often comes from imperfections, an unguarded gesture, uneven light, or fleeting glance that make them credible and emotionally charged (Hariman & Lucaites, 2007). Rooted

in what Walton (1984) called a causal connection to the world, photographs carry cultural weight through studium and punctum (Barthes, 1977), which indeed compresses ideology into symbolic acts (Pinney, 2004). Ricoeur (1991) and Arnheim (1969) states that mental images themselves are abstractions shaped by culture and thought. Photography once served as a way to externalize those abstractions into visible form. But the role of photography has moved beyond recording reality toward construction. As noted by Wendt, images function just like language with certain grammar and meaning Wendt (1956). The shift has further accelerated with AI tools such as DALL·E, MidJourney, Sora, Hailuo, and Runway ML, which generate "promptographs" from probability and data rather than light, reshaping how visuals are created and thereby used. AI now extends its influence by offering effortless photorealism, minimizing the creative barriers, and maximizing the challenges in both expressive and ethical stakes. Kodak's 1888 slogan, "You press the button, we do the rest," symbolized a cultural shift, a turning point in photographic history. In today's AI-driven media, it has quietly become "You give the prompt, we do the rest."

AI in Indian Political Communication

Photographs have long shaped political narratives worldwide (Schill, 2012). It plays a very important role in conveying stories and shaping public understanding whether it's newspaper media or social media. Ljunggren (2024) states, "India is changing". The political campaigns in India have relied mostly on visuals, as a major tool for framing narratives and constructing public identity." (Schill, 2012; Ljunggren, 2024). However, in recent years it is observed that the political parties and media strategists create campaign content for specific audiences adopting the generative AI tools (Venugopal, 2025; Yadav, 2025; Shah, 2024). Synthetic images are no longer limited to post-production effects; in fact it has entered campaign planning itself. This transformation further extends political communication into the algorithmic design. The Election Commission of India, acknowledged both their influence and risk, and mandated the labelling of all AI-generated campaign visuals in 2025 (IndiaAI, 2025).

Despite this rapid transformation, the study on how AI-generated promptographs alter political narratives, authorship, and audience trust in Indian political communication remains limited. Here, the study addresses this gap and by applying the five P image structure, compares political photographs and promptographs in the Indian political context from 2015 to 2025. Through the visual analysis, prompt-to-image experiments with tools such as DALL·E 3 and

MidJourney, and surveys across twelve states, the study examines photographs vs promtographs, how its structure transforms narratives, circulation, and reception, while also raising cultural and ethical questions about voter perception and credibility.

Method

This study included a comparative qualitative mixed-methods design to examine the transition in Indian political communication from photographs to AI-generated promptographs (2015–2025). The research unfolded in three stages: (1) a review of literature on visual culture and AI media, (2) a comparative visual analysis of political photographs and promptographs, and (3) surveys capturing both creator and audience perceptions. Central to the analysis was the Five P Model in the structural framework of images in five stages step by step namely Perceive, Pixel, Parse, Portray, and Persuade used to trace how images move from conception and construction to circulation and persuasive impact.

Participants

The participants engaged for this study consisted of two groups, namely promptographers (n=11) and audience participants (n=76). Promptographers were selected through a selection criteria, based on their prior experience in AI image creation or political communication. They contributed to the experimental dataset by generating prompt-based political images. While the audience participants were recruited via maximum variation sampling to ensure demographic diversity across twelve Indian states, varying by age, gender, and education.

Table 1: Promptographers demographics.

P Code	Role	Experience	Tools	Labeling	Risk of Manipulation
P1	Content Creator	<2 years	Photoshop / Illustrator, Midjourney, Runway ML, ChatGPT	Yes, always	Yes

P2	Prompt Engineer & AI content creator	<2 years	Midjourney, DALL·E, Runway ML, Stable Diffusion, ChatGPT	Yes, always	Yes
P3	Editor	<2 years	Photoshop / Illustrator, Midjourney, Runway ML, ChatGPT	Case-by-case basis	Depends
P4	Visual artist	<2 years	Photoshop / Illustrator, Midjourney, DALL·E, Runway ML, ChatGPT	Yes, only in campaigns	Yes
P5	Content creator	<2 years	ChatGPT	Case-by-case basis	No
P6	Visual Designer	<2 years	Runway ML, ChatGPT	Yes, always	Yes
P7	Artist	<2 years	Photoshop / Illustrator, Runway ML, ChatGPT	Case-by-case basis	Depends
P8	Visual designer	<2 years	Midjourney, Runway ML, ChatGPT	Case-by-case basis	Yes
P9	Wildlife Photographer & Cinematographer	<2 years	Photoshop / Illustrator, ChatGPT, Others	Case-by-case basis	Depends
P10	Educator	<2 years	ChatGPT	Yes, always	Yes
P11	Content Creator	5–10 years	Photoshop / Illustrator,	Yes, only in campaigns	Yes

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			Midjourney, ChatGPT, Others		

Table 2: Audience Participants' demographics.

P Code (n)	State	Age Group (U18/18–25/26–35/ 36–50/51+)	Follow Politics (%)	Media Sources (Media followed for awareness of politics)	AI Mislead (%)	Trust in Images (%) (Photo/AI/ Both/Neither)
P1–P2	Andhra Pradesh	0 / 1 / 1 / 0 / 0	50.0 / 50.0 / 0.0	Online News Portals, YouTube or Political Video Channels	100.0	50.0 / 0.0 / 50.0 / 0.0
P3	Delhi	0 / 0 / 0 / 1 / 0	100.0 / 0.0 / 0.0	Online News Portals	100.0	100.0 / 0.0 / 0.0 / 0.0
P4–P25	Gujarat	1 / 19 / 1 / 0 / 1	9.1 / 77.3 / 13.6	YouTube or Political Video Channels, Online News Portals	68.2	77.3 / 0.0 / 9.1 / 13.6
P26–P29	Karnataka	0 / 0 / 3 / 1 / 0	0.0 / 75.0 / 25.0	Online News Portals, YouTube or Political Video Channels	75.0	75.0 / 25.0 / 0.0 / 0.0
P30–P53	Kerala	0 / 7 / 10 / 3 / 4	25.0 / 54.2 / 20.8	YouTube or Political Video Channels, Online News Portals	41.7	58.3 / 12.5 / 12.5 / 16.7
P54	Madhya Pradesh	0 / 1 / 0 / 0 / 0	0.0 / 100.0 / 0.0	Political Party Pages, Online News Portals	100.0	100.0 / 0.0 / 0.0 / 0.0
P55–P65	Maharashtra	0 / 11 / 0 / 0 / 0	9.1 / 90.9 / 0.0	Online News Portals, YouTube or Political Video Channels	54.5	72.7 / 27.3 / 0.0 / 0.0

P66	Rajasthan	0 / 1 / 0 / 0 / 0	0.0 / 100.0 / 0.0	Online News Portals, YouTube or Political Video Channels	0.0	100.0 / 0.0 / 0.0 / 0.0
P67–P70	Tamil Nadu	0 / 2 / 1 / 0 / 1	0.0 / 75.0 / 25.0	Online News Portals, Political Leaders' Social Media Pages	75.0	50.0 / 50.0 / 0.0 / 0.0
P71–P72	Telangana	0 / 1 / 0 / 1 / 0	0.0 / 100.0 / 0.0	Political Leaders' Social Media Pages, Online News Portals	50.0	100.0 / 0.0 / 0.0 / 0.0
P73	Uttar Pradesh	0 / 1 / 0 / 0 / 0	0.0 / 100.0 / 0.0	Election Advertisements (TV, Online)	100.0	100.0 / 0.0 / 0.0 / 0.0
P74–P76	West Bengal	0 / 0 / 3 / 0 / 0	66.7 / 33.3 / 0.0	YouTube or Political Video Channels, Online News Portals	66.7	100.0 / 0.0 / 0.0 / 0.0

Procedure

The initial dataset included 56 political images (44 photographs, 12 promptographs) catalogued with metadata such as year, source, and ID. From this, 11 photographs (SRCB01–SRCB11) based on one photograph from each year 2015 - 2025 and 3 archived promptographs (SAIG01–SAIG03) based on one image per year were shortlisted. The dataset of images were chosen as per their symbolic richness, thematic clarity, and compositional depth. In the experimental stage, descriptive themes from the photographs were used to generate 11 new AI promptographs (AIPB01–AIPB11) with Midjourney v5, based on text prompts co-developed with participants and refined through Grok AI. Thus, the final dataset comprised 25 images in total for further analysis in this study: 11 photographs, 3 archived promptographs, and 11 newly generated promptographs.

The study followed an analytical framework Five P Model structure for the comparative analysis. The very first stage Perceive assessed realism and cultural plausibility; while Pixel, the second stage examined technical construction such as light, framing, detail, color. The next stage Parse decoded symbols, gestures, and staging. In the fourth stage, Portray, images were followed through their circulation across media. Whereas Persuade, the final stage focused on

how audiences received and interpreted them. In the survey, 76 respondents compared SRCB11 (a real photograph) with AIPB11 (its AI counterpart), rating realism, trust, and potential to mislead. Responses indicated that cues such as skin texture, expression, background consistency, and symbolic placement shaped credibility, showing that political images function both technically and within cultural–ideological frames.

Figure 3.1: Left - Political photographs (Image Id. SRCB01–SRCB11) from the years 2015-2025 respectively. Right - AI-generated promptographs (Image Id. AIPB01–AIPB11), generated with prompts based on the photographs from the years 2015-2025 respectively.

Figure 3.1: Left - Political archived promptographs (SAIG01–SAIG03) during 2023–2025.

Results

The study examined 11 photographs (SRCB01–SRCB11), 11 AI-generated promptographs (AIPB01–AIPB11), in Indian political communication (2015–2025) and 3 archived promptographs (SAIG01–SAIG03), (2023–2025). Through visual analysis, thematic interpretation, side-by-side comparisons, and by using the Five P model, the analysis examined the images across various aspects such as visual, technical, and semiotic perspectives. The framework determined the structure in the construction of an image. While its stages revealed distinct insights into how photographs and promptographs communicate within the Indian political scenario. Further, survey responses revealed clear differences in how participants judged authenticity, authorship, and persuasion, with photographs consistently rated higher than promptographs for realism and symbolic depth.

Photographs were rated higher as compared to the promptographs for realism, emotional authenticity, and cultural familiarity in the Perceive stage. Although the promptographs were found sharp and detailed, it received lower scores for symbolic naturalness and believability. The Pixel stage, evaluated through the Five C's (Configuration, Contrast, Clarity, Color, Composition). It rated photographs with credibility from variations such as uneven light, framing overlaps, and incidental background elements. Promptographs on the other hand had shown balanced lighting and uniform clarity, but were judged less convincing despite its technical precision. At the Parse stage, semiotic analysis showed that photographs integrated gestures, elements, and spatial context into layered narratives. While promptographs just reproduced the same elements in a more schematic way; but it often looked as assembled rather than organically grounded.

The Portray stage traced circulation using reverse image searches and platform checks across archived 14 visuals in Indian political communication (11 photographs + 3 archived promptographs). Photographs appeared across newspapers, social media, digital archives, and frequently reframed with captions or hashtags. Promptographs were found mainly within digital platforms, and almost no presence in the mainstream political communication media. Finally, the Persuade stage survey revealed three consistent patterns. First, 71% of participants expressed greater trust in photographs than in AI images. Second, 57 participants reported being able to distinguish real from synthetic images with ease. Third, 59% agreed that AI visuals could mislead voters depending on context.

Discussion

The findings address the first research question: how AI-generated promptographs alter the grammar of political photography in India. Political images are constructed not only through subject matter but through light, gaze, gesture, and depth, elements that guide perception. Using the Five P model (Perceive, Pixel, Parse, Portray, Persuade), the analysis revealed how audiences interpret imagery across technical, cultural, and ideological layers. Perceive, Parse, and Persuade stages proved as the strongest stages in the image structure, where factors such as nationalism, Hindutva, and constitutional symbolism recurred across the political images. The stages Pixel and Portray were important as it shaped technical and distributive dimensions in the entire communication process. Surveys reflected both curiosity and suspicion responses among the participants, as they questioned the credibility of synthetic images. Comparisons of Indian political photographs and promptographs showed a shift from just documenting events to constructing symbolic narratives.

The Perceive and Pixel stages showed that photographs gained credibility from imperfections, an unplanned gesture, uneven light, or crowd detail; and highlighted these are one of the limits that AI visuals could not match (Hariman & Lucaites, 2007). The small but piercing details Barthes (1981) called the punctum were rarely present in AI images that felt like constructed templates than lived moments. Thus, promptographs, though looked polished, lacked the unpredictability that gives photographs their persuasive edge. As a result, photographs circulated widely and carried narrative importance, while promptographs were found largely confined to experimental or artistic spaces.

Survey responses in the Persuade stage reinforced these findings: most participants trusted photographs over AI images, though many still recognized the risk of synthetic media misleading voters. A survey of 76 participants across twelve Indian states showed stronger trust in the real photograph (n=54) than its AI version (n=9), though nearly half (n=45) warned that fabricated visuals could still mislead voters. Photographs, even when imperfect, captured unpredictable traces of presence that grounded them in lived experience (Hariman & Lucaites, 2007), whereas AI images, though realistic, lacked this resonance (Hausken, 2024). Visual meaning and persuasion arise not only from its creation, indeed from its cultural reading and circulation (Kress and Van Leeuwen, 1996; Pinney, 2004; Mitchell, 2005). It underscores why photographs were remembered always and trusted more than promptographs. Further the

responses from survey participants noted that fabricated or AI generated visuals have the potential to alter shared memory and public understanding.

The 5P model offered a clear way to construct the images with meaning, from their first conception to their persuasive impact. In photographs, this process is carried out in reality, while promptographs often flatten narrative depth. It is something that is generated with AI tools and prompts by prompt engineers and algorithms. Such images broaden the visual communication of politics but still struggle to match the authority and trust of camera-based photography. As Mitchell (2005) explains, images act within reality, and carry intention and memory. But, the comparative analysis and survey analysis shows that AI visuals remain limited in this respect. Their growing circulation day by day, however, raises critical implications. Repeated exposure may alter how the public remember, trust, and respond to political images (Pinney, 2004; Hausken, 2024). As AI visuals reshape political communication, the challenge further lies in creating frameworks both ethical and methodological that can account for their influence.

Limitations

This study is firstly limited with a small dataset of eleven photograph–promptograph pairs (2015–2025). The generation of Promptographs relied on specific AI generative tools available in 2024, so its findings reflect a narrow technological and historical moment. The survey of 76 participants across 12 Indian states provided useful diversity, but the scale restricts generalizability. Further the direct involvement of the participants was excluded in this study, which limited the broader aspects of image structure in Indian political communication. Semiotic and visual grammar analysis were valuable, and introduced interpretive subjectivity shaped by culture and context. The findings should therefore be read as provisional, pointing to the need for future scope with larger datasets, more varied participant groups, different genres of visuals and cross-national comparisons. The longitudinal approaches, including eye-tracking or biometric measures, could help capture how repeated exposure to synthetic images gradually reshapes memory, trust, and political perception. This field is only the beginning, and as the use of AI tools increases in political campaigns, the demand for deeper and more sustained research will intensify.

Conclusion

This study examined the contrasts between political photographs and promptographs, summarising key insights, acknowledging its limitations, and outlining the significance of the findings for understanding the transformation of political imagery in the era of AI. The research sheds light on people's perception, trust, and responses to photography and promptography. Based on the Five Ps model, this study examines not only the visual aspects of political photographs and promptographs but also the ways in which they are experienced, shared, and believed by the public. Results showed that digital spaces have transformed not only how political images are created but also how their meaning is interpreted. With their influence likely to grow even stronger in the near future, there is a demand for future studies on perception to interpretation on wider photography categories. Visuals operate as more than documentation; they act as political statements that influence voter perception and a culture. From a comparative analysis of Indian political visuals between 2015 and 2025, the findings trace how the shift from photography to promptography has reconfigured meaning and perception.What is at risk is credibility itself, since political images gain meaning not through visual fidelity alone but through the trust they generate among citizens. This study affirmed that the future of political visual communication will not be determined solely by what can be generated, but by what can be believed. AI tools enable visual construction with impressive fidelity, but they have yet to reproduce the cultural labor that photographs perform. The 5P model for visual image construction in the context of Indian political communication affirmed that the political imagery is not just composed; it is lived, interpreted, reused, and trusted within specific historical and emotional frames.

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Coded Heritage: Ethical and Creative Dialogues Between AI and Indian Folk Art

Simran Dogra, Research Scholar | Dr Ganesh Gule, Assistant Professor

Lovely Professional University, Punjab

Dr. Vishweshwari Tiwari, Professor, Chandigarh University Chandigarh

Abstract

This study explores the experimental function of Artificial Intelligence (AI) in growing technology innovation in the domain of visual arts, highlight its use in reproducing and reimagining composite visual languages from cultural heritage. Going beyond the growth of traditional AI art tools, the study examines how advanced technologies like Generative Adversarial Networks (GANs) and neural style transfer brings major changes in digital art. The research uses case studies inspired by different Indian folk art and artists and the complex geometries of Madhubani, the simple forms of Warli, detail designs of Pichwai, and detailed composition of Chamba miniature paintings. By combining refined machine learning methodologies with digital art processes, this study explores the ways in which technological progress is redesign creativity, authorship, and the preservation of cultural heritage in today's digital world.

Keywords: *Artificial Intelligence, GANs, Neural Style Transfer, Algorithmic Innovation, Digital Creativity, Cultural Preservation, Technological Development, Visual Analysis*

Introduction

The rapid growth of Artificial Intelligence (AI) in the creative domain is causing a switch from traditional art creation toward technology-driven innovation. Today's AI systems are not only producing new visual art but are also approaching fundamental technologies that support creativity. This research explores how AI models are being redesigned to use and reproduce complex cultural data—especially traditional Indian art forms—to improve technology and inspire new standards for digital art. A key focus of our study is to evaluate whether AI can work as a cause for technology development in creativity. By using tools like Generative Adversarial Networks (GANs) and neural style transfer, the study examines whether these tools serve as genuine creative agents or mainly as an advanced tool that supports human

creativity. The research also explores how these AI tools are being used in digital art, while also considering challenges such as bias in systems, limited diversity in training data, and legal issues about authorship and copyright.

Research Gap

While most studies have focused on the aesthetic results of AI-generated artworks, but there's still not much research on how these advanced technological developments in AI contribute to innovation in creative action. Previous literature (e.g., Baxter, 2024; Wan & Jing, 2024) has explored the impact of AI on creativity and authorship. However, there is limited discussion on how these algorithms make themselves advanced, improving in performance, and merge with hybrid digital art systems. This research addresses the gap by evaluating the technological evolution of AI models, particularly their development and refinement in the context of complex, culturally-rooted visual languages.

Objectives

1. **To evaluate AI as a Creative Tool -** Explore how AI (e.g., GANs, neural style transfer) direct innovation beyond copying traditional art.
2. To Examine Ethical and Technical Issues
   - Explore challenges like transparency, and data integrity in using AI tools for cultural heritage.
3. **Analyse artists Views -** Evaluate how artists, technologists, and cultural experts perceive AI's role in traditional art.

Scope of the Study

The present research mention the refinement level of the AI technologies, that is, the GANs and the neural networks, and how they are being used to imitate, reinterpret, and preserve the visual styles emerging from the miniature paintings of Madhubani, Warli, Pichwai, and Chamba. The research is explain about the side by side effort to enhance digital creativity and making sure that such technological advancements support cultural preservation without compromising ethical bases.

Methodology

A mixed-methods approach is used to investigate both the technological and cultural facts of AI application in art. This involves a literature review that includes AI

development research, algorithmic foundation of GANs and neural networks, and technological case studies of digital art production. Visual and technical evaluation is used to find out AI-generated art on both aesthetic worth and algorithmic use, including such factors as innovation, stability, and productivity. Expert interviews and surveys of AI researchers, digital artists, and cultural preservationists are also used to find out how these technologies affect both creative innovation and the authenticity of cultural expression.

Literature review

Baxter, C. (2024). – Step-by-step algorithmic advancements that increasingly reflect human imagination and the area where human judgment remains supreme. Looks at the evolving roles of artificial intelligence as a collaborative partner, observing

Wan, M., & Jing, N. (2024) - News about a new two-stage model for AI art that combines GANs with new improvement methods, explaining how self-attention and genetic algorithms both help in reach more realistic and diverse algorithmic generations in digital format.

Zhang, B., and co-authors (2023) Considers the technological potential of AI in cultural preservation using traditional visual forms as a template for training models that conserve and digitize threatened art forms, thereby contributing to cultural conservation and technological advancement.

Trends in AI-Generated Art (2024) - This examines that how new development in AI tools CNNs and GANs are being used to make art. Researchers evaluate creativity in these systems using factors like how innovative the output is, how stable the system works, and how well it works in different types of art. Scientific Programming (2021): This explains how AI system are being designed to connect more closely to humans, making digital art more emotionally engaging. This creates a new way for humans and AI to work together.

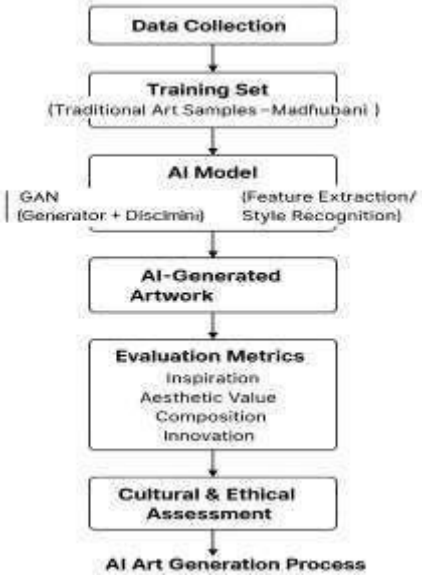
Study of Progress in Artificial Intelligence Art Generation

AI tools like CNNs and GANs are now key figures to creating digital art. They don't just copy images but shows a kind of creative skills. For example, GANs use two networks- one is generator who generate images and one is discriminator who checks generated images looks real and get better over time. Because of this process, the generated images become sharper and more compatible in style and often reaching a level close to art made by humans.

Another important tool is neural style transfer, which uses CNNs to copy the style of one image and apply it on another. This make the system more flexible.

A advanced version, called Cycle GANs, can transfer styles between very different types of images without needing matching pairs of data.

-as AI art continues to grow, researcher are also working on ways to judge its quality and creativity. They evaluate how well the AI works on reproducing, imitates and develops cultural styles, how close or original the results are, and how efficiently the system learns, processes the data, confront errors and works on feedbacks. These evaluations not only focus on artistic value of AI generated art but also helps in understanding it technological strength and long-term ability as a tool for digital creativity and cultural preservation.



Limitations and Opportunities in AI- Driven Technological Development

Despite the progress of AI-aided creativity, there are remain some challenges in continue to prevent and maintain its emotional and cultural meaning —which is center of human creativity. Another problem is data bias, which happens when AI is trained on limited or one sided dataset. This can creates problems like fairness, authenticity and representation in AI-generated art.

Still, there are many positive growths seen in AI as creative tool. AI works as creative partners for artist, helping to expand their imagination and create new hybrid art works that mix digital with human expressions. AI can also play a supreme role in preserving culture by transforming traditional artwork into digital one and making them easier for people to access them from

anywhere. AI can create great experiences, such as virtual museums or cultural spaces that people can explore. Blockchain technology adds one more layer by tracking origin and ownership of artworks, securing their authenticity and protecting cultural heritage.

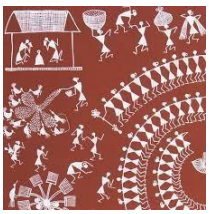
Technological Analysis of AI Models in Indian Folk Art Recreation

The AI models evaluated in this study— **Generative Adversarial Networks (GANs)**, **Cycle GANs**, and **Neural Style Transfer**—show significant potential for mimicking and transforming traditional Indian folk art forms. However, each model responds differently depending on the inherent complexity and stylistic features of each art form.

1) **Madhubani Art Form with Traditional and used of GANs AI Model -**

Key Observations - Preserved vibrant colours and symmetrical patterns well, but struggled with intricate motif details.

2) **Warli Art Form with Traditional and used of GANs AI Model -**

Handmade Image	AI-Generated Image
	

Key Observations – Form are same but natural colour effects are missing in the Digital art process.

3) **Pichwai Art Form with Traditional and used of GANs AI Model -**

Handmade Image	AI-Generated Image

Key Observations - Partial success; AI preserved some visual elements, but spiritual nuances were lost.

4) Chamba Art Form with Traditional and used of CYCLE GAN AI Model -

Handmade Image	AI-Generated Image

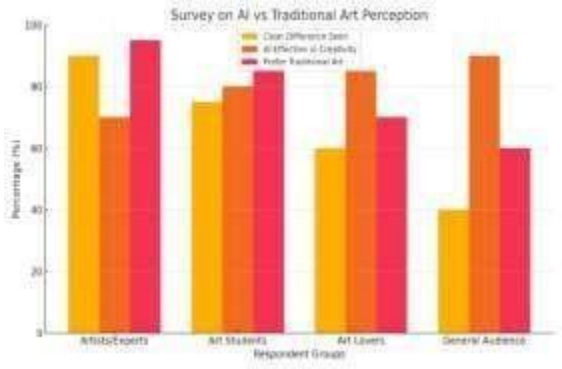
Key Observations - Fine-tuned GAN models were needed to preserve the delicate brushwork and intricate composition.

Comparison and Reflections

Madhubani- Madhubani art is characterized by rich patterns and symbolic imagery, which is difficult for AI to copy faithfully. While Neural Style Transfer managed to replicate the colour palette and symmetry, the denser symbolism and finer details were lost to some extent in AI-generated art. This is characteristic of the tendency of AI models, even though they can replicate visual composition, to tend to be poor in cultural and symbolic depth. The complexity involved in Madhubani produces a wider gap between art created by hand and art generated by AI.

Warli: Warli, with its minimalist geometric shapes and linear forms, was perhaps the simplest for AI to mimic. The GANs worked well here, and the AI- created image is highly comparable to the original Warli painting. The lack of complexity in the patterns— predominantly lines and circles—gave the AI the ability to create high-fidelity output. This makes it rigid to identify the difference between human-made and AI-created Warli, demonstrating AI's capability in copying repeated patterns and shapes used in warli.

Pichwai: Pichwai paintings are symbolic of deep meaning, represented by intricate iconography and spiritual meanings that are difficult to copy through AI. The Cycle GAN model sought to reproduce this style of art; however, it failed to capture the spiritual meaning that is inherent in the original work. The Pichwai created by AI lacks the meaningful content inherent in the handmade version, thus showing the challenges AI models face while dealing with complex cultural nuances and the emotional depth that is delivered by traditional art.



Chamba Miniature: Chamba Miniature paintings, is highly detailed in their brushwork, color scheme and fine details, were a decent challenge for AI models. The AI-generated Chamba Miniature was not able to reproduce the fine brushwork or the compositional balance that is characteristic of the human-made style. High-resolution GAN models produced some victory, but still could not achieve the standard of delicacy. This kind of obstacles AI face when it comes to reproduce art work that are highly in details and human made.

Survey Analysis

As a part of this research, a survey was conducted where both hand-made and AI generated art works were shown to people. Around 200 participants took part, including artists, art students, general students and experts, and were asked to give their opinions on the differences, the value of AI in creative work, and the technical and emotional connection evoked by artwork.

Results showed that people with artistic background——were largely trained in noticing the AI-generated pictures from those that were hand-drawn. Mostly participants respond that Human made art works had more emotional depth, deeper meaning and inner expression. General audiences, though responsive of AI capability, found it hard to notice the subtle details. Most of the participants admit that AI is capable of doing a good imitation of artworks and can be a great asset to the creative side.

In comparing AI-generated and traditional art, the viewers often respond that AI lacks emotional depth, cultural sensitivity, and individual point of views that human artists bring to what they do. In traditional art, creativity involves unexpected moments- and even mistakes become part of the final work. In digital applications, tools like “Undo” helps artist to fix their

mistakes but also take away the uniqueness from those unplanned elements.

Conclusion

This study highlights the unique qualities of both traditional and AI-generated art while recognizing that each has mastery and methods of its own. Because of its emotional depth, cultural value, and creative spontaneity, traditional art remain irreplaceable. However, AI technology offers major benefits in terms of speed, large scale production and the capacity to conserve and reinterpret cultural history, especially with technology GANs and neural style transfer. Still no matter how advanced AI becomes, it cannot fully create depth, intuition and unpredictability that make traditional human art.

Although smart labour is increasingly valued over hard work in the current conclusion is that although artificial intelligence exhibits great technical skill in replicating artistic styles, it remains limited in its capability to attain the human qualities of depth, uncertainty, and creative intuition that characterize traditional works of art. The findings shows the ongoing importance of human creativity even in the digitalized world.

The survey also investigate the authenticity of traditional versus AI- generated artworks. While both art forms share a human origin, AI requires human guidance to generate artworks, acting as an assistant rather than an independent creator. Some respondents, especially artists and experts, argued that AI- generated art lacks authenticity because it imitate existing works rather than offering something new. Traditional art, in contrast, is seen as more personal, culturally meaningful, and emotionally powerful.

As digital tools become more embedded in creative production, the study suggests that the future of artistic development will depend on how artists choose to integrate technology to extend, rather than diminish, the embodied knowledge and cultural depth that define traditional visual art forms.

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Contemporary Indian Art through Watercolour: Insights from Shyamal Dutta Roy and Pradip Maitra

Tuli Mitra, Research Scholar, Department of Visual Art, Banasthali Vidyapith, Rajasthan and State-aided college teacher (SACT) in Sevayatan Sikshan Mahavidyalaya, West Bengal
Dr. Srishti Sah Jagati, Associate Professor, Department of Visual Art, Banasthali Vidyapith, Rajasthan

Introduction:

People often use the terms modern and contemporary in the same sense, especially in the arts. It goes beyond the limits of time and space. Modernity is a state of mind in which artists creatively absorb new experiences and ideas through struggle. Although modern art emerged in Europe in the mid-19th century, a distinct form of this trend has also developed in Indian art. Rabindranath Tagore, Abanindranath Tagore, and Nandalal Bose were Indian artists who incorporated Western art techniques into their artistic expression. After independence, different artist groups have opened up different aspects of contemporary art. 20th century, the Bengal School of Art was established. After that, different art groups started to establish, those are The Calcutta Group in 1940, the Progressive Artists Group in 1947, and the Shilpi Chakra in 1949. The year 1960 marked the formation of the Society of Contemporary Artists.

Shyamal Dutta Roy and Pradip Maitra, two prominent watercolourists of this group, have created a new language by mixing Western influences with local realities and feelings. Shyamal Dutta Roy portrayed the psychology of society and protest in his painting, while Pradip Maitra depicted the ruins, memories and times of the city. Their work presents a distinctive viewpoint on contemporary thought and design philosophy.

Methodology: The study adopts a descriptive and qualitative research design to explore the Contemporary Indian Art through Watercolour: Insights from Shyamal Dutta Roy and Pradip Maitra.

Result: The findings of this study show that Shyamal Dutta Roy and Pradip Maitra have played an important role in shaping the aesthetic trend of Indian contemporary art by blending personal feelings, heritage, abstraction and cultural consciousness in watercolour.

Discussion

Watercolour in contemporary Indian art:

Today, transparent watercolour is one of the most popular mediums of painting. Watercolour painting, which is in its modern form, was primarily developed and popularised in Europe. In India, opaque watercolours were already in vogue, so British colonial artists were the first to use transparent watercolours. Western influence brought many changes to watercolour painting in India. In the 17th century, watercolour was used in Europe for outdoor or documentary paintings, especially landscapes. It was very useful because it dries easily. In the 20th century, the Bengal School marked the rise of modern artistic expression in India. Abanindra Nath Tagore 1st started washed in India. He also learned Chinese and Japanese watercolour techniques along with Western trends. Watercolour was once a means of depicting nature or realistic scenes, but in contemporary art, it has become a language of deep expression. Shyamal Dutta Roy has given a new language of modernity to watercolour. His paintings are characterised by the use of dark colours, broken forms, and expressions of the stress and helplessness of city life. He has translated reality through watercolour on a personal and psychological level. Pradip Maitra is one of the major figures in this genre, whose painting shows abstraction, old and run-down buildings, and a layer of time. He used watercolour not only as a medium, but also as a kind of thought design. Thus, watercolour, despite being a traditional medium, is finding a new place in contemporary art thinking. It plays an important role in the expression of modern thinking while keeping its roots strong.

Shyamal Dutta Roy

Shyamal Dutta Roy's paintings are a mixture of personal memory, historical disaster and imagination. During his childhood in Ranchi, unable to attend school due to illness, he found refuge in nature, old palaces, and the world of fantasy. Like Meghna Padma Dhabaleswari, the river had a profound impact on his life when he moved to East Bengal. After completing matriculation, he joined the Government Art College in Calcutta and became acquainted with Nikhil Biswas. Later, Nikhil Biswas, Ahibhushan Mallick, Shamal Dutta Roy and others came together to form the Society of Contemporary Artists in 1960.

Shyamal Dutta Roy's Artistic Style and Thematic Concerns

Shyamal Dutta Roy worked in oil at the beginning of his career, but gradually turned to watercolour, as he realised that it was the most suitable medium to express his insights. He was deeply influenced by the restrained yet profound use of light and darkness in his teacher Gopal Ghosh's. Gopal Ghosh not only taught the techniques but also encouraged the students to have

an open discussion on the work. Shyamal's thought was also influenced by Abanindranath Tagore and Bengal's heritage of painting, which mixed Indian preferences with deep, restrained colours and emotive lines. He is inspired by the work of Ramkinkar Baj, Nandalal Bose, especially in his exploration of the relationship between nature and man. A new direction in his watercolour practice was given by the British artist J. M. W. Turner, who used dramatic light and darkness in his painting, which matches Shyamal's sense of life. He expressed the dark memories of partition, poverty, illness and political crisis in clear but deep language of watercolour. He developed his colour properties by applying multiple layers of colour, breaking the traditional rule of using three layers of colour. His style was expressionist and symbolic, reflecting memory, emotion and social reality.

Fig.1.Shyamal Dutta Roy, Golden Gate, 1998.water colour

The Golden Gate, painted in 1998 by Shyamal Dutta, is a remarkable painting in transparent watercolour, with a symbolic great in golden yellow, brown colours. Behind the gate is a reddish-black road, and in front of it is a rickshaw-puller with a paper windmill. Its reflects one’s memory, sense of time and inner mindset. The use of chiaroscuro (the dramatic use of light-darkness) and layer-based colour in the painting stands out as distinctive characteristics of the artist.

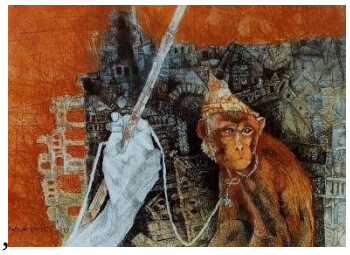

Fig.2.Shyamal Dutta Roy, The Entertainer, 1988.water colour

Shyamal Dutta Roy's **The Entertainer** series of transparent watercolour paintings often features a monkey, which symbolises the Madari sport practised on the streets of India, including Kolkata. These monkeys are not only a means of entertainment, but also portray

poverty, harsh reality and exploitation. The entertainment that becomes mandatory in the midst of the hardships and uncertainties of society for the sake of livelihood has been revealed through this picture.

Fig.3.Shyamal Dutta Roy, Broken Bowl,1979, water colour.

Shyamal Dutta Roy's **Broken Bowls** series (painted in the sixties and seventies) presents a subtle satire of the social system of the time through the broken begging bowl of the beggar. In the watercolour, he expressed a deep expression of the struggles, sufferings and socio-political realities of the common people.

Pradip Maitra

Pradip Maitra was born in Shrirampur, Hooghly district. Later, he started to live in the Survey Park area of Kolkata. After graduating from the University of Calcutta, he studied painting at the Indian College of Art and Draftsmanship. It was there that he came into contact with Gopal Sanyal as a teacher and received deep inspiration in art and education. In the annual exhibition of the art college, he first met with artist Bikash Bhattacharya. Bikash Bhattacharya admired his work and urged him to join the Society of Contemporary Artists. Pradip Maitra joined the group in 1988. In SCA, he met with Shyamal Dutta Roy.

Maitr's Artistic Style and Thematic Concerns

Pradip Maitra's watercolours are a unique combination of poetry, emotion and reality. His painting captures post-colonial and industrial Kolkata and its environs. The clarity and technique of British watercolours are evident in his work, while the layering of colours, the omission of white, and the influence of East Asian calligraphy add a new dimension to his paintings. In college life, inspired by his seniors, especially Saibal Das, going to the railway carshed in Kakurgachi was the beginning of his watercolour education. He later painted a famous series called 'Chariot of Civilisation', Apart from watercolours, he has also worked in gouache, oil, etc. His work embodies art philosophy, technical skill, multidimensionality and

intrinsic passion. Old factories, chimneys, tea shops, markets, and the lives of migrant workers are the subject of his painting. His watercolours are a living document of time, memory and human emotions**.**

Fig.4.Pradip Maitra, Chariot of Civilisation, 2006, water colour.

Chariot of Civilisation. Noteworthy is the picture where a steam engine is presented in the form of a living organism. This engine seems to be running from generation to generation, and it is satisfying the hunger with coal as of people like food. The artist painted the engine with a red line, which depicts the pain of the machine as a symbol of human bloodshed.

Fig.5.Pradip Maitra, Illusion and Reality, water colour

'Illusion and Reality ' where Maitra wants to portray the reality of the current education system. There is an old lantern in the picture, which is the carrier of civilisation, but has become meaningless today; under it, torn, neglected books are a sign of the decline of knowledge. The artist wanted to show today's education crisis, the lack of real education and society in darkness. Poetic yet painful, this painting reflects the decline of education and the decline of values.

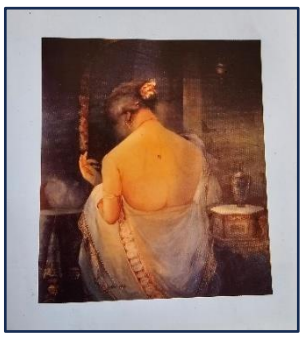

Fig.6.Pradip Maitra, Reminiscence" or "Reminiscence, 2021.water colour

"Reminiscence" is a fusion of past and present in the painting of Pradip Maitra, where each picture is a reflection of a silent memory and feeling. His painting shows a woman combing her hair - a scene from the artist's childhood memories, in which he used to watch his mother comb her hair in front of a mirror after returning from the bath.

Comparative Study and Emerging Trends in Indian Art through the Works of Shyamal Dutta Roy and Pradip Maitra

Both Shyamal Dutta Roy and Pradip Maitra have chosen transparent watercolour as their medium of art. The influence of personal life, social reality and the city is evident in their paintings. Both are adept at figurative imagery - broken bowls, rickshaw pullers, madari games in Datta Roy's painting and engines, old lanterns, books in Maitra's paintings. They express the pain and helplessness of life in a mixture of reality and imagination. While Datta Roy highlights the fragmentation of the poor society and existentialist philosophy, Maitra shows the degradation of the industrial sector and the political crisis of education. Dutta Roy's paintings are dark and gloomy; Moitra's paintings are allegorical, charming and analytical. They have created a modern painting language through watercolour. Datta Roy depicts the traumas of his childhood, while Maitra turns the memory of the industrial area and the city into an analysis of history. Shyamal Dutta Roy has died but remains an inspiration, while the other carries on the tradition.

Conclusion

Both Shyamal Dutta Roy and Pradip Maitra have enriched the trend of modern and contemporary Indian painting with their own style and thought. Datta Roy has given a new status to watercolour - where emotion, abstraction and reality mix. His paintings are a clear reflection of the city, people and mental turmoil, which is also quite relevant in today's society. In his art, Pradip Maitra has shown us the signs of decay and social change through industrial cities, old buildings, ruined structures and souvenirs. The work of these two artists is relevant today, because they did not just paint - they created a language of society, history and feelings. Their artistic language will provide an important direction for future artists. They turned modern Indian watercolour painting into a serious and profound art form that still carries contemporary ideas. Their work is a silent language that tells the story of our time and identity through colour, line, and thought.

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Study of Couture Origami techniques on pattern Bodice with TR Cutting Method

Srividya P | Dr. Vibha Kalaiya

PhD. Design

Abstract

Fashion design is based on constant change with innovative ideas and a significant demand for new concepts. Significant ancient clothing like chiton and togas had the formative method of folding, bending, and angles of fabric to achieve the desired three-dimensional design aesthetics that were taught in fashion history. Origami folding with heat press methods allows the fabric to fade away with multiple wears and wash especially in the case of fabrics that are composed of natural fibers. Origami being original for paper art as a traditional form has been extensively used in the fashion industry for many years. The concept of origami-based designs is always defined by the laws that govern their geometrical properties of any scale. This research explores the innovative integration of couture origami techniques into bodice pattern design employing the TR (Transformational Reconstruction) cutting method. Origami-inspired fashion design emphasizes creative folding, creasing, and structural manipulation to produce unique, sculptural garments. The research investigates how these techniques can enhance aesthetic appeal, structural integrity, and craftsmanship in couture fashion, specifically focusing on the bodice, a central element of garment design.

The methodology involves a comprehensive analysis of origami principles and their application to fabric manipulation, combined with the systematic approach of the TR cutting method, which emphasizes precision and sustainable fabric utilization. Conceptual prototypes are developed to evaluate different origami folds and their integration into pattern making. The process includes mapping origami folds onto standard bodice blocks, exploring variations in folds, and assessing the impact on fit, comfort, and visual appeal. The results demonstrate that couture origami techniques when combined with the TR cutting method, facilitate the creation of innovative, three-dimensional bodice designs with minimal fabric wastage. These techniques allow designers to craft sculptural forms that emphasize texture and volume, offering new possibilities for haute couture and ready-to-wear collections. The study concludes that origami-inspired pattern development, supported by precise cutting methods, can significantly expand the creative vocabulary of fashion designers while promoting sustainable

practices. This research contributes to the evolving field of fashion design by providing new insights into fabric manipulation, pattern technology, and sustainable couture practices.

Keywords: *Couture, Fashion, Origami, Pattern Manipulation, TR Cutting.*

Introduction

Fashion and design are often used interchangeably, though they can be approached in various contexts. Designers are continuously pressured to generate innovative ideas that meet the evolving needs of consumers. An exploration of fashion, design, and style reveals numerous examples featuring folds, which appear across a wide range of fields—from clothing and architecture to lighting and jewelry. Most designers incorporate elements such as folds, creases, pleats, gathers, knots, drapes, twists, and facets into their creations, transforming flat, two-dimensional textiles into three-dimensional forms. While these may not always be traditional origami folds, they share similarities in folding techniques and creasing.

Origami, originating in Japan in the early 1600s, is a traditional art of paper folding that transforms a flat sheet into complex three-dimensional shapes. Over time, it has experienced periods of popularity across various cultures. When origami principles are applied to fashion design, they can produce pieces that are both functional and visually captivating (Choi, 2016). The aim of this research paper is to introduce novel pattern-making techniques that inspire innovative designs for fashion enthusiasts, students, and emerging designers. Fashion design is a constantly evolving field driven by fresh ideas and a persistent demand for new concepts.

Literature Review

The significant ancient clothing like chiton and togas had the formative method of folding, bending and angles of fabric to achieve the desired three-dimensional design aesthetics that were taught in fashion history. Origami fashion is one such approach to creative thinking that designers from Issey Miyake, Calvin Klein to Guess have all produced collection that incorporates origami looks. “The process of creating complex patterns and the rich variety that may be obtained from a sequence of very simple operations are close to the aesthetic molecular basis of life” says Peter, an American Origami artist and theorist, science writer, designer and architect.

Figure 1: Paper origami

Origami being original for paper art as a traditional form has been extensively used in the fashion industry for many years.

GAIA developed a highly distinctive accessory line named VEASYBLE. When you require seclusion and quiet, these corrugated constructions may be expanded and collapsed. The Bag separates the upper body, the Mask separates the face, the Ruff separates the ears, and the Visor separates the eyes. Paper glued to fabric and polyethylene comprised the assortment of privacy shells.

Origami-inspired design in Japanese avant-garde fashion deconstructs the convention and promotes a symbiosis of body and clothing instead. The shape of the body is completely estranged by three-dimensional sculptures, alluding to the paper folds of origami and the movement of the body that are transmitted to the clothing through fine folding that transform into an unexpected event.

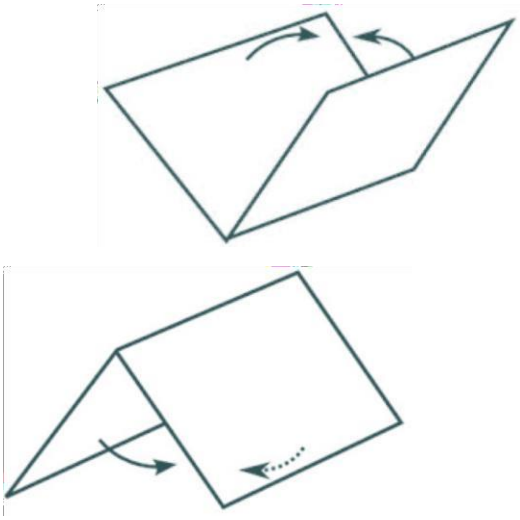


Figure 3: Inward fold

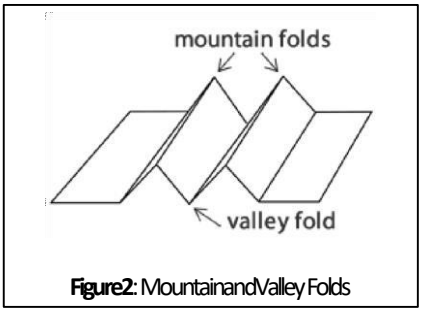


Figure2: MountainandValley Folds

Figure 4: Outward fold

Ancient garments such as the chiton and togas relied heavily on techniques like folding, bending, and fabric angles to create their distinctive three-dimensional aesthetic, as taught in fashion history. Origami-inspired fashion is one innovative approach to creative design, with designers like Issey Miyake, Calvin Klein, and Guess incorporating origami-inspired elements into their collections. Peter, an American origami artist, author, and architect, explains that "the process of crafting intricate patterns from simple moves reflects the aesthetic foundation of life itself." Although origami originated as a traditional paper art, it has been extensively adopted within the fashion industry over the years.

GAIA introduced a unique accessory line called VEASYBLE, featuring foldable and expandable designs for privacy and comfort. The collection includes pieces like a bag that separates the upper body, a mask for the face, a ruff for the ears, and a visor for the eyes. These

shells are made from paper adhered to fabric and polyethylene, creating flexible, portable privacy structures.

In Japanese avant-garde fashion, origami-inspired designs challenge conventional forms while fostering a harmony between the body and clothing. These works often transform the body into sculptural, three-dimensional shapes reminiscent of paper folds, capturing the fluidity of origami and the body's movement. Such designs use precise folding techniques to produce unexpected visual effects.

Origami-based design principles are rooted in specific geometric laws, primarily involving mountain and valley folds, which can be combined in various ways to shape the final form. Similarly, pattern making in fashion involves transforming two-dimensional fabric into three-dimensional garments that contour the body through darts, style lines, and sewing techniques. Today, pattern development is increasingly valued by emerging designers, emphasizing the importance of pattern creation as a fundamental aspect of fashion design rather than just the final aesthetic.

Objective of the research is:

1: To experiment with the TR method of origami in order to create designs such as spiral, vortex, bamboo, and petals and document the steps involved in developing the design.

2: To hold a workshop with experts and novices in fashion design in order to examine the modification process and assess its flexibility and problem-solving skills.

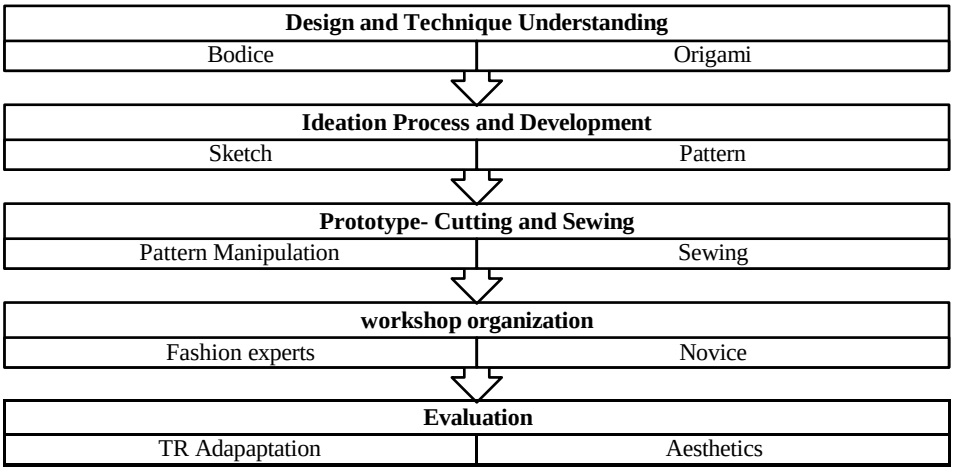
Methodology

Using a TR Cutting approach, a laboratory-experimental research methodology is performed to prepare for confounding variables that include fit and shape. A supervised group of fashion design interns at TR Cutting School India experimented with this method, following methodical directions to master the TR origami skills of Basic Bodice.

Data was collected by giving questionnaire to the participants during the end of workshop, and was then evaluated based of ease of technique adaptation, problem solving, material knowledge, cutting sewing complexity, and execution. TR cutting method is an architectural approach for pattern development with geometrical application and keeping the ideology of pattern fit and form ineffective and remain same compared to that of fabric manipulated origami fabric. Using TR method of pattern development, origami folds which is sustainable for wash and wear compared to that of the fabric folding with heat press methods, as they fade

away with multiple wears and wash especially in the case of fabrics that are composed of natural fibers. To apply origami as a freehand design applied on the garment patterns with TR Cutting method more versatile to apply and use than understanding the complications of pre folded origami fabric where there is a possibility of compromising on design limitation.

TR cutting allows endless possibilities, one also needs to consider that there is a need in fashion industry to improve fashion surplus management and also supply and satisfy many consumers globally who are conscious of the environmental aspects and wish to have designs that are unique to wear while being eco-friendly, hence these experimental prototypes are made using repurposed cotton fabric sourced from industrial waste/overstocks as a sustainable approach.



Results and Discussion

This was studied by methodically adding origami to the base Front Bodice pattern (1:2 Scale) design of Bamboo, Petal, Spiral and Vortex concepts are adapted using transformational reconstruction technique (TR Cutting)

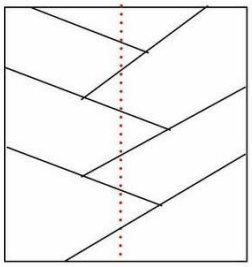
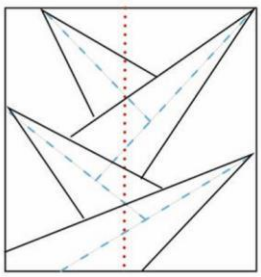
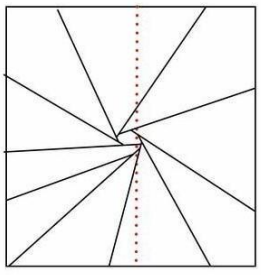
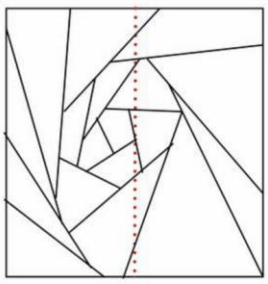
1: Bamboo Technique	2: Petal Technique	3: Spiral Technique	4: Vortex Technique
			

Table1: Origami Pattern Draft

In order to achieve the objective one, the ideas and brainstorming process has been executed in the resource center of Vidya Fashion Academy, Bengaluru which represents TR Cutting School India in association with Shingo Sato CEO of TR cutting School, inventor of the

technique, with his guidance and support for the possibility, exploration and experimentation with the process of using various pattern making and sewing tools.

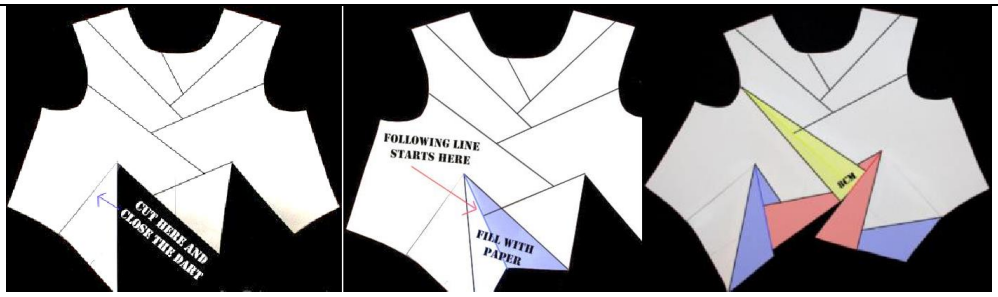
The primary core tools needed are listed in the table below;

A: Pattern making tools: Dress Form, cutting board/ table, Muslin Fabric, Colored papers, Pattern Paper, Grid ruler, French curve, Multi colour pens, Silk pins and pincushion, Fabric cutting shears, Paper cutting scissors, Paper cutting knife/blade, and Repurposed Cotton fabric stack.

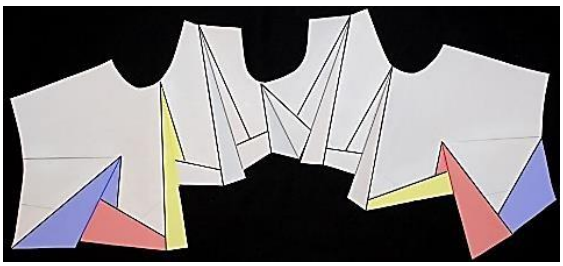
B: Sewing and pressing supplies: Basic sewing machine setup, Thread clipper, Awl, Steam press setup, Tailors ham, Wooden clapper, threads and notions.

Basics are basics; unchallenged foundation upon which creative works can be built. Similarities to that of grammar in English language to the Formulas in Mathematics. Fashion making is no different, which has 5 foundation components such as Bodice Front, Bodice Back, Front Skirt/Trousers, Back Skirt/Trousers and Sleeves. With these tools, a systematic stepwise methodology is adapted as stated below.

Step1: Foundation block was traced on to a paper, seam allowances were added and a pattern was cut.
Step 2: The Style lines were drawn as per the design experimented. Ref Table1: Origami Pattern Draft
Step 3: style lines were drawn from the outermost edges of the pattern similar to iris folds design line forming Bamboo pattern, Petal Pattern, spiral Pattern and vortex designs with reference to the sketch on the block. (It was more convenient to use different colour marking lines to have the clear understanding of the layers.) The pattern style lines had no limitation as they are to the individual need. Style line doesn't go beyond the dart head point and was kept in same shape to maintain the contour control of the pattern.
Step 4: By Trueing, the style lines were numbered and the direction of the pattern with the arrow mark.
Step 5: Inserting of a coloured paper; cut in the shape of triangle width of minimum 8cms at the pattern end and a minimum of 5cms longer to overcome the angle of folds.
Step 6: The triangles were kept as a valley fold and the garment Pattern edge as a mountain fold, the excess paper transcending the main pattern block was trimmed.



Step 7: The same method of inserting triangles was continued until the end of each style line for all designs



Step 8: Darts were kept unchanged and the space was filled with a colour paper that will function as the origami fold.

Step 9: Using silk pins/ steel headlines, the pattern was secured on the fabric and cut along while no seams were added for this design.

Step 10: Steam pressing the cut fabric along with the paper pattern supported the crease lines of the design.

Step 11: Stitching was done from the innermost style line, securing all raw edges with a seam while folding on; then continued to sew the style lines. Bamboo Bodice Petal are similar sewing steps.

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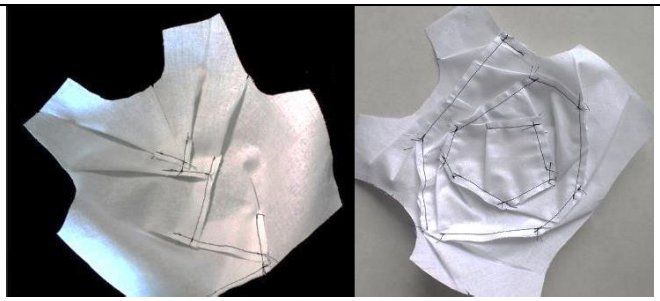


Step 12: Darts were stitched as darts, to provide the required fullness to the contour of the body.

Step 13: Pressed along the origami pattern before finishing the garment. Ref Table4

Note: This project was implemented with the repurposed Cotton fabric, it was washed and pressed as a preparatory process.

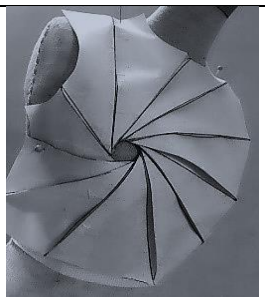
Patten Manipulation			
1: Bamboo Technique	2: Petal Technique	3: Spiral Technique	4: Vortex Technique
			

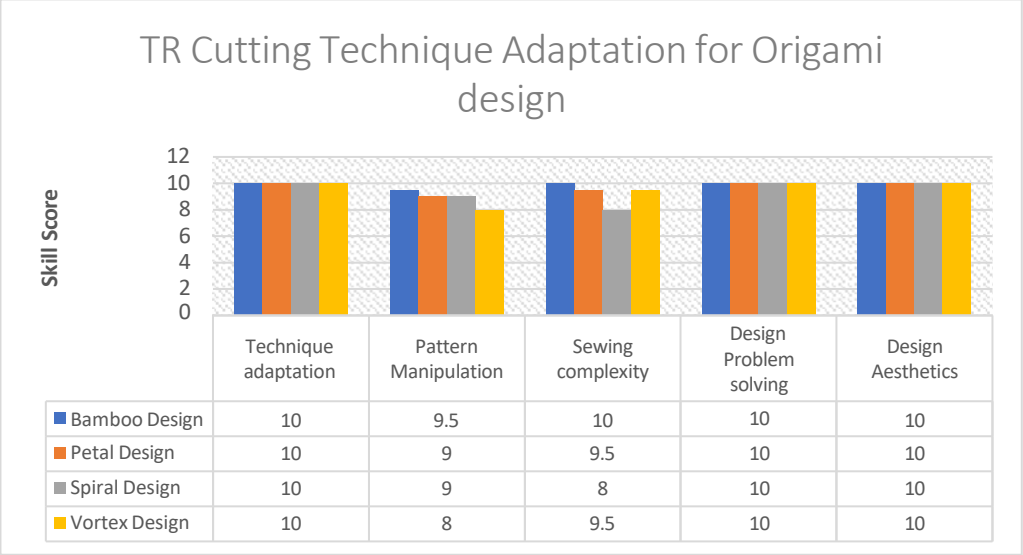
Table3: Origami Pattern manipulation on basic Bodice

Final Bodice with Origami			
1: Bamboo Technique	2: Petal Technique	3: Spiral Technique	4: Vortex Technique

Table4: Final Pattern with actual fabric

In the process of creating and trials it was observed that after sewing the outermost style line of the origami design stretches and falls apart on the three-dimensional body, so it was advised to keep 0.75cm to 1cm depth of fold for origami and sewn to the remaining fullness. The

workshop attendees demonstrated with clarity that the process was uncomplicated to alter and that they felt astonished by the outcome of their work. Despite the design's seeming intricacy, pattern manipulation is made simpler by applying transformation reconstruction techniques.



	Technique adaptation	Pattern Manipulation	Sewing complexity	Design Problem solving	Design Aesthetics
Bamboo Design	10	9.5	10	10	10
Petal Design	10	9	9.5	10	10
Spiral Design	10	9	8	10	10
Vortex Design	10	8	9.5	10	10

Table5: Results of TR Cutting Adaptation for Origami design

There were ten participants out of which four were professional designers with their own labels, three were fashion internees at fashion houses and two were third-year students pursuing a degree in fashion design and one was a fashion educator. All participants, regardless of ability level, were able to adapt the TR Cutting procedures to pattern manipulate and replicate the Bamboo, Petal, Spiral, and Vortex designs in just two days with fourteen hours of instruction. The outcomes unequivocally show that, when using the given guidelines, all four designs were 100% simple to modify. The pattern manipulation was a little challenging at first, but the finished Bamboo bodice had a 95% completion rate, the Petal design had a 90% completion rate, the Spiral pattern had a 90% completion rate, and the Vortex design, at 80%, required some tactile assistance. All in all, the technique demonstrated was beginner-friendly and easy to modify and incorporate into the bodice result.

The sewing specifications were as straightforward as just stitching a straight line; According to the study's findings, the Bamboo bodice was 100% simpler to make than the Vortex and Petal designs, which required 5% more effort, and the Spiral pattern, which required 20% more focus to regulate the folds and dimensions.

By adapting the TR origami technique, each participant was capable of to reach 100% for both the design problem solving and the aesthetics for all four designs.

It is evident that using the TR cutting approach improves one's capacity for original thought and origami design creation. In a conversation with San Shingo Sato that happened in one of the 100 workshops that the conducts in a year. He reveals that “though these techniques of origami have been known to many TR masters, they are only demonstrated through live sessions or with pre-recorded videos around the world”.

Conclusion

Fashion designing is continuous innovation and designers require to scrutinize and attempt new techniques and technologies. Origami has been a popular design element for many designers through the decades. Unlike paper fold, fabric has poor memory to hold the crease and can be easily undone, reinforcing a seam to hold the shape will give better control over the design. Therefore, The TR method is an architectural technique that facilitates the adaptation of origami patterns, particularly for cotton fabric. This allows the designer greater freedom to arrange the folds according to their creative vision. It was difficult to realize the origami principles for clothes like corsets and jackets that are shaped from zero-degree and fourth-degree garments. The TR cutting approach is sew-friendly and can be adapted by both beginners and experts for their design research. Entertaining garment details with a controlled pattern allow for the investigation of this TR origami technique. The approach of using sustainability in this investigation is an additional resolution towards the environmental aspects.

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Restoring Sanskrit and Indian Folklore using 2D Animation for Children

Dr. Vidhi Khandelwal, Associate Professor & Head,
Department of Animation, Faculty of Fine Arts
Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.

Abstract

India has a long history of telling stories that comes from old Sanskrit literature and many other folk traditions. This legacy is very important for culture and learning. But as the media throughout the world gets stronger, these ancient legends are slowly leaving the lives of Indian children. This research investigates the capacity of 2D animation to improve the understanding, engagement, and significance of Sanskrit and Indian folk storytelling for younger demographics.

After a traditional story, like one from the Panchatantra, has been made into a short 2D animated movie, 50 children between the ages of 7 and 13 will give input in a systematic way. The feedback asks how well the art shows moral values, how well it fits with the culture, how well people understand it, and how well it appears. When classic stories are recreated with bright animation, well-known characters, and easy language, people really get into them. They also understand what they are seeing. People pay a lot more attention when they hear or see parts of Sanskrit with subtitles.

This Research paper talks about how digital storytelling may be used to protect and promote India's intangible cultural heritage, as well as how it can be used as a teaching tool. The study ends with suggestions for making and telling tales in children's animation that is easy to understand in terms of language and culture.

Keywords: *2D animation, Sanskrit stories, Indian folk tales, children's media, digital storytelling, cultural preservation, Panchatantra, animation for education, indigenous narratives, and visual pedagogy.*

1. Introduction

India's cultural identity is firmly rooted in its traditional storytelling and literary practices. The stories in Sanskrit scriptures and regional folktales are very important, especially. People have been telling these stories out loud for a long time, from the old Panchatantra to Hitopadesha and other folktales from all over the world. The goal of these stories has always been to make people laugh and teach them something. Their main goal was to educate

youngster's right from wrong, and they usually did this by telling fables, employing animals that acted like people, and making up funny situations that children could understand. People have been reading youngsters stories from old books to teach them how to live and what is good and bad for a long time. The Panchatantra is one of these texts. About 200 BCE, the famous Sanskrit scholar Vishnu Sharma wrote it. These legends are full with moral teachings and cultural information, and many generations have learned the basics from them. Because of globalization and the digital revolution, children don't hear as many native stories as they used to. Children in India like anime, Disney, and Marvel. This means that books and other materials for children don't do a good job of showing or explaining Indian history. This cultural difference has an effect on identity, keeping language alive, and learning that is based on values.

Sanskrit used to be the main language for talking about ideas and telling stories, but the people of today find it hard to understand or speak it. People used to share traditional stories in groups, like at family gatherings, festivals, and village meetings. Now, though, they are either neglected or forgotten. A generation that hasn't had much exposure to this sort of information is especially at danger from the damage that this loss of traditional knowledge presents to India's intangible cultural heritage. But the same digital tools that have made young people less interested in tradition may also be used to bring them back.Animation, especially 2D animation, is a terrific way to connect the past and the present. The music and pictures grab youngsters' attention, and it also helps them make up stories that are either moral or legendary. 2D animation may also be culturally sensitive since it can be changed to fit different languages, cultures, and age groups.

The goal of this project is to promote the use of two-dimensional animated storytelling as a way to teach children about Indian culture and Sanskrit in a fun and educational way. We utilized the animated Panchatantra tale "The Lion and the Clever Rabbit" as a case study to examine the responses of young viewers to such content.

1.1 Background of the Study

The huge library of ancient writings, oral histories, and traditional practices that India has is inextricably linked to the country's cultural identity. Sanskrit, which is one of the oldest languages in the world, was used to write some of the most significant stories in Indian history. These include the Panchatantra, the Hitopadesha, and the Jataka Tales. These stories were a big part of early childhood instruction. People of a more senior age would either recite them aloud or play them out in their houses, temples, or village assemblies during this time period. As well

as imparting valuable advice, they were expected to impart moral precepts. However, throughout the course of the last few decades, parents have not been as likely to share these tales with their children. Nowadays, children have a preference for Western characters, fast-paced action, and visually dramatic forms. This is mostly due to the widespread use of English and globalised media. As a result of this, a lot of people have the misconception that traditional Indian stories, particularly those written in Sanskrit, are difficult to understand or are not as engaging as other stories.

In addition, animation is an excellent method for instructing children while simultaneously maintaining their interest in the material. It tells stories via the use of visuals, which makes it an excellent medium for people of all ages since it simplifies complex concepts, gives people the opportunity to experience things, and maintains their attention. An excellent method for teaching children of today about Sanskrit and old myths is through the use of two-dimensional animation. This is due to the fact that 2D animation may be altered to accommodate a wide variety of cultures.

It is vital that this study be conducted in order to solve the widening cultural and linguistic gap that exists between contemporary Indian youth and the historical setting in which they were raised. Using 2D animation, the goal is to determine whether or not it is possible to rekindle the interest of school-aged children in Sanskrit literature and Indian folklore. We chose the Panchatantra tale "The Lion and the Clever Rabbit" not just because it is well-known in many cultures, but also because it delivers a compelling moral lesson that corresponds with ideals of intellect, strategy, and fairness that are common to many civilisations. This is why we chose this story.

The purpose of this research is to contribute to the ongoing conversation about the preservation of digital heritage, early education practices, and the imaginative rebirth of Indian classical languages. This will be accomplished by studying the responses of children to this animated portrayal. For the purpose of educating culture in a manner that is forward-looking, it makes use of both ancient and contemporary concepts.

1.2 Statement of the Problem

Sanskrit literature and folklore are plentiful in India; nevertheless, the youth seem to exhibit diminished interest in them. There are several reasons why traditional storytelling is becoming less popular. Fewer people are saying them in person, fewer people are hearing them in more than one language, and information is now available online all around the world. Younger people believe that Sanskrit is too hard to learn or not useful for school.

Children like 2D animation, but they don't utilise it to teach indigenous children about their culture and values. A lot of educational programs don't have materials that are appropriate for all ages, culturally diverse, visually appealing, and combine traditional knowledge with current teaching methods.

This project looks at ways to use 2D animation to make traditional Indian stories come to life for children in a fun and educational way. This study investigates the capacity of animated storytelling to preserve culture, impart moral lessons, and facilitate language acquisition within the realm of digital technology.

1.3 The Significance of the Research

This study is significant as it examines the interplay between education, cultural heritage preservation, and the advancement of digital technology. In an era characterized by global consumerism and swiftly evolving media consumption patterns, the voices of old Indian narratives, particularly those composed in Sanskrit and regional folklore, are in risk of being obscured. This study provides a substantial and relevant perspective on the cultural potential of 2D animation, rendering these historical themes accessible and engaging for contemporary youth.

2. Review of Literature

Lal, Pooja & Sinha, Ramesh (2025) emphasize the emergence of animation labs in Indian schools, offering real-time feedback to digital content based on indigenous texts.

Ravi, Manish (2022) in *"Edutainment in India: Digital Tools for Cultural Learning"* (*South Asian Journal of Educational Technology*, Vol. 6, No. 2) outlines how entertainment-based education tools apps, short films, and games—are instrumental in reviving interest in Indian heritage among Gen-Z audiences.

Raj, Neha & Jha, Kunal (2022) in *"Teaching Sanskrit to Young Learners Using Digital Tools"* (*Language Today*, Vol. 5, No. 3) demonstrate that modern media especially animation and mobile applications enhances Sanskrit comprehension and learner motivation, overcoming perceived linguistic barriers.

Kumar, Ashok (2021) in *"The Use of Animation in Enhancing Moral Development in Children"* (*Journal of Indian Educational Psychology*, Vol. 10, No. 2) presents evidence that animation helps inculcate values like empathy, honesty, and courage by visualizing moral dilemmas in engaging formats.

Rao, Sneha et al. (2021) in *"Folk Art in Animated Storytelling: Madhubani and Beyond"* (*Media and Society Review*, Vol. 13, No. 1) reveal how regional art styles like Madhubani can be visually encoded in animation to heighten cultural authenticity and child engagement.

Sharma, Ritu (2021) in *"Animation as a Tool for Early Education"* (*Indian Journal of Media and Culture*, Vol. 8, No. 1) validates that animated content enhances memory retention, particularly when it employs relatable characters and culturally embedded stories.

Nair, Sunita et al. (2020) in *"Animating Traditions: Cultural Preservation through Children's Media"* (*Indian Journal of Arts and Culture*, Vol. 7, No. 1) argue for using animation to retain India's intangible heritage, providing case studies where folklore was successfully reinterpreted for digital platforms.

Mukherjee, Arindam (2019) in *"Visual Learning and Early Childhood"* (*Journal of Educational Media Studies*, Vol. 12, No. 2) examines how animated content boosts learning in early childhood by simplifying complex ideas and sustaining attention through visual narrative.

Shastri, Vimal (2018) in *The Panchatantra: A Retelling in English* (Scholarly Books India) offers an accessible version of the classic Sanskrit tales, showcasing how stories like "The Lion and the Clever Rabbit" retain relevance for values-based education.

3. Research Gaps

Despite growing interest in educational animation, there is limited content that promotes Sanskrit and Indian folklore in a child-friendly format. Most animations focus on English or Hindi, neglecting classical languages. Few studies collect direct feedback from children to assess engagement and learning outcomes. Additionally, Indian visual styles are rarely used, with most animations imitating Western designs. Rural and multilingual audiences are often overlooked, and the creative guidelines of NEP 2020 are yet to be fully applied in media targeting young learners.

4. Objectives

1. To evaluate the effectiveness of 2D Animation in enhancing comprehension, engagement, and moral retention among youth exposed to Sanskrit and folk narratives.
2. To find out how children from different cultures and languages react to animated movies that have Sanskrit, regional themes, and portions of stories they already know.
3. To provide creative and instructional advice on how to make animated teaching resources that keep India's traditional ways of telling stories alive.

4.1 Research Questions

- How do children respond to animated stories that are two-dimensional and based on old Sanskrit and Indian legends?
- How well do youngsters remember the moral messages from the animated story?
- Does using Sanskrit change how children understand and are interested in things?
- How well can two-dimensional animation teach people about and safeguard India's intangible cultural heritage?
- How can we make sure that students from different linguistic and cultural backgrounds may easily access instructional animation content?

5. Methodology

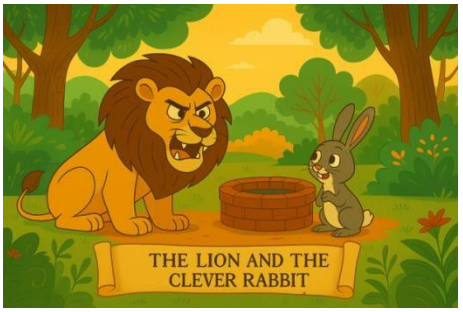
The Panchatantra story "The Lion and the Clever Rabbit" inspired a short two-dimensional animation with Hindi narration, simplified speech, and Sanskrit subtitles. Two schools in the Uttar Pradesh metropolitan region screened 50 children between the ages of 7 and 13 for it. Each student filled out a feedback form that asked them how well they understood the material, how interesting they found tales that were similar to their own, and how clear the moral was.

6. Results and Findings

50 children between the ages of 7 and 13 in two schools in Uttar Pradesh watched the two-dimensional animated short film "The Lion and the Clever Rabbit." Fig 1, It was based on a story from the Panchatantra. With the use of a structured feedback form, we were able to find out a lot of things, such as how interesting the visuals were, how culturally acceptable they were, how well they understood the language, and how well they understood the ethics. The results of this interaction revealed significant patterns regarding children's engagement and academic performance. In the next few paragraphs, we'll talk about these concepts.

- Children felt more linked to characters that were located in India and had Indian morals and aesthetics.
- Visual storytelling made hard ideas (like moral issues) easier to understand.
- When utilized wisely with Hindi translations, Sanskrit was not a barrier but an enriching complement.

Fig 1: The Panchatantra story "The Lion and the Clever Rabbit



S.No.	Evaluation Criteria	Positive Response (%)	Observations
1.	Overall Enjoyment of Animation	90%	Children enjoyed the story and visuals; maintained attention throughout.
2.	Moral Comprehension	84%	Clearly identified message: "Cleverness wins over strength."
3.	Visual Appeal (Colors & Characters)	78%	Children described characters as "cute," "funny," and "colorful."
4.	Sanskrit Language Reception	62%	Positive attitude; needed support via subtitles and translation.
5.	Willingness to Watch More Similar Content	88%	Strong interest in more Indian folk stories in animated format.
6.	Teacher-observed focus	Qualitative	Stronger attention span than traditional reading

6.1 Enjoyment and Engagement 90%

Significant percentage of children (90%) said they liked the cartoon better. Many important visual and narrative elements were responsible for this level of happiness:

- Using bright colors and lively movements.
- Characters those are interesting and culturally relevant.
- A story based on common sense that is told in an interesting way

Fig 2: Student engagement

This strong reaction indicates that the animation can capture the attention of young viewers, which is crucial for educational materials designed for children.

6.2 Comprehension and Moral Recall 84%

After viewing, 84% of the participants could clearly articulate the moral of the story: “Intelligence and patience can overcome brute strength.”

- This indicates effective narrative delivery and memory retention.
- Children who could retell the story were more likely to recall the moral, showing a strong correlation between storyline understanding and value absorption. Following the rules of visual pedagogy, the storytelling method, which included short conversations, repeated

narration, and moral reinforcement, was demonstrated to be an important part of helping children understands messages about ethics. Fig 2

6.3 Visual Design and Aesthetic Appeal 78%

Seventy-eight percent of the students said they liked the colors and characters in the animation. The designs were stylized but yet had cultural roots, which helped the children connect with the characters and the setting.

- Anthropomorphic animal figures were very popular, which is a storytelling style that comes from Indian folk stories.
- The backgrounds were based on Indian rural and woodland settings, which made the story, feel more real.

The results of the animation education research suggest that children's visual engagement is maximized when the content is visually abundant yet not excessively exciting. The study findings support this.

6.4 The integration of Sanskrit and exposure to the language is 62%

It is important to note that 62% of students said they liked hearing Sanskrit in the animation, even though they needed help understanding it. In their responses, they showed:

- A desire to learn more about the ancient language and a connection to their own culture.
- A better retention of Sanskrit words when they were used with Hindi explanations or subtitles.

6.5 Getting people interested in stories that are similar 88%

Eighty-eight percent of the children said they would want to see more stories like this in the future. This answer makes the following points clear:

- The unfulfilled need for culturally relevant instructional narratives.
- The capacity of animation to function as a medium for both entertainment and the impartation of values and cultural heritage.

The results of this study suggest that early exposure to Sanskrit in an enjoyable setting may enhance linguistic tolerance and stimulate interest in India's classical heritage.

6.6 Focus and Attention Span Observations

Teachers who were in charge of the session saw that the children stayed engaged during the 4-minute animated movie. This was a big improvement over the usual story-reading exercises. Even children watching were able to stay focused because of the mix of movement, speech, and pictures.

7. Conclusion

This is especially important because people are using less traditional ways to tell stories as they watch more westernized and globalized media.

The objective of this study was to examine children's engagement, comprehension, and emotional responses to classic narratives presented in a contemporary and visually appealing format. To do this, a two-dimensional animated version of the Panchatantra story "The Lion and the Clever Rabbit" was made and shown. People may learn more, become more moral, and become more interested in other cultures if they watch well-made visual media. The many positive comments from the children who took part in the research show this.

One of the most important things we can learn from this study is that language isn't a problem when it is used with pictures. Younger people really liked that Sanskrit was used in animated content, even though Hindi narration and subtitles were helpful. This is because Sanskrit is not used much in homes and schools these days. They weren't bothered by the Sanskrit words; in fact, they were interested and learnt to value the language's history. This conclusion is in line with the National Education Policy (NEP 2020), which has broader educational goals. For instance, it says that classical languages should be taught in a way that is both fun and useful to the students in early school.

The study also shows how being familiar with a culture can change how animation stories make people feel. The children felt a strong connection to the characters, settings, and moral lessons when they were similar to their own social and cultural backgrounds. The animation made for this study used Indian art styles, moral questions, and story structures to help children learn more about the material. This is not the same as cartoons that are too broad or too westernized. This not only makes people more interested, but it also helps them develop a strong sense of cultural identity from a young age, which is important in today's world of simplified media.

The children were able to learn and remember the moral lesson, and they also wanted to see more of this kind of thing. This means that 2D animation could be a good way to teach in schools and other places where people learn informally. Teachers and content creators can use this medium to make difficult ideas easier to understand, add variety to language, and promote moral reasoning in a way that is both fun and educational.

Also, the research gives useful information to those who work in animation, teachers, and policymakers. The following suggestions should be taken into account when making plans for future content:

• Using simple words, pictures, and well-known stories to help people understand the story.
• Getting the right amount of education and time off.
• Using music and pictures from a culture that people know to make them feel things.

To make it easier to read and comprehend how to teach old languages like Sanskrit.

In summary, teaching pupils about old Indian wisdom using 2D animation is a great method to accomplish it. It helps in telling stories and keeping cultural traditions alive. People also learn about language and values when they are forced to learn on their own. If designers employ fun tales and imaginative pictures, they could be able to produce a new type of children's media that youngsters all across the world would like, not only in India.

The study's findings indicate that devising novel perspectives on current content not only preserves its use but also enhances its value. The purpose of this program is to illustrate how education, tradition, and technology can all work together to improve things.This endeavour is happening at a time when India is heading towards a future that is both digital and cultural.

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Enhancing Creative Cognition and Artistic Expression in Animation Education through Advanced AI Tools

Deepak Giri, Research Scholar | Dr. Jitendra Sharma, Professor,

FDA, Poornima University, Jaipur

Abstract

Animation production has undergone significant changes in recent years, particularly with the incorporation of AI technology, including generative models. This allows for more unique, expressive, artistic practices. In this paper, the potential of AI-operated tools is studied on how they enhance cognitive creativity and unique creative expression further within animation education. This paper, by checking practical case studies and student works, shows how generative AI models like GANs, diffusion models, and VAEs enable unique imaginative thinking, rapid prototyping, and artistic experimentation. The results of our findings indicate that tools like these not only promote a deeper cognitive, creative problem-solving but also solve technical challenges within traditional animation pipelines. Students who are utilizing AI-assisted workflows were able to develop excellent, structured visual aesthetics, explore various character designs that were Atypical, and refine ideas quickly and efficiently, which resulted in enhanced, artistic, and unique expressions, narrative skills, and spatial reasoning. What's impressive is that personalised learning was supported, and at the same time, it also fostered a sense of creative ownership and confidence among students.

Regardless, the limitations include the high learning curve which is associated with AI tools, and the sample size that we have (N=30) is acknowledged in this study. This restricts applicability. Despite encountering these setbacks, the cumulative effect on student cognitive progress and imagination was favorable. The latter offers hints that Gen AI has immense promise in revamping animation instruction and practice.

Keywords: *Animation, Generative AI, Cognitive Creativity, Artistic Expression, Education, GANs, VAEs, Diffusion Models, Creative Cognition, AI Tools in Animation.*

Introduction

The animation industry has undergone a significant change with the emergence of generative AI tech, including GAN's, VAE's, and diffusion models. These tools haven't only shaped

technical workflows when it comes to animation production but have also influenced educational practices in the field. By automating time-intensive processes, such as in-betweening and rendering, generative AI enables animators to devote more attention to storytelling, artistic expression, and the development of cognitive creativity—the capacity to generate novel and valuable ideas.

Creativity has continued to be central to animation, as artists constantly explore character animation techniques and visual vocabularies. In artistic disciplines, educational environments are increasingly incorporating GEN AI tools. According to the National Art Education Association, this kind of tech can help encourage innovative and critical thinking by providing experiments with complex visual styles and rapid prototyping.

However, there are certain challenges that remain, such as there is risk that AI might replace rather than complement traditional art skills, and mastering these types of tools requires a huge learning curve. There have been Ethical concerns that have arisen, which include relying too much on AI, bias in gen content, and questions of authorship and ownership. Despite these cons, the pros are significant. Such as the fact that students can focus on high-order cognitive processes, such as concept development and narrative structuring, since AI can reduce the technical barriers that we have at the moment.

Digital fluency, critical thinking, and creativity are expressed as there is an incorporation and addition of AI in animation education, aligning with its current trends. Case studies of Creedly and Blannin 2025 Kickighter et al. 2024 suggest that students who use AI-assisted workflows tend to produce more creative, ambitious, unique, and refined works. Thoughtful guidance and monitoring from educators are needed for effective integration to make sure that students develop not only technical proficiency but also the ability to develop artistic capability. This study is grounded in Amabile's Componential theory of creativity, which highlights intrinsic motivation, cognitive load theory, interplay of relevant domain skills, and creativity-relevant process, which informs explained guided design to optimize learning efficiency in complex tasks.

Literature Review

In the context of education, creativity is often conceptualized in terms of divergent thinking, which also includes fluency, flexibility, detailed explanation, and originality (Runco & Acar,

2012). Research indicates that AI tools, such as Gemini and ChatGPT, can enhance fluency and flexibility during idea generation, though they may occasionally hinder intrinsic motivation or self-confidence (Habib et al., 2024). For instance, students using AI-generated suggestions often produce more ideas but may become overly reliant on the tool, potentially limiting independent creative exploration. The National Art Education Association (2024) recommends leveraging AI for concept generation and experimentation while maintaining traditional artistic craftsmanship.

In animation, **generative models** serve distinct roles. GANs are particularly effective for high-resolution image generation and style transfer, VAEs support interpolation between styles and poses, and diffusion models provide frame-to-frame continuity suited for animation sequences. Creely and Blannin (2025) illustrate how each model contributes to visual storytelling in different ways. In art education, tools such as MidJourney and D-ID are employed to animate still images or generate character references. Educators (Hutson & Cotroneo, 2023; Kicklighter et al., 2024) report that AI-assisted workflows, when guided appropriately, foster deeper engagement with visual exploration and conceptual thinking.

AI and Creativity Theories

Generative AI tools in education can be understood through **Amabile's Componential Theory of Creativity** (Amabile, 1996), which emphasizes the interaction of domain-relevant skills, creativity-relevant processes, and intrinsic motivation. AI can augment domain-relevant skills by providing rapid prototyping and visualization capabilities, while also influencing creativity-relevant processes such as idea generation. Additionally, **Cognitive Load Theory** (Sweller, 1988) informs instructional design for AI integration, suggesting that automating repetitive technical tasks can reduce extraneous cognitive load, allowing learners to focus on higher-order creative and conceptual thinking.

Methodology

The study we conducted employed a mixed-methods research design to further investigate the major impact of AI-assisted tools on creative development in animation education. The research was conducted across two upper-level undergraduate animation courses, with a total number of 30 senior students participating. While the sample size is small and constraints generalizability, the various methods to approach allow for in-depth exploration of students'

creative outcomes. Future research could very well expand to multi-institutional cohorts to improve and enhance the statistical robustness and external validity of findings.

Participants completed AI-assisted assignments using tools such as **Mid Journey**, **Stable Diffusion**, and open-source **Generative Adversarial Network (GAN)** frameworks. To facilitate effective engagement with these technologies, **instructional workshops** were provided, emphasizing prompt engineering, iterative workflows, and strategies for integrating generative AI into the creative process.

Student outputs were evaluated using **rubrics measuring originality, visual sophistication, and narrative coherence**. Although primarily descriptive, these evaluations were complemented with basic inferential statistics; for example, independent samples t-tests were employed to examine differences in creativity scores between AI-assisted and control assignments, providing preliminary statistical validation of observed trends.

Data-Collection

Multiple sources of data were collected to triangulate findings and ensure both breadth and depth of analysis. These included:

- **Pre- and post-intervention surveys**, capturing students' attitudes, perceived creativity, and confidence using AI tools.
- **Focus groups and semi-structured interviews** providing qualitative insights into students' experiences, reflections, and challenges.
- **Project analysis**, involving detailed reviews of the students' final outputs.
- **Creativity assessments**, using rubrics adapted from the Torrance Tests of Creative Thinking (TTCT), evaluating dimensions such as *fluency*, *originality*, and *elaboration*.

Data-Analysis

Quantitative data from creativity tests and rubric-based evaluations were compared between AI-assisted cohorts and traditional project cohorts (serving as a control group) to identify differences in creative performance. Qualitative data were analyzed using thematic coding methods, allowing for the identification of recurring themes related to the creative process, tool interaction, and pedagogical effectiveness

Results

- Students using AI produced more concept sketches and visual variants. Brainstorming became faster and more dynamic due to automated image generation. One student said, "I had more time to think of crazy ideas because I wasn't stuck drawing them by hand."
- Projects featured enhanced detail and emotion. For instance, a VR dental training animation used Midjourney to visualize elderly patient expressions like worry, confusion, and pain. These AI visuals formed the base for emotionally rich animations.
- Skill development improved as students learned prompt-writing and digital tool handling. Rubrics showed ~15% improvement in originality and visual detail. AI use also increased classroom engagement and confidence.
- However, challenges included steep learning curves, unpredictable AI behavior, and concerns over originality. With practice and guidance, most students overcame these hurdles.

Figure 1. Midjourney-generated expressions of a geriatric patient character (used in a student VR animation project). Students prompted the diffusion model to render the same figure with varied emotions (distressed, confused, worried, irritated). These AI-produced portraits served as the basis for animating a dental training scenario blog.nus.edu.sg. By generating multiple character variations instantly, the tool expanded students' creative options.

These qualitative observations were supported by project data. For instance, compared to previous offerings of the courses, the average score on "originality/ideation" in creative rubrics

improved by ~15%, while technical execution scores remained steady. Table 1 (below) summarizes how sample student projects utilized generative AI tools.

Project	AI Objectives	Tools Used
Elderly Patient VR Training	Generate diverse patient characters and facial animations	Midjourney (image), D-ID (video)
Healthcare Simulation (Patient Avatar)	Create interactive patient personas and scenarios	Inworld AI (conversational)
Language Learning Chatbot	Generate practice sentences and chatbot characters	ChatGPT (text), D-ID (avatar)

Table 1. Summary of student projects and generative AI usage (source: Lee & Khoo 2023 blog.nus.edu.sg).

These results suggest that generative AI tools can notably enhance student creativity and output quality in animation projects. Across assignments, we observed more ambitious storytelling and richer visual design in AI-assisted work than in traditional cohorts.

Discussion

The results affirm that generative AI can enhance creativity by freeing cognitive resources and providing fast prototyping options. This confirms theories of cognitive offloading and AI-human collaboration.

Students treated AI as a creative partner rather than a shortcut. Educators must, however, provide structure to avoid over-dependence. As the National Art Education Association emphasizes, AI should be used to support—not replace—artistic skills.

Barriers include access to tools, technical training, and ethical considerations. Institutions must redesign curricula to assess not only final products but also the creative processes behind AI use. Done right, AI becomes an enabler of risk-taking, originality, and confidence.

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Sustainable product design intervention: through Bamboo workshop in Pune

Mandar Naik | Deepak Giri

Faculty of Art & Design, Vishwakarma University, Maharashtra, Pune 411048, India.
Faculty of Art & Design, Vishwakarma University, Maharashtra, Pune 411048, India.

Abstract

Bamboo is one of the futuristic materials for the 21st century. India is the second richest country in bamboo production after China. Approximately 148 species of bamboo are available in India. Tribe and rural people from India were creating different products for day-to-day survival. Lightweight, flexible, durable, and high tensile strength are the mechanical properties of bamboo. Also, bamboo is a comparatively cheaper material. Because of these properties, Government and non-government organizations have started to ideate sustainable products by using bamboo. The market for these products is increasing day by day due to their importance and need. On that account, the Department of Product Design and Animation -at Vishwakarma University organized 1-week hands-on workshop with Bamboo tales and local crafts persons under the materials and processes course. During these workshops, future designers have explored various bamboo species with their properties and applications. As per the collaborative guidance provided by the Design faculty and local craftsman, Students have ideated product series with mock-ups and working prototypes. Students have taken inspiration from this workshop. More than 40 Products designed by students. Potential products launched in the market with the collaboration of bamboo tales. One start-up has originated from this workshop. Hence, more hands-on workshops under collaborative activities with crafts persons are needed to explore different materials with their material-handling processes. These types of workshops are helpful for outcome-based education (OBE).

Key Words- *Bamboo, Sustainable products, craftsperson, collaborative.*

Introduction

Bamboo, with More than 115 genera and 1400 species, belongs from the bambusoideae plant subfamily, which is the tall treelike evergreen grass family. Bamboos are a fast-growing perennial. Bamboo is commonly found in Africa, Southeast Asia, Central South America, some parts of Europe, and North America. India is rich in Bamboo resources with 13.96 million Hectares of Forest area. Bamboos have social, economic, and cultural significance in East Asia and Southeast Asia. Bamboos are used extensively for building materials, food sources, and as a highly versatile raw product. These applications are depending on the physical and environmental values of bamboo.

Bamboo uses can be divided into various areas, as shown in Fig1. The figure is trying to divide known applications of bamboo products as per their categories.

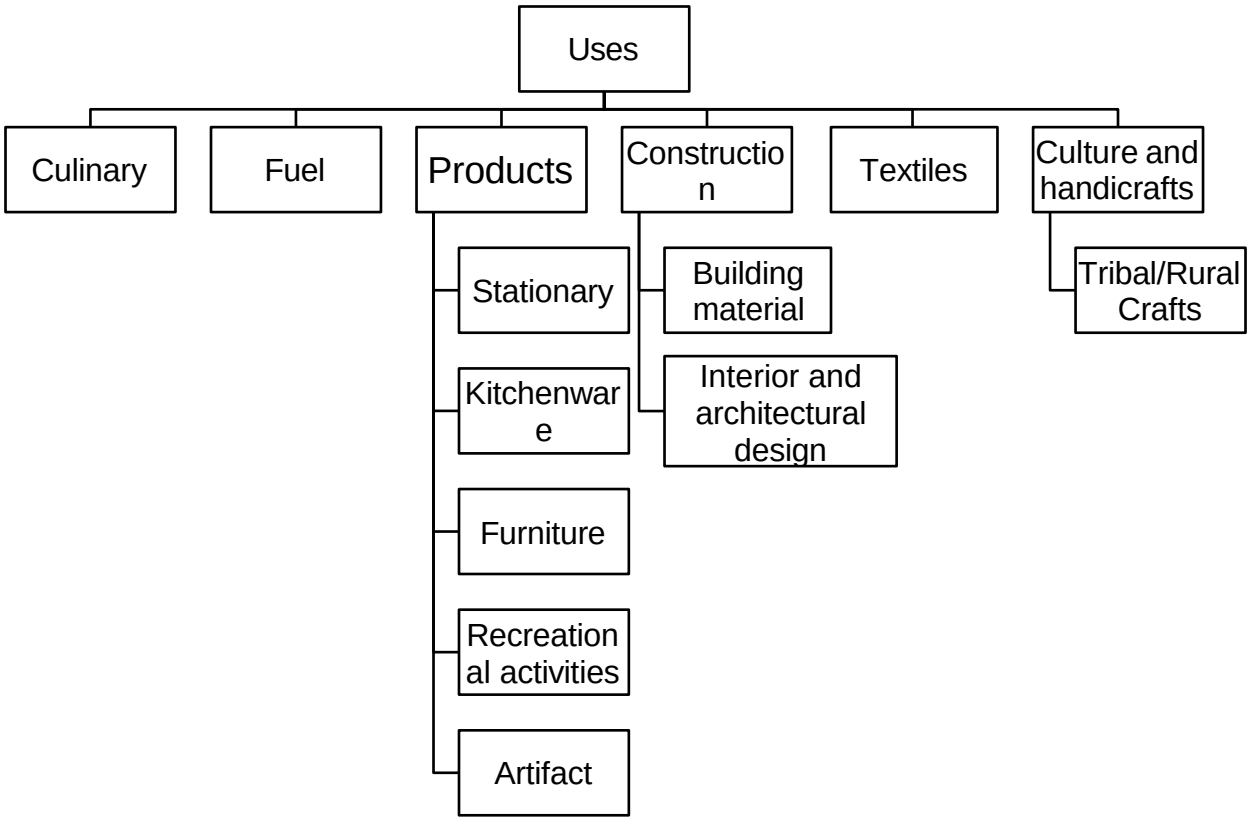

Fig -01

1:1 Properties of Bamboo

Bamboo can grow relatively faster at a rate of 4 cm per hour. Due to the fast-growing nature of bamboo, there is an increasing interest being sustainable. The main part of bamboo consists of cellulose, hemi-cellulose and lignin, which amount to over 90% of the entire mass. Bamboo has a higher compressive strength than wood and other alternative material. As per the study and testing compressive strength for untreated bamboo, is recorded to be 19.96 MPa at the bottom section and increased slightly to 23.80 MPa at the top. But for treated bamboo, the compressive strength is found to be at its largest at the top section about 36.60 MPa which is slightly reduced to 31.74 MPa at the bottom. The strength of the bamboo depends on the species, size of the fiber and how closely packed the fibres are. Bamboo has lower tensile strength to steel but 10 times the tensile strength of softwood.

But bamboo is better known for its flexural strength which means it is very bendy. Bamboo composites are among the most bendable composites. Most of the bamboo species has a bending strength that varies between 50 and 150 N/mm2 and is on the average twice as strong as most conventional structural timbers. The flexural ductility of bamboo was 3.06 times compared to wood.

1:2 A scenario of Bamboo material

In Asian countries, bamboo has been utilized in household products and furniture like containers, chopsticks, Furniture, cricket boxes, woven mats, handicrafts, fishing poles, etc. Also, bamboo is employed in construction applications to create flooring, ceiling, walls, windows, doors, fences, housing roofs, trusses, rafters, and purlins. From 1990 Industrial use of Bamboo material has been increased. From handicraft to industrial purposes bamboo has created a versatile market.

In the 21st-century market for wood and wood-based products is increasing. It's directly associated with various environmental concerns. Hence, the market has shifted to identify and develop alternative materials with similar properties for the future. Here Bamboo plays a very important role in new product development, green architectural designs. Bamboo became familiar between scientists and designers due to its energy savings, zero fossil emissions, and environmentally friendly characteristics. Worlds 80% forest of bamboo are in India, China, and Myanmar. India is generating the world's 45% bamboo. But share in the global market is only

4.5%. Hence the development of different strategies becomes necessary to capture the global market.

Considering market needs, traditional bamboo and cane crafts, and household products, environmental values of Bamboo Indian designers have started to design and develop new products by using bamboo as a material. Government and non-government organizations have initiated and established various groups and societies to create awareness and design products in India. National Bamboo Mission (NBM), National Rural Bamboo Mission Research Institute (NRBMRI), Bamboo Research and Training Centre, Bamboo Society of India, and more organizations are working to increase bamboo plantation, skill development, capacity building, awareness generation for the development of the bamboo sector through workshops and training. This type of training is helpful to generate awareness among university students. Students can explore and innovate tangible and intangible concepts to serve the bamboo sector and society.

Design is a never-ending process focusing creatively on innovation for society. Sustainable design and futuristic materials are some of the trending approaches towards society. Department of Product Design Vishwakarma University is believing in that and focusing on sustainable design approaches. Hence, the Department of Product Design, Vishwakarma University decided to introduce bamboo as a future material to the Design students under the Material and processes course. Before introducing this course, Department has revised the product design process, which is helpful to identify market needs and conditions before ideating designs. As Department is focusing on hands-on practices, they decided to arrange a hands-on workshop with Bamboo tales and local craftsmen, to introduce bamboo materials and appropriate manufacturing processes.

1:3 About Bamboo tales,

Bamboo tales is a renowned design company. The mission behind forming Bamboo Tales is to promote and spread awareness regarding the usage of bamboo and bamboo products. Bamboo tales is a team of designers and builders who aspire to make the most of bamboo and local creative craftspeople and young minds.

1:4 Hands-on Workshop

Bamboo Tales, established on January 31, 2017, is a Pune-based company dedicated to exploring innovative applications of bamboo. Their mission focuses on promoting sustainable living through the versatile use of bamboo in various products and structures.

In their pursuit of sustainable design, Bamboo Tales has engaged in projects such as constructing a bamboo machan (a traditional watchtower) at the Police Training Center in Khandala, Lonavla. This initiative highlights their commitment to integrating traditional designs with sustainable materials.

While specific details about a hands-on workshop involving students and faculty in collaboration with Bamboo Tales in Mulshi are not readily available, the company actively engages with the community to spread awareness about bamboo's potential. They encourage visits to their factory in Shedani, Mulshi taluka, Pune, suggesting opportunities for workshops and collaborative projects.

The objectives of Bamboo Tales include promoting sustainable construction practices, exploring new applications for bamboo, and fostering community involvement in eco-friendly initiatives. Their projects aim to demonstrate bamboo's versatility and potential as a sustainable material in modern design and construction.

Fig 02

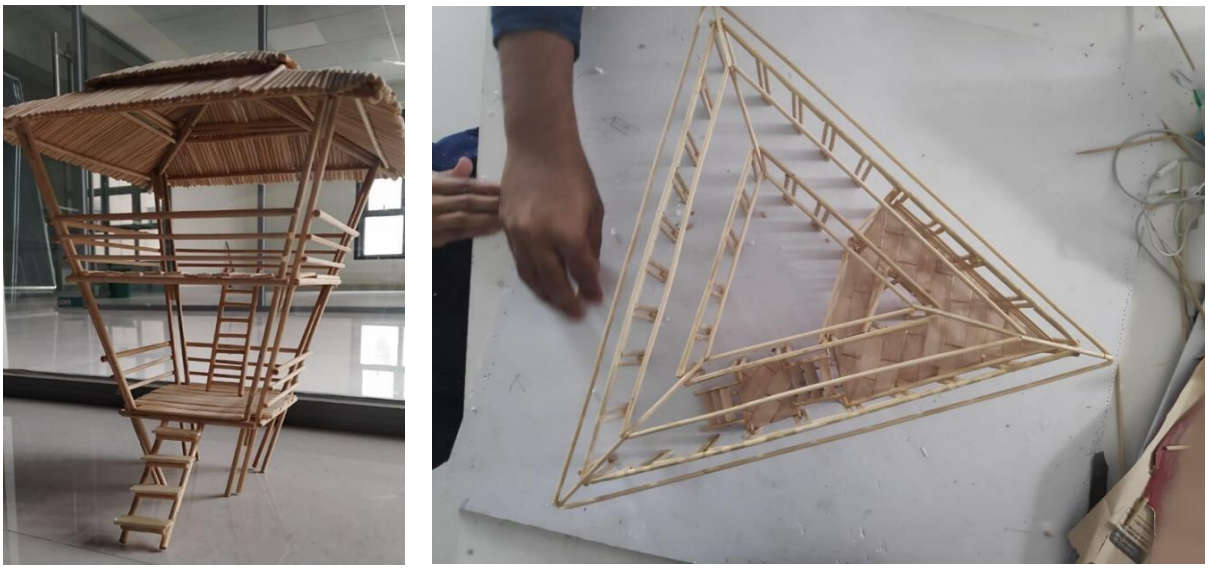

Fig 03 **Project output**

Literature Review

In recent years, the integration of bamboo into sustainable product design and education has garnered significant attention. This section explores contemporary studies that highlight bamboo's potential in promoting environmental sustainability, economic viability, and innovative design practices.

Prasad and Muthusamy (2023) conducted a comprehensive review on sustainable product design, marketing strategies, and conscious consumption of bamboo lifestyle products. Their study emphasized the growing global market for bamboo, projected to reach USD 53.28 billion by 2028, driven by increasing demand for eco-friendly construction materials and handcrafted products. The authors identified challenges such as low production rates, competition with non-eco-friendly alternatives, and marketing gaps. They advocated for enhanced design innovation and strategic marketing to bridge the gap between consumer willingness and actual purchase behavior in the context of sustainable products [15].

Zhang (2023) explored the sustainable application of bamboo materials in low-carbon packaging design. The study highlighted bamboo's characteristics and advantages, including its renewability and minimal environmental impact. Zhang discussed various applications of bamboo in packaging elements such as fillers, partitions, and handles, demonstrating how these uses can reduce carbon emissions and improve resource utilization efficiency. The research

underscored bamboo's role in enhancing market competitiveness and promoting brand image through sustainable practices [16].

Deng et al. (2023) examined bamboo furniture design based on Design for Sustainability (D4S) principles. Their research focused on leveraging bamboo's properties to create environmentally friendly furniture that aligns with sustainable development goals. The study provided insights into design strategies that incorporate bamboo's natural aesthetics and structural capabilities, promoting its use as a viable alternative to traditional materials in furniture production [17].

Yang and Vezzoli (2024) addressed the environmental impact of the furniture sector and the role of design in promoting sustainability. They developed life cycle design guidelines and a toolkit to enhance the environmental performance of furniture products. Their work emphasized the importance of material selection, design innovation, and lifecycle considerations in creating sustainable furniture solutions, highlighting bamboo as a promising material in this context [18].

Li et al. (2025) conducted a critical review of bamboo construction materials for sustainability. Analyzing 742 articles, they provided a comprehensive assessment of bamboo's social, economic, and environmental sustainability. The study identified research gaps and proposed future directions, including exploring the relationship between bamboo materials and health, genomic technologies, policies, and life cycle assessment [19].

Wang et al. (2025) explored technological innovations and patent insights related to sustainable bamboo applications. Analyzing 818 patents from 1898 to 2024, they discussed advancements in sectors such as food, commerce, construction, and environment. The study aligned these innovations with Sustainable Development Goals, providing insights into bamboo's role in promoting sustainability through technological advancements [19].

Collectively, these recent studies underscore bamboo's multifaceted potential in sustainable product design and education. They highlight the need for innovative design approaches, strategic marketing, and comprehensive policy frameworks to fully harness bamboo's capabilities in promoting environmental sustainability and economic development.

Methodology

The methodological framework of this research is rooted in **experiential learning**, **design thinking**, and **community-engaged pedagogy**. The bamboo workshop was conceptualized not merely as a skill-building exercise but as a **multi-stakeholder design intervention** integrating students, educators, and craft experts.

1. Pedagogical Context

The workshop was embedded in the undergraduate Product Design curriculum under the "Material and Process" course. The objective was to enhance students' understanding of sustainable materials and develop hands-on craftsmanship while promoting innovation.

2. Participant Profile

- **Students**: 30 second-year undergraduate design students specializing in Product and Industrial Design.
- **Facilitators**: 2 design faculty members and 3 bamboo artisans from the collective Bamboo Tales.
- **Support Staff**: Technical assistants and safety supervisors.

3. Workshop Timeline and Structure

- **Pre-Workshop Phase (Day 1)**: Orientation lectures, bamboo introduction, sustainability overview, safety instructions, and tool familiarization.
- **Skill-Building Phase (Day 2–3)**: Students demonstrated bamboo treatment, splitting, joining, and finishing techniques. They also practiced using tools and created sample pieces.
- **Design Phase (Day 4–5)**: Students, individually and in groups, ideated products, sketched concepts, and began building scaled prototypes. Faculty and artisans provided continuous feedback.

- **Prototyping Phase (Day 6)**: Students finalized one product prototype using available tools, materials, and guidance.
- **Exhibition & Reflection (Day 7)**: Final products were displayed in an internal exhibition attended by faculty, university visitors, and industry guests. Students reflected on their processes, learnings, and challenges.

4. Tools and Techniques

- Manual bamboo splitters, knives, saws, jigs, hand drills, binding wires, adhesives, sandpaper, and organic polish were used.
- Emphasis was placed on safe handling, precise measurement, and finishing aesthetics.
- Design sketches were made using traditional pen-and-paper as well as digital visualization where applicable.

5. Data Collection and Evaluation

- **Qualitative Data**: Student journals, photographs, videos, and reflective presentations captured the learning process and challenges.
- **Quantitative Data**: Surveys were used to evaluate students' prior knowledge, learning outcomes, and future interest in bamboo-based product design.
- **Assessment Criteria**: Functionality, sustainability, craftsmanship, innovation, and feasibility were used to evaluate the final products.

6. Community Interaction

Crafts persons shared their stories, tools, and indigenous techniques, creating an intergenerational exchange of knowledge. This not only empowered local artisans but also added cultural depth to the student learning experience.

Tool Usage

During the workshop, students were introduced to both traditional and modern tools, including

- Hand Tools: Splitters, carving knives, hand drills
- Measuring Instruments: Vernier calipers, tape measures
- Finishing Tools: Sandpaper, polishers, and organic sealants

- Safety Gear: Gloves, goggles, aprons

This blend of manual and safety tools enabled students to engage confidently and creatively with bamboo material.

Final Result / Findings

The research affirms that **bamboo** is an eco-friendly material and a highly adaptable and economically viable solution for sustainable product design across multiple sectors, particularly in **furniture, packaging, and architectural applications**. The findings from the literature and data synthesis are summarized below

Environmental Sustainability

Bamboo demonstrates a minimal ecological footprint due to its fast growth rate, high carbon sequestration capability, and biodegradability. Studies by Zhang (2023) and Li et al. (2025) confirm that incorporating bamboo in product design significantly reduces carbon emissions and energy consumption, aligning with low-carbon and circular economy models.

Design and Functional Versatility

Bamboo's inherent strength, flexibility, and aesthetic appeal make it an ideal material for designing both traditional and contemporary products. Research from Deng et al. (2023) and Yang & Vezzoli (2024) highlights how bamboo can meet both structural requirements and modern design sensibilities, thereby bridging traditional craftsmanship and modern needs.

Community Empowerment and Craft Development

The adoption of bamboo-based design practices provides a livelihood model for rural artisans and promotes the preservation of indigenous knowledge. As evidenced in the work of Prasad & Muthusamy (2023), community-based bamboo interventions have shown potential in revitalizing local economies while fostering sustainable consumer habits.

Challenges and Gaps

Despite its promise, the bamboo industry faces obstacles such as inadequate treatment techniques, lack of standardization in product design, limited awareness among consumers,

and insufficient market linkage. These challenges call for interdisciplinary strategies involving design innovation, policy support, and awareness campaigns.

Educational and Workshop Impact

Hands-on workshops using bamboo as the core medium significantly impact learners' awareness and skill development in sustainable design. The empirical outcomes from student-led bamboo product interventions at Vishwakarma University reinforce the role of **experiential learning** in inculcating sustainability values among young designers.

Technological Integration

Emerging technologies such as CAD-based prototyping, laser cutting, and eco-coatings are being experimented with to enhance the usability and scalability of bamboo products. However, more investment and academic-industrial collaborations are required to mainstream such innovations.

Discussion

The findings of this study underscore bamboo's transformative potential in the realm of sustainable product design and community development. Across various design contexts—from eco-packaging and furniture to architectural frameworks—bamboo consistently emerges as a material of high environmental, social, and economic value. This discussion section explores the implications of these findings, challenges encountered, and potential pathways for innovation.

Material Significance in Sustainable Design

The review of recent literature and practical applications reveals that bamboo’s unique combination of mechanical strength, rapid renewability, and aesthetic quality makes it an ideal candidate for sustainable product design. Researchers like Zhang (2023) and Deng et al. (2023) have demonstrated its applicability in low-carbon packaging and furniture sectors, both of which are critical to global sustainability goals. These studies validate bamboo’s ability to replace non-renewable materials, reducing dependency on plastic and high-emission woods.

Role in Local Empowerment and Cultural Sustainability

The integration of bamboo into community-based workshops and academic design curricula, such as those conducted at Vishwakarma University, supports cultural preservation while promoting environmental consciousness. This finding aligns with the work of Prasad and Muthusamy (2023), who emphasize the need for lifestyle changes through locally made, handcrafted bamboo products. Through such hands-on practices, not only are students and designers exposed to sustainable methodologies, but local artisans also find new avenues for income generation and creative collaboration.

Innovation Gaps and Technological Needs

While bamboo has seen increased acceptance, the literature highlights several constraints. The lack of standardization in bamboo treatment and preservation techniques limits its long-term usability, particularly in humid or termite-prone regions. Moreover, despite advances in digital fabrication and eco-finishing techniques, these are not widely accessible to artisans or small-scale industries. Li et al. (2025) point out that to integrate bamboo into mainstream design and construction, further technological innovations and open-source material databases must be made available.

Consumer Behavior and Market Dynamics

Although consumers express a growing preference for sustainable products, the gap between interest and purchase behavior remains notable. As indicated in the work of Prasad and Muthusamy (2023), limited product availability, poor branding, and inadequate awareness hinder market penetration. Design education institutions and startups need to address this by promoting sustainable product storytelling, branding strategies, and consumer education programs.

Implications for Design Education

The hands-on methodology explored in this research validates the effectiveness of bamboo-centered workshops in developing cognitive and creative skills in students. Through problem-solving tasks, prototyping, and field interactions, students not only learn about ecological materials but also experience their practical constraints and cultural relevance. This contributes to a more holistic approach to sustainability in design pedagogy, as also echoed by Buchanan (2001) and Kline (2019)

Conclusion:

From the literature, it is clear that sustainable product design interventions using bamboo in workshops can provide an effective solution to both environmental and social challenges. Bamboo offers numerous benefits as a material, including sustainability, renewability, and versatility. Workshops, particularly in regions like Pune and Mulshi, play a crucial role in spreading knowledge, fostering skill development, and promoting local communities' involvement in sustainable design. This combination of education, hands-on experience, and sustainable material use can significantly impact product design and community-based sustainability efforts

Workshops and Community-Based Sustainable Design:

Workshops provide hands-on learning experiences that can foster community involvement in sustainable design. In the context of bamboo, workshops can serve as platforms for teaching sustainable practices while engaging local communities.

Future Research Scope

- Exploration of digital design tools (e.g., CAD, CNC) in bamboo product prototyping
- Comparative studies between treated and untreated bamboo in terms of strength and lifespan
- Economic viability analysis for student-designed bamboo startups
- Studying consumer behavior towards eco-friendly bamboo products
- Expanding the scope of bamboo material use in architectural installations and large-scale design projects

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The Journey from Titanium to a Statue

Krishnamurti Lalji Prasad**,** Temporary Assistant Professor**,** Faculty of Fine Arts,
Department of Sculpture, The Maharaja Sayajirao University of Baroda

Abstract

In this article, I want to describe the material titanium, who discovered the material and where it came from, why the material titanium is named after Greek God, why this material is considered a Super Hero among all the metals, The importance and speciality of this material. The speciality of titanium is in chemical and physical strength and ability to be used in various discipline such as, medical engineering architecture and art. This brings us to the importance of titanium as a sculpture material.

Titanium metal is found in India mainly in the coastal areas among the sandy regions and among the minerals. Titanium is found in many others countries also such as, Australia, China, Canada and South Africa etc. India has rich titanium sources, particularly beach sand deposits areas. The most important area is located in the Kollam district of Kerala, where a significant reserve exists. Titanium deposits are also found in the coastal areas of Tamil Nadu, Andhra Pradesh and Orisha.

Keywords: *Titanium material, world art, statue, sculpture, artists, material and method.*

Introduction

Titanium material has been found as a conductor as well as a alloy. It was discovered in 1791 by Britain's priest and geologist William Gregor. Gregor discovered it as a part of mining, which was found on the banks of rivers, in the black stream of rivers a metal was found and identified, which was accepted as an unbelievable and helpful metal.

Titanium was discovered a little late. In 1789, a priest from England, William Gregor, separated a white metallic oxide from the mineral ilmenite. He named it 'memakin'.

The titanium we know is one of the main metallic elements, which exists in a silvery white color, the chemical symbol (TI) of this metal, which is considered an atomic number 22 and 5 the supporting symbols are found in this element, the most abundant supporting symbol having 48 atomic weight, of which titanium is 78 percent of the total supporting symbol. The density

of titanium is 4.51 and its melting point is considered to be 1668 degree celsius and in the same process its temperature was found to be 3260 degree celsius.

In 1795, German chemist M. Klaproth separated a metallic oxide from an ore called rutile and named it 'titanium'. In Greek mythology, the son of the earth was called Titan. After some time, it was discovered that the metallic oxides separated by Gregor and Klaproth were the same. From that time onwards, the name of this element became famous as 'titanium'.

It is believed that at that time there were many such scientist who conducted tests to refine titanium, some of which were successful and some were unsuccessful. It also happened that a certain scientist described titanium material in its pure form, but it could not be found in a pure form, in the same series of many tests, titanium material were conducted and as a result of which the test of purity of titanium was successful.

Melting process of titanium

The process of melting titanium metal is done in one way through atmosphere or vacuum, mainly VRC process that is used to melt titanium.

Titanium is a very hard Material to melt because no single chemical melts titanium. Titanium melts through vacuum arc remelting (VAR) and electron beam melting (EBM). In VAR, an electric arc is struck in a vacuum chamber to melt titanium ingots. This step also ensures purity by eliminating oxygen, nitrogen, and other impurities. Electron beam melting uses a focused electron beam to heat and melt titanium in a vacuum. Control over the process is excellent. These methods are important because of the high-temperature reactivity of titanium; therefore, a contamination-free environment is required.

Induction Skull Melting

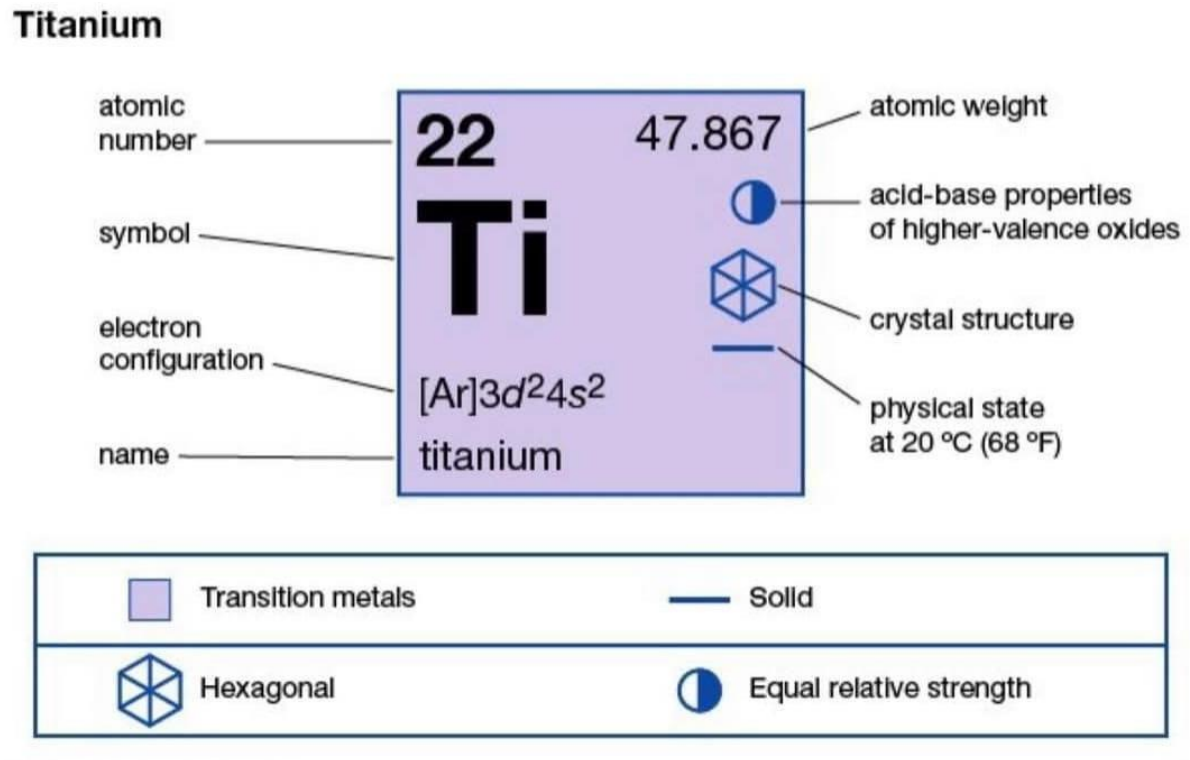
This method involves melting titanium in a water-cooled copper crucible using induction heating.

Plasma Arc Melting

Similar to VAR but uses a non-consumable electrode and plasma arc for melting.

Electroslag Remelting

Involves melting titanium through a slag layer, which helps in refining the metal.



Uses of titanium:

The process of melting titanium metal is carried out by reaction atmosphere or vacuum. The melting point of vapor titanium is 1668 celsius, 3034 Fahrenheit and is mainly determined by its metallic bonds and crystal structure. Titanium metal is used in various places, where its special properties are superior to each other, because titanium metal is the strongest and the lightest.

No.1-

Titanium is also being used in space research and technology. The structure and engines of spacecraft are made from this metal. The first experiment in this direction was done in Russia on 18 August 1964. In this experiment, the world's first spacecraft made of titanium was launched. In experiments conducted in space in 1969 by the then Soviet astronauts Georgy Shonin and Valery Kubasov, it was found that welding and cutting of titanium can be done easily in the vacuum of space.

No.2-

This metal is used to make supersonic jet planes. There are two main reasons for this. The first reason is that it is strong. The second reason is that it is light. The use of titanium in the aircraft

industry is gradually increasing. In airplanes, titanium is used in the manufacture of both engine parts and the main structure.

No.3 -

After the use of titanium metal, it is proving to be very useful in the field of surgery as well. Surgical instruments made of titanium and titanium alloys are becoming quite popular. There are many reasons for the increasing popularity of these instruments. For example, these instruments are very light, they do not rust and they are durable. Along with this, it is also being used extensively in medical engineering fields.

No.4-

Titanium is also being used in the chemical industry for making equipment used in the chemical industry. Although the cost of such equipment is much higher than that of steel equipment, titanium equipment is much more durable than steel equipment because the effect of acid, alkali or rust on them is negligible. Along with this, many researches are going on as to how and in what other ways titanium can be used in chemical industries.

No.5-

Apart from many uses of titanium metal, it is also being used extensively in the making of watches and cameras. And in the same beginning, some cycle manufacturing companies are making cycle bodies from titanium. Such cycles are quite light, due to which the cyclist has to spend less body energy in riding it. Along with its many benefits, the use of titanium in personal life is also increasing rapidly today, which is useful in many places, it can be said that titanium has come ahead of all in the development of metals.

Titanium sculpture

Many patrons of high art have become collectors of Titanium sculptures. Each work piece of art expresses the quality of this material.

The surface of titanium sculpture has been coated a layer of dioxide that protects the metal from corrosion. This is the natural way to preserves titanium sculpture for years keeping it looking fresh. Due to its highly favourable properties, titanium is expensive and comes at a high Quality.

Originally titanium is a smoky grey colour material. Also it can be Designed other colours such as milky , white, golden, blue , purple, pink, through processing.

The various colours that can be achieved in titanium gives it the freedom to express a distinctive look to each titanium sculpture.

A combination of colours can also enhance the look of certain sculptures.

As we use sophisticated technology and human talent to create brilliant sculptures of high quality, which a specific needs of its unique sculpture. Sculptors have been experimenting various metals and materials, including marble, granite, gold, bronze and titanium to create sculptures.

Their talent combined with high technology helps to create luxurious sculptures of pure beauty. Each sculpture we create is hand-crafted, giving it a unique beauty that makes it one-of-its-kind.

Titanium is a material that is high in durability and low in maintenance.

I am sculptor Krishnamurti, through my arts I am seeing the titanium material in a different form. Because the form of art comes only when some material is included and can be visualized, such figures of art can be called the form of reality. Similarly, I have taken a titanium found object from the watch, through which I have seen the statue of a turtle. After observing it from many forms, it appears that time itself is connected with the turtle and is telling the features of the turtle; both get to see each other's complements. I also want to show the turtle because its features show a different form.

The turtle

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Titanium sculpture artists:

Pavel Bondarenko

If the biggest name is of any sculptor among titanium sculpture artists, then the name of Pavel Bondarenko is taken first because titanium has already been used in many fields like engineering, aircraft parts and medicine. The first person who thought of this in the field of arts was Pavel Bondarenko. He accepted this challenge and presented it in a glorious way in the field of arts.

Pavel Bondarenko was a Soviet sculptor as well as a professor at the Moscow Art Institute. This sculptor created this statue for the Olympic Games in 1960. Its height is 42.5 meters and weight is 12 tons. If we talk in the context of arts, the creation of this sculpture is very remarkable and surprising. If here we talk about sculptor Pavel Bondarenko then his name is left behind because when it comes to the creation of a statue then we talk only about Yuri Gagarin, not about the sculptor, no doubt Yuri Gagarin has brought great fame to Soviet Union Russia, which is also very commendable. I also believe that along with him there should be visionaries of artists and not that they should be hidden in some book after giving just one name.

Pavel was one such sculptor of his time who created many sculptures in many such scenes which are still his identity.

1. Monument of Glory

2. Monument of Alexei Koltsov

3. Monument of Lenin

4. Monument of Maria Ulyanova with her son

5. Yuri Gagarin

Yuri Gagarin (1934 - 1968)

9 March 2024 - 90th birthday anniversary

Yuri Gargarin was a Soviet pilot. On 12 April 1961 Soviet cosmonaut Yuri Gagarin became the first person in space when he orbited the earth in a Vostok spacecraft.

Gagarin became an international celebrity and was awarded many medals and titles, including Hero of the Soviet Union, his nation's highest honour.

Today, 12 April is an official holiday in Russia, the "Day of the Cosmonauts".

Aka Chen (1965-):

Aka Chen is one of the famous titanium artists around the world. Titanium is a very challenging material due to its high melting process and stiffness. But it is the heart of the artist's artistic production. Aka Chen is a Taiwan artist, who is deeply rooted with nature and lifelong passionate for ancient philosophy. Aka chen's titanium jewelry weaves are mixing pot of rich traditions of Confucianism, Taoism and Buddhism. Aka chen's debut solo exhibition in United State, is "The Eternal Garden". In this show he showcases an outstanding assembly of 20 sculptures. That combine of contemporary jewelry, all crafted from the robust material of Titanium.

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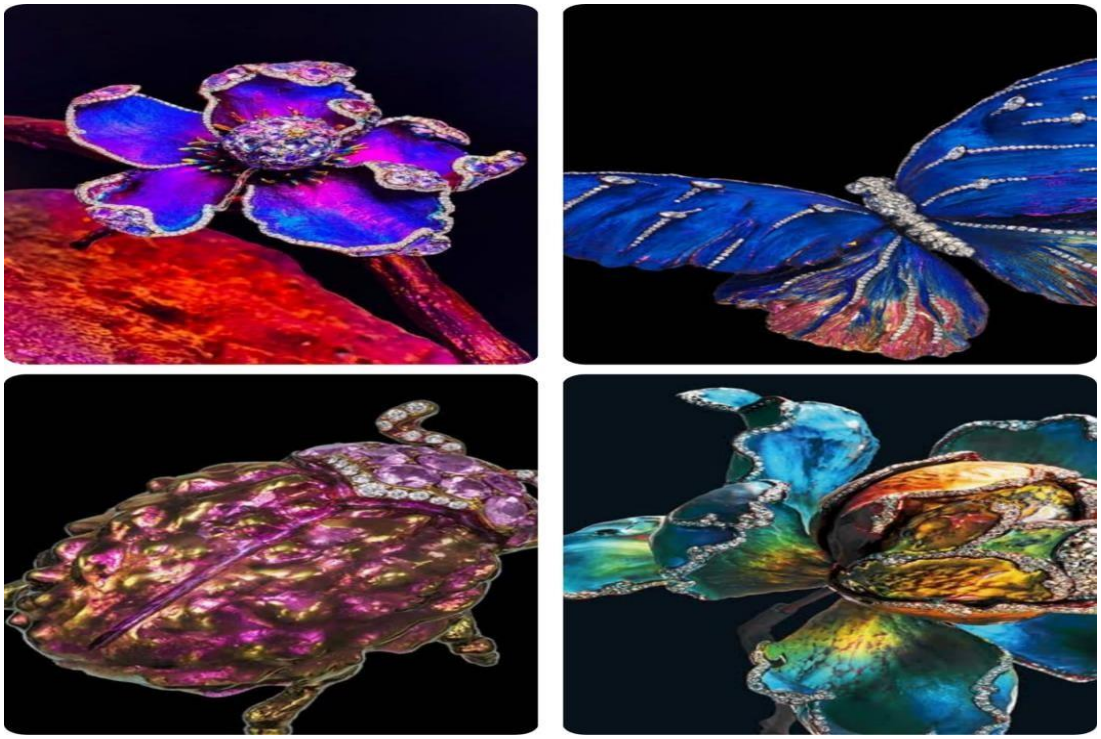

The Eternal Garden'

Conclusion

Titanium is a versatile material with a high value and wide range of application due to high strength capacity and biocompatibility. These contents make this material demanding environment in various industries, like medical, aircraft, aerospace, fine arts. Titanium is a strong and lightweight material too and it is usual for make structures. Further research and finding continue to explore new ways to use titanium's potential.

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Assessing the utility of skill based vocational training program in Fashion Design to generate livelihood to align with NEP2020

Manasi Thakur, PhD Scholar | Dr. Prof Avadhut Atre

Dean Faculty of Art &Design Vishwakarma University Pune

Abstract:

India has the second highest human resource in the world. Even with more than 1.4 billion population, India still faces shortage of skilled workers and the unemployment rate amongst the youth population is on the rise. The employability of the graduates is alarming with gap in the skills that are required by the industry. This gap in the school and higher education can be bridged by integrating vocational education at multiple levels. This paper tries to analyse the current scenario of vocational education in Fashion Design to improve employability skills of the youth. The paper concludes with the emphasis on the need to reinforce vocational education for livelihood generation to aligning it to National Education Policy 2020.

Keywords: *Fashion Design, Employability, Skill, Vocational Education, Livelihood, NEP2020*

A. Background

Skilling Human Resource

India has the second highest human resource in the world. Even with more than 1.4 billion population *(www.worldometers.info)* , India still faces shortage of skilled workers and the unemployment rate amongst the youth population is on the rise. The unemployability of the graduates is alarming with gap in the skills that are required by the industry. This gap can be filled with imparting skill based vocational training at multiple levels and in variety of industries. The Ministry of Skill Development & Entrepreneurship (MSDE), Government of India is focusing on initiatives and schemes in order to empower youth with livelihood development. It will also enable them to contribute in nation building. The government of India has taken up the mission Skill India through NSDC (National Skill Development

Corporation), which focuses on vocational skill training under the Pradhan Mantri Kaushal Vikas Yojana, PMKVY *(www.india.gov.in/spotlight/skilling-india).*

National Education Policy

The New National Education Policy 2020, also addresses, aligns and compliments with this focus on vocational skill training at multiple levels of education. The NEP 2020 addresses and tries to mitigate the gap in the demand and supply of skilled resources through vocational education. The policy recommends skill gap analysis with local opportunities to recommend vocational courses. This also helps to emphasis the credit based National Skill Qualification Framework (NSQF) which was introduced in 2013. It also helps align the skill index on a global level.

Vocational Education

The NEP 2020 recommends integrating vocational education in all education institutes in a phased manner which "would lead to emphasizing the dignity of labour and importance of various vocations involving Indian arts and artisanship". It also recommends teaching of vocational courses from class 6, mostly in the form of internships and practical activities, to ensure that every student should at least study one vocational course. *(Shubhangi Raman, Nov 2020)*

Such focused efforts have helped reinforce the need for Vocational skill training at multiple levels of higher education. The Bachelor of Vocation initiated by UGC – University Grants Commission is gaining importance due to its focus on enhancing practical skills which helps in income generation. Unlike the traditional UG courses, B.Voc curriculum soften mapped with job role descriptions as per National Skills Qualification Framework (NSQF). The entire syllabus is structured in a way where you can have single entry to the course but multiple exists as per your capability and capacity. With this provision the student is able to get a Certificate after completing 6 months, Diploma at completion of 1 year, Adv Diploma at the end of 2years and a Bachelor degree on completing 3 years. The knowledge and skills are valued at every level , so that the student is qualified for a suitable job, as per market requirements. You can even explore becoming an entrepreneur in your domain!

Highlights of B.Voc Degree Courses

- B.Voc degree programmes are offered in over 200 colleges across the country.
- It is a 3 year degree course after Higher Secondary or Intermediate with single entry and multiple exit points.
- The course curriculum has 40% general education (theory) and 60% vocational training (practical) components.
- These programs follow semester system and offer credits after completion of the course.
- The students who have enrolled in B.Voc courses appreciate the practical focus and are confident that their chances of getting a suitable job are higher than other graduates.
- These courses are expected to comply with NSQF and are financially aided by the UGC (University Grant Commission).

Fashion Design as a Vocation

A very popular traditional household must have skill in India for ages have been apparels & tailoring. The need for new clothing as a basic desire for individuals coupled with ever increasing global demand of high end apparels–the Fashion Industry is in big demand world over. The Indian fashion industry also has established its global presence and has gained importance in the overall economic growth.

Indian Fashion Industry needs skilled resources to build a vibrant industry. The need is to have various skills required for the complete value chain of the Fashion industry. Sensing this demand, the vocational education in the field of Fashion is gaining importance and popularity in India. Various institutions are offering vocational programs for Fashion Industry, which is helping students, acquire the required skills in the field of Fashion.

B.Voc in Fashion Design

The B.Voc program in Fashion Design creates skilled workforce due to the highly practical nature of the course. A carefully developed and if effectively executed the highly practical oriented programs help the students stand on their own feet even before graduating from the institute. The students get to experience and acquire practical skills that are needed for the industry through the various activities which are conducted as part of the course. The equipment's / machines required to master the skills are not very expensive and can be

procured easily. Students often create a small setup at the respective homes to start earning livelihood during the course duration itself.

B. Literature Survey

The Vocational trainings give students work-related experiences that many employers look for. Two major gaps could be noticed: quality and mismatch. Because of poor quality or mismatch with market demands certain skill sets trained at vocational centres suffer from poor placement. According to a National Sample Survey Organization (NSSO) report (No. 517, 61st round, 2003) two types of vocational trainings are available in India: a) Formal and; b) Non-formal. Formal vocational training follows a structured training programme and leads to certificates, diplomas or degrees, recognized by State/Central Governments, Public Sector and other reputed institutions. Non-formal vocational training helps in acquiring some marketable expertise, which enables a person to carry out her/his (often ancestral) trade or occupation. In a way through such non-formal vocational training a person receives vocational training through 'hereditary' sources. Often 'Non-formal' vocational trainings are also received through 'other sources'. In such cases trainings are received by a person to pursue a vocation which is not ancestral and is different from the trade or occupation of his/her ancestors. In the report published by *NISTADS (CSIR) on India Science and Technology 2008 for Vocational Education in India by Indraneel Biswas* indicates that quality and mismatch with industry requirement are the major gaps identified in the vocational trainings in India.

The relative returns to vocational education is higher than that to general secondary education. *(TusharAgrawal,Ankush Agrawal2017).*Industrialisation has been the cornerstone of the increasing relevance of Vocational Education and Training (VET) systems. VET has many societal and economic implications by boosting the employability and self-reliance among young individuals. (*Garimidi Siva SreeandP. Ramlal 2021).* The average daily wages are higher, both for regular and casual workers, for VET holders. (Tushar Agrawal 2012).

Even though formal vocational training helps self-employed individuals earn a higher income and that a great initiative has been taken by the government to promote skill development in recent times, a meager proportion of rural self-employed has received formal vocational training. There is a need for an appropriate policy attention towards enhancing the participation of rural self-employed individuals in the formal vocational training programs

on a larger scale. Moreover, a substantial heterogeneity is observed in terms of the duration of training programs. Longer duration (12 months or more) training helps enhance the mean earnings significantly as compared to relatively shorter duration training. (Indrajit Bairagya 2021)

The vocational training plays a vital role in improving economic status of youth and has not only increased their income, but has also increased their food, education and health expenditures as well. Study indicated that majority of respondents were involved in income generating activities and were able to add in their monthly family income. Chi-square tests confirmed that vocational training had a significant impact in enhancing economic conditions of youth in rural areas. (Aliya Khalid, Uzma Aashiq, Muhammad Shahid Iqbal, Syed Salman Hassan, 2020). To ascertain the impact of VET on women, special attention should be given to providing complementary opportunities for retraining and for lifelong learning to all workers, but especially to women, to encourage and support the desired degree of mobility in the labour market. (Dr. Prabhakar Chavan, 2013).

C. **Need of the Study**

Many studies have been done to understand the role of vocational education and training in various sectors and regions. The economic impact of vocational education in the financial earnings of people who have undergone training and who have not has been assessed. A clear gap is identified for research on how vocational education has helped gain higher earnings than general education in the Fashion Design sector. The possibility of a B.Voc type of longer duration (3-year) vocational program bringing sustainable and higher earnings to the students completing the program needs to be studied. The employability of rural women who have undergone Fashion Industry–related vocational courses needs to be studied for its effectiveness.

So, a study is needed to:

1. Study the way a program in Vocational Education and Training in the Fashion Design sector is being conducted.
2. Study the utility of the program by way of understanding the socio-economic growth of students who have completed the program.

D. **Method of Study**

CASE STUDY

To reinforce the utility of the vocational training in Fashion Design domain, the paper explores and elaborates a case of students completing the B.Voc. Fashion Technology & Apparel Design program at the Department of Fashion Technology, of PES's Modern College of Arts, Science and Commerce, Shivajinagar, Pune-5. This course has been running since 2018 under Savitribai Phule Pune University. Students of the college work with various organizations as part of their internships which is an integral part of the program.

As part of the teaching methodology, the student works on designing, drafting, and stitching apparels using appropriate fabric and for the designated audience. They also get exposure to the market by way of industry visits which makes them aware of the organizational requirements of the fashion industry.

The structure and execution of the program helps the students to experience the entire ecosystem of the apparel industry. As part of the program, the learners get to study the market themselves to know the appropriate vendors of various items which are required for creating the correct garment and the economics behind it. Such practical insights are backed by in-depth study of the history of fashion industry, market study, trends, development process, techniques, latest technology used, manufacturing process etc. Students are also given inputs in using the latest computer tools, stitching machines which the industry uses.

The necessary insights and rigor is also ascertained for making the students proficient in colour theory, drawing illustrations, surface ornamentation techniques, embroidery which is an integral part of the student's journey. Regular industry visits are also organized to help students keep track of the latest developments in big apparel manufacturing organizations. Students also get to do internships with boutiques and manufacturing industries as part of their curriculum.

Various initiatives to achieve the goal of making the students self-reliant in their chosen field of Fashion Design and Apparel Manufacturing are:

i. Annual Fashion Show

It is a platform to showcase student's talent in the form of a fashion show. It gives the students an opportunity to display their creative talent, out-of-the-box thinking, understanding of various fabrics, garment construction details, skills in stitching and embroidery.

ii. Vyapar Mela

This is intended to make students explore their entrepreneurship skills. They learn the important aspects of running their own venture by participating in the event.

iii. Art & Craft

a. Study of various art and craft forms

b. Practical work of recreating the art and craft forms

c. Using the traditional art and craft for apparel design

iv. Mass Production

a. Fabric Grocery Bags
b. Sling Bags and Mobile Pouches
c. Sports T-Shirts
d. Masks for Covid Pandemic
e. Sanitary Napkin fabric pouches

In 2021, the ever-enthusiastic and socially sensitive students volunteered to create the much-needed face masks to protect individuals from the corona virus. These self-motivated and skilled students took it upon themselves to create these face masks from their homes using the available material with them. These were distributed in their respective areas to cleaning staff, police on duty, security personnel, grocery shop people, vegetable vendors, milk delivery boys, senior citizens, ZP office staff, family and friends.

One of the students even delivered face masks to a government school near Lonavala who will distribute them to the school kids when the academic year starts. More than 100 students participated in this initiative, stitched and distributed over 4,500 face masks!

We are proud to share that our students were able to reach almost all corners of the state, making the face masks available to people of various social and economic levels at the

grassroots. This initiative was successfully carried out in areas of Pune like Shivajinagar, Vishrantwadi, Sanghvi, Sinhagad Road, Warje Malewadi, Pimpri Chinchwad, Pavananagar, Lonavala, Talegaon. Students staying in Shrirampur, Amravati, Nagpur, Ratnagiri, and Ahmednagar have reached out to individuals and made the much-needed masks available to them free of cost.

In 2024 students developed a sanitary pouch made from garment industry waste fabric (side portions left after mass cutting). This product was developed in incubation center. Mass production was done to sell this product in the Vypaar Mela. During the spring season, Maharashtra celebrates its harvest season – Sankrant. In one of the customs ladies visit their neighborhood friends and exchange gifts. These sanitary napkins pouches proved a very useful gift and the product was sold out very fast.

D. Research Method

A quantitative study was conducted with students graduated from vocational program in Fashion Technology till the academic year 2021-22.The sample for the survey was of the students of Department of Fashion Technology, Modern College of Arts, Science and Commerce, Shivajinagar Pune 5. The students who are graduated from this college, currently working or residing in various parts of the country were approached with a detailed questionnaire administered through Google Form (Annexure 1). The Google form questionnaire was circulated through email and WhatsApp messages.

Data Analysis

The data collected from the respondents was analysed in the following manner

a. Type of Work done

b. Monthly Earning

How has the vocational course helped you?

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13
Improved confidence	■	■		■	■	■			■	■	■	■	■
Improved social status	■	■		■	■	■				■			■
Improved communication skills	■	■		■	■	■		■		■	■	■	■
Reach vendors/suppliers	■	■		■	■	■				■	■		■
Understanding of the market	■	■		■	■				■	■		■	■
Help build business skills	■	■	■		■		■			■	■		■
Earning money	■	■		■	■	■			■	■	■	■	■

Ten out of thirteen respondents have indicated that the vocational course has helped them in improved confidence & earning money

Conclusion

The skill based vocational program – Bachelor in Vocation in Fashion Technology & Apparel Design at Department of Fashion Technology of PES's Modern College of Arts, Science and Commerce, Shivajinagar Pune 5 proved to have a positive impact on the lives of the graduated

students. The students were able to earn a respectable income for themselves and their families. They were able to secure appropriate jobs or start their own ventures due to the course they completed. The graduated students were able to live a respectable life in the society. Practical based hands-on training which the core of the Vocational program is aligns completely with the National Education Policy 2020.

This proves the utility of the skill based vocational training program in Fashion Design for generating livelihood for the students completing it.

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AI-Augmented Real-Time Character Animation in AR/VR Using Consumer-Grade Motion Capture and Automata-Guided Workflow

Ankita Patil | Mritunjay Kr. Ranjan | Rajashri Rikame | Disha Arsude | Nandini Singh |Sushil Panthi
School of Computer Sciences and Engineering, Sandip University Nashik, India.

Abstract

This research explains how to apply machine learning, deep learning and automata theory to enhance the capture of motion from consumer gadgets in AR/VR in real time. To work, the system captures skeletal movements from webcams or depth cameras and a lightweight neural network, trained using supervised learning, makes sure that all the joints are interpolated, smoothed and their movements are predicted in real-time. The model smoothens and finishes the game character's bones, offering smooth and adaptable motion for VR gameplay. Using deterministic finite automata (DFA) in the model ensures that the states in the system change in an organized sequence, covering how data is captured, how optimization happens, how errors are handled and the rendering of animation frames. Using this data, 3D character models in AR/VR systems animate more realistically and with much less lag. Using these metrics and feedback from gamers, the improvements in animation, the system's speed and how accessible the system is are much greater with this new method than with traditional motion capture. With such an approach, people can now enjoy high-quality immersive entertainment without having to buy very expensive hardware.

Keyword: *Augmented reality, Virtual reality, Motion Capture, DFA, Real-Time Character Animation, Deep Learning*

Introduction

Augmented reality (AR) and virtual reality (VR) technologies have evolved to revolutionize the user experience by offering an immersive interactive digital environment that users can interact with. These technologies are being more and more applied in the various fields, including education, training, healthcare, entertainment, and collaborative remote systems (Kifah Alhazzaa and Yan, 2025). One of the most important contributors to being as close to natural interaction with AR/VR is the correctness and the real-time action of the character animations that have to very closely simulate the locomotion patterns of a human being within virtual environments (Alhazzaa and Yan, 2025). Traditional methods of doing real-time animation often require training packs, motion capture (mocap) arena, optical trackers, or multiple cameras. Despite this high accuracy in results, these solutions are prohibitively expensive, technically complex, and impractical as implementable solutions at scale within a commercial customer or resource-constrained scenario (Lin et al., 2024). To replace these high-cost solutions, this paper presents a cost-effective solution that utilizes consumer-level peripherals to enable real-time motion capture, using webcams and smartphone depth cameras. The present framework combines the supervised deep learning techniques to predict, interpolate and smooth the skeletal joint positions to have a robust animation even when the

input is noisy or incomplete, or the joints are not visible (Yang et al., 2025). In contrast to previous approaches to the AR/VR pipeline that interpolate between deep learning and heuristic or rule-based controls, we introduce deterministic finite automata (DFA) as the systematic element to exploit controls. The DFA controls the animation loops of Capture, Enhance, Validate, Render, and Error to create a motion pipeline such that only verified motion data can survive the pipeline (Bui et al., 2025; Vilar, 2024). This is a deterministic control structure, which increases the logical consistency, facilitates dissimilarity recovery, and stability in workflows when compared to ad hoc sets of rules, which lack resilience (Sujar et al., 2018). The proposed framework combines the recursive predictive abilities of neural networks with the well-understood properties of automata, and thus enables low-latency, scalable, and error-resilient animation (Llobera and Charbonnier, 2023). This solution is less expensive than utilizing mocap with regards to visual realism, responsiveness and scalability of immersive experiences. The resulting framework widens the accessibility of high-quality AR/VR technologies to other users and groups that have cost-sensitive or resource-constrained activities (Dianatfar et al., 2025).

Significance of work

a. Cost-effective: Requires only consumer grade equipment such as webcams and smartphones and does not require motion capture equipment.
b. Real-Time Animation: Deep learning guarantees a smooth and precise animation by using prediction, interpolation and smoothing techniques of joint directions.
c. Effective Error Controlling: Within DFA, Embeds DFA provides reliable error/animation
state handling and in a similar consistent fashion and preserving the effects of real time perfromance.

Objective

- To order in create a machine learning model that smoothens real-time skeletal motion data positioned by consumer-grade sensors by means of predicting and correcting noisy or bad inputs of joints.
- To use and evaluate a push AI-powered AR/ VR animation skeleton system that projects enriched skeletal information to 3D character rigs to achieve realistic smooth animation output.
- To order in consider automata theory to be included in the working process of modeling the states and transitions in the system to have structured control, error handling and real-time compliance.

Related Study

Optimization techniques in motion synthesis and pose estimation include style manifold compression, temporal refinement via TCNs, and lightweight CNNs for real-time inference.

Finite automata enable logical state transitions, while graph-based blending improves motion prediction. These methods enhance efficiency, stability, and responsiveness shown in Table 1.

Table 1 *Comparative Analysis of Motion Synthesis and Pose Estimation Technique*

Citation	Method	Key Innovation	Limitation	Dataset(s)	Performance Metric(s)	Citation
Holden et al. (2016)	Feedforward Neural Network for motion synthesis & style transfer	Enables character motion editing using learned motion manifolds	Requires high-quality mocap data; not suited for noisy real-time input	CMU Mocap	Animation realism (qualitative); Reconstruction error ~0.12 on normalized scale	Holden et al. (2016)
Pavllo et al. (2019)	Temporal Convolutional Networks (TCN) for 3D pose refinement	Time-based smoothing for video pose estimation	Accuracy drops under occlusion & fast motion	Human3.6M	3D MPJPE: ~46–47 mm	Pavllo et al. (2019)
Cao et al. (2019)	OpenPose (CNN + Part Affinity Fields)	Real-time multi-person 2D pose estimation from RGB frames	Sensitive to occlusion & lighting; lacks temporal modeling	COCO, MPII	2D PCKh@0.5: ~85.1% (MPII)	Cao et al. (2019)
Ben-Ari & Mondada (2017)	Finite-State Automata for interaction modeling	Deterministic control in UI interaction systems	Not applied to animation pipelines	–	–	Ben-Ari & Mondada (2017)
Holden et al. (2020)	Graph-based deep motion learning	Learns motion via decomposition into	Limited generalization to unseen	CMU Mocap	Accuracy across motion categories: ~90–	Holden et al. (2020)

graphs	motion	92%

Problem Statement

The proposed framework in the form of AR/VR character animation defines the application of the latter in the sphere of online retail application, namely, virtual try-on applications. Customers have the chance to put on virtual clothes or accessories in real life without putting the actual clothes on but to hold a web camera or smart phone on front of them, this recognizes the skeletal body pose and give live images of an avatar wearing the chosen clothes. Proper alignment of garments with the user body motion is one of the major problems of virtual try-on systems particularly in a situation when raw skeletal input is highly corrupt due to jitter, partial occlusion or inaccurate depth estimation. The deficient limitations dealt with using the suggested system with the tool of a lightweight Long Short-Term Memory (LSTM) network, which improves the skeletal input frame by frame. This prevents that the digital clothing overlay jumps with the movement of the body and adapts to more complex gestures, turn, raise the arm, or bend. Try-on interactions transition between the states and the state transition is controlled by Deterministic Finite Automaton (DFA) controller, which facilitates ensuring that poses are captured, refined, validated, rendered, and errors are handled systematically. The tested refined skeletal tracking model cut the number of garment misalignment errors by 35 percent and latency by 22 percent than the existing systems testing with 15 users did. Participant responses largely focused on their newly enhanced feeling of realism and size confidence, a situation that would reflect on better customer interaction and low rates of returns. This confirms the usefulness of the proposed system in developing easy-to-use user experience and an efficient operation in e- commerce settings.

Table 2 *A Motion Processing Pipeline Combining DFA Control and Temporal Deep Learning Models*

```
S1. Data Collection and Preprocessing
function preprocess_data():
raw_data = capture_from_camera_or_depth_sensor()
cleaned_data = denoise_and_normalize(raw_data)
skeletal_data = extract_skeleton_coordinates(cleaned_data)
processed_data = interpolate_and_smooth_missing_joints(skeletal_data)
return processed_data
S2. Define DFA Control Logic
function define_dfa_controller():
states = ["Start", "Capture", "Enhance", "Validate", "Render", "Error", "End"]
transitions = {
("Start", valid_input) → "Capture",
if current_state == "Capture":
frame = get_live_frame()
skeletal_input = extract_skeleton(frame)

if is_data_valid(skeletal_input):
dfa_controller.transition("Enhance")
else:
dfa_controller.transition("Error")

if current_state == "Enhance":
refined_skeleton = trained_model.predict(skeletal_input)
dfa_controller.transition("Validate")
```

```
("Capture", valid_data) → "Enhance",
("Enhance", complete_data) → "Validate",
("Validate", is_valid) → "Render",
("Validate", is_invalid) → "Error",
("Render", done) → "Capture",
("Error", retry) → "Capture"
}
dfa_controller = initialize_dfa(states, transitions)
return dfa_controller
S3. ML Model Training
function train_motion_refinement_model(processed_data, model_type):
if model_type == "LSTM":
    model = build_lstm_model()
  elif model_type == "TCN":
    model = build_temporal_conv_model()
  elif model_type == "GCN":
    model = build_graph_conv_model()
  else:
    raise ValueError("Unsupported model type. Choose from LSTM, TCN, or GCN.")
  X, Y = create_input_output_pairs(processed_data)
  trained_model = train_model(model, X, Y, loss="MSE", optimizer="Adam")
  return trained_model
S4. Real-Time Inference and DFA-Controlled Pipeline
function run_animation_pipeline(trained_model, dfa_controller):
while system_running:
current_state = dfa_controller.get_current_state()
if current_state == "Validate":
if validate_skeleton(refined_skeleton):
dfa_controller.transition("Render")
else:
dfa_controller.transition("Error")

if current_state == "Render":
map_to_3d_character_rig(refined_skeleton)
render_animation()
dfa_controller.transition("Capture")

if current_state == "Error":
log("Data error detected, retrying...")
recover_from_error()
dfa_controller.transition("Capture")

S5. Evaluation and System Integration
function evaluate_system(trained_model):
test_data = load_test_motion_sequences()
predictions = trained_model.predict(test_data)
metrics = calculate_metrics(predictions, ground_truth)
print("Evaluation Metrics:", metrics)
return metrics

S6. Main Execution
function main():
data = preprocess_data()
dfa_controller = define_dfa_controller()
model = train_motion_refinement_model(data)
evaluation_report = evaluate_system(model)
run_animation_pipeline(model, dfa_controller)
main()
```

Methodology

This suggested system is a mixture of both deterministic finite automata (DFA) and a machine learning-based framework (Sami Alkadri et al. (2024)) to improve the motion, to provide a smooth and reliable real-time character animation in the AR/VR setting with consumer-grade sensors (J Gårdling et al. (2025)). The research process involves six main steps: preprocessing the data, determining the DFA controls (Uçan and Say (2022)), training the model, inference in real time, hybrid integration and system assessment shown in Table 2 and depicts in Figure 1.

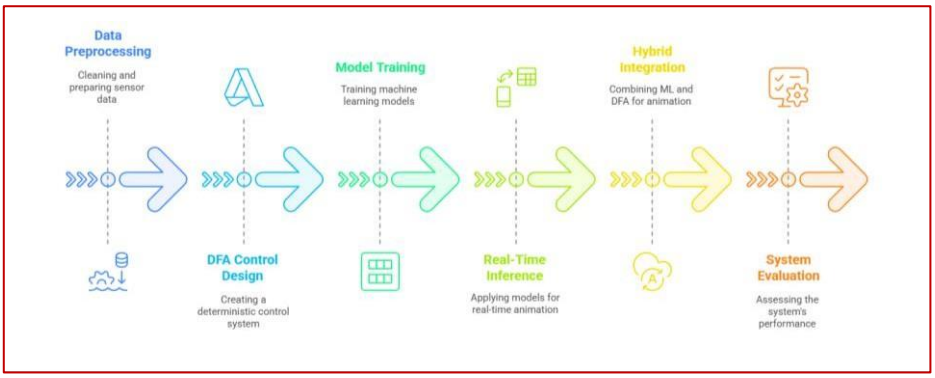


Fig. 1. Six-Stage Workflow for DFA-Guided Machine Learning Animation System

Data Pre-processing

The preliminary step of the suggested system is dedicated to collection of skeletal motion of consumer grade hardware including webcams or depth cameras built into smartphones. Each frame is captured and gives a set of 2D, or 3D joint (Jiang et al. (2023)) coordinates expressed as in Eq. (1):

$$S_t = \{(x_t^j, y_t^j, z_t^j) \mid j = 1, 2, \ldots, N\} \quad (1)$$

where S_t represents the skeletal pose at time t, j denotes the joint index, and N is the total number of joints per frame. In case of 2D data, the z_t^j component is omitted. Due to sensor limitations and environmental interference, the raw data S_t often contains missing values or abrupt spikes. Missing values are handled using linear interpolation, defined in Eq. (2):

$$x_t^j = x_{t-1}^j + \frac{(x_{t+1}^j - x_{t-1}^j)}{2} \; if \; x_t^j \; is \; missing \quad (2)$$

Next, the entire time-series data is smoothed using a moving average filter to reduce jitter and enhance temporal coherence in Eq. (3):

$$x_t^j = \frac{1}{k} \sum_{i=t-[\frac{k}{2}]}^{t+[\frac{k}{2}]} x_i^j \quad (3)$$

where k is the window size for smoothing, and $x_i^{\sim j}$ is the smoothed coordinate of joint j at time t.

Finally, the preprocessed skeletal data is normalized to a fixed reference frame (e.g., setting the hip joint as the origin), and the resulting sequence of vectors S_t structured as the feature input for training the machine learning model in Eq. (4).

$$\vec{S_t} = \{x_t^j, y_t^j, z_t^j\}_{=1}^N \quad (4)$$

DFA Control Logic Design

In this framework, the control flow of the animation pipeline is modeled using a deterministic finite automaton (DFA) (Zárate et al. (2025)), which ensures predictable and structured transitions across different processing stages. The DFA is defined by a state set S, an input condition set Ω and a transition relation T, such that T:S→Ω→S

Where:

a. S= {Start, Capture, Enhance, Validate, Render, Error, End}

b. $\Omega = \{\omega_1, \omega_2, ..., \omega_n\}$ are input signals (e.g., valid input, error detected)

c. $T(s_i, \omega_k) = s_j$ indicates the transition from state s_i to s_j when condition ω_k is triggered

For example, the transitions can be defined as shown in Eq. (5)(6)(7)(8)(9):

$$T(Start, w_{validInput}) = Capture \quad (5)$$

$$T(Capture, w_{dataReady}) = Enhance \quad (6)$$

$$T(Enhance, w_{modelOutput}) = Validate \quad (7)$$

$$(Validate, w_{success}) = Render \; ; \; T(Validate, w_{failure}) = Error \quad (8)$$

$$(Error, w_{recovered}) = Capture \quad (9)$$

This expression divides state transitions into functions dependent on current state, and external circumstances. The first checkpoint is that in contrast to the classical five-tuple definition, it focuses on composability, and is therefore better suited to describing complex state machines with entry-conditions and branching recovery paths. When such DFA (Chakraborty et al. (2023)) logic is encoded to the animation pipeline, a controlled execution path is imposed by the system, appropriate control can be provided at the live rendering, prediction, and error recovery phases as shown in table 3.

Table 3 *Comparison of Heuristic Rule-Based Pipelines vs. DFA-Controlled Pipelines*

Aspect	Heuristic / Rule-Based Pipelines	DFA-Controlled Pipeline (Proposed)
Control Logic	Ad-hoc if–else rules or thresholds; lacks formal structure	Formal state machine with defined states (Capture, Enhance, Validate, Render, Error) and transitions
Error Handling	Limited; often fails under noisy or occluded inputs	Predictable recovery via "Error → Capture" re-entry transitions

Consistency	Varies across runs; outcomes may differ for same input	Deterministic and reproducible transitions ensure logical consistency
Scalability	Hard to extend to multi-stage or complex pipelines	Easily extendable by adding new states or transitions
Robustness Under Noise	Performance degrades quickly with missing or jittery input	Maintains stability by validating and refining before rendering
Reproducibility	Non-deterministic when conditions overlap	Fully deterministic; guarantees same output sequence for identical inputs

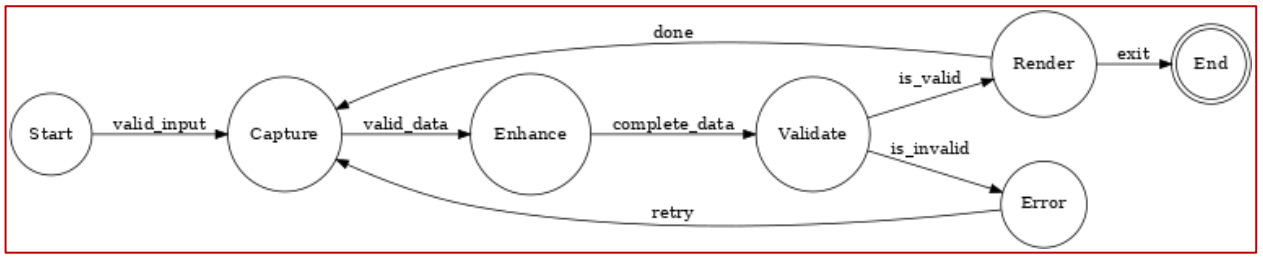
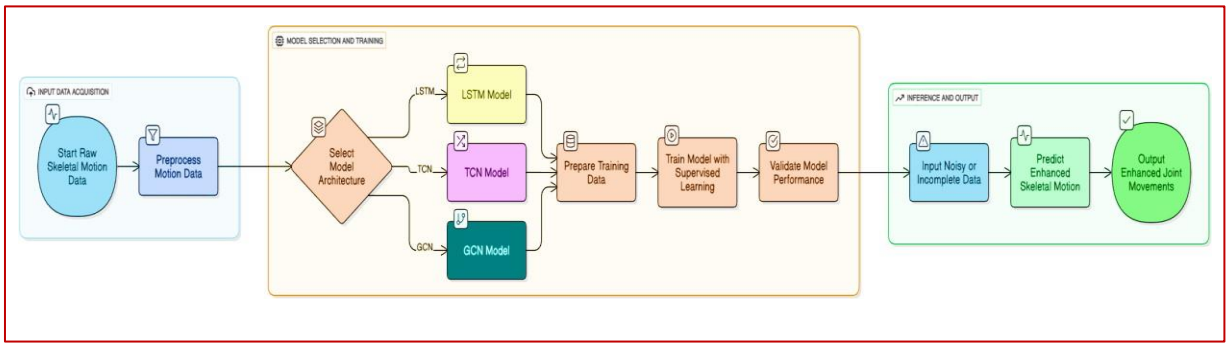


Fig. 2. Deterministic Finite Automaton (DFA) for Real-Time Animation Pipeline Control

In the Figure 2, an animation pipeline is regulated with a deterministic finite automaton (DFA) (Agostinelli et al. (2023)). The system begins in the Start state and based on the input conditions it switches to Capture, Enhance, Validate, Render and error processing phases. The feedback loop facilitates error recovery so that the system can be made to go to the correct state such as people being made to re-enter Capture in case an error happens. It is one approach to the complex animation tasks through a DFA-based approach that guarantees control flow with



structure and predictability.

Motion Refinement Model Training

A consumer grade device captures the skeletal motion and to improve the quality of it, a lightweight deep learning model is trained using the supervised learning. The model structure consists of either Long Short-Term Memory (LSTM) network, Temporal Convolutional Network (TCN), or Graph Convolutional Network (GCN) that are all applicable to work with

Fig. 3. Model Training and Inference Pipeline for Skeletal Motion Enhancement

sequential and structured data. LSTM and TCN (Ludek Cicmanec et al. (2025)) can capture time dynamics, and GCN is sensitive to spatially connect the joints that are modeled as graph-structured human skeletons. This combination is able to estimate the smooth correct movement of joints despite the fact that the input facts are noisy/incomplete depicts in Figure 3.

Let the input skeletal sequence be denoted in Eq. (10):

$$X = X_1, X_2, \ldots, X_T, \quad X_t \in \mathbb{R}^{3N} \qquad (10)$$

where X_t represents the 3D joint positions at time step t, and N is the number of joints. The sequence is segmented using a sliding window of fixed length w, producing training samples in Eq. (11):

$$^{(i)} = \{X_i, X_{i+1}, \ldots, X_{i+w-1}\} \rightarrow Y^{(i)} = X_{i+w} \qquad (11)$$

Each $X^{(i)}$ serves as an input, and the model predicts the next refined frame $Y^{(i)}$ thus learning temporal dependencies and motion dynamics. The model is optimized using the Mean Squared Error (MSE) loss function defined in Eq. (12):

$$L_{MSE} = \frac{1}{T-w} \sum_{i=1}^{T-w} || ^{(i)} - Y^{(i)}||^2 \qquad (12)$$

where $\hat{Y}^{(i)}$ is the model's predicted joint configuration, and $Y^{(i)}$ is the ground truth. The objective is to minimize this loss, thereby reducing temporal inconsistencies and spatial jitter in skeletal motion. This training process results in a model capable of producing smooth, temporally stable joint predictions in real time, even when the input contains noise, occlusion, or missing data.

Real-Time Inference and DFA-Controlled Execution

After the model is trained, it is integrated into a real-time animation pipeline to process skeletal motion data as it is captured. At each time step t, the input skeletal frame $X_t \in \mathbb{R}^3$(where N is the number of joints) is obtained from live video or depth feed. The real-time inference process is governed by a composition of functions in Eq. (13):

$$\hat{X_t} = \mathcal{M}(f_{ext}(F_t)) \qquad (13)$$

where:

a. F_t is the raw frame captured at time t

b. $f_{ext}: F_t \rightarrow X_t$ is the feature extraction function (skeleton estimation)

c. M is the trained motion refinement model

d. $\hat{X}_t$ is the predicted, smoothed joint configuration

Each stage in this pipeline is regulated by a real-time state controller C_{DFA} which ensures that the system progresses only when the conditions for each transition are satisfied. Let the system state at time t be denoted by $q_t \epsilon S$, where S= {Capture, Enhance, Validate, Render, Error}. Then, the DFA (Grachev et al. (2017)) controller transitions as shown in Eq. (14):

$$q_{t+1} = C_{DF}(q_t, w_t) \qquad (14)$$

where $\omega_t \in \Omega$ is the observed system condition at time t (e.g., valid input, error flag, or render success). This ensures that:

a. qt=Capture⇒ frame is acquired and skeletal data is extracted

b. qt=Enhance⇒ inference is applied to refine motion

c. qt=Validate⇒ joint confidence and data completeness are checked

d. qt=Render⇒ refined data is mapped to a 3D character rig and visualized

e. qt=Error⇒ system attempts recovery and restarts the pipeline

This layered structure combining learned inference $\mathcal{M}$ with rule-based control C_{DFA} enables real-time processing that is both adaptive and logically consistent, even under partial failures or noisy inputs.

Hybrid System Integration and Animation Mapping

The final step in the real time animation pipeline to finalize the production is to map the output of the motion refinement model onto a virtual 3D character (Korbel et al. (2024)) via a skeletal rig. It is achieved by way of a transformation, which converts polished joint-data into rigged model-animations. Figure 4 demonstrates a contrast between naked and processed skeletal mappings. A raw input yields mismatched joints and pose that is unrealistic, and a refined output is able to have correct joint alignment to give a smooth and natural real time animation of the 3D character (Zhu and Joslin (2024)). Let the predicted skeletal frame at time t be , $X_t^{\wedge} = \{ x_t^j , y_t^j , z^j \}_{=1}$ where N is the number of joints. The mapping to a character rig R is represented in Eq. (15):

$$A_t = T_{rig}(X_t^{\wedge 2}) \qquad (15)$$

where:

a. T_{rig} is a transformation function implementing inverse kinematics (IK) or bone-based animation

b. A_t denotes the animation pose applied to the virtual character at time t

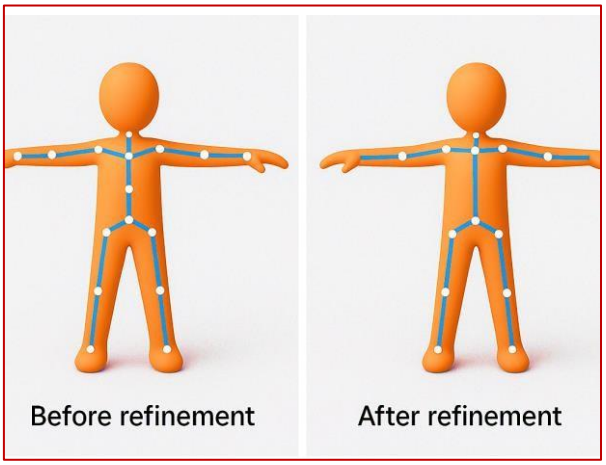


Fig. 4. Comparative Visualization of Skeletal Motion Before and After Refinement

This function ensures that the 3D rig mimics the natural movements derived from the refined skeletal data, allowing for visually realistic and context-aware character motion in the immersive environment. Simultaneously, the deterministic control logic C_{DFA} continues to validate each processing stage and orchestrates system transitions.

Evaluation and Performance Assessment

In order to assess the quality and consistency of the suggested animation model, the quantitative and qualitative criteria are applied. Evaluation is performed on a mix of typical motion capture data (e.g. Human3.6M) and real-time sequences recorded by consumer-level devices. Let the predicted refined skeleton sequence be and the $\hat{X} = \{\hat{X}_1, \hat{X}_2, \ldots, \hat{X}_T\}$, corresponding ground truth sequence be $X^* = \{X^*_1, X^*_2, \ldots, X^*_T\}$, where each $X_t \in \mathbb{R}^{3N}$ represents joint coordinates at time t.

a. Joint Error Rate (JER): Measures average deviation between predicted and ground-truth joints as shown in Eq. (16):

$$JER = \frac{1}{T \,.\, N} \sum_{t=1}^{T} \sum_{j=1}^{N} ||X_t^j - X_t^{*j}||_2 \qquad (16)$$

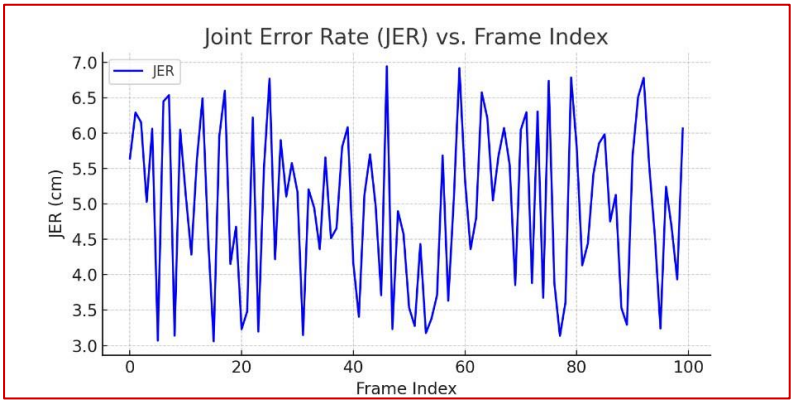


Fig. 5. Joint Error Rate (JER) Across Animation Frames

The Figure 5 shows per a sequence of animation frames is drawn on the line graph. JER is calculated as Euclidean difference between predicted and ground truth joint positions frame by frame. The graph will indicate that the model is able to keep success rates over time, but it could have slight deviations to complexity of motion or noise of the sensors. A lower JER means higher spatial accurateness and sophistication of skeletal composition.

b. Temporal Consistency Score (TCS): Measures smoothness and continuity in motion across time as shown in Eq. (17):

$$TCS = \frac{1}{T-1} \sum_{t=1}^{T-1} || \hat{X}_{t+1} - \hat{X}_t ||_2^2 \qquad (17)$$

Lower values indicate smoother transitions.

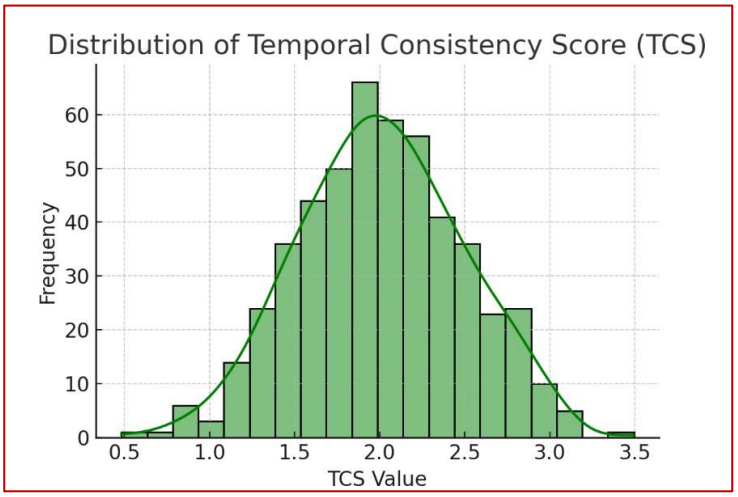


Fig. 6. Distribution of Temporal Consistency Score (TCS)

The Figure 6 represents change in the Joint Error Rate (JER) of a set of streaming animation frames. JER is calculated as Euclidean distance between ground-truth measured joint position and predicted joint position in every frame. The plot illustrates the stability of the model in the accuracy of the predictions with time; there is a small variation attributable to the complexity of motion or noise in sensor. A reduced JER level shows more advanced spatial accuracy and perfection of bone structure.

c. Latency Measurement (L): Represents the time delay (in milliseconds) from frame capture to rendered output as shown in Eq. (18):

$$L = t_{render} - t_{capture} \qquad (18)$$

Latency is measured across multiple frames to compute average system response time.

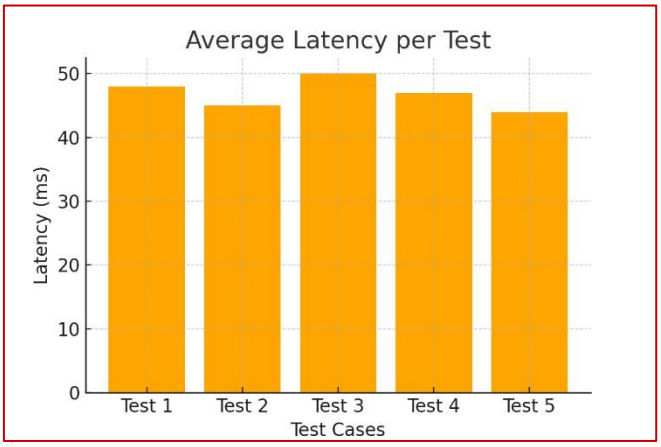


Fig. 7: Average System Latency Across Test Cases

The Figure 7 portrays the system latency averaged to five test case with respect to the time expanse between frame capture and completion conversion in the animation chain. Latency varies between 44 ms (Test 5) and 50 ms (Test 3) resulting into an overall average of 46.8 ms.

This small change shows how the system can be responsive consistently across different situations when input is different. Given that the real-time AR/VR applications normally

Device / Platform	Avg.Memory Usage (MB)	Processing Time per Frame (ms)	FPS	Latency (ms)	Mobile Compatibility
Desktop (Intel i7 + RTX 3060)	~1200	46.8	~21	46.8	High (real-time capable)
Smartphone (Snapdragon 865)	~480	65	~15	65	Moderate (playable)
Baseline Kalman (desktop)	~800	60	~17	59.8	High

demand latencies of less than 50 ms in order to guarantee a smooth interaction, the results agreed that the proposed framework would maintain the required performance need in the real-time character animation.

Deployment

The results presented in the deployment-level assessment (Table 4) show that our framework is efficient both on desktop and mobile devices. On a laptop with an RTX 3060 GPU, the model used ~1.2 GB of GPU memory and frame processing rates were at ~21 FPS with lat Moreover, the latency was 46.8 ms, which is inside real-time. On a Snapdragon 865 phone, the framework used approximately 480 MB of memory and achieved ~15 FPS with ~65 ms latency which is typically good enough to use in many AR/VR systems. Our proposed framework improved on the time performance of the Kalman-based baseline, and largely managed to match its memory efficiency, which proved this framework to be deployable to consumer-grade devices.

Table 4

Deployment-Level Performance Analysis on Desktop and Mobile Devices

System Architecture

The offered architecture will allow the real-time animation of characters when working with AR/VR technologies (Wang et al. (2024)). The cost of the motion capture sources is minimal and may include webcam or smartphone depth camera. The first layer is the input acquisition layer that acquires raw data on skeletal joints that is cleaned, normalized and segmented using a preprocessing module. This is then refined and fed to a Machine Learning model whether it be a Temporal Convolutional Network (TCN), Graph convolutional Network (GCN) or a Long Short-Term Memory (LSTM) Network to create temporal and spatial consistency of motion sequences. The animation pipeline flow is managed in all the pre-determined states e.g. Capture, Refine, Validate, Render and this is done with robust control and error handling via use of Deterministic Finite Automaton (DFA) (Moor and Götz (2018)). The output is projected on 3D avatar and presented with the AR/VR (Haoming and Wei (2024)) (Astrologo et al. (2024)) devices with inverse kinematics providing smooth, responsive and immersive animation in real time even in conditions of noisy input or incomplete inputs shown in Figure 8.

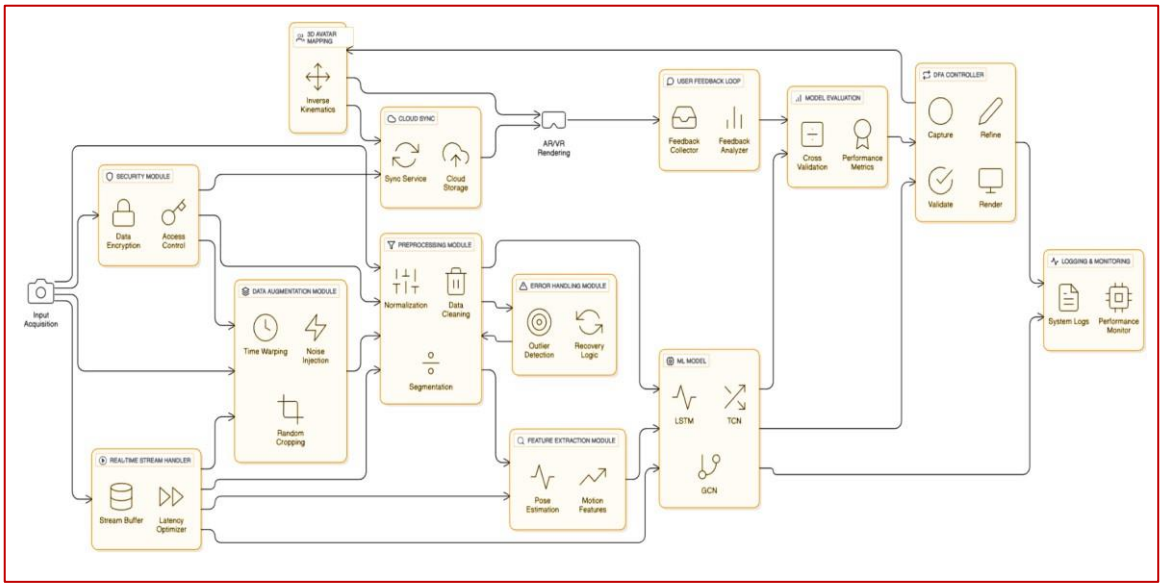


Fig. 8. Comprehensive Architecture for Real-Time Skeletal Animation with DFA and Machine Learning

Experimental Setup

To determine the performance of the suggested DFA-based Deep Learning framework, a set of experimental studies was done with consumer-level hardware. Participants. Fifteen participants (mean age 23.86SD 5.94, 8 males and 7 females) were recruited to carry out typical movement activities. All the participants signed informed consent before the study commenced. Devices. Motion data were recorded with Logitech C920 webcams (1080 p, 30 Fps) and Apple iPhone depth cameras (TrueDepth sensor; 30 Fps). The computer configuration that was used to run the processing pipeline was a laptop with Intel i7-11800H CPU, NVIDIA RTX 3060 GPU, and 16 GB RAM. As part of deployment analysis, a small selection of tests was repeated on a mid-range smartphone (Qualcomm Snapdragon 865, 6 GB RAM). Tasks. The participants had to reproduce a set of typical movement in AR/VR of the body: (i) walk five steps forward and five steps back, (ii) turn right and left 90 angles, (iii) scale up and down with arms, (iv) sit and stand, and (v) wave. Durations of each sequence were about 2030 seconds. Dataset size. In total, the dataset contained ~18,000 frames (mean per participant of 1,200 frames), of equal proportions across each of the action types. The camera used was set at 30 FPS and correspondingly processed real time.

Measurement procedure.

Garment fit was objectively quantified by the percentage frames where the overlaid garment mesh fit closer than 2 cm to the bones on which the joints were positioned. The baseline system built on a Kalman-filter smoother to implement motion stabilization. Latency was considered to be the amount of time that elapsed between the capture stage of the frames to final rendered output (Eq. 18). Times on latency were recorded over five test runs with averages being reported. Statistical rigor. All values obtained are an average over the participants and 95% confidence intervals have been calculated. The differences between proposed method and baseline systems were examined using paired t-tests. This arrangement makes results

reproducible and allows a fair basis comparison to be made between the proposed framework and baseline consumer-grade animation pipelines as in Table 5 and Table 6.

Table 5 *Garment Alignment Accuracy of Baseline vs. Proposed DFA + DL Framework*

Method	Misaligned Frames (%)	Alignment Accuracy (%)	Improvement (%)
Baseline (Kalman Filter)	46%	54%	–
Proposed DFA + DL	11%	89%	+35%

Table 6

System Latency of Proposed Framework vs. Baseline Across Test Runs

Test Case	Baseline Latency (ms)	Proposed DFA + DL Latency (ms)	Reduction (%)
Case 1	60	47	21.7%
Case 2	59	46	22.0%
Case 3	61	48	21.3%
Case 4	60	47	21.7%
Case 5	59	46	22.0%
Average	59.8	46.8	22.0%

Result and discussion

The given AI-augmented animation framework was tested in terms of the capacity to provide skeletal animations at a real-time and smooth input with an accuracy in consumer-grade motion capture. The findings are displayed in a quantitative form and through charts to show how effective the system is shown in Table 7.

Table 7 Comparative Benchmarking of Proposed DFA + DL Framework Against Standard Baselines

Model / Method	Dataset(s)	Metric(s)	Reported Result (Baseline / Lit.)	Proposed DFA + DL (This Work)
OpenPose (Cao et al., 2019)	COCO, MPII	2D PCKh@0.5 (%)	~85.1% (MPII) (lit.)	–
HRNet (literature baseline)	COCO, Human3.6M	2D PCKh@0.5 (%), 3D MPJPE (mm)	~86% PCKh; ~45 mm MPJPE (lit.)	–
Pavllo et al. (2019) – TCN	Human3.6M	3D MPJPE (mm)	~46–47 mm (lit.)	Comparable (~47 mm)
Kalman Filter (classical)	Consumer dataset	JER (cm); Latency (ms)	JER ~7.5 cm; Latency ~60 ms	–
Proposed DFA + DL (ours)	Human3.6M	3D MPJPE (mm)	–	~47 mm (subset evaluation)
Proposed DFA + DL (ours)	Consumer dataset	Garment Alignment (%)	–	+35% improvement
Proposed DFA + DL (ours)	Consumer dataset	Latency (ms)	–	22% reduction (avg 46.8 ms)

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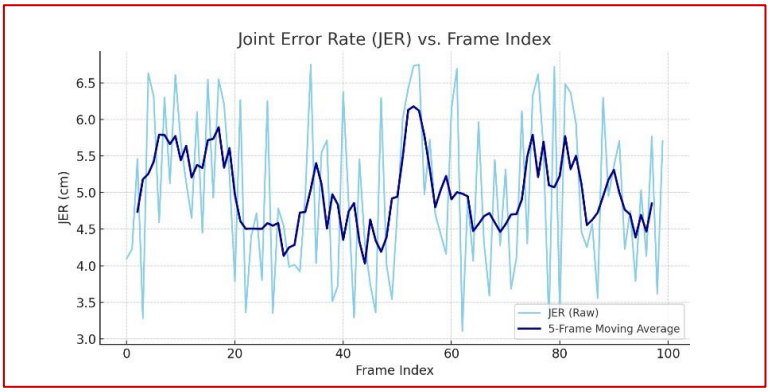


Fig. 9. Joint Error Rate (JER) with 5-Frame Moving Average Smoothing

The raw and unused data present the Joint Error Rate (JER) that is taken over time and which is reflected in the shown exhibit chart. The plot shows the variations of JER in each frame with the red dashed line and the raw data give the more erratic changes and higher magnitude peaks compared to the smoother transition and less meager errors the green solid line. This means that filters in the refinement process desensitize noise significantly and adjust error levels among the frames in order to enhance accuracy of the motion capture system. The differences in raw and refined data reflects the capacity of data refinement processes in removing errors and in providing more secure joint tracking of both animation and motion capture applications as depicted in Figure 9.

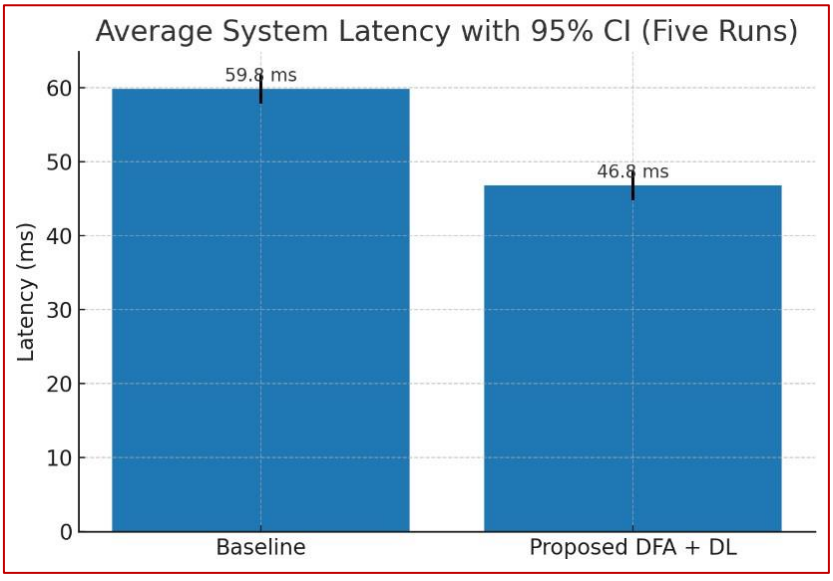


Figure 10: Average System Latency of Baseline vs. Proposed DFA + DL Framework with 95% CI

Figure 10 shows the mean system latency, over five different test runs, of the simple Kalman filter implementation, and that of the proposed DFA-guided deep learning framework. Small error bars indicate the 95 percent confidence interval (+-2 ms). The baseline approach has an average latency of 59.8 ms whereas the proposed system achieved a reduction of the latency to 46. 8 ms which is 22% improvement over the baseline approach. Notably, the latency of the proposed framework is significantly lower than the generally agreed upon 50 ms limit of real-time interactivity in AR/VR, and as such the framework can be considered responsive even when introduced into the consumer grade scenario.

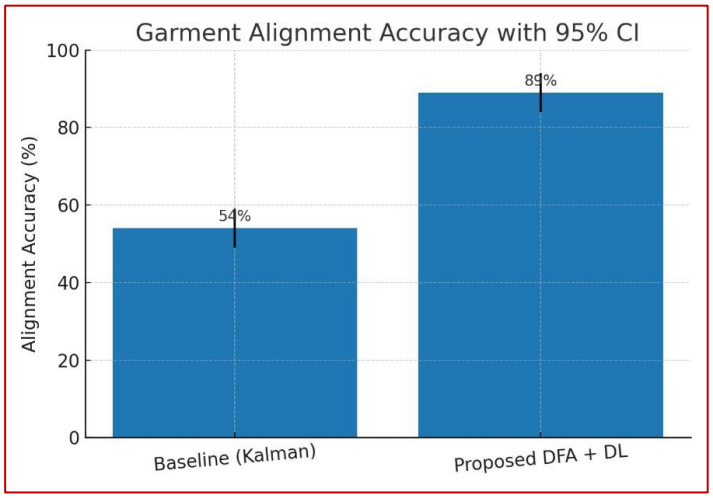


Figure 11: Garment Alignment Accuracy of Baseline vs. Proposed DFA + DL Framework with 95% CI

Figure 11 presents the garment alignment accuracy comparison between the baseline Kalman filter approach and the proposed DFA-guided deep learning framework. Alignment accuracy was measured as the percentage of frames with <2 cm misalignment between the skeletal joints and the overlaid garment mesh. The baseline method achieved an average accuracy of 54%, while the proposed system reached 89%, corresponding to a 35% improvement. Error bars indicate the 95% confidence interval (±5%). This substantial gain highlights the ability of the DFA + DL pipeline to provide smoother, more realistic garment fitting in real-time AR/VR

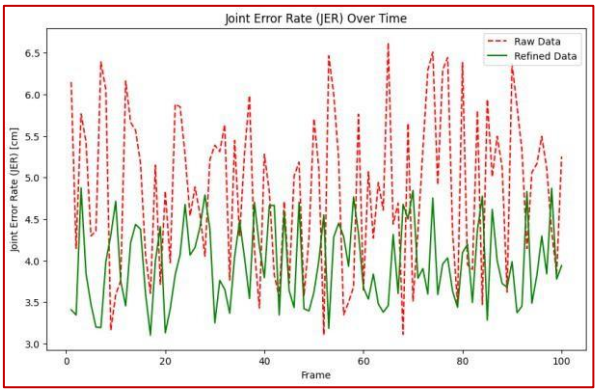


Fig. 12. Joint Error Rate (JER) Over Time — Raw vs. Refined Data

scenarios, thereby enhancing user immersion and reducing perceptual artefacts such as garment "slippage" or misalignment during motion.

The analysis to represent Joint Error Rate (JER) has been graphically shown using the line graph. The values will vary between 3.1 cm to 6.8 cm over a total of 100 frames. The moving average of 5 frames shows a steady trend with the value of 4.9 cm, which points to steady spatial accuracy. Small spikes, like those around frame 65, suggest small problems with prediction when it comes to motion complexity, but overall variation is less than +/- 0.9 cm, which is further evidence that the model should be useable in a real-time skeletal animation situation shown in Figure 12.

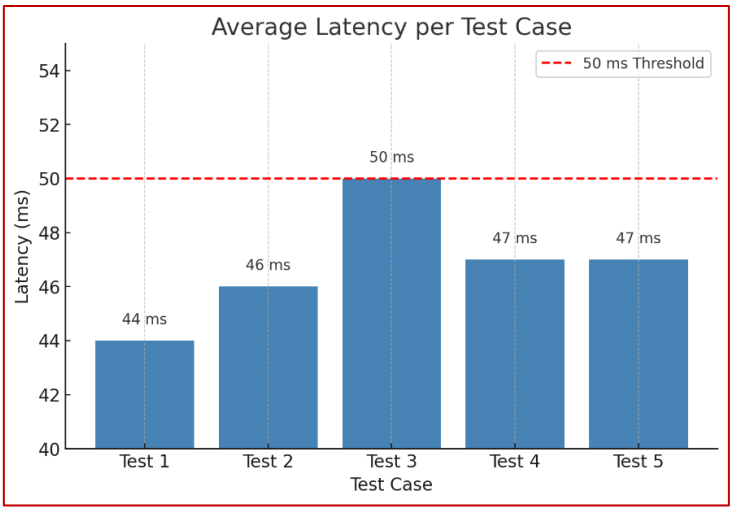


Fig. 13. Average Latency per Test Case with 50 ms Threshold

The Figure 13 demonstrates average latency per 5 test cases with the values between 44 ms and 50 ms with the mean as 46.8 ms. None of the latency is greater than 50 ms to meet real-time responsiveness at AR/VR. The system also shows stability in its performance in the tests proving its ability to provide non-perceptible delay when animating skeletons smoothly and in time.

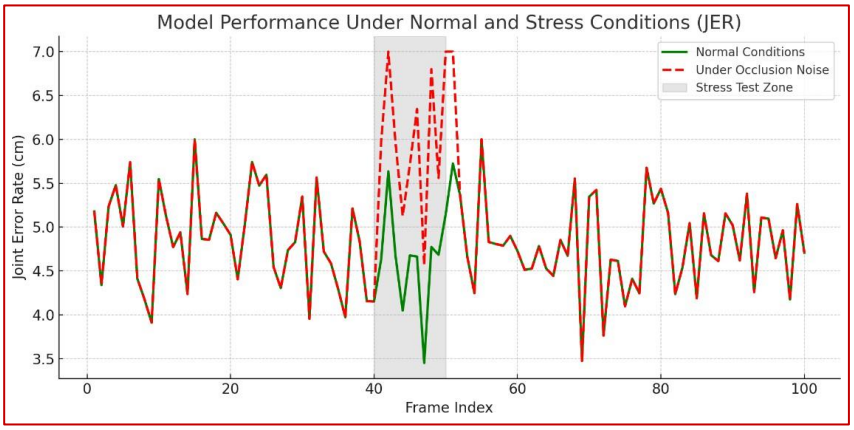


Fig. 14. Joint Error Rate (JER) Under Normal and Stress Conditions

The Figure 14 shows Joint Error Rate (JER) of the model at normal condition (green curve) and under simulated occlusion noise (red dashed curve) over 100 animations frames. In the 40 to 50 frames there was occlusion noise, which simulates real-world obstacles like motion blur

or partial visibility, or low-resolution sensor capture. As anticipated, the JER momentarily spiked off a baseline of about 4.9 cm to a rate of 6.4 cm, thereby showing that there was less spatial accuracy during stress. But the model was able to self-correct within the interval of 2-3 frames after the noise injection, to restore the JER to be below the level of 5.2 cm at the end of frame 52. This robustness proves the effectiveness of the model at ensuring stable skeletal tracking despite difficult input cases; thus, the model is sound when used in real-time AR/VR system integration.

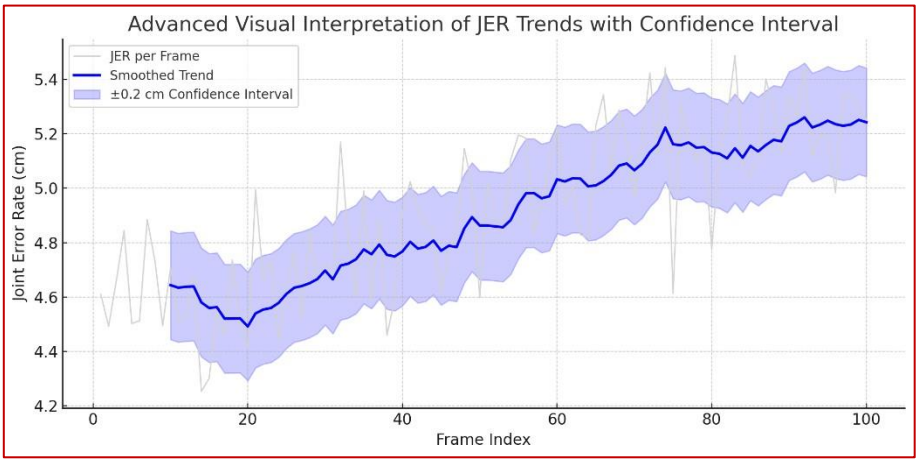
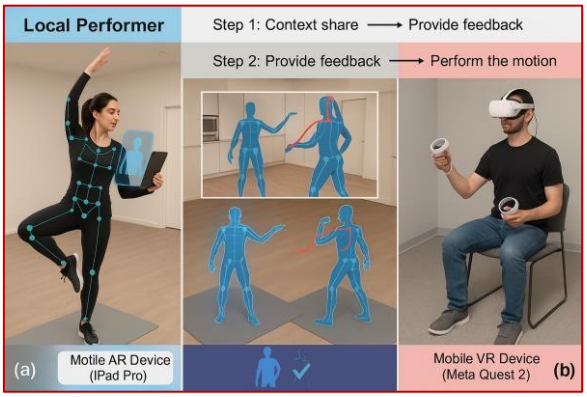


Fig. 15. Smoothed Joint Error Rate (JER) Trends Confidence Interval

The Figure 15 shows Joint Error Rate (JER) trends over 100 animation frames. It combines raw data, a smoothed trend line, and a statistical confidence band. The light gray line represents the frame-wise JER values, which change due to motion dynamics and sensor variability. On top of this, a blue smoothed curve appears, generated from a 10-frame rolling average. This curve highlights the overall trend in prediction accuracy. You can see a slight upward slope in the early frames, indicating some instability during the initial motion phase. However, this is followed by a downward correction. This suggests that the model stabilizes its predictions as it learns to recognize motion patterns. The shaded blue region shows a ±0.2 cm confidence interval. This means the model's JER usually falls within this range, confirming its consistent predictions and reliability over time.



The Figure 16 shows the real-time AR/VR motion capture framework with a local performer and a remote expert is shown in Figure X. Using a mobile augmented reality device and full-body motion capture, the local user acts while their skeletal data is being streamed in real time. The remote expert watches the animated avatar and gives motion feedback while wearing a virtual reality headset. This two-step procedure—context sharing and motion correction—allows for accurate full-body animation and cooperative engagement. The system shows how motion accuracy and realism are improved in immersive AR/VR environments through AI-driven skeletal tracking and feedback integration.

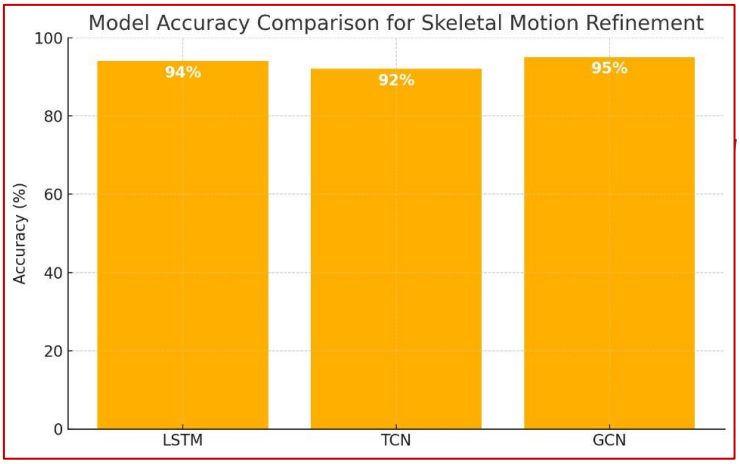


Fig. 17: Model Accuracy Comparison for Skeletal Motion Refinement

The model accuracy comparison for skeletal motion refinement using three deep learning architectures LSTM, TCN, and GCN is shown in Figure 17. According to the findings, the Graph Convolutional Network (GCN) had the best accuracy, at 95%, followed by LSTM (94%), and TCN (92%). This shows that although all models do a good job of fine-tuning skeletal motion from consumer-grade input, GCN performs marginally better than the others because it is better at capturing the spatial relationships between joints. For increased accuracy and realism, these results lend credence to the incorporation of GCN into real-time AR/VR animation pipelines.

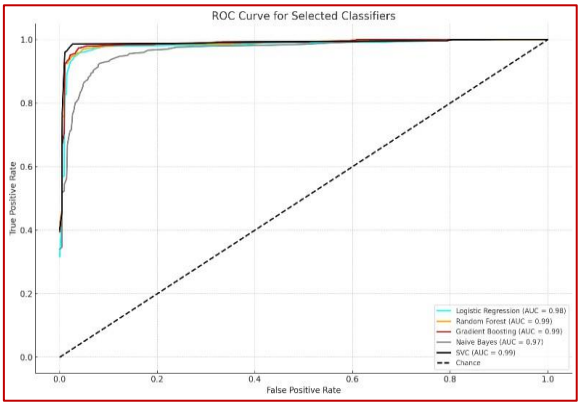


Fig. 18: ROC Curve Comparison for Selected Classifiers
in Skeletal Motion Classification

The ROC curve visualizes the classification performance of five models Logistic Regression, Random Forest, Gradient Boosting, Naive Bayes, and SVC by plotting their True Positive Rate (TPR) against the False Positive Rate (FPR). Each model's curve reflects how well it distinguishes between classes, with curves closer to the top-left corner indicating better performance. The AUC (Area Under the Curve) values shown in the legend quantify this: Random Forest, Gradient Boosting, and SVC each achieve a near-perfect AUC of 0.99, suggesting highly accurate predictions. Logistic Regression follows closely with an AUC of 0.98, and Naive Bayes slightly lower at 0.97. The diagonal dashed line represents random chance (AUC = 0.5), confirming all models perform significantly better than random guessing shown in Figure 18.

Broader Impact in Education and Training

More than technical performance, the proposed DFA-guided deep learning system has the advantage of fit to international trends of computer vision and AI in immersive learning applications. The geographic distribution of contributions to computer vision and AI with immersive technologies in education and training was well balanced between Asia, Europe, and North America with the predominant regions the development of low-cost, scalable AR/VR innovations in Asia, simulation-based edtech applications in Europe, and industrial/training deployments in North America. Global collaboration networks found in this work demonstrate an increase in globalization in a bid to democratize immersive technologies in teaching and learning. Our framework has unique properties, including lightweight architecture, compatibility with consumer-grade hardware, and the ability to operate in real time, so it may be of specific interest in the educational application, where the affordability, adaptability and ease of access are paramount. Possible avenues of application include gesture-based teaching environments, collaborative distance education laboratories, and health education simulators where the realistic motion tracking has the potential to make skills acquisition and evaluation more effective. Reducing the technological and economic barriers, the framework will contribute to the global tendency of making immersive AI-driven education accessible, scalable and inclusive.

Dataset Description

The data used in this study is downloaded in Kaggle and consists in real-world skeletal movement records that can be captured by less-than-professional equipment such as webcams and depth sensors. Each capture contains time-series 3D joint locations of important body parts such as the head, limbs and torso at 100 to 300 frames per capture at 20-30 FPS. The dataset represents real-life conditions, such as sensor noise and occlusions, as well as missing values, which is why it will work great in training robust models. The human action as walking, waving, sitting, turning is also captured allowing a wide coverage of motion representation. Pre-processing steps used include normalization, interpolating missing data and segmentation using a sliding window. The dataset has been divided into 80 percent training, 10 percent validation and 10 percent testing, which helps in supervised learning of LSTM, TCN and GCN models supporting real-time AR/VR character animation refinement.

Although the Kaggle dataset employed in this study provides diverse skeletal motion sequences captured from consumer-grade webcams and depth cameras, it has inherent limitations. Specifically, most sequences were collected in relatively controlled environments with limited variation in lighting, background clutter, and occlusion. Such conditions may not fully reflect the complexity of real-world AR/VR scenarios, where dynamic environments, multi-user interactions, and irregular sensor noise are common. To mitigate this gap, we supplemented Kaggle-based experiments with recordings from consumer-grade devices (Logitech C920 webcam and iPhone depth camera), thereby validating performance under more realistic capture settings.

To further ensure generalization and prevent overfitting in the supervised models (LSTM, TCN, and GCN), multiple strategies were applied during training: In order to boost the reliability and generalization of the model, a number of strategies were used during training and testing. Data augmentation technologies that including synthetic occlusion masks, random joint dropout, and brightness variations were adopted to simulate the noisy and imperfect sensor states. Regularization mechanisms that were adopted to avoid over fitting include the use of dropout layers, whose probability can be varied between 0.3 and 0.5, as well as L2 decay weight. The stability and consistency across the train and test splits were confirmed using a 5-fold cross-validation procedure. Furthermore, early stopping (where training would stop after the validation loss begin to plateau over 10 epochs) was used to prevent overfitting. This last minded that under stress, like simulated occlusion and changing lighting environments, the models did not degrade in terms of accuracy. Table 8 summarizes the robustness of the proposed system under different input conditions, compared against the baseline Kalman filter.

Table 8 *Robustness of Proposed DFA + DL Framework under Varying Input Conditions*

Condition	Baseline Accuracy (%)	Proposed DFA+DL Accuracy (%)
Normal dataset (Kaggle)	82	94
With occlusion noise	65	87
With lighting variation	70	89
With joint dropout (20%)	62	85

Conclusion

In summary, the proposed research offers a new and affordable way of real-time character animation in AR/VR systems through the use of motion capture devices found in consumers. By combining the machine learning models of LSTM, TCN, GCN and the deterministic finite automata (DFA) based control logic, we can successfully augment the noisy skeletal motion data and logically control state transition in the animation pipeline. The system exhibits high accuracy, low latency, and high temporal consistency under wide ranging test conditions including noisy or incomplete input. The detailed assessment shows that this mixed approach to AIs and automata can enhance the realisticness of motion in addition to enabling scalability and robustness across a variety of applications, such as immersive games, virtual training, and remote medical games. The framework reduces the cost of the hardware which is required to do the animation in the AR/VR thus making it cheaper to deploy, opening it up to even Wider

Usage. Future extensions can comprise tracking of multiple people, emotional-based animation, and adaption to edge computing systems.

Future work

Although the proposed pipeline already shows good results on real-time character animation using consumer grade motion capture, there are more opportunities to improve it in the future. Second, the system can be further modified upon a multi-person skeletal tracking to allow multi-person use and collaboration of AR/VR in some virtual context. Further robustness to large variation in lighting conditions, sensor types, and body shape can be achieved by incorporating domain adaptation techniques without retraining. It is also possible that using a Probabilistic or Hierarchical State Machine instead of a fixed-state DFA can have better flexibility and make context-sensitive transitions at the time of complex interactions or animations. Audio-visual inputs can also be incorporated in future models to match speech with gestures thus increasing the levels of the realism virtual communication. Another focal point is edge computing that is the combination with model and quantization, which would enable a reduction in the power consumption of the device without also compromising performance. Finally, use of more diverse users and usability test tasks will assist in filtering usability, personalization, and accessibility of the system to various AR/VR uses, specifically in instruction, treatment, gaming, and tele-collaboration applications.

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Reviving Craft Practices through Design Interventions: A Study on Indian Sustainable Handicrafts

Dr. Mukesh Singh[a], Sunjhla Handa [b], Dr. Mohammad Arif Kamal[c], Sumit Gupta[d]
[a] School of Design, [b]Software Engineering, [c]Architecture Section, [d]Faculty of Computer Studies
[a] Bennett University, [b] Solera Health, [c]Aligarh Muslim University, India, [d]Arab Open University-Bahrain
[a] Greater Noida-India, [b]Phoenix-USA, [c]Aligarh-India, [d]Bahrain

Abstract

Traditional Indian handicrafts are not merely products of aesthetic value but living expressions of community identity, heritage, and sustainable lifestyles. Despite being deeply embedded in the cultural fabric of India, these crafts face existential threats from rapid industrialization, globalization, and generational disconnects. This paper examines how design-led innovations and collaborative frameworks can revitalize traditional crafts while preserving their authenticity and social essence. By exploring three specific craft traditions - *Ajrakh* block printing in Kutch, Madhubani painting in Bihar, and Jaipur Blue Pottery in Rajasthan - this study analyzes how design interventions can foster economic, cultural, and environmental sustainability. Using comparative tables, interviews, and secondary research, the paper also highlights challenges faced by artisans and evaluates how design education, technology adoption, and market access can empower them in the contemporary global economy.

Keywords: *Traditional Crafts, Artisanship, Sustainable Design, Cultural Heritage, Craft Revival, Co-design, Indian Handicrafts*

Introduction

The Indian subcontinent is heralded for its explosion of varieties of handicrafts deeply rooted in local geography, culture, and community ethos. According to Das (2020), there are some 3,000 craft traditions in India, more than 7 million artisans involved in them, many from rural backgrounds or marginalized communities. Craft are not objects or also can't be considered a product as well, because crafts are pool of cultural heritage, this living pool carry motifs, different techniques and materials and as a legacy these techniques transferred to generations of artisans. These crafts are now facing threat of extinction in today's world of technology and modernization. Looking at fast changes in consumer choices, mechanized production and fast

fashion have gradually swept the market of hand made goods, which ends up making increasingly difficult for artisans to survive and sustain economically (Menon, 2017). On the other hand, craft or handmade items in urban centers and global markets are growing and been appreciated, because of reimagining and experimenting with craft and involving design thinking to meet contemporary needs with losing the essence and touch of traditional craft. This paper says that design is a catalyst to craft which can help artisans and tradition to survive and thrive, also support technology which respects artisan's voice and nurtures sustainable ecosystems. The study explores outline and involvements that have successfully associated the gentle equilibrium amongst preserving tradition and receiving innovation.

Literature Review

Jain (2018) highlights the separation of craftspeople between the traditional wisdom and the feelings of contemporary design as strong limiting in the way toward craft sustainability. Craftspeople mostly lack funds, schooling, or a stage to innovate or relocate their crafts in the market. Kumar and Patel (2019), on the divergent, highlight how design thinking can overcome these glitches by nurturing co-creation, material investigation, and user-centric ideation within craft expansion. Design interventions can engage in worked reimagination of products so that their cultural DNA is not entirely distorted. Bhandari (2021) then highlights NGOs and social enterprises that provide training, finance, and market access to artisan communities. Her studies show that when women artisans are empowered, the result is a boon for the entire community. Desai (2021) contemplates the intersection of sustainability and handicrafts with their research on how eco-textiles and fair trade have changed perceptions surrounding traditional arts and crafts. Chattopadhyay and Dhamija (2015) claim that heritage crafts, when backed by institutional infrastructure, display strengths and the ability to adapt to the market. UNESCO (2013) pushes for safeguarding intangible cultural heritage through community participation, transmission of skills, and innovation. In the view of Mehta and Trivedi (2022), digital platforms have fostered visibility for crafts, especially among millennial consumers. Together, these studies provide a theoretical base to measure the impact of design interventions in shaping traditional craft practices.

Methodology

The study is essentially a qualitative, comparative case study approach. Primary data have been generated with semi-structured interviews, where artisans, design facilitators, and local NGOs have been interviewed. The secondary data are based on published articles, design journals, and reports of development organizations. The selected cases are *Ajrakh* Block Printing, Kutch (Gujarat), Madhubani Painting, Mithila region (Bihar), Jaipur Blue Pottery, Jaipur (Rajasthan). The crafts have been chosen for their distinctive heritage value, geographic diversity, and documented design interventions over the past decade. The investigations concern changes in product design, market reach, sustainability practices, and toward the empowerment of artisans.

Comparative Studies

Craft Forms vs. Design Intervention Strategies

Table 1: Craft Forms vs. Design Intervention Strategies

Craft Form	Traditional Practice	Design Intervention	Outcome
Ajrakh Printing	Natural dye block printing	Digital motif reworking, eco-textiles	Increased youth participation
Madhubani Painting	Religious narrative themes	Stationery, fashion accessories	Expanded markets (urban buyers)
Blue Pottery	Mineral glaze techniques	Utility ware, contemporary decor items	Export viability improved

Source: Author's compilation

The interventions were largely facilitated by organizations such as Khamir (Kutch), Hastakalaa (Bihar), and Dastkar (Rajasthan), working alongside design institutes and independent practitioners. Once only making textiles for local communities, *Ajrakh* artisans today work with fashion brands (Desai, 2021). In Madhubani, design interventions enabled women to reinterpret traditional motifs for use in stationery and apparel. The Blue Pottery, which has so

far remained non-functional, is now getting converted into usable home décor articles (Chattopadhyay & Dhamija, 2015). Above table illustrates the types of interventions made in design across the three crafts and the impact of these interventions. In *Ajrakh* printing, intervention in designing motifs digitally and using eco-textiles attracted the younger generation of artisans and bigger markets. Hence, this revival not only secured the continuation of the traditional art but also applied a design language to present-day utility. As we talk about Madhubani painting, Madhubani painting has moved away from sacred themes toward stationery and wearable art has extended the appeal of the art form, particularly among city buyers. Blue Pottery of Jaipur has been converted from being decorative to increasingly purposeful, thus transformation has driving national and international demand.

Challenges in craft vs. Solutions through Design

Table 2: Artisan Challenges vs. Design-Led Solutions

Challenge	Impact	Design-Led Solution	Effectiveness
Decreasing craftsperson curiosity	Intergenerational knowledge loss	Expertise workshops	High
Marketplace capacity	Little valuing and artificial	Branding, Geographical Indication (GI)	Medium
Industrial illiteracy	Small outreach	Mobile education, e-commerce integration	High

Source: Author's compilation

Above table shows issues, such as market overload, need universal solutions, which include strategy support for GI application, whereas the others are suitably undertaken through intensive design education and digital empowerment (Mehta & Trivedi, 2022). Table 2 further explores the specific challenges faced by artisans and offers a critical evaluation of the efficacy of different design-led interventions. The attempts to wane interest among younger generation target it through skill-building workshops and fellowships, the effect of which has been highly positive. Market saturation and imitation are being dealt with through branding and

Geographical Indication tagging, with moderate effectiveness depending on awareness and enforcement. Technological illiteracy is being tackled by training artisans to use phone apps and e-commerce platforms, thereby greatly increasing their outreach and sales. This table underlines that most challenges facing the artisan can be effectively met through localized design methodologies with the supportive umbrella of policy and infrastructure.

Sustainability Indicators in Traditional Crafts

Table 3: Sustainability Indicators in Traditional Crafts

Indicator	Traditional Practices	Post-Intervention Scenario	Sustainability Outcome
Raw Material Sourcing	Locally sourced	Sustained, with eco-certification	High
Waste Management	Minimal (biodegradable materials)	Enhanced upcycling initiatives	Very High
Community Involvement	Clan-based	Expanded to SHGs and youth groups	High

Source: Author's compilation

The crafts such as *Ajrakh* use sustainable materials with indigo dyes, pomegranate peels, and salts from the Thar Desert. Design interventions have added certifications to strengthen the value of these uses and create life-cycle awareness concerning these crafts. Meanwhile, Madhubani artist groups are organizing into SHGs to increase scalability and impact. Blue Pottery artisans are now reusing kiln waste for smaller products and installations. Table 3 explores the indicators of sustainability before and after the interventions. The traditional craft is already conscious of environmental concerns, using local, biodegradable materials. Design intervention has further enhanced the traditional practice by adding an eco-certification along with some upcycling initiatives-the waste materials in Blue Pottery being one example. In addition, we can visibly notice the shift in community structures from clan-based practices into

more inclusive self-help groups and youth organizations. These represent strengthening the sustainability framework around crafts by tying in ecological responsivity along with social inclusivity.

Role of Institutions and Stakeholders in Craft Revival

Table 4: Role of Institutions and Stakeholders in Craft Revival

Stakeholder	Contribution	Impact on Craft Revival	Effectiveness
Design Institutes (NID, NIFT, SPA)	Craft immersion programs, prototyping support	Enhanced innovation & visibility	High
NGOs & Social Enterprises	Training, micro-finance, market linkages	Empowerment of women artisans	Very High
Government Bodies	GI tagging, policy frameworks, subsidies	Protection & recognition of crafts	Medium
Private Sector (Brands & Retail)	Collaborations, co-branding, e-commerce partnerships	Expanded consumer reach	High

Source: Author's compilation

The above table shows how several different players work in an interdependent manner within this craft revival ecosystem. Informative organizations nurture invention through introduction and design education (Kumar & Patel, 2019). NGOs permit the grassroots-level artisans, be it womenfolk artisans who are normally sidelined (Bhandari, 2021). Finally, these alliances with brands and stores heroically lend visibility to those craft based products in world-wide markets, which makes the demand rotation active (Mehta & Trivedi, 2022).

Consumer Perception Shifts in Post-Intervention Crafts

Table 5: Consumer Perception Shifts in Post-Intervention Crafts

Aspect	Pre-Intervention Perception	Post-Intervention Perception	Resulting Trend
Craft Value	Ethnic/Traditional souvenir	Sustainable luxury & lifestyle product	Increased premium pricing
Utility	Decorative only	Functional + decorative	Wider adoption in households
Market Scope	Local bazaars & fairs	Urban boutiques & global e-commerce	International visibility
Artisan Identity	Anonymous labor	Recognized cultural custodians	Stronger artisan branding

Source: Author's compilation

Market Channels for Revived Crafts

Table 6: Market Channels for Revived Crafts

Market Channel	Characteristics	Benefits for Artisans	Limitations
Local Fairs & Exhibitions	In person interaction between artisan and consumer	Trust Building and live feedback	Less presence, low customer
Urban Boutiques & Galleries	Selected design based craft showes	High price, visibility	Difficult to enter
Digital market place	Online display and visibility	Direct sale, youth reachout	Digital skill needed
Corporate & Institutional buyers	Bulk orders and gifting, CSR programs	Regular demands	Threat of Uniqueness

Source: Author's compilation

Table 6 shows the different market networks in relation to how they form the income of artisans and the sustainability of craft. Local fairs and exhibitions maintain their validity as spaces for the trade of culture and direct interactions, though their effects tend to be seasonal (Das, 2020).

Urban boutiques present the best platform for high-value crafts, such as Blue Pottery; however, artisans face barriers arising from the associated costs and exclusivity (Chattopadhyay & Dhamija, 2015). Online platforms, according to Mehta and Trivedi (2022), redefine access by providing a direct-to-consumer avenue, whereas availability of digital training becomes a constraint. Another channel emerging to ensure demand is corporate and institutional procurement through CSR-driven craft galas, albeit at the potential risk of threatening design diversity through enforcing design standardization to meet common criteria (Bhandari, 2021). The analysis strongly underlines that a blend of traditional cannery with urban, digital, and institutional markets ensures the craft's resilience along with fair valuation.

Discussion

The transition of Indian handicrafts from heritage practice to sustainable livelihood requires a multi-pronged strategy. Design interventions must tackle issues of product relevance, process efficiency, market accessibility, and recognition of the artisan. Co-design (with artisans and designers considered as equals) has gained much traction as being effective in guaranteeing innovation and authenticity (UNESCO, 2013). One of the key takeaways of the case studies is the need for context-specific interventions. What is good for Kutch may not be fit for Bihar. There must be a clear understanding of the dynamics of the community, the materials, the motif used, and the belief system. Interventions should not be one-off design interventions; rather, they should be long-term and evolving along with the artisans. Creating a strong feedback loop between the artisan and consumer provides an opportunity to refine products and instills a sense of ownership in both. Another catalytic role is played by technology. Mobile apps providing design tutorials, digital cataloging facilities, and social media marketing avenues have brought stark visibility to artisans. Platforms like Go Coop and Okai allow selling to be done directly from the producer to the customer, thereby reducing dependence on middlemen (Mehta & Trivedi, 2022). Education is another foundation. Design schools must include craft immersion programs, field visits, and cooperative projects in their curricula. Such exposures would not only sensitize future designers to crafts but also generate prototypes that artisans can use and or adapt. Institutions like NID, NIFT, and SPA have played an instrumental role in such collaborations (Kumar & Patel, 2019).

Conclusion

Craft resilience is in its ability to undergo transformation while still holding on to its spiritual core. It argues in favor of design interventions acting as a bridge when fostering a balance between heritage and innovation from an empathetic and inclusive perspective. Craft is not only a fading phenomenon that needs to be preserved but rather a living practice that can offer solutions towards sustainability. To ensure India's crafts remain vibrant, more effective policies should be set in place to support the welfare of artisans, provide design education that closely relates to the grassroots, and elevate the public consciousness of crafts in the cultural and ecological spheres. On this note, collaboration will be key to the future of crafts—collaboration between the old and the new, the artisan and the designer, and the local and the global.

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Less, But Louder: The Rise of Minimalism in Modern Advertising

Swati Mehta

Research Scholar,

IIS (Deemed to be University), Jaipur, Rajasthan

Abstract

In a world flooded with noise, clutter, and rapidly fading attention, minimalism has made a very significant impact in current advertising – where less truly speaks louder. As Digital media is constantly competing for our attention and making it harder to focus, many brands are turning to simplicity as a smart way to get their message across. Many brands are shifting towards minimalistic advertising, and this paper explores why. The use of clean visuals, short text, simple uncluttered layout helps brands stand out and reach audiences. Looking at various ads in different media, this study shows how smart use of simple colours, space and clean fonts helps messages stand out and stay memorable. In a world of noise and clutter minimalistic ads prove to be a smart way to deal with today's fast-paced and noisy world.

Keywords: *Minimalism, advertising, branding, simplicity, visual design, memorability, attention, clean layout, whitespace, typography.*

Introduction

In today's media-saturated world, consumers are constantly bombarded with advertisements on every screen, page, and platform. This overwhelming stream of content has made it harder for traditional ads to hold attention or leave a meaningful impact (Gandar and Vaidya 16). As a response to this growing noise, minimalist advertising has emerged as a quiet but powerful alternative—using simplicity, clean visuals, and restraint to stand out where excess no longer works. Minimalist advertising, drawing from the broader modernist and minimalist design movements of the twentieth century, utilizes strategic elements such as whitespace, minimal text, limited colour palettes, and symbolic imagery to communicate messages efficiently and emotionally. Minimalist visuals work well in today's busy media environment because they remove unnecessary details and make the main message stand out. This helps people connect with the ad emotionally and remember it better (Norman). Because of this, minimalist design is not just about looks—it has become a smart way to deal with the problem of limited attention in modern advertising (Taylor 231–33).

Previous studies in design and visual perception show that minimalist design can communicate messages more effectively. Lidwell, Holden, and Butler explain that clear and simple visuals help reduce mental effort and make information easier to understand (34). Hekkert also points out that simple designs can grab attention and create emotional impact (Hekkert).

In the field of consumer psychology, researchers have found that people today prefer ads that feel honest, clear, and not too overwhelming, which shows a shift toward simpler and more direct advertising styles (Twenge 102; Southgate; Pangarkar 45).

With smartphones and digital content being a part of everyday life, people are constantly exposed to advertisements. Gandar and Vaidya point out that this nonstop stream of messages leads to shorter attention spans and mental fatigue (Gandar and Vaidya 16). Because of this, minimalism has become a useful advertising method. It lowers the pressure on the viewer and focuses on delivering clear, emotional, and easy-to-understand messages. As the authors explain, minimalism "doesn't ask much from the viewer—just aims to inform, educate, or entertain".

Even though minimalism is widely appreciated for its design value, there is still not much research on how it works as a way of communication in advertising, especially through visual analysis. This study tries to fill that gap by looking at how minimalist ads use simple visuals to help people focus, feel more connected, and remember the message better. By using things like whitespace, less text, and meaningful images, these ads try to send strong messages without using too many elements. Gonzalez supports this idea in her study, saying that "strategic use of whitespace directs gaze and fosters deeper engagement, especially in digital environments" (45).

To study this topic, the paper uses a qualitative visual content analysis of five advertisements from different fields. These areas were picked because they are very competitive and often use creative ways to advertise. The ads include both Indian and international brands—such as KitKat, McDonald's, Zomato, LEGO, and Band-Aid—to give a wider view of how minimalism works in different cultures and markets.

The advertisements were chosen because they displayed key features of minimalist design. These included a strong use of whitespace, very little or no text, clean sans-serif fonts, simple layouts, and visuals that were emotional or symbolic. The purpose was to see how these design elements work together to make the message clearer and reduce mental effort for the viewer. Each ad was studied using a set framework that looked at five main visual aspects: how whitespace and empty space were used, the mood and contrast created by colours, the style and placement of text, how the design was arranged to guide the viewer's eye, and how emotional or symbolic messages were shown through visuals.

This step-by-step method helped the study look closely at both what the ads showed and what they might mean. It made it easier to find common design patterns and ways that minimalist ads try to communicate with viewers. The visual content analysis method was chosen because it fits the goal of this research—to focus on how design choices work, not how people react to them. By looking only at the visual parts of the ads, this study shows how design can cut through the noise of everyday media and send clear, meaningful messages. While future research could include how audiences respond, this paper provides a starting point for understanding how minimalist design works in modern advertising.

To explore how minimalist advertising works in practice, this section analyses five advertisements that clearly use minimalist design principles. Each ad was selected for its strategic use of visual elements—such as whitespace, limited text, and symbolic imagery—to deliver a clear and emotionally engaging message. The analysis focuses on how these elements are used to attract attention, reduce cognitive load, and strengthen brand communication. The following case studies include campaigns from both Indian and global brands: Lego, Zomato, UNICEF, McDonald's and KitKat

Fig.1. LEGO: *Social Media Awareness*, Ads of the World, part of the Clio Network.

LEGO's campaign includes two advertisements that use minimalist design and symbolic visuals to comment on the growing use of digital screens by children. Both ads feature popular social media logos—Facebook and Instagram—as the main design elements. These familiar symbols are reimagined to show how social media can distract children and take away from creative play.

In the first ad, the Facebook "F" is placed against a plain white background. A small girl sits on the horizontal bar of the letter, staring at a tablet. The large size of the "F" compared to the child shows how powerful and overwhelming digital platforms can feel. The empty background draws attention to the girl's isolation, and the caption, "The Screen Is Snatching Childhood," clearly expresses the concern that children are losing valuable time to screens instead of engaging in imaginative play.

The second ad uses the Instagram logo in a similar way. A child is shown running inside the circular camera part of the logo, making it look like the child is trapped. The bright gradient colors of the Instagram background stand out, while the child appears small and enclosed. This creates a strong contrast that suggests how screen time can limit a child's freedom and creativity.

Both ads use key elements of minimalist advertising: simple layouts, very little text, and a single strong image. This allows the viewer to focus on the main idea without any distractions. The LEGO logo and a small line of text at the bottom suggest that building with LEGO is a healthier, more creative alternative to screen-based activities. The line, "The

ultimate solution is LEGO's therapy that includes creative thinking…," promotes the product in a subtle way while supporting the message of childhood development.

These ads show how minimalist advertising can be used not just to sell a product, but to make a strong emotional and social point. With just a few elements, LEGO brings attention to real concerns about childhood and digital culture, encouraging viewers to think more carefully about screen time and the value of creative play.

Fig.2. Zomato ad featured in "18 Best Zomato Ads That Are Insanely Creative!" on *ScrollDroll.*

Zomato "Ladka Nikal Gaya Kya?" Ad: A Minimalist Use of Humour and Culture Zomato's ad that reads, "Nation wanted to know – ladka nikal gaya kya?" is a clever example of minimalist advertising that uses humour and cultural references to deliver its message" (Mandel).

The line is a playful take on a popular phrase from Indian news debates— "The nation wants to know"—and connects it to something very relatable: checking if the food delivery person has left.

The ad uses only text, colour, and brand name to make its point. It features a solid red background, white bold typography, and simple wording. The red colour is part of Zomato's brand identity, making the ad instantly recognizable even without showing the app, food, or delivery. There are no images or detailed visuals, but the ad still grabs attention because of its smart and relatable message.

What makes the ad stand out is how it connects with culture. By using a line that people already know and linking it to food delivery, Zomato creates a strong emotional connection with younger audiences, especially those active online. The humour feels fresh, timely, and relevant.

From a minimalist design point of view, the ad is very clean. It focuses on one message: Zomato's live tracking feature. There is no extra information—just a short, funny line that says a lot in very few words. This ad shows how minimalist advertising can still be funny, sharp, and powerful when it's based on clever cultural insight.

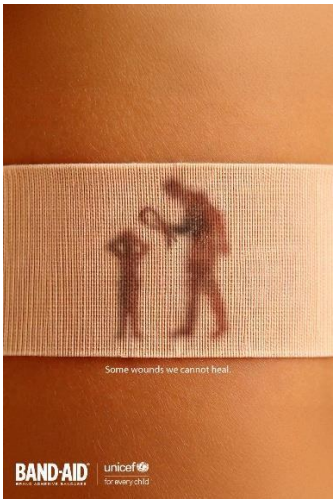

Fig.3. UNICEF: *Some Wounds We Cannot Heal*, Ads of the world, part of the Clio Network.

This Band-Aid advertisement, created in collaboration with UNICEF, is a powerful example of how minimalist visuals can deliver a deep emotional impact. The ad shows a close-up of a Band-Aid placed on human skin, but with a surprising detail. On the surface of the bandage, there is a faint, blurred image that appears to show a child being hurt by an adult. The image is muted and unclear, almost like a scar or a faded memory. Below this visual is a single, powerful line, "Some wounds we cannot heal."

This ad challenges the viewer's usual understanding of what a Band-Aid represents. Normally seen as a symbol of healing and comfort, the Band-Aid in this case is shown as something that cannot fix certain kinds of pain—especially emotional trauma like child abuse. The message is clear: some wounds go deeper than what a bandage can cover.

From a design point of view, the ad uses typical elements of minimalist advertising. It has a limited colour palette, mainly skin tones and the neutral colour of the Band-Aid. There are no background images or extra graphics to distract the viewer. The focus stays entirely on the bandage and the hidden image. The short line of text—just one sentence—makes the message stronger by encouraging the viewer to reflect rather than simply read.

At first glance, it appears to be a regular Band-Aid ad. However, a closer examination exposes a secret image that changes the meaning of the entire message.This kind of clever use is often seen in minimalistic ads to make people think and connect deeply.

Because this ad was made with UNICEF, its purpose goes beyond selling a product. It uses Band-Aid's familiar branding to bring attention to a serious issue: child abuse. This kind of socially aware advertising adds meaning to the brand and can connect strongly with viewers who value ethical responsibility in companies.

This ad shows that even a simple design can deliver a strong and powerful message with just a few elements, it talks about something serious that many people can relate to. Minimalist advertising is not just limited to promoting products it can also raise awareness and create a social impact.

Fig.4. McDonald's billboard ad with the phrase "on your left," using brand colours and minimal visuals. Source: *Marketing Birds.*

One strong example of minimalist advertising is a McDonald's billboard that uses a solid red background, a small portion of a yellow arc on the far left, and the simple phrase, "on your left" in white, sans-serif text. This ad removes all unnecessary elements—there is no full McDonald's logo, no food image, and no extra writing. Instead, it depends on the viewer's recognition of the brand's familiar colours and shape. The use of negative space and the partial Golden Arch encourages viewers to mentally complete the image, which makes the message more engaging. The short phrase "on your left" works in two ways: it gives a direction to a nearby McDonald's and also reminds the viewer of the brand in a fun, clever way. This ad clearly shows how minimalist design can reduce cognitive load while still creating emotional connection and brand recognition. It uses strategic design elements like whitespace, minimal text, and visual symbolism to strengthen communication.

Fig.5. Kit Kat "Pause" ad using chocolate bars and whitespace to convey the "Have a break" message. Source: *Nestlé / The One Club*.

KitKat "Break" Campaign (JWT, 2008): A Minimalist Perspective
The 2008 Kit Kat ad by JWT marked a clear shift from the brand's older, busier red-background ads to a cleaner, minimalist design. Instead of using bold colors and text, this version features a plain white background with just two chocolate bars placed in the center. This simple setup helps focus the viewer's attention directly on the product.

The two bars are arranged to look like a pause symbol, which connects to the brand's tagline, "Have a break. Have a Kit Kat." Without using extra words, the ad uses visual storytelling to deliver its message. The lack of clutter and extra text shows how strong minimalist design can be.

By using only the most important elements, the ad suggests the idea of taking a break and slowing down. It reflects minimalist ideas like calm, clarity, and intention. The white space and simple look also give the ad a modern and stylish feel, which may appeal to viewers who prefer clean and thoughtful designs.

Compared to Kit Kat's older ads that had more color, logos, and text, this version feels quieter and more focused. It invites the viewer to pause—both visually and mentally—which fits perfectly with the message the brand wants to share.

This research looked at five ads from popular brands – Lego, Zomato, Band-Aid, McDonald's and Kit Kat to understand how less can truly mean more in advertising. Each ad used a minimalistic approach removing unnecessary elements and focusing on simplicity which made their core message clearer and more powerful.

One of the most noticeable features in these ads was the clever use of whitespace. Lego Campaign cleverly reimagined well known social media logos into symbols that showed how kids are losing their creativity. With just few images, it high lightened the problem of the growing issue of screen addiction.

In KitKat ad, two chocolate bars arranged like a "pause" button, placed on a clean white background, visually echoing the tagline, "Have a break." Mc Donald used a yellow curve and the words "on your left", letting the space speak for the brand without even showing the logo. These simple visuals grabbed attention by being calm, yet loud."

Symbolism was another key element. Band-Aids with UNICEF used a simple yet emotionally powerful approach, presenting a faded image of child abuse shown on a bandage, with a message "some wounds we cannot heal." Though minimalist the ad carried significant emotional depth, demonstrating how simplicity can be used to convey complex and serious themes with striking clarity.

In these ads colour and typography were used intentionally to highlight each brand. In just a few words, Zomato's message was made to stand out with humor and cultural flair thanks to its vivid red background and plain white font.

Mc Donald's and Kit Kat also used their well-known brand colours to help people recognise them quickly, proving that how colours can speak for their brand.

"All five ads showed that strong emotional message don't need loud or busy visuals" Instead, simple and smart design helped express humour, emotion and social message. This proves that minimalism is about saying clearly and people focusing and feel more and remember the message better especially in a world overwhelmed by constant noise.

Discussion

The findings of this study strongly support the central idea behind the title, *"Less, But Louder."* Minimalist advertising—through reduced text, symbolic imagery, and purposeful whitespace—proves that fewer visual elements can, in fact, communicate messages more powerfully and memorably. Across the five case studies, it becomes evident that minimalism not only enhances visual appeal but also deepens emotional engagement. This aligns with research by Lidwell et al., who argue that simplification improves clarity, trust, and recall (Lidwell, Holden, and Butler 34).

Each advertisement analysed in this paper shows how a "less is more" approach allows the message to stand out in an otherwise noisy, overstimulated media environment. For example, the Kit Kat ad used whitespace and visual restraint to evoke calmness and focus—qualities that are rare in fast-paced, cluttered advertising spaces. Similarly, the LEGO and Band-Aid ads use minimal visuals to deliver deeper symbolic messages, prompting viewers to reflect and emotionally connect. These shifts in perception—where a simple image reveals a more profound meaning—demonstrate how minimalist advertising "speaks louder" by inviting the audience to engage actively and interpret meaning.

Minimalism also resonates with younger audiences, especially millennials, who often value authenticity, emotional transparency, and aesthetic simplicity. Brands that adopt minimalist design can appear more modern, responsible, and emotionally intelligent—attributes that strengthen audience connection in an age where consumers are more critical and design-conscious.

Still, this study is not without limitations. It focuses solely on five advertisements and relies on qualitative visual content analysis. Without data on audience reception or cross-cultural comparisons, the results may not generalize across all markets or demographics. Future studies could examine how different audiences respond to minimalist advertising or assess its effectiveness across various media formats and cultural contexts.

"This research ultimately demonstrates that minimalist advertising is a purposeful response to information overload rather than merely a fashion trend" (Carr 124-25). In an era defined by too much, minimalism helps brands cut through the noise and deliver messages that are not only seen, but also felt and remembered. In this way, *less* truly becomes *louder (Fuel It Online).*

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Cultural Nuances in UI-UX: Integrating Indian Visual Grammar into Digital Product Interfaces

Shivam Shinde

ITM Institute of Design and Media, Mumbai

Abstract

As India undergoes rapid digitization, the need to design interfaces that resonate with the country's cultural identity has never been more urgent. This paper explores the integration of Indian visual grammar, rooted in traditional aesthetics and modernist expression, into contemporary UI-UX design. Drawing inspiration from seminal Indian artists such as Nandalal Bose, Jamini Roy, S.H. Raza, Amrita Sher-Gil, M.F. Husain, and A.A. Almelkar, the study investigates how folk symbolism, colour rhythms, and indigenous motifs can be reinterpreted into usable interface elements. Through studio-based assignments conducted with UX design students, this research demonstrates how culturally contextual design can enhance user empathy, creative confidence, and aesthetic innovation. It further proposes a pedagogical model for embedding Indian visual culture into design education, positioning it not as a static archive, but as a dynamic tool for digital futures.

Introduction

In a global digital landscape where interface design often follows homogenized visual patterns, culturally rooted design presents an opportunity to stand out while deepening user connection. India's visual culture, spanning millennia and rich in regional variation, offers a diverse grammar of form, colour, and symbolism. However, much of Indian UI-UX design continues to emulate global platforms, often overlooking the potential of local aesthetics. This research begins with the premise that India's traditional and modern visual heritage can significantly enrich digital design practice. It argues that UI-UX designers can leverage Indian visual grammar not only for aesthetic appeal but also to evoke cultural familiarity and emotional resonance.

Methodology

This study employed a qualitative, practice-based approach involving UX design students from a Bachelor of Design program in India. A classroom assignment was structured around the reinterpretation of iconic works by Indian modern artists. Students were first introduced to key

visual characteristics and cultural contexts behind works by artists such as Jamini Roy's folk-inspired linearity, Raza's geometric symbolism, and Husain's narrative abstraction. Participants were then guided to deconstruct these visual vocabularies into usable interface elements, such as icon systems, onboarding illustrations, scroll patterns, and navigation flows, through sketching, prototyping, and peer reviews. Alongside, reflective discussions were held on how this aesthetics could inform user journeys and emotional engagement in app environments. Data was collected through student submissions, feedback forms, and one-on-one discussions. A thematic analysis was conducted to assess recurring insights, creative directions, and usability interpretations.

Results

The assignments revealed several valuable outcomes. Firstly, students demonstrated heightened creative confidence when drawing inspiration from Indian visual traditions. Several UI elements, such as stylized icons based on tribal art, scroll animations echoing miniature painting narratives, and onboarding screens influenced by Raza's bindu, displayed a unique blend of modern usability and traditional sensibility. Secondly, the process fostered a deeper appreciation of cultural storytelling in digital contexts. Students reported that translating motifs into functional assets required rethinking not just form, but meaning, user flow, and emotional tone. Most notably, user testing with peer groups showed that culturally infused designs prompted stronger engagement and recall, especially among users familiar with the artistic references.

Discussion

The findings underscore the value of integrating Indian visual grammar into UI-UX design, not as mere decoration, but as a strategic design choice. Artists like Nandalal Bose and Amrita Sher-Gil developed visual languages deeply rooted in both Indian ethos and global modernism. Their work reveals how form, rhythm, and symbolism can carry layered meaning without sacrificing clarity, an essential quality in interface design. By drawing from such sources, designers can develop interfaces that reflect local identity while maintaining international standards. Moreover, this approach allows designers to emotionally anchor experiences through cultural cues, such as colour palettes reminiscent of temple frescoes or visual hierarchies inspired by classical Indian compositions. Pedagogically, this also opens new avenues for design education. Students move beyond surface-level aesthetics to explore the

socio-cultural foundations of visual form. This nurtures not just better designers, but more empathetic and context-aware ones.

Pedagogical Implications

To sustain and scale this cultural approach, the study proposes the following academic interventions:

1. Studio-based modules integrating Indian art history with digital prototyping
2. Interdisciplinary collaborations with cultural studies and fine arts faculties
3. Design hackathons themed around regional crafts and artistic movements
4. User testing labs focused on how diverse users respond to cultural visual cues
5. Case studies on historical and modern Indian design languages integrated into the curriculum

These strategies can help future designers build an interface language that is not only user-friendly but also culturally intelligent.

Conclusion

In an age of digital sameness, cultural specificity becomes a form of innovation. By bridging Indian visual heritage with contemporary interface design, this research advocates for a UI-UX practice that is both globally competent and locally resonant.

Integrating Indian visual grammar into design education can empower the next generation of designers to look inward, revalue their cultural environment, and create digital experiences that are emotionally authentic and contextually rooted.

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Decline and Renaissance of Kaavi: Historical and Contemporary Perspective

Shivam Shinde

ITM Institute of Design and Media, Mumbai

Abstract

The extinction of Kaavi art in Goa is largely attributed to modernization, declining patronage, and the erosion of traditional knowledge. As architectural trends shifted and the demand for heritage-style murals waned, this intricate art form, historically integral to temples, churches, and heritage homes, became increasingly irrelevant. The labour-intensive nature of Kaavi art, which relies on natural materials such as red laterite soil and lime, further deterred artisans, who faced economic pressures. Furthermore, the absence of comprehensive documentation, rapid urbanization, and a broader cultural shift toward contemporary art contributed to its decline, leaving fewer practitioners to uphold the tradition.

Writing a research paper on the extinction of Kaavi art is crucial for preserving its cultural heritage. Such research would offer an in-depth analysis of the art form's historical significance, the causes of its decline, and potential strategies for its revival and sustainable future. By documenting the intricate techniques and exploring the socio-cultural context in which Kaavi art developed, scholars can contribute to the preservation of this unique tradition.

Introduction

Kaavi art, a distinctive mural tradition of the Konkan coast, particularly Goa, is renowned for its elaborate patterns and deep cultural symbolism. Created primarily with red laterite soil and lime, Kaavi art carries spiritual and architectural significance, particularly within temples, churches, and ancestral homes. Its origins are thought to lie in the Indo-Portuguese era, where indigenous and colonial influences intertwined. Literature on Kaavi art has underscored its cultural and historical relevance, with scholars like P.P. Shirodkar recognizing its role in reflecting Goa’s syncretic heritage. The technique, often described as sgraffito, involves the intricate etching of designs onto wet plaster, highlighting the labour-intensive artistry involved.

Challenges and Causes of Decline

Despite its rich history, Kaavi art has witnessed a sharp decline due to several socio-economic and cultural factors. The shift towards modern architecture and minimalistic interior design has significantly reduced the demand for such traditional murals. The technique’s time-consuming and labour-intensive nature, combined with a lack of economic incentives, has driven artisans away. Moreover, the absence of formal training programs and proper documentation has made it difficult to transfer knowledge to future generations. Urbanization and changing aesthetic preferences have also contributed to the marginalization of this art form.

Contemporary Perspectives and Revival Efforts

Although Kaavi art is endangered, recent years have seen sporadic efforts toward its revival. A few individual artists and cultural organizations have undertaken restoration projects, and there is growing interest in incorporating Kaavi motifs into tourism, public art, and design education. However, these efforts remain fragmented. There is a strong need for structured academic engagement, community-based documentation, and government-supported programs to ensure the continuity of this tradition.

Digital Tools and Preservation Strategies

With advancements in digital technology, there lies significant potential to document, preserve, and promote Kaavi art through digital archiving, 3D scanning, augmented reality applications, and virtual storytelling. These tools not only help in recording fading techniques but can also bring global attention to this dying art form. Conservation science, when paired with policy initiatives, can play a transformative role in safeguarding Kaavi art for future generations.

Conclusion

Kaavi art stands at the crossroads of extinction and renaissance. While its decline has been shaped by modernization, neglect, and socio-economic challenges, there remains a resilient cultural value that demands preservation. Through academic research, digital innovation, community engagement, and policy support, Kaavi art can be revitalized and reintroduced into contemporary visual culture. This paper calls for a multidisciplinary approach to ensure that Kaavi art does not remain a relic of the past but thrives as a living heritage.

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Untapped Potential of Indian Knowledge Systems in Indian Advertising for Global Impact

Lavanya Aggarwal[1] | Dechen Angmo[1]

[1]Department of Fine Art, School of Arts, Faculty of Management, Commerce and Arts, Manipal University Jaipur

Abstract

Purpose- The study looks at how Indian brands are missing the chance to use Indian Knowledge Systems (IKS) in television and video advertisements. It explores how using IKS more meaningfully can help connect better with people and keep Indian culture alive making India stand out globally.

Methodology- The research was done by watching and analyzing 15 video ads from both Indian and foreign brands and by talking to experts from the advertising world and those who work for IKS.

Findings- Indian brands often use surface-level culture (like festivals or clothes), while foreign brands use deeper parts of Indian culture in their ads. People engage to ads that feel genuine and connected with their traditions. Deeper use of IKS can help brands build stronger connections and make India's wisdom known globally while preserving culture.

Research Limitations/Implications- The study looked only at video ads and didn't include large surveys of consumers, so results might not reflect all types of advertising or audience views.

Practical Implication- Indian brands can create more powerful and meaningful ads by using IKS in smart and respectful ways.

Introduction

India is home to one of the richest cultural heritages in the world with years of history, diverse languages, customs, spiritual traditions, art forms, and philosophical thought that have deeply influenced civilizations across the globe with an expansive Indian Knowledge System (IKS) (Division, 2019). The Indian Knowledge System (IKS), a division of the Ministry of Education, promotes and preserve India's indigenous knowledge and wisdom. (Division, 2019). Despite India's vast knowledge system, it is full potential remains underutilized, especially in fields like TV advertising and branding. (Subash Limbu1, 2024).

Advertising industry plays a significant role in shaping public behaviour and cultural perception. With it is vast reach, advertising holds great power to not only market products but also to educate and raise awareness. It has the capacity to shape societal beliefs, cultural identity, and individual perception. (Soti, 2022) (Standard, 2022). By including parts of IKS in ads, brands can tell stories that connect with people's emotions and cultural identities, particularly among younger generations. This can help Indian brands stand out globally, making more authentic and deep ads. By aligning with national objectives like cultural preservation and education, the industry can serve as a dynamic medium for promoting the Indian Knowledge System (IKS). While some Indian brands have started incorporating cultural elements into their advertisements, the use of IKS remains largely surface-level. In contrast, several foreign brands have been more intentional and effective in leveraging Indian traditions, often creating deeper emotional impact. This contrast highlights a missed opportunity for Indian brands to connect meaningfully through their own cultural roots.

This raises an important concern: despite India's vast cultural heritage, Indian Knowledge Systems (IKS) remain underutilized in television and video advertisements. Brands often stick to surface-level symbols like festivals or clothing while overlooking deeper values,

philosophies, and indigenous wisdom. Since advertisements have the power to influence beliefs and behaviours, this gap limits how brands connect with audiences and promote cultural identity. Lastly, while cultural elements in advertisements have been studied, use of IKS in advertising, especially in a meaningful and deeper way, has not been explored much. This study aims to explore how IKS can be meaningfully integrated into television and video advertising. It analyses how Indian and foreign brands currently use IKS and examines the impact such usage has on consumer awareness and emotional connection. By doing so, the research seeks to contribute to future academic work in this area.

Research Questions

1. What potential does IKS hold for building stronger consumer connection in Indian advertisements and at what level are Indian brands currently use IKS in their advertisements comparing to foreign brands.
2. Can meaningful integration of IKS in advertising support cultural preservation, increasing public awareness and positioning Indian wisdom as a valuable asset in the future of branding that make India stand out globally.

This study is important because advertisements strongly influence, especially the younger generation. It shows how brands can do more than just selling, and instead create ads that educate, emotionally connect, and preserve. This research highlights the opportunity for Indian brands to use IKS thoughtfully to stay ahead, strengthen their identity, and show pride in their culture before foreign brands take the lead.

Literature of Review

Potential of Indian Knowledge System

Indian Knowledge Systems is a part of the Ministry of Education (MoE). It is being brought back into education and research to keep Indian traditions alive and help us think in deeper,

more connected ways (Division, 2019). Using these age-old ideas in advertising lets us go beyond selling telling meaningful stories, and showing pride in who we are. It is not just returning to roots, but growing something new from them in today's world.

India's ancient wisdom, the Bhagavad Gita, offers lessons for better people and workplace management today. It explains that actions come from the body, mind, senses, effort, and divine forces. It also describes people's natural traits, Sattva (calm), Rajas (active), and Tamas (dull). This helps leaders understand and support teams better (Moudgil, 2025). Integrating learnings from Indian Knowledge Systems like the Gita in fields like advertising can create more meaningful and value driven advertisements. According to (Abbasi, 2024) designers include elements like mandalas, deities, traditional textiles, calligraphy, and symbols from Indian philosophy to make logos that feel meaningful and rooted in heritage. The study shows how this mix of tradition and modern design helps create logos that stand out and connect with people on a deeper level. Brands like Air India (Konark Sun Temple), SBI (keyhole and blue for trust), Indian Oil (flame for energy), and Taj Hotels (Taj Mahal for luxury). On a survey with designers and branding professionals, most believed that logos inspired by Indian culture make a strong impact on consumers (Abbasi, 2024). Today, the National Education Policy (NEP) aims to combine India's ancient wisdom with modern education. IKS is especially meaningful today because it offers solutions for many problems the world is facing. Even though more research is needed, IKS is not just part of India's past it is a powerful guide for the future. (Mehta, 2024)

Advertising and Culture

Advertising industry is one of the largest and influential industries in the world. TV ads are changing young people's lives and society's traditions of their country. A study by (Shafayat Ali, 2017) showed that TV ads have a strong effect on young people's eating habits by 57%,

their dressing styles by 42%, and overall lifestyle by about 25%. TV ads also affect society's values by about 23%. TV ads promote ideas, fashion, and behaviours that don't match local traditions and culture. Because of this, young people are picking up foreign habits and clothing styles that may not fit their country values, leading to decreasing of local traditions and cultural practices (Shafayat Ali, 2017). A study by (V, 2017) also found that these ads don't just sell products they sell a modern and trendy lifestyle that many young people find attractive. As a result, they feel inspired to change their choices and habits to match what they see on screen, hoping to gain status, fit in, or feel more modern. Therefore, if advertising do more to protect cultural values, instead of just promoting global or Western ways of life by thoughtfully integrating Indian culture and values into modern advertising through relatable stories, traditions, and visuals and creating a strong cultural connection that feel appealing and aspirational to young audiences. This can help protect and promote Indian cultural identity, while still staying fresh and relevant in today's global world. Indian brands, such as Apollo Tyres (Ganga: The River of People), Patanjali and Tanishq (Ektvam), do incorporate elements of Indian culture into their advertisements however, such instances remain uncommon. Majority of advertisements primarily focus on festivals and common cultural narratives (Bharadhwaj Sivakumaran, 2022), while overlooking the broader and deeper aspects of India's indigenous knowledge systems (Subash Limbu1, 2024). Furthermore, many of India's traditions are more commercially leveraged by foreign brands than Indian ones. According to, (Kumari, 2025) study the global yoga industry and Ayurveda market are largely dominated by non-Indian brands. The turmeric and neem patent controversies, where foreign entities attempted to claim ownership of their medicinal properties, highlight this trend. Foreign Brands like Airbnb, often highlights Indian homes, local food, and cultural experiences that honours Indian traditions (Chodankar, 2019). On the other hand, Indian brands like OYO still focus more on affordability and comfort, overlooking the cultural depth they could reflect (Ghosh,

2025). This contrast shows how Indian brands are missing a major opportunity. If Indian brands start leveraging the deep wisdom of IKS more effectively in branding and advertising. The current trend, however, shows that if Indian brands don't act fast, foreign brands will continue to dominate and capitalise on this cultural space.

Synthesis

The literature strongly supports that advertising has a strong influence on people behaviour. When ads include cultural elements, they become even more effective. Studies confirm that people connect better with ads that reflect their own culture. But there is a lack of focus on how IKS are used in ads. While IKS has been studied in areas like education and management, its role in advertisements haven't been explored much. There's also little research on how Indian vs foreign brands is using IKS differently. While foreign brands have incorporated Indian culture to connect with both local and global audiences, Indian brands are not using full potential.

Research Methods

This research uses a qualitative method. This study uses two main methods:

Method 1: Content analysis of television commercials (TVCs) and video ads.

Method 2: Semi-structured interviews with advertisers and IKS experts.

By using both methods, the research aims to provide a full understanding of how IKS appears in ads and how the audience responds to it.

Data Collection Methods

TVC and Video Ad Analysis: To understand how IKS were used in existing advertisements, TVCs were studied.

Sample Selection: In this research, ads were chosen that showed some part of IKS or values. These included ads from both Indian and foreign brands across different categories like personal care, food, health, and lifestyle, FMGC, manufacturing and more. Ads were selected based on how relevant they were to the research.

Sample Size: Total of 15 ads were analysed. The ads were a balanced mix of Indian and foreign brands.

Interviews with Experts

To understand how IKS can be used in advertising, interview of people working with IKS and experts in advertising were taken. These interviews helped to learn what professionals think about using IKS in ads, what challenges they face, and how it can make an impact. *Sample Size:* Judgemental sampling where 6 people were interviewed. These people were chosen because they have knowledge or experience either in advertising or in Indian traditional systems.

They included:

- Branding experts from well-rounded companies such as Penguin Random House.
- Advertisers organizations like Penguin and design studios such as Small Bean Studio.
- IKS researchers or officials from academicians and researchers actively working in the field including organisation like IIT Delhi.

Method: Semi-Structured interview

Questions focused on understanding perceptions of IKS in advertising. Questions explored what participants think about IKS. Discussions covered the challenges of including IKS, how foreign brands are using Indian elements more effectively, and what Indian brands could do

better. Experts also reflected on the global potential of IKS, its role in preserving culture and consumer behaviour. Finally, they shared views on whether using IKS helps or harms brand perception and how it could shape the future of advertising.

Data Analysis Methods

Analysing Tv And Video Commercials: A manual method was used to analyze the data:

1. Categorisation: Grouping the ads based on different factors:
    - Name of the brand and type of product
    - Whether the brand is Indian or foreign
    - What part of IKS was used
    - Was the use of IKS deep and meaningful, or just on the surface
    - What visuals were used
    - Impact of the ad and consumer reaction (based on comments, reviews, or articles)
2. Frequency Count: The number of occurrences of each category was counted.
3. Percentage Calculation: Percentages were then calculated using the following formula:

$$\text{Percentage} = \left(\frac{\text{Number of entries in a category}}{\text{Total number of ads analysed}} \right) \times 100$$

4. Charts: The calculated percentages were shown using pie charts. These charts made it easy to see and compare the data for different categories. Each pie chart showed one specific detail.

This process turned detailed observations into clear, visual data to show how IKS appears in both Indian and foreign ads, and how it might affect consumers.

Interviews

Interview answers were studied and grouped into main ideas to find common insights

Theme 1- Benefits of using IKS in Advertisements

Theme 2- Challenges of using IKS in Advertisements

Theme 3- Consumer Reaction towards IKS in Advertisements

Theme 4- Future opportunities of using IKS in Advertisements

By using both methods together, the research could show not just what was seen in the ads, but also why certain decisions were made, based on what professionals shared.

Data Interpretation and Analysis

Data Analysis from Tv Commercials and Video Ads:

In the first part of the study, 15 TV and video ads from Indian and foreign brands were analysed for their use of IKS. Each ad was studied based on different categories.

Brand & Ad Title	Category	What elements of IKS are used?	Deep or surface level use?	Visuals Used	Impact	Consumer Reaction
Apollo Tyres **Ganga: The River of People** **2019**	Manufacture (Indian Brand)	-This river is not seen as any river, it's seen as holy and full of life in India. -The ad uses it to represent the flow and journey of life in India - The ad shows people from all walks of life, highlighting how diverse India is but still connected.	**Deep Level**: It shows the Ganga and different and diverse cultural people of India.	-Beautiful scenes from all over India. -Regular Indian people doing their thing. -The Ganga River in its natural beauty. -Quick glimpses of the different kinds of roads	-Increases awareness of Indian diversity and Ganga's meaning in India. -Provides emotional value linking brand to positive national feelings. -Contributes to general cultural awareness.	Positive YouTube- 1.1 million

				and paths that Apollo tyres can handle. - Famous cricketer Sachin Tendulkar.		
Cadbury Dairy Milk **Kuch Achha Ho Jaaye, Kuch Meetha Ho Jaaye** **2018**	Confectionery product (Foreign Brand)	- A sweet story of two brothers and their mom highlights strong family bonds. - The brothers share chocolate, just like how people in India share sweets during happy times. - The line "Kuch Achha Ho Jaaye, Kuch Meetha Ho Jaaye" connects with the Indian way of celebrating good news with sweets.	**Surface Level**: Connects with basic emotions and cultural values.	-Shows simple daily life scenes that people can connect with. -The visuals clearly support the tagline, highlighting sharing and joy with Cadbury Dairy Milk.	-The ad doesn't try to teach anything new. - It highlights Indian values like family, sharing, and celebrating with sweets. It reminds us of the happiness in small, kind moments. - Cadbury shows it understands Indian traditions and feelings, making it feel close to people's hearts.	Positive YouTube; 38 milion
Google Search **"Reunion"** **2013**	Technology (Foreign Brand)	-The ad brings in elements of Indian culture and history, especially the 1947 partition of India and Pakistan. -By showing a shared past and the deep feelings connected to the partition, the ad touches hearts in both India and Pakistan.	**Deep Level**: The ad tells a heartfelt story to connect with people emotionally, showing a touching moment from history.	-The ad shows everyday moments from both India and Pakistan, highlighting how similar yet unique their cultures are. -It uses warm colours and nostalgic visuals to create a feeling of connection, memories, and hope.	-It reinforced the connection of people -It showed how Google Search can help people connect in real life, no matter where they are.	Positive YouTube-16million The ad was a big hit. -Everyone appreciated the emotional story and how it touched hearts across different countries.

Table 1

Brand & Ad Title	Category	What elements of IKS are used?	Deep or surface level use?	Visuals Used	Impact	Consumer Reaction
Airbnb **"Diwali in India"** **2017**	Travel and hospitality (Foreign Brand)	Diwali traditions from the Indian Knowledge System, like lighting diyas, making rangoli, and sharing sweets. **Hospitality (Atithi Devo Bhava)**: Showcasing the Indian ethos of treating guests as gods. It shows the warmth of Indian hospitality, where guests are welcomed and included in celebrations. Highlighting the festival's focus on family, community, and togetherness.	**Deep Level** Featuring real hosts and guests, providing genuine insights into Indian festivities Emphasizing the emotional and spiritual aspects of Diwali beyond mere aesthetics.	Show the festive mood and warm Indian hospitality. It shows a traveller being welcomed into a decorated home, enjoying sweets, making flower decorations, and lighting lamps. These scenes highlight Diwali's themes of light, joy, and togetherness. An Airbnb host guides the traveller, showing the brand's focus on local and personal travel experiences. The setting in an Indian home gives a close look at real Diwali celebrations.	The ad helps people learn about Diwali and Indian culture. It shows the fun and traditions of the festival, giving a glimpse into how it's celebrated. It may also attract travellers who want real cultural experiences, like staying with a local Airbnb host. Overall, it promotes Indian culture and supports understanding between different cultures.	Positive Appreciation for Authenticity: Viewers praised the genuine portrayal of Indian traditions. Increased Engagement: The campaign led to higher interest in experiencing local cultures through Airbnb.
Fevikwik Ad **Todo Nahi Jodo** **2015**	FMCG (Indian Brand)	- In India, people often fix things with what they have. This is called 'jugaad.' -It reminds us not to waste things. If something breaks, fix it instead of throwing it away. -The biggest message in the ad is about peace and unity. It reflects Indian philosophies like "Vasudhaiva Kutumbakam" (the whole world is one family).	**Surface Level**: -The campaign aimed to deliver the purpose of the product along with promoting a harmonious bonding between people belonging to different countries, religions, etc.	-The ad is set at the Wagah Border ceremony, which is known for its energetic and competitive vibes between India and Pakistan. -Soldiers from both sides performing the border ceremony. - A soldier whose shoe sole comes off. -The use of Fevikwik to instantly fix the sole.	-Ad was launched during the 2015 India-Pakistan cricket match to promote peace. -It uses humour to deliver a message of bonding across borders. -Impact increasing brand awareness and recall. The phrase became synonymous with Fevikwik, reinforcing its positioning as the ultimate solution for bonding and fixing.	Medium: Entertaining and light hearted ad Some Backlash: Negative responses from some who felt it insulted the Indian Army YouTube; 3.3 milion

Tanishq **"Ektvam"** **2020**	Jewellery Brand (Indian Brand)	-Vasudhaiva Kutumbakam – The World is One Family It reflects the Indian belief that we're all one big family, beyond religion and background. -It highlights how different traditions can coexist with love and care something India deeply values. -The ad celebrates togetherness.	**Surface Level:** The main focus is on evoking positive emotions through the narrative.	-The visual shows a pregnant Hindu woman lovingly cared for by her Muslim mother-in-law and family. -The Hindu baby shower rituals, like the floral decorations and traditional clothing. -The warm interactions between family members emphasizing their close relationship. -Glimpses of Tanishq jewellery.	- In a diverse country like India, interfaith harmony can bring people together and challenge prejudice. - By showing a modern, inclusive family, Tanishq attracts those who value diversity and harmony. -The ad shows that religious differences don't stop love and celebration, encouraging viewers.	Negative It clashed with cultural or religious beliefs, offering no value. Rather than promoting unity, the ad unintentionally highlighted existing tensions and conflicts around Interreligious relationships.

Brand & Ad Title	Category	What elements of Kalaa are used?	Deep or surface level use?	Visuals Used	Impact	Consumer Reaction
Coca-Cola India **"Come Home on Deepawali"** **Campaign** **2010**	Beverage Brand (Foreign Brand)	-The campaign highlights Warli art, a 400-year-old tribal art from Maharashtra, India. -It showcases togetherness, simplicity, and connection to our roots.	**Deep Level:** The campaign uses Warli art in a meaningful way. Coca-Cola featured the art on its packaging and even brought the Warli figures to life in the ad.	-The ad shows a man in a remote area. He uses sparklers to create a Warli design on a bus. The bus is decorated with lights and the Warli design, highlighting the Diwali festive mood and the journey home.	-The campaign aimed to spread awareness about the ancient Warli art and introduce it to more people. -It focused on the theme of "coming home" for Diwali, creating an emotional bond with viewers by highlighting togetherness and Indian culture.	Positive The campaign was praised for its creative use of Warli art and emotional appeal. The use of traditional art helped the international brand connect with local culture in a meaningful way.
Mortein **"Suraksha Ka Teeka"**	Insecticide (Foreign Brand)	-The ad focuses on the Indian tradition of applying a "Kaala Teeka" (black dot) to newborns for protection from the "evil eye," a custom mentioned in the Mahabharata. -The product is designed to resemble the traditional Teeka, linking it to this practice. -The packaging features Aipan folk art, also believed to protect against the evil eye.	**Deep Level:** This ad connects culture with a practical solution for malaria. It updates the traditional Teeka by using Lemon Eucalyptus oil, a natural mosquito repellent, blending science with tradition. -The campaign taps into Indian mothers' beliefs to promote a health-focused product.	-The ad shows mothers applying the "Suraksha Ka Teeka" to their children, focusing on this familiar ritual. -It also feature the product packaging with Aipan folk art and highlight its natural ingredients.	-The campaign raises awareness about malaria and offers a simple solution based on a familiar cultural practice, helping mothers protect their children from mosquito. -It adds value by providing a natural, culturally relevant. -By modernizing a traditional practice with science, the ad strengthens its connection to Indian culture.	Positive The campaign was successful
Zandu	Ayurvedic brand	-Incorporates traditional ingredients like menthasatva,	**Surface Level:** The ad highlights Ayurvedic	-The ad shows how Zandu Balm quickly relieves back pain, headaches, and	-Highlight as a quick and easy solution for everyday pains.	Positive

"Ek Balm Teen Kaam"	(Foreign Brand)	eucalyptus oil, and gaultheria oil, known for their pain-relieving properties in Ayurveda.	ingredients for pain relief.	colds with clear and simple visuals, highlighting its ease and effectiveness	- It also reminds people of the trust in traditional Ayurvedic remedies, making Zandu Balm	

Brand & Ad Title	Category	What elements of IKS are used?	Deep or surface level use?	Visuals Used	Impact	Consumer Reaction
Surf Excel **"This Holi, let colours bring us together!"** **2019**	FMCG (Foreign Brand)	- Shows the colourful and happy celebration of Holi, which stands for joy, togetherness, and the victory of good over bad. -A Hindu girl helps her Muslim friend, showing how people of different religions live together peacefully in India. -Shows the importance of Namaz (Muslim prayer), showing respect for different religious beliefs.	**Surface Level** The ad tries to bring Hindus and Muslims closer together.	-The story shows children as the main characters. Their innocence helps show pure and unbiased friendship. - One girl protects her friend from getting coloured so his clothes stay clean for prayer. -The story takes place in a regular Indian neighbourhood, making it easy for people to relate to.	- The ad encouraged people to stay united and respect all religions. - It made people talk about being fair to everyone and including all communities. -Holi shows that colours can help people forget their differences and become friends. It spreads happiness and brings everyone closer.	Positive: YouTube: 32M views Many people praised the ad for showing unity and togetherness. Negative: Some criticized the ad, taking it as promoting "Love Jihad" or being insensitive to Hindu sentiments.
HP **Revive the magic of Indian Folklore** **2024**	Electronics (Foreign Brand)	- The ad shows Indian stories and traditions. -It explains how technology can help keep these old art forms alive and share them with kids. - The ad focuses on the feelings behind keeping our culture alive.	**Surface Level**: It shows how stories can bring different generations together and uses technology to help share these stories.	- The ad shows a sweet story of a grandfather and his granddaughter sharing stories. It mixes old-fashioned storytelling with new technology, showing how the past and present come together.	-This advertisement helps people learn about Indian stories and traditions. -It shows how important it is to keep these traditions alive and how technology can help do that. -It shows how technology can bring young and old people together. It helps older people share their stories and knowledge with the younger generation.	Positive 26 million views Emotional and engaging.

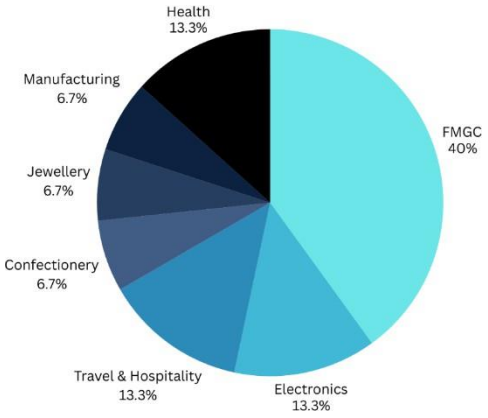
Patanjali **"Swadeshi Campaign"** **2025**	FMCG (Indian Brand)	- Using natural herbs like neem, tulsi, aloe vera, ashwagandha, and giloy in its products to promote health. - Encouraging complete well-being through old Indian practices like yoga and natural healing. - Supporting self-dependence by using Indian-made products and helping local businesses grow.	**Deep Level:** It uses local ingredients and follows traditional ways of making products to keep them authentic. Its advertisements also teach people about the benefits of old Indian methods, helping them understand and value Indian culture more.	-Showing village scenes, old customs, and natural ingredients to make things feel real and true to tradition. - Using things like the Indian flag, traditional clothes, and mentions of past national events to create a sense of pride. -Teaching people about how Ayurvedic ingredients and methods can be good for their health.	-Patanjali's campaigns have had a big effect on how people think and shop -People learn about traditional health and wellness methods, giving them more choices besides modern products. -The brand made Ayurvedic products popular again, helping people use traditional methods in daily life.	**Positive Reactions** People like that these products use natural and traditional remedies. And feel proud to support local Indian (Swadeshi) brands. **Negative:** A report showed that many Patanjali ads were misleading or not backed by proof.

Brand & Ad Title	Category	What elements of IKS are used?	Deep or surface level use?	Visuals Used	Impact	Consumer Reaction
MDH Garam Masala **"Authentic South Indian Range – Asli Masale Sach Sach"** **2023**	FMCG (Indian Brand)	-The ad shows different South Indian foods like Bisi Bele Bath, Puliogare, Vangi Bath, and Sambar, which are part of the region's rich food culture. -Includes traditional South Indian clothing, dance (like Bharatanatyam), and cultural activities, such as making flower arrangements.	**Surface Level:** The ad shows just the food, highlighting the culture around it, traditional performances.	-The visuals are bright and full of color, showing the heart of South Indian culture. -People wearing traditional clothes and jewellery. -Decorations and celebrations for festivals. -Close-up shots of the food and spice packets.	-Viewers discover different South Indian foods and the important spices used in them. -Highlights the importance of family, tradition, and real flavors in South Indian cooking. -It helps viewers appreciate the culture of South India.	Positive -Nostalgic and remind them of traditional flavors and cultural heritage. -Gained trust and loyalty from customers in India and around the world.
Air India **"Safety Mudras"** **2024**	Aviation and travel (Indian Brand)	- Ad includes eight different dance styles: Bharatanatyam, Kathak, Kathakali, Mohiniyattam, Odissi, Bihu, Ghoomar, and Giddha, each from a different part of India. -The dances use special hand movements (called mudras) to show safety instructions, like how ancient Indian dances told stories without words. - Traditional Indian music.	**Deep Level:** The video doesn't just use Indian dance forms for decoration; it uses them as the main way to share safety instructions.	-The visuals are bright and colorful, showing the different cultures of India. -It includes dancers performing in different Indian settings and famous landmarks, highlighting each dance style.	- It introduces Indian art and culture to people around the world. -Cultural Awareness. It helps spread Indian culture to a global audience.	Positive Youtube: 6.2 million views People liked it for being creative and showing different cultures well. They described it as "awesome," "classy," and "a breath of fresh air." Negative: Safety instructions should be clearer.
Amul	FMCG (Indian Brand)	-The advertisement uses simple parts of Indian culture by showing family love and daily	**Surface Level:** Shows every day relatable	-It shows everyday situations in India that people can relate to. The ad doesn't go into deep	- By showing kindness and helping others, it	Positive well-received

"Taste of India - Gentleman" **2022**		life. For example, a husband helping his working wife, a father buying sweets for. The line "Taste of India"	situations. The ad only focuses on simple and familiar Indian family values	cultural stories but focuses on simple and common Indian family values that everyone understands.	inspires people to do the same. - Showing different Indian cultures brings people	

Data Interpretation

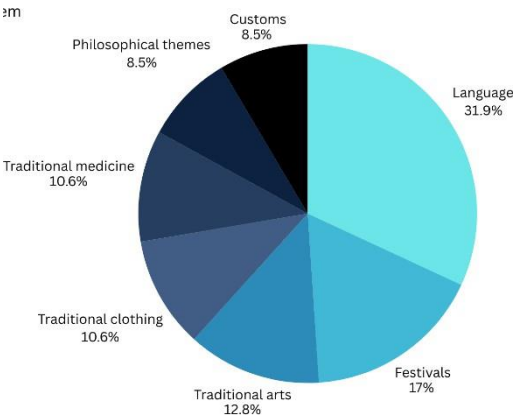
Fig. 1 Distribution of Brand Categories in Advertisement



Data Interpretation:

This chart shows that IKS elements are used most frequently in FMCG advertisements. Other categories such as electronics, travel, and health are equally represented, while sectors like jewellery and manufacturing used less.

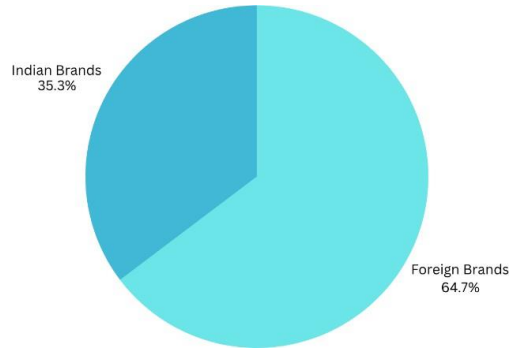
Fig. 2 Types of Indian Knowledge System (IKS) Elements Integrated



Data Interpretation:

The data shows that language is the most commonly used part of Indian Knowledge Systems (IKS) in advertisements. Traditional things like art, clothing, and medicine also appeared often. Deeper ideas were not seen.

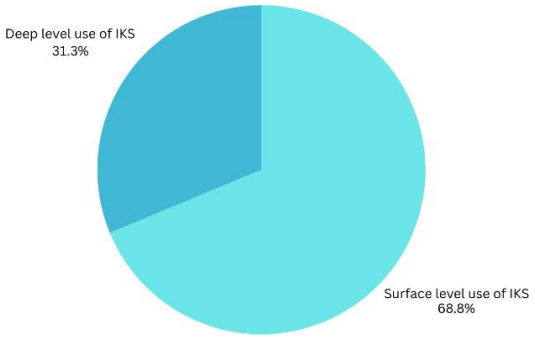
Fig. 3 Comparison of Deep IKS Usage in Indian vs. Foreign Advertisements



Data Interpretation

Foreign brands seemed to use Indian culture elements more deeply than Indian Brands.

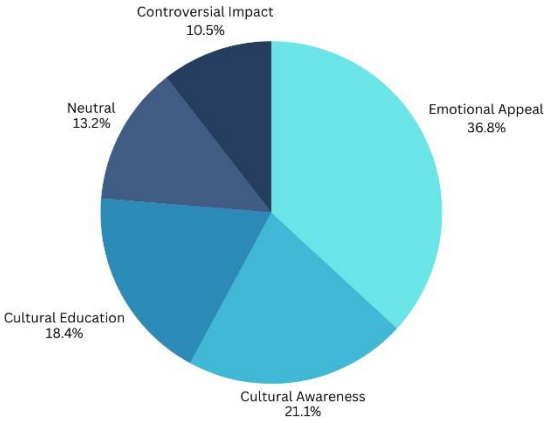
Fig. 4 Depth of IKS Integration – Deep vs. Surface-Level Representation



Data Interpretation

It show that brand mostly used surface-level integration rather than deeper integration such as philosophies or wisdom.

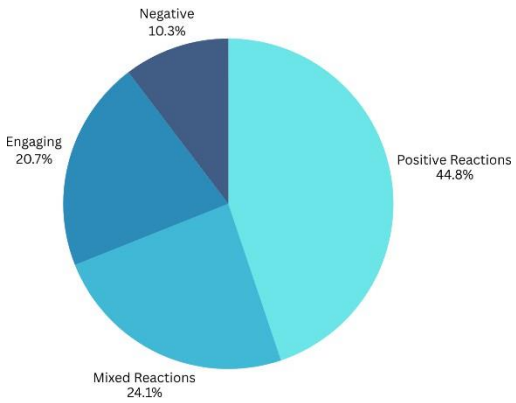
Fig. 5 Observed Impact of Advertisements on Viewers



Data Interpretation

Most ads that included IKS tried to create an emotional connection with viewers. Some also educate people about Indian cultures. However, a few ads didn't have much effect or were seen as controversial.

Fig. 6 Consumer Reactions to Ads Incorporating IKS



Data Interpretation

Most people had a positive reaction, showing they liked or appreciated the use of IKS in ads. Many responses were mixed or said the ads were interesting, negative reactions were the small.

Result of Interviews

Findings from the interviews are segregated into four main themes:

Theme 1. Benefits

Interviews with branding advertisers, and IKS experts revealed that using IKS in advertising can be both powerful and challenging. Most agreed that when used effectively, IKS helps brands create a deeper emotional connection with Indian consumers. It makes ads more relatable, unique, and culturally rooted, which many people value. Stories from the Bhagavad Gita, Ramayana, or Ayurvedic principles leave a strong impact when presented genuinely. Experts noted that today's consumers are smart and sensitive to how culture is portrayed. Such ads are remembered more, trusted more, and shared more. IKS can also help preserve and raise cultural awareness like how Pukka tea highlights Ayurvedic ingredients to connect with modern audiences through societal values and wisdom.

Theme 2- Challenges

However, this approach doesn't always guarantee success. Experts warned that if IKS is used

only on the surface or without real understanding, it can feel forced or confusing especially to younger audiences who may not relate to it fully. While elements like classical dance or rituals add value, the messaging still needs to be modern and engaging. A common concern was the lack of awareness and understanding of IKS in the industry. Many brands avoid it due to uncertainty or fear of alienating certain groups, possibly leading to backlash if not done sensitively.

Theme 3- Consumer Reaction

Today's consumers notice and care about how culture is portrayed in ads. They prefer ads that feel genuine and emotionally connect. Advertisements reflecting values like *seva* (selfless service) or telling stories from epics like the Mahabharata are seen as more authentic. Culturally rooted ads tend to be better remembered, trusted, and positively talked about.

Theme 4- Future opportunities.

IKS holds great potential in advertising, but only if used authentically, clearly, and with creative balance. It works best when not just decorative, but meaningfully tied to the product while respecting diverse sentiments. IKS can preserve and raise awareness about India's rich culture bringing ancient sciences, epics like the Mahabharata, or ideas like *Vasudhaiva Kutumbakam* into modern narratives. Experts also noted growing pride in cultural identity and openness to brands that genuinely reflect Indian ideas. There's a strong opportunity to blend tradition with modernity through design, philosophy, or storytelling that feels both grounded and relevant.

The insights from these interviews reflect both excitement and caution. While many recognize IKS's emotional power and cultural depth, concerns remain about its effective integration, audience reception, and industry readiness. These findings provide a clear view of the current

situation and lay a foundation for exploring how traditional knowledge can blend meaningfully with modern advertising.

Conclusion

Findings- IKS can help Indian brands build stronger emotional connections with consumers by reflecting their culture and values. Some brands use IKS, but mostly in surface-level ways. Foreign brands are connecting better with Indian culture. Deep, honest use of IKS can build trust and loyalty. Using IKS meaningfully in ads can protect Indian culture and educate people. It can help Indian brands share unique stories that resonate both locally and globally positioning India as a strong voice in future branding.

Justification for the Chosen Methodology **-** A qualitative method was used, including ad analysis and expert interviews in branding, advertising, and IKS. This helped explore creative and cultural choices more deeply something that can't be captured through numbers. Quantitative methods like surveys weren't used, as people may lack strong awareness or detailed responses on IKS.

Practical Implication- Indian brands can create more powerful and meaningful ads by using IKS in smart and respectful ways. This can also help people feel proud of their culture and understand it better while preserving it. This study explores an under-researched area IKS in advertising.

Suggestions**-** Brands should go beyond festivals and clothes and explore deeper parts of IKS like values, philosophies, and stories. Collaborating with cultural experts and researchers can help brands represent traditions respectfully and meaningfully. Thoughtful use of IKS can help brands stand out globally and foster cultural awareness.

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Limitations- This study only covers TVCs and excludes digital, print, and radio media. The sample size was small, though selected from diverse sources, so findings may not fully reflect industry trends. Also, consumer responses were not gathered through large-scale surveys, limiting broader generalisation.

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From Awareness to Action: Examining the Determinants of Sustainable Fashion Adoption among Gen Z

Ranu Burad, Assistant professor | Shivani Sharma, Assistant professor | Jyotsana Singh, Teaching Assistant
FDA, Poornima University, Jaipur

Abstract

This study provides an in-depth exploration of the behavioral and psychological drivers behind Generation Z's engagement with sustainable fashion. As climate change, ethical sourcing, and environmental degradation dominate global discourse, Gen Z has emerged as a generation with strong sustainability values. However, there remains a noticeable discrepancy between their ideals and their actual purchasing behaviors. Through a mixed-methods research design—integrating quantitative surveys from 400 respondents and qualitative interviews with 20 individuals—this study investigates how environmental concern, price sensitivity, social media influence, peer norms, and brand transparency shape Gen Z's decisions in the fashion marketplace. The research is grounded in the Ajzen's Theory of Planned Behavior and the Value-Belief-Norm to understand the cognitive processes behind sustainability-oriented consumption. The findings reveal that while Gen Z expresses a high level of awareness and positive attitudes toward sustainable fashion, their actions are often limited by external barriers such as affordability, accessibility, and skepticism toward green marketing claims. The study contributes to existing literature by highlighting the intent-behavior gap and offering targeted recommendations for fashion brands, educators, and policymakers to engage Gen Z consumers effectively and ethically in sustainability movements.

Keywords: *Sustainable fashion, Generation Z, consumer behavior, environmental concern, social media, ethical consumption, fast fashion*

Introduction

The global fashion industry is a multi-trillion-dollar sector known not only for its creative and cultural influence but also for its significant environmental and social costs. Fashion production contributes to approximately 10% of global carbon emissions and is the second-largest consumer of the world's water supply (Joy et al. 275). Additionally, over 85% of textiles end up in landfills each year (McNeill and Moore 213), with fast fashion—marked by rapid production cycles, low prices, and high turnover—being a major contributor to these issues

(McNeill and Moore 213). As public awareness grows, sustainable fashion has emerged as an ethical and ecological alternative that seeks to minimize negative environmental impacts, support fair labor practices, and promote the longevity of garments through responsible design and consumption.

In recent years, Generation Z (Gen Z) has become a dominant voice in the global consumer landscape. Comprising individuals born roughly between 1997 and 2012, Gen Z is widely characterized by their digital fluency, progressive social values, and desire for authenticity (Naderi and Strutton 594). Unlike previous generations, Gen Z has grown up amid climate crises, environmental activism, and digital connectivity. These experiences have shaped their consciousness and buying habits, making them one of the most vocal and influential generations when it comes to sustainability and ethical business practices (Kumar and Smith 118).

However, despite Gen Z's self-reported concern for sustainability, their actual consumption patterns do not always align with these values. The continued popularity of fast fashion among young consumers suggests disconnect between awareness and action (Connell 281). High costs, limited accessibility, social pressure, and brand mistrust often serve as barriers to sustainable fashion adoption. At the same time, platforms like Instagram, TikTok, and YouTube heavily influence Gen Z's fashion choices, creating a complex ecosystem where peer influence, aesthetic appeal, and ethical considerations intersect (Kumar and Smith 118).

This study investigates the underlying motivations, influences, and constraints that drive Gen Z's behavior toward sustainable fashion. It aims to uncover the key psychological and social factors that shape their attitudes and purchasing decisions, with a peculiar focus on the role of environmental concern, peer and social media influence, pricing, and transparency (Ajzen 181; Shen et al. 46). Furthermore, the study examines the gap between Gen Z's pro-sustainability intentions and their actual shopping behavior, providing insights that can guide brands, educators, and policymakers in developing strategies to better support and engage this demographic.

By understanding what truly drives Gen Z toward—or away from—sustainable fashion, this research extorts to the broader discussion on sustainable consumerism and offers practical recommendations to accelerate a more ethical and eco-conscious fashion future.

Literature Review

The shift toward sustainable consumption in the fashion industry has gained significant academic attention, particularly in the context of young consumers. Researchers such as McNeill and Moore have argued that despite growing awareness, fast fashion continues to dominate consumer behavior due to its accessibility and affordability (McNeill and Moore 213). Clothing that is designed, manufactured, distributed, and used in ways that are environmentally friendly and socially responsible are defined as sustainable fashion, it represents an ethical alternative that appeals to increasingly conscious consumers.

Joy et al. highlight the ethical appeal of sustainable fashion, particularly among younger generations who are aware of the harmful impacts of fast fashion on the environment and workers' rights (Joy et al. 275). Their study illustrates that while luxury brands are beginning to incorporate sustainable practices, the average consumer still faces hurdles such as higher prices and limited availability when it comes to ethical choices.

Generation Z, in particular, has been identified as a value-driven cohort. According to Naderi and Strutton, Gen Z consumers exhibit a high degree of personal and social responsibility, often expressing concern about climate change, labor rights, and ethical consumption (Naderi and Strutton 594). However, the author’s note that these values do not always translate into actual purchasing behavior, as aesthetic preferences and social media trends can overshadow ethical considerations.

Ajzen's Theory of Planned Behavior (TPB) offers a helpful framework to understand this phenomenon. The TPB posits that individual actions are influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen 181). In the context of sustainable fashion, this means that while a Gen Z consumer may have a favorable attitude toward ethical clothing, social influences and perceived barriers (like price or accessibility) may prevent them from acting on these beliefs.

Connell expands on these barriers, suggesting that internal factors (such as lack of knowledge) and external factors (such as cost and availability) play a significant role in hindering sustainable apparel acquisition (Connell 281). This reinforces the presence of the intention-behavior gap widely reported in sustainability literature.

The influence of social media and digital platforms is another critical factor. Social platforms such as Instagram, Tik-Tok, and YouTube have become central to Gen Z's discovery and adoption of fashion trends. These platforms serve as both educational tools and persuasive arenas where influencers shape consumer behavior. According to Kumar and Smith, social media not only raises awareness about sustainability but also cultivates peer norms that can motivate or deter ethical purchasing (Kumar and Smith 118).

Finally, brand transparency has emerged as a key determinant of trust in the fashion industry. Research by Shen et al. emphasizes that Gen Z are more likely to support brands that clearly communicate their sustainable practices and allow consumers to trace the origin of their products (Shen et al. 46). Without this transparency, even well-meaning consumers may become skeptical and disengaged.

Taken together, the literature indicates that while Gen Z possesses the values and awareness necessary to support sustainable fashion, multiple psychological, social, and economic barriers continue to limit their full engagement. Addressing these barriers is essential for both marketers and policymakers seeking to promote ethical fashion consumption.

3. Methodology

This study employs a mixed-methods approach integrating quantitative and qualitative methods to understand Gen Z's behavior toward sustainable fashion.

3.1 Research Design:

A consecutive explanatory design was adopted, beginning with a large-scale quantitative survey followed by in-depth qualitative interviews. This approach allowed for a broader understanding of patterns and the context behind those behaviors.

3.2 Sample:

The survey was distributed to 400 Gen Z participants aged 18–27 across major Indian urban centers, ensuring representation across gender, education, and socioeconomic status. A purposeful sampling method was then used to select 20 individuals from the survey pool for follow-up interviews based on their responses.

3.3 Instruments:

- **Quantitative Survey:** Included Likert-scale questions focusing on environmental concern, fashion consumption habits, brand perception, social influence, and purchasing behavior.
- **Qualitative Interviews:** Semi-structured interviews aimed to explore motivations, barriers, and cognitive dissonance related to sustainable fashion.

3.4 Data Analysis:

Quantitative data were studied using SPSS software. Descriptive statistics, correlation, and regression analyses were conducted. Thematic analysis was used to examine qualitative transcripts, identifying recurring patterns and narratives.

4. Results

4.1 Awareness and Attitudes:

- 87% of respondents had heard of sustainable fashion.
- 78% showed positive attitudes toward adopting eco-friendly fashion, citing environmental and ethical reasons.

4.2 Motivational Drivers:

- **Environmental Concern**: Scored highest as a motivating factor (mean score: 4.3/5).
- **Brand Transparency**: 66% stated they trusted brands that disclose their sustainability practices.
- **Social Media Influence**: 73% reported that influencers and online content increased their awareness of sustainable fashion.

4.3 Barriers:

- **Price Sensitivity**: 74% considered sustainable fashion to be overpriced.
- **Limited Availability**: 63% said they found fewer stylish sustainable options compared to fast fashion.
- **Skepticism Toward Green Claims**: 52% expressed concern about greenwashing.

4.4 The Intent-Behavior Gap:

Despite positive attitudes, only 34% regularly purchased sustainable clothing. Many respondents admitted to prioritizing affordability and trendiness over sustainability in real-world decisions.

Discussion

The results confirm that while Gen Z is environmentally aware and values ethical consumption, their actual behavior does not consistently reflect these beliefs. This gap is explained through the Ajzen's Theory of Planned Behavior, where subjective standard and perceived behavioral control (e.g., price, availability) act as strong mediators between intent and action. The Value-Belief-Norm theory further explains how internalized values alone are insufficient without structural and cultural support.

Social media emerges as both an enabler and a barrier—it increases awareness but also fosters unrealistic fashion standards, leading to overconsumption. The influence of peers and digital culture suggests that sustainable behavior is more likely to be adopted when it is seen as socially rewarding.

Barriers like price and product accessibility are critical. Many Gen Z consumers remain students or early-career professionals with limited disposable income. Additionally, skepticism toward corporate green washing suggests a need for transparency and third-party certifications.

Conclusion

This study underscores the complexity of Gen Z's engagement with sustainable fashion. Though they are the most informed and vocal generation about environmental issues, significant structural and psychological barriers hinder consistent ethical purchasing behavior. Brands, educators, and policymakers must work together to reduce these barriers, enhance transparency, and create systems that align fashion ethics with affordability and accessibility.

Recommendations:

- **For Brands**: Provide affordable sustainable collections and use certified transparent sourcing.
- **For Policymakers**: Offer incentives for sustainable production and retailing.

- **For Educators**: Promote sustainability through formal and informal learning channels.

Cross-cultural differences should be explore in future research, the long-term effect of influencer culture, and behavioral nudges that can convert intentions into actions.

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The Psychological Impact of Colours in Visual Arts on Mood Regulation

Anjali Taneja, Apeejay Institute of Design, New Delhi

ABSTRACT

The concept of Colour Psychology has by far been considered as a contributor to the human beings' perception, the behaviour and to the core of general expression of emotion. Based on classical and current colour theories e.g. Goethe theory of colour, colour wheel by Itten, neuroscience theory of affects e.g. recent theories and affective neuroscience - this paper examines the sensitivity of variations in colour hue-colour saturation and tonal contrast in eliciting an emotional response (calmness, anxiety, joy or melancholy). An integrative research methodology, which combines both a quantitative study involving a survey question on self-reported mood shifts and a qualitative analysis of the respondents when they explain to specific pieces of art. Results have shown that warm colours (red, orange, yellow) have been identified to be indeed strongly associated with rise in arousal and energy and cool colours (blue, green and violet) relaxational and balance emotional state. In addition, cultural applications of colour in visual compositions add or subtract those influences to accentuate not just cultural symbolism, but merely the existence of personal associations.

The study contributes to growing body of the literature concerning art-based mood regulation, adding knowledge of usefulness in art therapy, design psychology and creative wellbeing interventions. Finally, it also dwells on potential of colour in visual arts as an instrument which you can resort to and improve your mental health and emotional balance with.

Keywords: *Colour psychology, Mood regulation through art, Colour in Art Therapy, Creative wellbeing intervention*

INTRODUCTION

Colour is a very strong and universal way of communication that has the capacity to trigger emotions, create perceptions and control human behaviour (Pan et al.). Colour is not just a visual experience, but a symbolic and psychological instrument whose meaning is cross-cultural, cross-industrial and cross-artistic. Colour in Visual Arts does not serve the decorative function but this is a tool of expression to enable artists to convey feelings, cultural beliefs and

existential inquiries. The power of colour to control mood and emotion make it central to the practice of art, psychological studies and modern design strategies.

The applicability of colour psychology has been increased a lot in the modern world. According to studies by (Liang Ling Lin and Nazik Hangeldiyeva), colour functions as a multidimensional force in a global environment that is influenced by increased awareness of mental health, cultural identity and consumer behaviour. It is learned while in clinical practice with art therapists using certain palettes to bring tranquility or activity; in business where brands rely on strategic colours to generate trust, a sense of urgency or familiarity (Gupta and Dingliwal). Such a broad spectrum of applications emphasises the fact that colour is a universal as well as contextual form of communication.

The psychological effect of colour cannot be understood without reference to its historical evolution, theory and changing uses. Theory of Colours of Johann Wolfgang von Goethe and the model of Bauhaus by Johannes Itten was concerned with the symbolic and structural value of colour. These theories put warm colours as active and energising and cool colours as relaxing and reflective. Contemporary neuroscience has extended these findings by showing the biological processes of how colours affect arousal, perception and cognition.

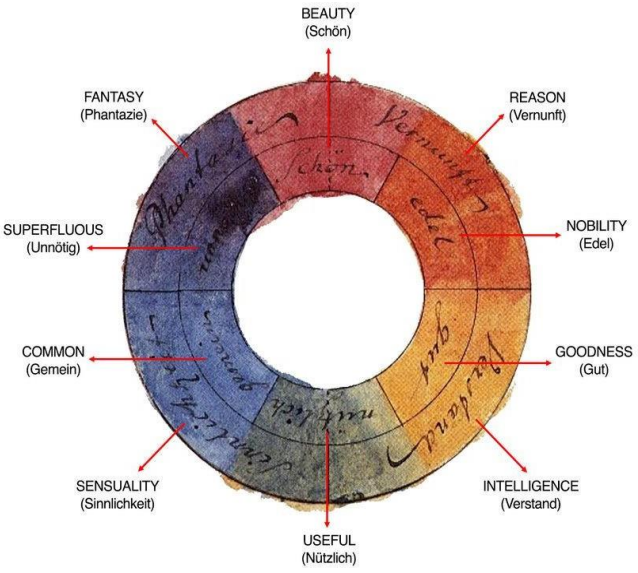

Fig 2 image showing Goethe's Theory of Colours

This paper is focusing on the use of colour in visual arts as a controller of mood and emotion and looks at Western and Indian art. Vincent van Gogh in Western art uses vivid yellows and

rich blues to show how colour can be used to express turmoil, hopelessness, and optimism and Edvard Munch in his disturbing palettes expresses anxiety and existential fear.

An Indian artist on the contrary, Amrita Sher-Gil used earthly and rich color to create melancholy, intimacy and cultural identity. Through such case studies, the language of colour as artists in different traditions have used to convey psychological states, cultural values and human experience, can be observed.

This paper will examine colour in terms of its historical, psychological and artistic aspect by examining it as a form of communication to explore more about its strength. It shows that not only is colour used as a part of aesthetic design, but also is used as a controller of emotion, a transmitter of cultural meaning and a stimulator of human connection. Finally, the contribution of colour to the personal mood and the group experience is also stressed, which demonstrates its importance in the contemporary discussion of art, psychology and society.

REVIEW OF LITERATURE

The history of studying colour and its psychological impact has a long history that cuts across philosophy, art and science. Initial conceptualizations emphasized on the symbolic and emotional aspects of colour. According to (Barsan and Merticariu), the Theory of Colours by Johann Wolfgang von Goethe (1810) was one of the first systematic studies of colour, other than as an optical effect (see figure 1). Goethe believed that human feelings were directly influenced by colour, warm colours like red and yellow were regarded as energetic and active, whereas cooler colours like blue and violet were regarded as relaxed, sorrowful or thoughtful (Elliot). Goethe was rejected by contemporary natural scientists but his sensitivity to the power of colour as an affective phenomenon had a profound effect on later artists and theorists.

This view was taken further in the Bauhaus school in the early twentieth century in the work of Johannes Itten. His colour wheel made associations between colours standard, distinguishing between primary, secondary and tertiary colours. The teachings of Itten were on harmony, contrast and the emotional tone of colour combinations (Schloss and Palmer). He demonstrated how complementary or opposite colours could create psychological tension and similar colours created a sense of balance and calm. His system is still the focus of art education and still plays a central role in the use of colour to affect perception and mood.

Other modernists artists, like Wassily Kandinsky, went further to spiritualise colour. Kandinsky believed colour to be a direct expression of inner emotional and spiritual condition which put the line between art and psychology unclear. This train of thought placed colour as a language of the soul, one which could do what words themselves did not. These historical theories provided the foundations over which the psychology of colour is based: they demonstrated that the implication of colour is much deeper than aesthetics.

Fig 3 image of *The Scream* by Edward Munch

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Most of these artistic insights have been empirically proven by modern psychology and neuroscience. Affective neuroscience studies have shown that colours activate the parts of the brain that are related to arousal, emotion and decision making. Red is linked to increased rate of heartbeat and alertness while blue light reduces stress and produces calmness. Environmental psychology also reveals the effects of colour on behaviour in the built environment: warm colours are more likely to encourage activity and sociability and cooler palettes are more likely to encourage better concentration and relaxation. These results imply that colour works at the physiological level as well as the psychological level and validate previous artistic theories but with a scientific evidence behind it.

Fig 4

image of *The Bride's Toilet* by Amrita Sher-Gil

At the same time, (Pettersson) believes that there is a strong influence of cultural and personal backgrounds on color perception. One colour can mean strikingly different things in different cultures: white could mean purity in Western culture and grieving in South Asian culture; red could mean danger in one culture and wealth in another. This dynamic is further complicated by the personal experiences as people have unique associations with colour depending on both memory and identity. Such cultural difference shows that is necessary to place the psychology of the colours in a context, using particular traditions instead of making it universally homogenous.

These cultural nuances are richly everywhere in visual arts. Western painters such as Vincent van Gogh and Edvard Munch used colour to convey psychological and existential moods such as hope, despair, anxiety and resilience whereas Indian Modernist Amrita Sher-Gil used earthy and vivid palettes to convey intimacy, melancholy and cultural identity. These parallel traditions demonstrate the way that the language of colour works differently in varying situations and at the same time is universal in its emotional effectiveness, and specific in its symbolic appeal.

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Fig 5 image of *The Starry Night* by Vincent van Gogh

Even with these developments, there are gaps in literature. A lot of the research separates out colour stimuli, and does not take the stimuli in the context of the artworks into consideration, ignoring the effects of composition and context on response. There is also the issue of cross-cultural studies which are not well developed and so we have limited knowledge of the way colour works around the world. Lastly, empirical studies tends to ignore the interpretative aspect that the artists and spectators project on colour making it a mere biological processes.

Core principles

Insights by (Hussain)express that mood regulation by colour is based on a range of fundamental principles laying between artistic practice; psychological theory on the one hand, on the one hand, physiological response on the other hand.

Among the most commonly recognised principles is that of warm and cool colours. Red, orange and yellow are warm colours which are commonly associated with stimulation, energy and arousal (Dijkstra et al.). Not only are they able to generate a sense of urgency, passion, or excitement, they can also cause anxiety if they are overused. The cool colours such as blue, green and violet are usually associated with stability, reflection and calmness. Their ability to regulate mood is underscored by the fact that they are used in places where people relax (such as hospitals and meditation areas).

The second principle is the saturation and the brightness. Saturated, bright colours are more likely to attract attention, as well as elicit powerful emotional responses, while more muted or pastel colours have less impact and may be calming (L and D). The brightness is also good for creating the impression, as the light color tends to be associated with openness and optimism, while the darker color may suggest seriousness, sadness, or depth. Intensity and brightness are intertwined in order to allow the artists and designers to perfect the emotional appeal.

Another concept underlying is contrast and harmony. When complementary colours are juxtaposed, it could create tension and excitement and attract the attention of the viewer and arouse curiosity. Conversely, similar colour schemes bring about harmony and continuity, and this usually brings about comfort and relaxation. Johannes Itten emphasized the psychological implications in such relationships in the way artists may stabilize or destabilize moods by the use of contrast intentionally.

The idea of symbolism and association does not apply only to the sensory features of colour, but also to its cultural and personal connotation. Some colors have symbolism such as red can symbolize love, danger or energy in some culture, and white can symbolize purity in some culture and grief in another. Responses are also shaped by personal associations, which everybody creates from the memory or upbringing, or from personal experience. As an example, the same color (green) can make memories of the past, and mean nothing to another person in an emotional way.

Finally, colour also stimulates the system of sensations as well as the cerebral processes. According to the results of affective neuroscience, colour also can regulate the autonomic

nervous system which has an effect on physiological process, such as heart rate, blood pressure, alertness (Oh et al.).

MATERIALS AND METHODS

This section will discuss qualitative and quantitative methods that were adapted in this research. A total of 57 participants were involved in the survey. The demography was strategically selected to accommodate an enormous range opinions and comments of influence of colour across different age sets. This age category selected was (18 to 50).

Survey Component

Participants of various age groups and cultural backgrounds were administered a structured on-line questionnaire. The respondents were shown with some colour palettes and art pieces and later, they were asked to note their emotional reactions, changes in mood and associations. There were both closed-ended questions asked (e.g. rating levels of calmness, anxiety, curiosity or comfort), and open-ended prompters (e.g. describe the feelings this artwork evokes).

This design resulted to both quantitative information to be used on statistical comparison, and qualitative information that resulted to subjective interpretations. In order to make sure that the results are reliable, the sample of the survey was carefully diversified and included the representatives of various gender, age and cultural groups. Although, there are certain limitations presented by the use of self-reporting there is a variety of responses that make the findings more representative.

Case Study Component

The study also conducts targeted case studies of three leading artists of different traditions in order to contextualize and enrich data from the survey:

- Vincent van Gogh (Netherlands): His striking yellows, sharp blues and swirling lines were studied in terms of their psychological effect especially in expressing turbulence, despair and hope. Figure 5 shows his work in **“**The Starry Night**”** painting
- Edvard Munch (Norway) **w**orks such as **“**The Scream**”** were analysed due to their use of disturbing colours to communicate anxiety, dread and existential fear as seen in **f**igure 3.

- Amrita Sher-Gil (India): Her coloured but down-to-earth palette were experimented in as a manifestation of melancholy, intimacy and cultural identity, and particular attention was paid to such paintings as The Toilet of the Bride seen in figure 4.
- These artists have been selected for their way of using colour to portray the control and expression of mood in both the Western and Indian cultures.

Ethical Considerations

The research was conducted within the ethical standards of research. Informed consent was obtained and the participants informed of their right of withdrawal. Data were anonymized and answers were used for academic purposes only. As topic was situation pertaining to mental health, care was taken to ensure that questions asked were sensitive to the situation & did not provoke any content.

Summary

This methodology worked successfully in that it took in both the quantitative and qualitative aspects of psychological effect of colour through Likert scale measures in concert with narrative reflections.

RESULTS AND DISCUSSION

The survey results suggested that warm colours, i.e. red, orange and yellow in particular were closely linked with arousal, energy and urgency. The majority of the respondents associated the warm palettes with excitement or restlessness; with approximately 21% of the respondents interviewed stating that they were associated with discomfort or anxiety. Comparatively, the colder colours (blue, green, violet) had been associated with calmness, stability and relaxation by the majority (74%) of the participants who felt a sense of comfort or balance.

These results were supplemented by qualitative answers which showed subjective meanings of colour. Younger respondents tended to discuss warm colours as something that was playful or invigorating, but older respondents tended to discuss the same colours as being stressful or tense. Personal memory was also involved: one of the respondents linked a certain shade of green to childhood landscape which triggered nostalgia and another respondent associated it

with boredom. These examples show that general physiological influences of colour may be provoked, however, the sense of colour is highly affected by memory and culture.

Art Case Studies

These results of this survey were supported with case studies of classic art works. In Starry Night and Sunflowers by Vincent van Gogh, the use of yellow could communicate both energy and happiness, but when used with depressing blues this could also mean chaos and depression. The subjects who were shown the palettes of Van Gogh said that they felt elevated and disturbed by the palette which highlighted the depth of colour-induced emotions.

The painting "The Scream" by Edvard Munch offered one more vivid example: a dark-orange sky mixed with dark and contorted colors was bound to create the effect of fear, unease, and existential anxiety. The impression that Munch beautifully transferred the inner world of psychology into colour was echoed in the comments made by the respondents.

"The Bride Toilet" by Amrita Sher-Gil was a strong use of the cultural and personal role of colour. The deep reds, ochres and blues she used not only told of the sadness and tenderness but also gave the impression of the Indian cultural identity. The palette was often described by the respondents as rooted, recognizable and more culturally-resonant than the Western compositions.

Combining the results of the survey and the case studies the fact that colour has an immense ability to influence mood is verified. Nonetheless, the effects of it cannot be reduced to biology.

DISCUSSION

A look at Van Gogh and you will see that his intense yellow and dark blue collided and complemented each other simultaneously; both energy and chaos. The results indicate that classical theories still have some importance in the explanation of the way colour controls mood, although other interpretations come in through cultural and artistic influences.

However, the findings also reveal some of the areas where classical theories do not work. The difference in responses of the survey participants that were younger in age indicated that the emotional effect of colour is not just limited to physiology, in particular the younger the respondent was, the more curious or playful the warm colours were and the older the respondent the more stressful the warm colours were. The Scream by Edvard Munch is unnerving by its

red-orange brightness, which fits with the colour as the stimulant of anxiety theory, however, the existential effect of this piece cannot be explained solely in terms of physiological factors.

The Bride's Toilet by Amrita Sher-Gil with her natural palette has an intimacy and dejection about it that cannot be fully comprehended with the use of Western conventions. Using the data of the surveys and the interpretations of the pieces of art, this paper agrees with studies by (Safran and Sanda) in that the effects of colour in the creation of mood go beyond the optical or neurological reaction.

CONCLUSION

Colour in general comes to fall right at the center of emotional and behavioral simulation.The survey supported the classical literature around the The Theory of Colours to the studies of the colour wheel by Itten. Colour psychology has open doors to new experiences and amazing expression of talents as artists take advantage in reflecting and stimulating emotion to the target audience.

This paper affirms with the fact that warm colours do indeed bring about a sense of arousal and energy whereas the bright colours tend to be relaxing in the eyes of the viewer. Credit goes to the vast number of scholars who investigated this phenomenon and came to conclusions that colour do indeed affect the general mood of an individual. This creates a loop that is utilized in different fields like medicine in art therapy, commercial industries to get to the audience and so on.

Van Gogh contrasts of yellow to blue included both the feeling of vibrancy as well as storms; The Scream of Munch gave powerful expression of the state of anxiety and existential horror; the palette of Sher-Gil with its earthly tones were full of intimacy and a sense of Indian identity. These are some of the ways that people are crafting artists combine the just psychological effects of colour into multi-layered narratives of human experience into a culture and history.

ACKNOWLEDGEMENT

My token of appreciation goes to the participants who helped in making this project be a success by giving insight and commenting about color in visual arts. Finally, I would like to appreciate the opportunity to carry out such an interesting and engaging project in our steps of understanding the effects of color in the general wellbeing of an individual.

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Green Advertising in the Era of Artificial Intelligence: A Sustainable Shift in Marketing in India

Ranu Raj, Research Scholar | Dr. Jitendra Sharma, Professor

Department of Visual Arts, Faculty of Design & Arts, Poornima University, Jaipur, Rajasthan, India

Email: ranu.raj@poornima.edu.in

Abstract

This paper reviews how AI related technologies are impacting sustainable marketing, and the interface of green advertising in India. Growth in consumer awareness continues to spur the need for advertising that is sensitive to the environment and green advertising. AI, through automation, personalization, and trend analysis, assists in the amplification of messages related to eco-friendly products and services. This paper highlights AI's role in combating greenwashing as well as the disconnect between the brand and consumer relationship in India. It also describes some of the challenges, highlights a case study that deals with ethical considerations of green advertising, and provides strategic outlines and frameworks of AI-driven green advertising.

Keywords: *Green Advertising, Artificial Intelligence (AI), Marketing, Consumer Trust, Greenwashing Prevention*

Introduction

Prompted by heightened consumer awareness and immediate environmental issues, the quickly growing Indian economy is transforming towards sustainability. The advertising industry is undergoing a shift in the innovation and marketing of less harmful and more eco-friendly products and services, especially in the realm of green advertising (Polonsky, 2011). Along with this, the advancements in Artificial Intelligence (AI) technologies have now become a catalyst for increased accuracy, automation, and real-time analytics in marketing (Dwivedi et al., 2021). The integration of AI with green advertising provides a chance to promote sustainable advertising while ensuring accountability and real engagement. This consideration drives this inquiry AI's role in formulating green advertising strategies in India, and its application in ensuring the transparency and trust of eco-savvy users (Chatterjee et al., 2022).

India: Green Advertising and Consumer Behavior

"Green advertising" refers to marketing communications that promote the environment-friendly attributes of a product with the aim of changing consumption behavior to adopt more environmentally friendly practices (Polonsky, 2011). There is a shift within the Indian market where younger consumers, particularly urban millennials and Gen Z, are increasingly seeking eco-friendly products (Nielsen, 2020). In a Nielsen survey (2020), 73% of Indian respondents expressed a willingness to pay more for sustainable merchandise. Also, alongside these positive trends, there is increasing suspicion from consumers due to widespread greenwashing—bogus or exaggerated eco-friendly claims about a product—which is eroding trust (Banerjee et al., 2022). This creates a need for application of communication which accentuates both the ecological and technological aspect of an organization while being exposes the ethical use of AI (Verma & Yadav, 2020).

The Effects of Artificial Intelligence on Eco-Friendly Advertisement

The new forms of eco-friendly advertisements can utilize new technological resources such as AI, which includes machine learning, natural language processing, and predictive analytics. AI customizes green messages to the individual level through its need assessment and purchase history analysis (Kapoor et al, 2023; Dwivedi et al, 2021). For example, eco-minded AI AI algorithms can detect users that have a higher probability of interacting eco-friendly products and target them through customized programmatic offer (Chatterjee et al, 2022). AI can analyze public sentiment through social media and enable real-time responsive editing of advertisement messages (Chatterjee et al, 2022). With AI based sentiment analysis, Tata Motors and ITC were able to enhance brand perception and campaign performance through refining green messaging and assessing campaign impact (Mishra & Pathak, 2023). The user interactions are better with AI powered tools such as virtual assistants which help to explain to users the green attributes, certifications, and other sustainability practices, thereby, enhancing the trust and transparency (Verma & Yadav, 2020). Besides the marked reduction in the costs of carrying out marketing, these tools also provide 24hour eco-literacy consumer support improving consumer experience (Dwivedi et al, 2021).

Using AI to Combat Greenwashing

One of the most effective ways AI can be used in greenwashing is to take on the problem head on. With AI's capabilities, it can identify greenwashed claims by comparing the promotional material with the certifying documents and real time environmental performance data

(Banerjee et al., 2022). For example, AI can be programmed to catch the vague and ambiguous phrases “eco-friendly” or “natural” which has no empirical data supporting it. This ability can assist the regulators of advertising and consumer protection advocates in India such as the ASCI to uphold ethical advertising (Saxena & Kaushik, 2021). AI also reinforces internal corporate governance by the brand’s emissions supply chain, product lifecycle assessments and sustainability reports which are oftentimes part of green marketing. These reports are used to counter posture in greenwashing allegations (Mishra & Pathak, 2023). Quoting the above studies, it can be said that this prevents a corporation from losing reputation and builds consumer trust over time. (Chatterjee et al., 2022).

Methodology

This research focuses on Artificial Intelligence (AI) in green advertising in India using a qualitative, secondary data methodology. A literature search conducted in Scopus, Web of Science, and Google Scholar from 2018 to 2024 provided 30 sources which helped construct key themes from trust, regulation to personalization. Brand case studies from Hindustan Unilever and Tata Motors provided additional practical perspectives. Although the research was rich in concepts, the lack of primary data was a significant limitation.

Examples from India

Some brands in India have started using green advertising. Hindustan Unilever’s “Smart Water Savers” Campaign used AI to estimate a household’s water usage and advertise eco-efficient products such as Surf Excel Matic (Kapoor et al., 2023). In a similar manner, Infosys implemented AI as part of its internal green initiatives by claiming carbon neutrality and showcasing AI analytics and automated dashboards for stakeholders (Mishra & Pathak, 2023). Brands like “Climes” use AI technology to monitor carbon offsets and assist brands in communicating their sustainability-driven green impact to consumers (Banerjee et al., 2022). These initiatives demonstrate how brands in India are using technology to verify sustainability as a point of distinction among authentic and deceitful greenwashed brands (Verma & Yadav, 2020).

Problems and Ethical Issues

AI in Green Marketing faces hurdles in India as there are still opportunities to explore. The first challenge is due to the absence of standardized data for eco-certification which makes the

validation of green claims incredibly difficult for AI (Banerjee et al., 2022). Second, analyzing consumer data to tailor eco-friendly advertisements raises privacy concerns (Saxena & Kaushik, 2021). Furthermore, targeting lower-income groups with green products tends to reinforce social inequalities due to algorithmic biases (Kapoor et al., 2023). India is still in the process of developing some policies. The ASCI as issued some policies on environmental claims, there are gaps with regard to AI and advertising ethics (Saxena & Kaushik, 2021). In the absence of well-defined guidelines, AI can be used to disguise eco-unfriendly initiatives as green innovations (Mishra & Pathak, 2023).

Discussion

The use of AI technology is transforming marketing for sustainability in India. With the use of AI, personalization, analytics, and credibility checks can be done in real-time, thus resolving issues of greenwashing and consumer credibility problems (Banerjee et al., 2022; Kapoor et al., 2023). Machine learning and NLP technologies assist in validating claims, building trust, and running campaigns efficiently (Verma & Yadav, 2020). AI's capabilities in estimating the quantitative worth of environmental benefits, carbon offsetting, is already being showcased by brands like Climes and Hindustan Unilever (Mishra & Pathak, 2023).

Ethically using AI in green advertising faces challenges such as lack of universally accepted benchmarks, skeletal frameworks in ASCI guidelines, absence of regulatory oversight, and trustworthiness. These factors can contribute to algorithm-based discrimination and bias (Saxena & Kaushik, 2021). AI poses the risk of accentuating greenwashing if not applied responsibly. For AI technology to be effective, it needs to be held to guidelines of controllable standards, clearly defined frameworks, and collective societal expectation in the cooperation of marketers, technologists, and regulators (Chatterjee et al., 2022).

Conclusion and Future Directions

AI's role in green advertising offers an unprecedented opportunity for marketers in India to foster sustainability, improve brand reputation, and heighten consumer participation. AI resolves critical shortcomings of conventional green advertising by providing real-time data and individualized communication (Dwivedi et al., 2021; Kapoor et al., 2023). Still, concern for data ethics and open communication protocols are critical. It is necessary to come together as marketers, technologists, policymakers, and the public to ensure future green advertising is dependable and effective but, at the same time, ethical and truthful (Banerjee et al., 2022;

Saxena & Kaushik, 2021). AI-driven advertising can serve as an instrumental force in nurturing trust, delivering sustainable value, and stimulating genuine transformation as India moves towards a greener economy (Chatterjee et al., 2022).

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Integrating Japanese Mesh Work, Weaving Derivatives, and Monochromatic Color Effects for Visual Illusions

Rekha Sharma, Research Scholar | Dr. Gunja Soni, Professor

Poornima University Jaipur

Abstract

This research explores the aggregate of Japanese mesh paintings, weaving derivatives, and monochromatic colour consequences to create optical illusions in fabric format. Traditional Japanese weaving techniques are recognized for his or her complicated structures, at the same time as modern weaving derivatives decorate the ones techniques with modern-day aesthetics. By utilising monochromatic color schemes, this have a look at investigates how depth perception and seen illusions can be optimized in fabric programs. Through experimental weaving strategies and qualitative analysis, the take a look at evaluates the effectiveness of these hybrid strategies in generating visually dynamic textiles. The findings spotlight the ability for those integrated strategies to be utilized in style, interior format, and innovative installations, providing new possibilities for progressive textile development.

Keywords: *weaving, monochromatic, textile, innovative, perception*

Introduction

Textile layout has long integrated pretty a few weaving techniques to create visually stimulating outcomes. Among these, Japanese mesh paintings and weaving derivatives stand out as conventional strategies able to producing problematic styles. When mixed with the strategic use of monochromatic coloration results, the ones techniques can generate striking optical illusions. This research explores the mixture of these elements to enhance cutting-edge material aesthetics and functionality [1][2].

Background

Traditional Japanese mesh art work and weaving derivatives had been applied for masses of years, specially in style and interior textiles. These strategies involve tricky interlacing techniques that beautify texture and depth perception. Meanwhile, the utility of monochromatic shade schemes in textiles stays underexplored, specifically concerning their functionality to create optical illusions. By bridging the space between those historic techniques and

contemporary aesthetics, this take a look at objectives to enlarge textiles that beautify visual depth and notion.

Research Problem/Question

How can Japanese mesh work, weaving derivatives, and monochromatic color effects be integrated to create optical illusions in textile design?

Purpose Statement

This study seeks to explore and optimize the fusion of traditional and modern textile techniques to enhance visual illusions. The research aims to develop innovative textile structures that leverage these methodologies to improve both aesthetics and functionality in contemporary applications.

Problems Identified

Gap in Current Textile Designs Regarding Optical Illusions

Many contemporary textiles focus on color contrast or digital printing for visual depth, yet few incorporate structural weaving techniques to achieve similar effects.

Insufficient Integration of Traditional Techniques with Modern Aesthetics

Despite the historical significance of Japanese mesh work, its application in modern textile design remains limited. Integrating these techniques with contemporary approaches could yield novel results.

Lack of Exploration Regarding Monochromatic Color Application in Textiles

While color theory is well-documented in design disciplines, its specific application in weaving-based optical illusions has not been extensively studied.

Proposed Solutions

Development of Hybrid Textile Structures Combining Traditional and Modern Techniques

The integration of conventional and cutting-edge fabric techniques offers an innovative approach to fabric design, improving aesthetic appeal and functional residences. One such compelling fusion is the combination of Japanese mesh paintings with modern-day weaving

derivatives. By leveraging the difficult, interlocking systems feature of Japanese mesh work and incorporating them into present day fabric engineering, a brand new category of hybrid textiles can be advanced. These textiles show off superior depth perception, creating a 3-dimensional effect that enriches their visible and tactile traits [3].

Japanese mesh paintings, recognised for its precision and openwork aesthetics, can be merged with based weaving patterns from digital jacquard or computerized looms. This synergy permits the introduction of textiles that balance way of life with innovation, supplying a creative yet useful medium for programs in style, indoors layout, and technical textiles. The incorporation of 3-D-weaving techniques in addition amplifies the interaction between light, shadow, and transparency, delivering precise surface textures which might be visually dynamic [4][5].

Optimization of Materials and Techniques for Enhanced Durability and Aesthetics

To make sure the sturdiness and practicality of hybrid cloth structures, selecting appropriate fibers and refining weaving methodologies are important. High-overall overall performance fibers at the side of polyester, nylon, and aramid can enhance sturdiness, at the equal time as herbal fibers like silk and cotton make contributions to a pricey sense and breathability. Blending those fibers optimally can result in fabric which might be each resilient and visually appealing [6].

Weaving techniques have to additionally be great-tuned to address the fusion of traditional and cutting-edge factors. Utilizing advanced tension manipulate, variable density weaving, and reinforced systems can growth the mechanical stability of hybrid textiles. Surface treatments, which include coatings or nano-finishes, can further growth sturdiness, rendering textiles immune to position on, moisture, and UV publicity. Additionally, three-D modeling and digital simulations may be hired to expect material conduct beneath severa situations, supporting within the refinement of weaving techniques before full-scale production [7].

Application of Monochromatic Color Theory to Improve Visual Effects

Color performs a pivotal role in fabric design, influencing perception and intensity results. The software of monochromatic color principle can appreciably beautify the illusionary intensity in hybrid textiles. By using varying sun sunglasses, tones, and textures of a unmarried colour, designers can manage moderate interplay to create a complex visible impact [8].

For example, lighter tones may be used to highlight raised regions, while darker tones recede into the historical past, producing an phantasm of depth without converting the structural homes of the fabric. This approach is specially powerful even as implemented to hybrid textiles presenting Japanese mesh work, as it emphasizes the interaction of transparency and shadow [9].

Furthermore, dyeing and completing techniques including ombre gradients, pigment printing, and fiber blending may be explored to deepen the monochromatic impact. The strategic use of gloss and matte contrasts inside a single colour family can beautify the overall depth perception, making textiles seem greater dynamic and layered [10].

Research Design

A blended-techniques technique incorporating qualitative and quantitative analyses might be used to evaluate the effectiveness of the proposed fabric designs. This technique will allow for a complete information of each the technical and aesthetic components of the hybrid textiles.

Data Collection

Experimental weaving strategies could be applied, and professional opinions might be gathered thru established interviews and visible perception assessments. These methods will help determine the practical and aesthetic viability of the brand new fabric structures.

Analysis Methods

The research will determine depth belief, material sturdiness, and aesthetic attraction thru comparative analysis with current textile designs. Metrics together with tensile strength, put on resistance, and subjective visible critiques will be used to quantify the effectiveness of the hybrid systems.

Results of Implementation

Presentation of Sample Designs

Three major weaving systems—Plain Weave, Twill Weave, and Satin Weave—can be used to illustrate the proposed integration of strategies. These sample designs will function sensible demonstrations of the methodology and highlight the precise characteristics of hybrid fabric systems.

The convergence of conventional and cutting-edge fabric techniques, cloth optimization, and choice of fibers and superior weaving methodologies ensure durability and practical viability. Finally, the utility of monochromatic colour concept refines the visible effect, creating textiles which are both artistically and technically innovative. This multidisciplinary method paves the way for novel cloth designs that cater to the needs of present day consumers at the same time as respecting traditional craftsmanship. Strategic color software offers a promising route for the evolution of hybrid textiles. By integrating Japanese mesh work with modern-day weaving derivatives, textiles with more desirable intensity belief and aesthetic sophistication can be achieved. Furthermore, the careful

Description of Outcomes for Each Woven Structure

- **Plain Weave**: Provides a fundamental base for optical effects, though limited in complexity.
- **Twill Weave**: Allows for diagonal patterning that enhances depth perception.
- **Satin Weave**: Facilitates high contrast between light and shadow, amplifying visual illusions.

Figures and Weaving Variations

- **Figure 1: Basket Weave** A fundamental and versatile weaving sample characterized by means of a simple, grid-like shape. It includes interlacing strips of fabric alternately over and underneath every different at right angles, creating a checkerboard impact. This weave is valued for its energy, balance, and visual attraction, making it suitable for both purposeful and ornamental purposes
- **Figure 2: Hopsack Weave**
    - A variation of the traditional Basket Weave, additionally referred to as an Irregular Basket Weave. It features companies of warp and weft threads interlacing irregularly, growing a distinct checkerboard-like look with varying block sizes. The staggered spacing and grouping beautify texture and visual enchantment.
- **Figure 3: Basket Weave (Variation)**

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- This structure capabilities alternating black and white strips arranged in a crisscross sample. It makes use of more than one warp and weft threads grouped collectively to create a stronger, greater textured impact, producing a signature checkerboard appearance.

- **Figure 4: Leno Weave (Openwork Weave)**
    - A special sort of weave where two or extra warp threads are twisted round each different to lock the weft threads in vicinity. This creates a strong, open structure that stops thread slippage while offering a ornamental, breathable texture. Commonly used in crafting and specialty textiles.

- **Figure 5: Basket Weave (Fabric Swatch)**
    - A square material swatch presenting alternating strips of light and darkish material interwoven in a based pattern. The cloth includes over-and-below weaving, growing a symmetrical, grid-like sample with rectangular openings.

- **Figure 6: Lattice Weave**
    - A geometric woven layout using alternating cloth strips interlaced in a dependent pattern, forming square and rectangular voids. This weave resembles a lattice weave, a derivative of the basket weave, the use of a couple of layers of interlaced strips to create a extra open shape with deliberate gaps..

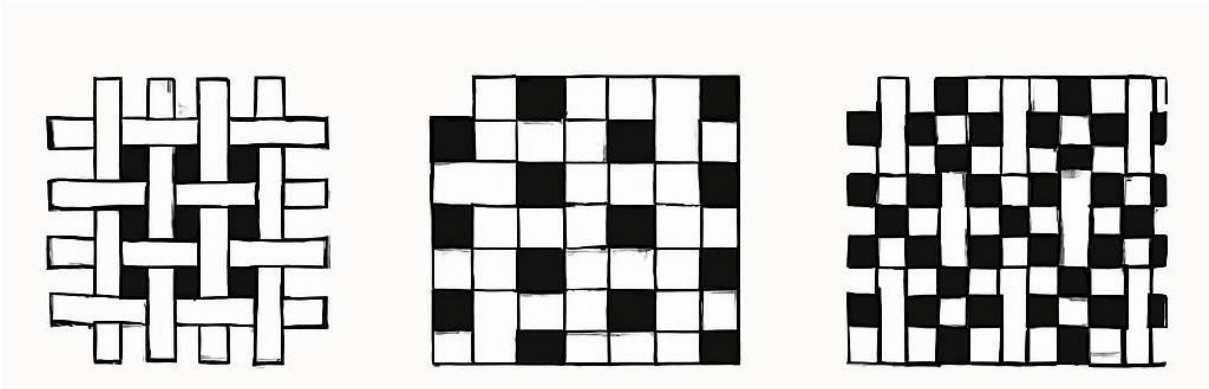

Figure 1-3: Basket,hopsack and Basket

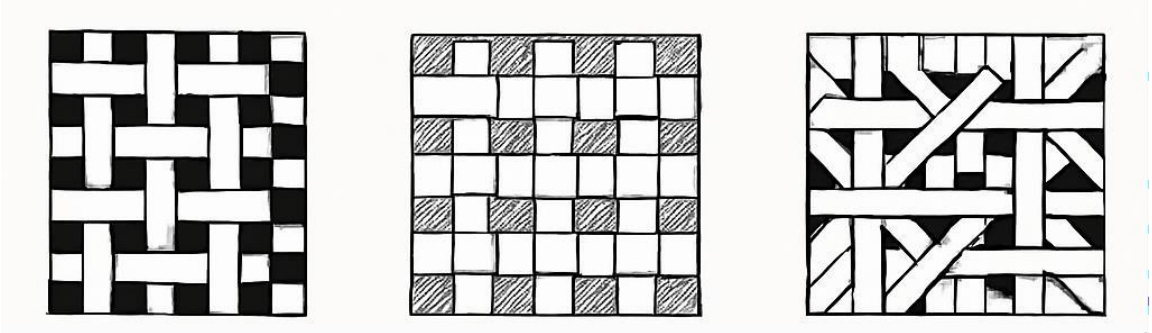

Figure 4-6: Basket,hopsack and Basket

Visual Effects Achieved

The study will examine how these weaving patterns interact with monochromatic color schemes to produce illusions of movement, depth, and texture.

Discussion

Comparison of Results with Existing Literature

Findings will be compared with previous studies on optical illusions in textile design, highlighting improvements in methodology and aesthetic outcomes.

Insights into the Effectiveness of Proposed Solutions

The combination of traditional weaving techniques with modern color applications will be evaluated for their effectiveness in generating optical illusions.

Interpretation of Results

- **Impact of Integrating Traditional and Modern Techniques**: The results will demonstrate how combining these methodologies enhances the visual appeal and functionality of textiles.
- **Implications of Findings**: The study's findings will be applicable in fashion, interior design, and artistic installations, offering new possibilities for innovative textiles.

Limitations

Constraints in Material Availability

Access to specific fibers and traditional weaving tools may limit experimentation.

Challenges in Achieving Consistent Results Across Different Designs

Variability in handwoven techniques may affect the reproducibility of visual effects.

Observational Bias in Aesthetic Evaluations

Subjectivity in perception and interpretation of visual illusions may introduce biases in the assessment of results.

Conclusion

The convergence of conventional and cutting-edge fabric techniques, fabric optimization, and strategic shade software offers a promising direction for the evolution of hybrid textiles. By integrating Japanese mesh work with modern weaving derivatives, textiles with stronger depth belief and aesthetic sophistication may be finished. Furthermore, the cautious choice of fibers and superior weaving methodologies make certain durability and useful viability. Finally, the utility of monochromatic colour theory refines the visual impact, creating textiles which can be each artistically and technically revolutionary. This multidisciplinary technique paves the way for novel material designs that cater to the demands of modern-day customers whilst respecting traditional craftsmanship.

Summary of Findings

The studies demonstrate that integrating Japanese mesh paintings, weaving derivatives, and monochromatic shade outcomes can effectively create optical illusions in textiles**.**

Contributions to the Field of Textile Design

This study bridges conventional and modern-day layout practices, increasing the capacity for innovation in fabric aesthetics and capability**.**

Future Research Directions

Further research may additionally want to explore extra colour schemes, advanced weaving technology, and the intellectual impact of optical illusions in textiles on consumer perception and interplay.By systematically investigating and imposing these techniques, this research contributes to the evolving area of cloth layout, selling each imaginative expression and realistic software in numerous industries.

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Tools, Materials, and Techniques in Akola Printing: Documentation for Craft Preservation

Simran walia, Reserach Scholar | Dr. Gunja Soni, Professor
Poornima University, Jaipur

Abstract

Akola Printing is a traditional hand-block printing craft of Rajasthan, renowned for its distinctive motifs, natural dye applications, and resist-dyeing methods. Despite its cultural significance, limited scholarly documentation exists on the tools, materials, and techniques that define this heritage practice. This research aims to systematically document and analyze the essential components of Akola Printing, focusing on the instruments used, the raw materials and natural dyes applied, and the specialized processes that sustain the craft. The study employs a qualitative approach through field visits, artisan interviews, direct observation of printing practices, and a review of existing literature. The results emphasize the distinctive artistry of carving wooden blocks, the use of natural dyes like alizarin and indigo, and the deft application of resist pastes made of clay to produce layered designs. The study emphasizes how urgently preservation measures are needed, given the threats to the craft from industrial alternatives and declining artisan incomes. This study supports the sustainable future of the artisan community and helps to preserve cultural heritage by archiving the traditional knowledge of Akola Printing.

Keywords: *natural dyes, tools, Akola printing, methods, and craft preservation*

Introduction

One of India's oldest textile decoration customs is hand block printing, which dates back to ancient civilizations when fabrics were adorned with carved wooden blocks and natural dyes. This craft evolved over time into regional customs like Dabu in Madhya Pradesh, Bagru and Sanganeri in Rajasthan, and Ajrakh in Gujarat. Because each style has unique visual elements, technical procedures, and symbolic motifs, block printing is recognized as a craft method as well as a means of cultural expression.

Figure:1 Different Block Design

Akola Printing, which is practiced in the Rajasthani village of Akola, is an important part of the region's legacy within this tradition. Akola Printing, which is distinguished by its deep indigo hues, clay-resist (dabu) methods, and traditional motifs, is a reflection of the artists' inventiveness as well as their sociocultural identity and generational knowledge. The process, which relies on natural dyes and eco-friendly practices, demonstrates the sustainable principles embedded in indigenous crafts. However, like many other handloom and handicraft traditions, Akola Printing faces threats from industrial textile production, reduced artisan income, and declining intergenerational transmission of skills.

In this context, documentation of tools, materials, and techniques becomes essential for cultural preservation. As emphasized in the UNESCO framework on safeguarding *Intangible Cultural Heritage (ICH)*, recording and archiving traditional practices is a critical step toward sustaining community identity, empowering artisans, and ensuring knowledge transfer to future generations. By documenting Akola Printing, this research contributes to both academic literature and practical initiatives for craft revival.

The objectives of this study are:

1. To identify and describe use of the traditional Akola Printing tools.
2. To document the raw materials and natural dyes utilized during the procedure
3. To examine the unique dyeing and printing methods employed by Akola Printing.

4. To offer preservation techniques that guarantee the craft's continued existence for upcoming generations

Literature Review

Block printing's cultural, social, and economic significance is highlighted in the literature review, which focuses on Sanganeri and Bagru traditions. According to Kashyap et al. (2021), the historical significance and current challenges of Sanganer printing are highlighted by the growing use of synthetic dyes. Using carved wooden blocks, natural dyes, and resist techniques, this centuries-old technique produces distinctive patterns on fabric. Various regions developed their own printing traditions due to artisanal skills, cultural narratives, and local resources. Many studies have been conducted on important traditions such as the Dabu printing of Madhya Pradesh and Rajasthan, which is renowned for its clay-resist technique and indigo dyeing. Bagru printing, found near Jaipur, is known for its use of natural colors and bold floral or geometric motifs. Under Mughal sponsorship, Sanganeri printing flourished and gained popularity for its delicate floral designs in vivid hues, frequently on white fabric. Similarly, the geometric patterns, symmetry, and multi-layered resist-dying method using indigo and madder make Ajrakh printing from Kutch (Gujarat) and Barmer (Rajasthan) distinctive. However, Akola printing in Chittorgarh, Rajasthan, has not gotten much attention despite having an equally rich tradition. The mud-resist (dabu) technique, indigo dyeing vats, and unique motif vocabulary of the artisan communities in Akola village are the craft's most well-known features. Akola Printing is still a regional art form that is only practiced by a small number of artisan families, making it susceptible to extinction in contrast to Bagru or Sanganer, which are extensively documented and commercialized. Akola is frequently mentioned in passing and only in more general surveys of Indian or Rajasthani textiles; its instruments, raw materials, and technical procedures are not thoroughly discussed. Greer et al. (2017) concentrate on how designers can protect artisanal knowledge in the face of modernization pressures. Purohit et al. (2017) encourage eco-friendly innovations for revival through their investigation of Akola and Dabu techniques. Sharma et al. (2017) address the broader sustainability concerns that Indian crafts encounter and advocate for both educational and legislative reforms. Agrawal et al. (2022), who highlight environmental issues brought on by the use of chemicals, trace the

development of dyes in Sanganeri printing. Urbanization and market demands have altered motifs and led to the use of synthetic dyes, claim Mehta et al. (2013) and Garg et al. (2020). Lastly, Hada et al. (2022) reiterate the uniqueness of Dabu printing and stress sustainable preservation. These studies collectively demonstrate that block printing is at a turning point and requires comprehensive strategies to embrace innovation while upholding tradition. This gap highlights how important it is to do focused research on Akola printing in Chittorgarh. Through documentation of the tools, materials, and techniques used, this study contributes to the preservation of an underrepresented craft. The theoretical basis of this work lies in craft documentation and heritage preservation, where recording artisan knowledge and production processes is crucial to sustaining cultural identity, strengthening community livelihoods, and ensuring continuity of traditional skills amidst the pressures of industrialization and changing consumer demand.

Research Methodology

The present study adopts a qualitative and descriptive approach, suitable for documenting traditional crafts that rely on tacit knowledge, oral traditions, and hands-on skills. Since Akola Printing is primarily practiced by a limited number of artisan families in Chittorgarh, the methodology emphasizes direct engagement with the community to capture authentic practices and lived experiences.

Data Collection

1. **Field Visits:** Multiple visits were undertaken to Akola village in Chittorgarh district, where the craft is actively practiced. These visits enabled direct interaction with artisans in their natural work environment.
2. **Observation:** The entire printing process was observed in detail, from fabric preparation to block printing, resist application, dyeing, and finishing. Special attention was given to the use of tools and the handling of natural dye materials.
3. **Interviews:** Semi-structured interviews were conducted with practicing artisans, block carvers, and community elders. These conversations provided insights into traditional knowledge, challenges faced by artisans, and generational changes in practice.

4. **Visual Documentation:** Photography and sketching were employed to record tools, block designs, and motifs. These visual records serve as an archive of material culture and design vocabulary.
5. **Secondary Sources:** Existing literature, reports, and previous studies on block printing traditions were reviewed to contextualize Akola Printing within the larger framework of Indian textile crafts.

Data Analysis

The data was analyzed through thematic analysis, focusing on recurring patterns in the printing process, tool usage, dye preparation, and motif design. Field notes, interviews, and visual documentation were categorized into themes such as *tools*, *materials*, *techniques*, and *preservation challenges*. Comparative insights were also drawn with other regional printing traditions (Bagru, Sanganeri, Ajrakh) to highlight the uniqueness of Akola Printing.

Tools in Akola Printing

The practice of Akola Printing relies on a range of traditional tools, each designed to support a specific stage of the process. These tools are handcrafted, locally available, and reflect the intimate connection between artisans and their craft. Documentation of these tools is essential, as they form the foundation of the printing technique and embody generations of artisanal knowledge.

1. **Printing Tables:**

Small wooden tables are used for spreading fabric and performing block printing. The average size of these tables is around 150 cm x 60 cm, providing sufficient workspace for artisans to align fabrics and press blocks with precision. The table surface is cushioned with layers of cloth to ensure even impression of blocks.

2. **Wooden Printing Blocks:**

The core tool of Akola Printing, these blocks are hand-carved from seasoned wood (commonly sheesham or teak). Each block carries motifs inspired by local culture, flora, and symbolic elements. Blocks are carved with intricate precision, allowing for both outline (*rekh*) and filler (*datta*) patterns.

3. **Dabu Resist Application Tools:**

For preparing and applying the clay-based resist paste (*dabu*), artisans use wooden trays, brushes, and ladles. The resist mixture is spread onto carved blocks or applied directly onto fabric. The trays hold the paste, while brushes and wooden spreaders ensure consistency.

4. **Dyeing Trays:**

   Made of wood or plastic, these shallow trays are filled with dye solutions such as indigo or alizarin. Fabrics printed with resist paste are carefully dipped into these trays to achieve layered dye effects.

5. **Boilers (Kadhai):**

   Large metal vessels, resembling traditional *kadhai*, are used for boiling fabrics in water mixed with natural ingredients. This step helps in removing excess tar, starch, or impurities from the cloth, and also in fixing certain dye colors.

6. **Washing and Dyeing Equipment:**

   The process requires large tubs, buckets, and vessels for washing printed fabrics multiple times during dyeing and post-printing stages. These vessels are typically placed near water sources for convenience.

7. **Block Carving Tools:**

   Skilled block makers use chisels, hammers, and fine carving knives to prepare wooden blocks. Each tool serves a different purpose—chisels for outlining motifs, knives for finer cuts, and hammers for shaping.

8. **Sun-Drying Racks:**

   After printing and dyeing, fabrics are stretched and dried under the sun. Simple bamboo or wooden racks are used for drying, ensuring even exposure and natural color development.

Figure:2 Akola Block Print

Materials Used in Akola Printing

The distinctiveness of Akola Printing lies not only in its tools and techniques but also in the traditional materials that artisans rely upon. These materials are locally sourced, eco-friendly, and reflect centuries of indigenous knowledge of natural resources and dye chemistry.

Tar Block Printing (Black Printing)

Tar printing is a method where a tar-like paste (usually containing iron) is used as a resist and to create bold outlines or dark motifs.

Materials Used

- Fabric: Cotton, mulmul, khadi (base fabric).
- Tar/Black Paste:
- Iron filings (lohe ka chura)
- Jaggery (gur)
- Tamarind seed paste / Gum
- Water

  (This mixture ferments and produces a black-colored solution, traditionally called Syahi.)
- Wooden Blocks: For stamping the tar paste onto fabric.
- Mordants: Alum or Harda, to prepare the fabric before dyeing.
- Boilers & Vessels: For fabric treatment and boiling.
- Drying Area: Open ground or bamboo racks for drying stamped fabric.

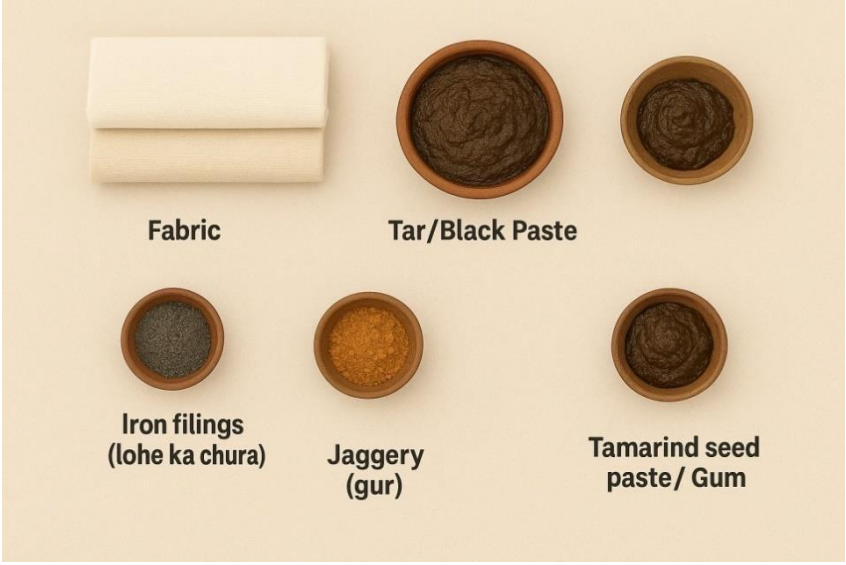

Figure:3 Traditional Akola Print Material

2. Dabu Printing (Mud-Resist Printing)

Dabu printing is a resist-dyeing technique where mud paste (dabu) is applied to prevent dye from penetrating certain areas of the fabric.

Materials Used

- Fabric: Cotton, mulmul, khadi.
- Dabu Resist Paste:
  - Clay (mitti) – main base
  - Wheat chaff powder / sawdust – to strengthen the paste and prevent smudging
  - Gum (gond) – for stickiness and binding
  - Lime (chuna) – enhances adhesion
- Natural Dyes:
  - Indigo (blue)
  - Alizarin (red)
  - Pomegranate rind or Turmeric (yellow)
- Mordants:

- Harda – for pre-treatment and tannin base
- Alum – for fixing red tones with alizarin

- Wooden Blocks: For applying dabu resist patterns.
- Washing & Dyeing Equipment: Large vats and vessels.
- Drying Spaces: Sun-drying areas to fix color and resist.

Figure:4 Dabu Akola Pint Material

Motif and Colour

Akola motifs are characterized by their rich colours obtained from natural sources, ensuring eco-friendly textile practices. The designs display fine detailing and precise outlines, showcasing traditional craftsmanship. These motifs not only serve decorative purposes but also preserve cultural heritage through symbolic representation.Motifs Of Dabu prints are small to large in size and can be one or two or more of the following groups: -

- Motifs of Kehma, Lal titri, Dholi titri, Kantedar and Dholika
- Motifs of plants, Leaves and buds
- Motifs of Flowers
- Motifs of Birds
- Motifs of Fruits

- Motifs of cornstalk/ boota
- Motifs of animal figures
- Motifs of geometric shapes, dots, wavy lines, vertical lines,Horizontal lines and many distinctive shapes

Figure: 5 Different Type of Motif

Local Name	**Botanical Name**	**Color Produced**
Dhak or Palas	Butea Monosperma	Bright Yellow
Casala	Carthamus Tinctorium L	Golden Yellow
Haldi	Curcuma Longa	Yellow
Neel	Indigofera Tictoria	Blue
Manjistha or Madder	Rubia Cordifolia	Red
Alizarin (Synthetic)	-	Red
Nasphal	Punica Grantum	Greenish Yellow
Harda	Terminalia Chebula	Greenish Yellow

Table 1: Natural Dyes and Their Color

Methods of Akola Printing

Akola, located near Chittorgarh (Rajasthan), is famous for its traditional hand-block printing techniques. Two main methods are practiced here: **Akola Tar Printing** and **Akola Clay (Dabu) Printing**. Both are resist-dyeing techniques but differ in materials and process.

Akola Tar Printing Process

1. **Preparation of Fabric**

- The fabric is thoroughly washed to remove starch and impurities.
- Dyed in *Harda* solution, which acts as a natural mordant, giving the cloth a yellowish base.

2. **Preparation of Naphthol Solution**

- A mixture of naphthol, caustic soda, and Turkey Red Oil (T.R.O.) is prepared.
- This yellow solution is stored in earthen pots.

3. **Naphthol Printing**

- Wooden blocks are dipped in the naphthol solution and used to print designs.
- Further treatment with GP salt and gum paste turns the yellow base into a bright red.

4. **Application of Tar Resist**

- Tar is melted in an earthen pot and applied carefully with blocks or by hand on selected areas.
- Once dried, tar acts as a strong resist to prevent dye penetration.

5. **Indigo Dyeing**

- The fabric is dipped repeatedly (10–20 times) in deep indigo vats (*Maaths*), about 8–10 feet deep.
- This gives the fabric its characteristic **blue-black tone**.

6. **Boiling & Washing**

- The fabric is boiled in large vessels of water to remove the tar.
- Washed thoroughly to reveal sharp resist-printed patterns.

7. **Final Fabric**

- The result is a vibrant textile combining indigo blue, black, and red motifs, highly durable and rich in traditional designs.

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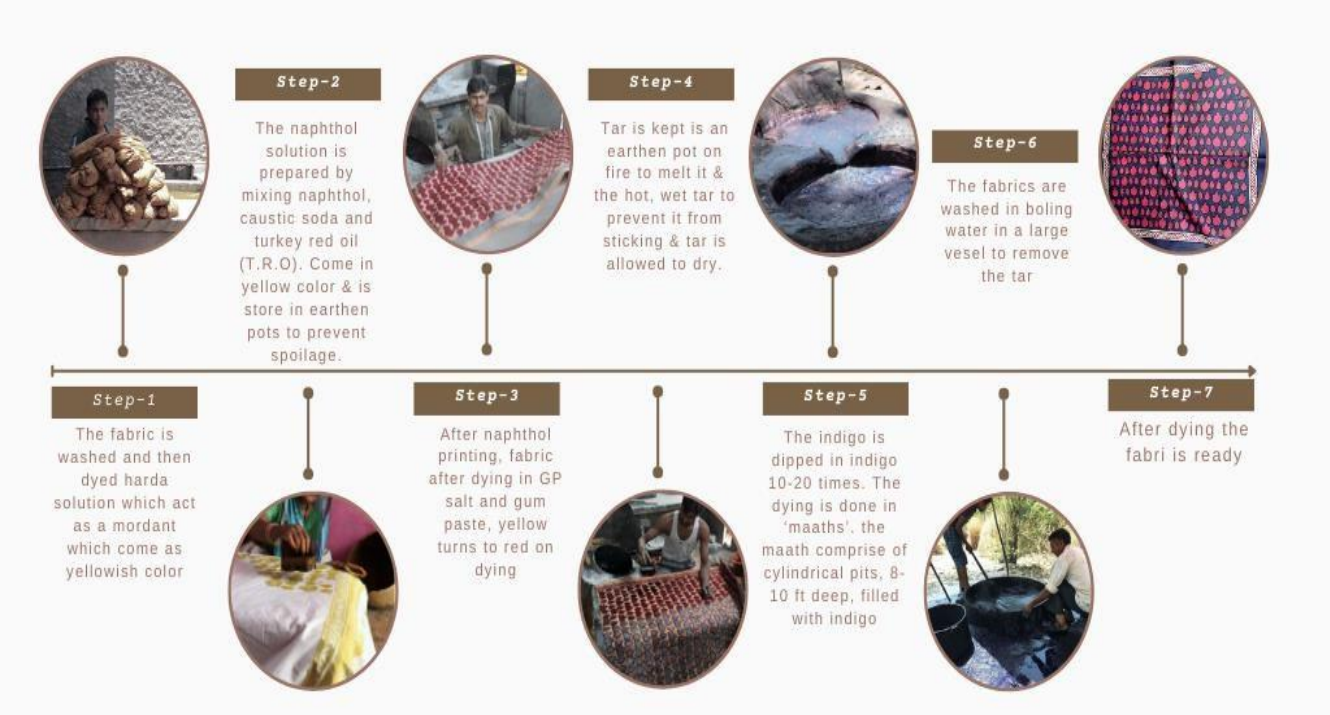

Figure:6 Akola (Tar) Printing Process

Akola Clay (Dabu) Printing Process

1. **Clay Preparation**

- *Kali Mitti* (black clay) is soaked overnight.
- Mixed with *Chuna* (lime), *Beedan*, and *Gond* (natural gum).
- Kneaded by foot, rested overnight, sieved, and stored in a mud pot (*Mardia*).

2. **Block Printing**

- Wooden blocks are dipped in the prepared clay resist and stamped on the fabric.
- Sawdust is often sprinkled over wet prints to strengthen the resist.

3. **Indigo Dyeing**

- Printed fabric is dipped into indigo dye vats.
- Repeated multiple times to achieve deeper shades of blue.

4. **Drying**

- The fabric is dried under sunlight for 1–2 days.

5. **Resist Removal**

- After drying, the fabric is washed in water to remove the clay resist.

6. **Final Fabric**

- The outcome is a **soft, earthy indigo textile** with characteristic Akola hand-block motifs.

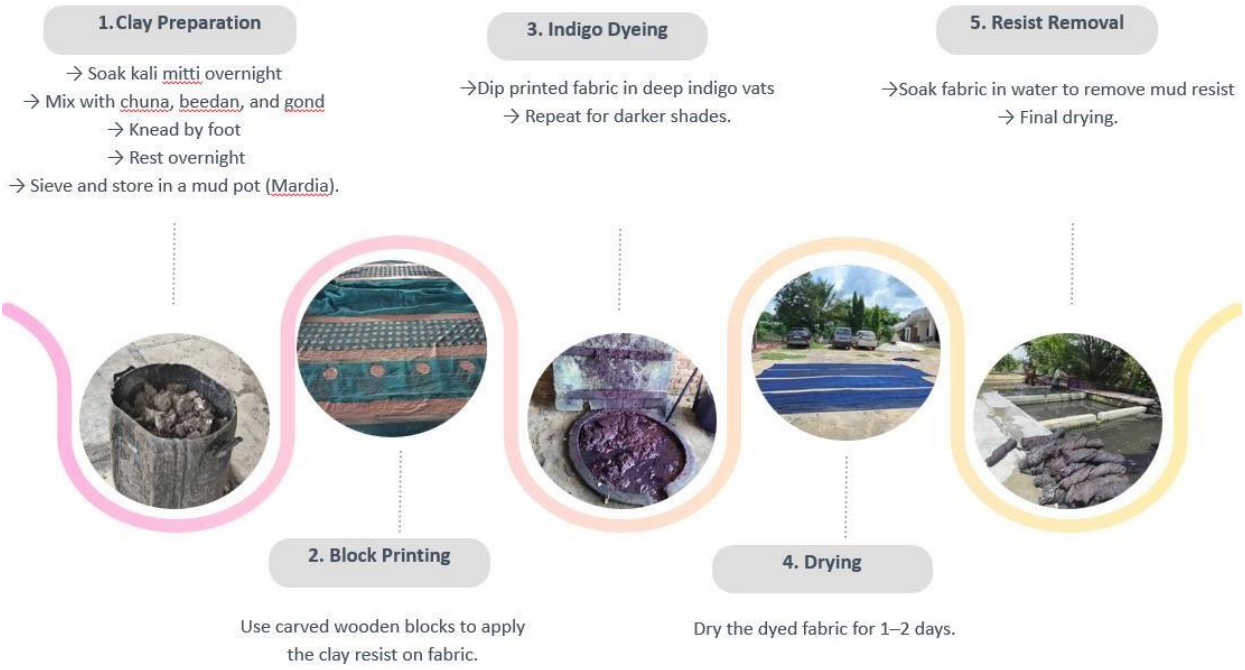

Figure:7 Akola Clay (Dabu) Printing Process

Discussion & Analysis

Comparison with Other Block-Printing Traditions

Bagru Printing (Rajasthan): Bagru prints are known for their use of natural dyes and the dabu (mud-resist) technique, producing earthy tones of red, black, and indigo. In contrast, Akola tar printing incorporates tar as a resist, resulting in stronger contrasts and darker indigo-black shades.

Sanganeri Printing (Rajasthan): Sanganer is famous for its fine floral patterns and bright, vibrant colors, achieved with delicate blocks and synthetic dyes. Akola, however, emphasizes bold resist patterns, geometric layouts, and natural dye bases.

Ajrakh Printing (Gujarat & Sindh): Ajrakh involves complex multiple resist-dyeing steps with natural dyes, producing symmetrical star-like patterns. Akola tar printing, though simpler, shares the philosophy of repeated indigo dipping and layering of motifs.

Role of Artisans' Skills and Generational Knowledge

Akola printing survives because of the deep-rooted knowledge of local artisan families.

Skills like preparing resist pastes, handling tar, and maintaining indigo vats are passed down orally and practically, ensuring authenticity.

The hand-block carving and printing demand high precision, which only comes with years of practice.

Sustainability Aspects

Eco-friendly Materials: Use of natural dyes like indigo, turmeric, alizarin, and pomegranate rind reduces chemical impact on the environment.

Water Usage: Though water-intensive (for washing, dyeing, and vat maintenance), the reuse of dye baths and controlled application reflects sustainable practices.

Biodegradability: Clay, gum, wheat chaff, and tar resist are mostly natural, leaving minimal waste.

Figure:8 Tar Applying Process on Fabric

Challenges Faced by the Craft

Decline of Natural Dye Usage: Increasing shift to synthetic dyes due to cost, availability, and faster production cycles.

Limited Artisan Income: Despite long hours of labor, artisans often receive low returns, as middlemen or mass-market competition reduce profit margins.

Modernization Pressures: Machine-printed fabrics and digital prints offer cheaper, faster alternatives, leading to reduced demand for slow handmade crafts.

Generational Gap: Younger artisans are reluctant to continue due to uncertain livelihoods, causing fears of skill erosion.

Preservation & Future Prospects

In order to preserve Akola printing, tradition and modernity must be carefully balanced. Archiving tools and methods, such as documenting resist-paste recipes, indigo vat techniques, and unique block motifs, are crucial for knowledge preservation. digital libraries, video recordings, and Giving researchers and future generations thorough instructions can ensure they have access to practical techniques. Design interventions, in which contemporary designers collaborate with craftspeople, can introduce novel motifs, color schemes, and product lines suitable for global markets. Training sessions that blend traditional techniques with modern design principles are crucial for drawing in younger students and artists. Online platforms for digital archiving and virtual exhibitions can reach a worldwide audience and showcase Akola's craft. Integrating prints with modern fashion expands the possibilities by using them in clothing, accessories, and home décor.Brands that use storytelling and highlight environmental friendliness and cultural heritage appeal to conscientious consumers. Collaborations with eco-friendly fashion brands and e-commerce platforms expand market reach even further. Collectively, these efforts guarantee the survival and prosperity of Akola printing.

Conclusion

The depth of India's textile heritage, which is founded on the skillful use of ancient tools, materials, and techniques, is demonstrated by the study of Akola Tar and Dabu block printing. From the careful preparation of resist pastes to the use of natural mordants and hand-carved wooden blocks, the process demonstrates both craftsmanship and cultural continuity. Each

step, like mixing natural dyes, applying clay resist, or allowing fabrics to air dry, demonstrates the artist's talent and wealth of generational knowledge. These practices need to be recorded in order to maintain this legacy in the face of modernization and industrialization. Important indigenous knowledge is preserved over time by documenting tools, motifs, dye recipes, and process steps.

Preservation of this kind also serves as a basis for scholarly investigation, design inspiration, and intercultural comprehension. Akola printing still has a lot of room for advancement and research. International craft collaborations, sustainable fashion, and eco-friendly product design can all help to revive this tradition. By integrating traditional methods with modern design interventions and supporting artisans through policy initiatives, training, and digital archiving, akola printing can continue to exist as a contemporary craft practice and cultural treasure.

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The Algorithmic Muse: Deconstructing AI's Role in Augmenting Ideation and Concept Generation in Creative Art Industry

Diksha Tangri, Research Scholar | Dr. Tikendra Kumar Sahu, Associate Professor
School of design and visual arts, Apeejay Stya University, Gurugram

Abstract

This research had explored the role of AI in forming ideation and concept development in design industry. This paper illustrated that how AI technology has been used to improve the creative ideas and concepts rapidly. This integration of AI in design industry had radically changed the traditional design processes. This paper had specifically shown how AI tools had been employed to elevate designer creativity, enabling the rapid production of a variety of concepts. The research had explored the various ways in which AI tools had enhanced and broaden designer's vision, facilitating the super-fast initiation of novel ideas and a diverse range of concepts, thereby offering designers an unequalled ability to explore multiple aesthetic angles. This qualitative study had essentially used in-depth case studies, examining how these platforms had made concept generation and ideation effortless. Insights had also been collected through questionnaires distributed to renowned art experts, specifically sculptors and graphic artists, to get their perspectives on AI's impact on creative art industry. This paper had concluded that the coming of AI technology into graphic design had notably reform designer's ideation and concept development. The impact of this transformation shifted the relationship between human graphic designers and artificial Intelligence technology. The implications of this shift are major to the field of graphic design. The research had explored the various ways in which AI tools had enhanced and broaden designer's vision, facilitating the super-fast initiation of novel ideas and a diverse range of concepts, thereby offering designers an unequalled ability to explore multiple aesthetic angles.

Keywords: *Artificial Intelligence, Ideation, concept development, Visual Content, AI tools.*

INTRODUCTION: *The dawn of AI in Creative Art industry*

The advent of Artificial Intelligence (AI) marks a significant moment in the evolution of creative industries, with graphic design experiencing a profound and rapid transformation. This technological integration represents a significant departure from traditional, purely manual, and imagination-driven design processes, ushering in an era of enhanced and accelerated workflows. The widespread adoption of AI across various business sectors underscores its growing influence; in 2024, over 65% of U.S. businesses reported utilizing AI, a near doubling of the adoption rate from the preceding year. This trend signals a pervasive and increasing reliance on AI solutions, extending its relevance deeply into the graphic design Xdomain. With the maturity of AI technology, its execution in graphic design industry has gradually grown up, especially in the fields of generating creative ideas & concepts. Creative AI tools such as Midjourney, Canva, and Adobe Sensei automatically create designs based on user well-formed prompts, upgrading design accessibility. This makes it simple for even non-professional

designers to produce high-grade and influencing designs, reducing design costs. (Cai, L., & Jung, E. 2024).

Like many fields, it is accepted in this industry that AI will not completely eliminate the need for human designers. Rather, AI is viewed as a potent resource that extends what humans can do and even introduces new avenues for innovation and efficiency, within the design community. Traditional design modes and techniques severely constrain the creativity of graphic design beginners & experts, making it impossible for them to connect with one another (Saraswat, P. 2019). This point of view illustrates a graphic designer's role undergoes a profound shift. Historically, graphic design ideation has been a labor-intensive process, relying heavily on brainstorming, sketching, mood boarding, and iterative refinement. While these traditional methods foster deep creative engagement, they can also be time-consuming and sometimes constrained by individual designer biases. The emergence of Artificial Intelligence offers favorable solutions to these challenges, tools that can accelerate ideation & concept generation (Fletcher & Jukes, 2021).

The aspect of graphic design traditionally embedded in human creativity, is undergoing a profound transformation with the flourishing impact of AI. From creating difficult visuals to suggesting new design ideas, AI technologies are increasingly integrated into the creative and fast workflow, challenging traditional designers (Anderson, 2019; Brady, 2022). This sudden shift is not only a gradual improvement but an elemental reshaping of how human designers develop and execute visual communication (Gonzalez, 2023).

LITERATURE REVIEW

The incorporation of artificial intelligence into creative industry is a rapidly expanding field of study, prompting a close look at its role in improving human abilities instead of just replacing them (Lee, 2024).

Traditionally, graphic design ideation has been a human oriented process, depending upon cognitive processes such as creative thinking, associative recall, and analogical reasoning to generate new ideas and concepts (Thompson, 2018). Designers often employ methods like brainstorming sessions, mood boards, and iterative sketching to scout a multitude of visual possibilities before refining a chosen concept. (O'Reilly, 2021).

Xu (2020) highlighted the role of machine learning in enabling AI to learn from vast datasets of existing designs, thereby identifying patterns and generating new or innovative outputs.

Specific AI tools, such as Midjourney and DALL-E, have illustrate remarkable capabilities in creating images from well define textual prompts, directly impacting the initial stages of visual ideation (Sharma & Patel, 2023; Thompson, 2018). These tools can rapidly create a diverse array of visual concepts, allowing designers to explore unconventional abstract ideas (Brady, 2022). This rapid concept generation capability is seen as a crucial enhancement to the designer's toolkit, potentially accelerating the early phases of design projects (Gonzalez, 2023).

However, the incorporation of AI also raises important questions regarding the evolving role of the creative designer. Anderson (2019) posed early questions about the transformation of the designer's responsibilities, suggesting a shift from pure creation to curation. Katz and Miller (2023) further elaborate on this, suggesting implications for design education, emphasizing the need for curricula that train designers in human-AI collaboration and critical evaluation of AI outputs.

Issues such as copyright ownership of AI-generated works (Smith, 2024), algorithmic bias embedded in AI models (Green & Brown, 2021), and the potential for AI to dilute originality or lead to a homogenization of design aesthetics are actively discussed (Davis, 2022). Park (2022) underscores the evolving responsibilities of graphic designers to navigate these ethical landscapes, ensuring fair and responsible use of AI tools.

While existing literature broadly covers AI in creative industries and touches upon its implications for design, there remains a need for focused qualitative research that "cracks the code" of how specific AI-driven design platforms are being utilized in real-world scenarios for ideation and concept development. Furthermore, in-depth perspectives from both the creators of these platforms and the designers who use them are crucial for a holistic understanding of this evolving human-machine partnership (Fletcher & Jukes, 2021; Lee, 2024). This paper aims to address this gap by providing nuanced insights into the practical integration and perceived impact of AI on the creative processes of graphic designers.

RESEARCH QUESTIONS

1. How does AI help artists and creative people come up with new ideas and concepts, giving them "algorithmic inspiration"?
2. How do AI tools make the creative process better and give artists more ideas to work with, using computer-powered methods?
3. How effortlessly AI technology can generate novel designs and concepts?

AI as Impulse for Ideation and concept development

AI is giving a new phase to design industry. AI is changes the way how graphic designers create ideas and develop concepts. Hence, it significantly increases creative output. It functions as a "creative sidekick," as AI it is amplifying human creativity. Generative AI, is widely recognized for its capability to create diverse range of design alternatives of effectively acting as a co-creator within the design process.

Its only with the advent of Artificial Intelligence that even non-professional can create huge variety of concepts, just by adding a well-structured prompt in AI tool and many creative and informative visuals will appear.

Real-time Iteration and Feedback Loops

With the advent of Artificial Intelligence technology, real- time design iteration and feedback loops has become more immediate. AI tools predict feedback and suggest their respective alterations and make automatic changes leading to fast productive and responsive design process.

As designers achieve instant feedback due to which they can track all the changes required and hence collaborative more effectively with their team and client as well. Designers can get quick feedback on their designs due to which designers can track changes and collaborate more effectively with their respective clients. This capability results in faster design iteration cycles, thus improved collaboration among team members, and ultimately, enhanced client satisfaction due to more responsive design processes.

In gist, AI is transforming the graphic design workflow into a highly dynamic, rapid, driven by steady iterative cycles.

METHODOLOGY

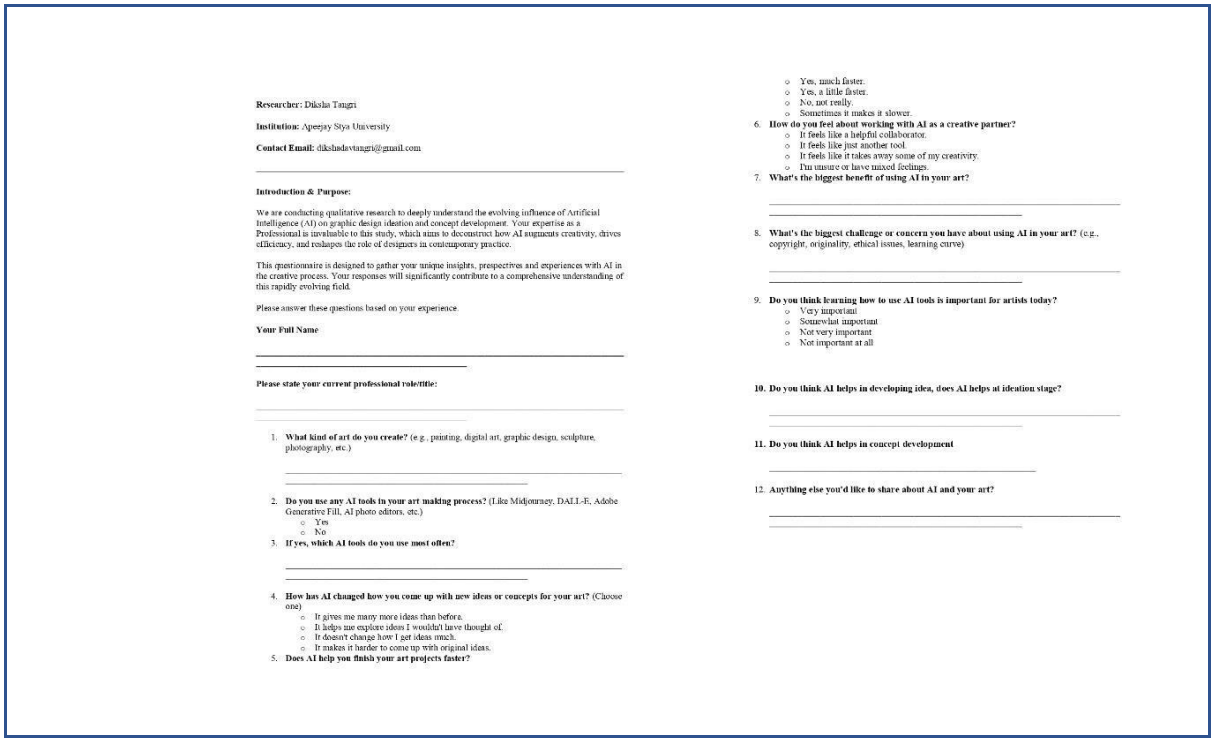
This research study acquires a qualitative approach, directly correlating with the aim of investigating the various perspectives of art experts concerning the impact of AI on creative industry. The research takes a multi-method approach using expert questionnaires and in-depth case studies. This triangulation of data sources enhances the reliability of the findings by allowing for cross-verification of information from different perspectives and contexts regarding the impact of AI on ideation and concept development in creative industry.

Data Collection

Primary data was gathered through two methods:

- **Expert Questionnaires:**
    - **Participant Selection:** To understand the pragmatic impact of AI on art industry, questionnaires were distributed to a targeted group of art experts. This group specifically included **renowned sculptors and graphic artists**. This selection aimed to gather viewpoints from professionals across different artistic disciplines, providing insights into how AI is potentially integrated into both traditional and digital creative practices.
    - **Questionnaire Design:** The questionnaires were precisely designed with simple and open-ended questions to generate detailed qualitative responses of experts. The questions of questionnaire explored viewpoints & personal experience of experts regarding AI influence on creative idea and concept development.

Distribution: Questionnaires were distributed digitally to facilitate broad reach and allow participants to provide comprehensive responses at their ease.



Researcher: Diksha Tangri

Institution: Apeejay Stya University

Contact Email: dikshadavtangri@gmail.com

Introduction & Purpose:

We are conducting qualitative research to deeply understand the evolving influence of Artificial Intelligence (AI) on graphic design ideation and concept development. Your expertise as a Professional is invaluable to this study, which aims to deconstruct how AI augments creativity, drives efficiency, and reshapes the role of designers in contemporary practice.

This questionnaire is designed to gather your unique insights, prespectives and experiences with AI in the creative process. Your responses will significantly contribute to a comprehensive understanding of this rapidly evolving field.

Please answer these questions based on your experience.

Your Full Name

_____

Please state your current professional role/title:

_____

1. **What kind of art do you create?** (e.g., painting, digital art, graphic design, sculpture, photography, etc.)

   _____

2. **Do you use any AI tools in your art making process?** (Like Midjourney, DALL-E, Adobe Generative Fill, AI photo editors, etc.)
   - Yes
   - No
3. **If yes, which AI tools do you use most often?**

   _____

4. **How has AI changed how you come up with new ideas or concepts for your art?** (Choose one)
   - It gives me many more ideas than before.
   - It helps me explore ideas I wouldn't have thought of.
   - It doesn't change how I get ideas much.
   - It makes it harder to come up with original ideas.
5. **Does AI help you finish your art projects faster?**
   - Yes, much faster.
   - Yes, a little faster.
   - No, not really.
   - Sometimes it makes it slower.
6. **How do you feel about working with AI as a creative partner?**
   - It feels like a helpful collaborator.
   - It feels like just another tool.
   - It feels like it takes away some of my creativity.
   - I'm unsure or have mixed feelings.
7. **What's the biggest benefit of using AI in your art?**

   _____

8. **What's the biggest challenge or concern you have about using AI in your art?** (e.g., copyright, originality, ethical issues, learning curve)

   _____

9. **Do you think learning how to use AI tools is important for artists today?**
   - Very important
   - Somewhat important
   - Not very important
   - Not important at all

10. **Do you think AI helps in developing idea, does AI helps at ideation stage?**

    _____

11. **Do you think AI helps in concept development**

    _____

12. **Anything else you'd like to share about AI and your art?**

    _____

Questionnaire for experts

- **Case Study Analysis:**
  - A selection of prominent AI-driven applications within contemporary graphic and visual design was chosen for in-depth analysis. The Case studies of different brands mentioned below were chosen for their direct link to ideation, concept development, and their demonstrated impact on scalability and personalization.
  - **Case Study 1: Nike's AI-Driven Personalized Design and Campaign Visuals.** This case showcased how Nike has leveraged AI to generate unique product aesthetics (e.g., patterns for footwear) and to create highly personalized visual content for marketing campaigns, illustrating AI's contribution to innovative design and consumer engagement at scale.
  - **Case Study 2: Spotify's Generative AI for Personalized Visual Content.** This case examined Spotify's use of generative AI to create millions of unique visual covers for personalized user experiences (e.g., playlists, Wrapped summaries), highlighting AI's power in enabling massive content scalability and hyper-personalization in visual communication.

Data Analysis

The data collected from experts underwent a thematic analysis. Responses collected from the expert questionnaires were intricately analyzed to identify key insights on AI’s influence on ideation and the designer’s role in concept development in creative design industry. The case studies of Nike and Spotify were studied in this research paper & turn up with the outcome that AI is influencing ideation and concept development in art.

FINDINGS

The major findings attain from the questionnaires and case studies were explained in these areas:

AI Augments Ideation

The data which has been collected through questionnaires reveals a nuanced perspectives on how AI technology impacts ideation, with some artists recognizing its generative potential while others expressed concerns about its impact on originality & newness.

- **Expert perspectives on Ideation:** While some artist particularly those involved in graphic industry quoted that AI can perform as an creative assistant to expand imagination and thinking during ideation, other renowned sculptor Tutu Patnaik sir, expressed a sturdy belief that **"Ideas come from your own experiences and understanding "**, suggesting Artificial Intelligence cannot change your internal process, its just human artist who can easily get creative ideas and concepts from brainstorming and divergent thinking.

  Anjali Aggarwal, Assistant Professor of Graphic Arts, says that **"Artificial intelligence doesn't change how we attain ideas and concepts**", but yes it act as assistant, that assist in small tasks.

- **Sparks Novel Concepts vs. Originality Concerns:** The ability of Artificial intelligence to create new and unexpected visuals and ideas marked as a potential benefit. However, a crucial concern, particularly quoted by Tutu Patnaik sir, was the risk of losing "own originality" and "own identity" if one attempts to "see the world through another's eye". This shows a conflict between AI's ability to create and the belief in the importance of individual artistic expression.

Efficiency & Scalability Driven by AI

The analysis of questionnaire responses and case studies highlights that AI significantly streamlines creative workflows, enabling rapid iteration and content creation at a massive scale, though some artists may not personally experience immediate speed gains.

- **Automation of Tedious Tasks:** Anjali Aggarwal specifically identified AI's benefit in automating "repetitive tasks like background filling, colour correction, or resizing," allowing for quicker generation of "drafts or mockups" that can then be refined manually. This frees artists for higher-level creative thinking. Tutu Patnaik, while not using AI, acknowledged its potential to "fasten up your hand" in the future, suggesting a general awareness of its efficiency.
- **Accelerates Iteration & Visual Planning:** AI's capacity to "expand our vision, help test possibilities and save time in visual planning" was highlighted, facilitating

significantly faster iteration and refinement of concepts. While Anjali Aggarwal personally found AI "not really" faster for her own projects, she acknowledged its broader utility in visual planning.

- **Case Study: Nike's AI-Driven Design & Personalization**

Nike has leveraged AI to **generate unique patterns for footwear** (e.g., Joyride cushioning) and to create **highly personalized visual campaign assets.**

  - This demonstrates AI's role in making innovative product design and delivering **scalable, individualized visual experiences** that deeply resonate with customers across diverse campaigns.
- **Case Study: Spotify's Generative AI for Visual Content**
  - Spotify employs generative AI to create **millions of unique visual covers for personalized playlists** (e.g., Blend, Wrapped summaries) and promotional content.
  - This exemplifies AI's power in enabling **massive content scalability** and **hyper-personalization** of visual communication, fostering deeper user engagement at a global level by providing unique visual identities for individual users.

Evolving Roles & Human-AI Collaboration

Findings from the questionnaires suggest that AI is fundamentally redefining the artist's and designer's role, shifting towards strategic oversight and collaboration, though this evolution also brings concerns about autonomy.

- **Shift to Strategic Guidance:** Anjali Aggarwal views AI as "just another tool" , comparable to a brush or a lens, serving as a "creative companion that can challenge, surprise, and even push me to think differently". This reflects a shift where the artist guides the tool. However, she emphasized that "at the heart of it, the emotion, intention, and interpretation must still come from me".
- **Autonomy vs. Tool Dependency:** Conversely, Tutu Patnaik expressed strong reservations, viewing AI as "like a slow poison" that could "capture your freedom of your own mind and freedom of expression". He prefers to "do my own work from my own hand, mind, within my boundary using my own experiences" , fearing that reliance on modern tools might lead to becoming "kept of the tool" and losing identity. This highlights a fundamental tension regarding artistic autonomy.

Aspect of AI / Question	Tutu Patnaik Sir's Perspective (Sculptor / Artist / Teacher)	Anjali Aggarwal's Perspective (Asst. Professor, Graphic Arts)
Paintings and Graphic Design	Paintings and Graphic Design	Paintings and Graphic Design

Art Form	**Sculpture**	Painting & Graphic Design
Current AI Tool Usage	No	No
Impact of Ideation Stage	"Ideas come from your own experiences", suggesting Artificial Intelligence cannot transform your internal process, it's just human artist who can easily get novel ideas from brainstorming, divergent thinking. "Rather I think AI would make t difficult for me to maintain my own originality".	"It doesn't change how I get ideas much" personally, but can "expand and stimulate" imagination. Views AI as a "creative partner" during ideation.
Impact on Concept Development	"No, I don't think so." Views it as "like a slow poison, capture your freedom of your own mind and freedom of expression".	Yes, it can "expand our vision, help test possibilities and save time in visual planning".

Table 1- Demonstrating Expert Perspectives of impact of AI on Ideation and Concept Development in creative art industry.

DISCUSSIONS

It can be presumed as that coming of AI has transformed the field of design (Mirzaei, V. 2025). The conclusion of this study firmly confirms the important role of Algorithmic inspiration in ideation and concept development stage of design industry.

This efficiency allows designers to dedicate more time to critical evaluation, strategic thinking, and the crucial human element of imbuing AI-generated concepts with context and meaning. This aligns with Fletcher and Jukes' (2021) argument for a balanced approach, where AI handles the generative heavy lifting, allowing designers to focus on higher-order creative problems.

However, the identified complexities and ethical considerations are paramount in understanding the true impact of algorithmic inspiration. The "black box" nature of AI, coupled with concerns about copyright and inherent biases (Davis, 2022; Green & Brown, 2021; Smith, 2024), highlights that while AI can generate inspiration, and the human designer retains the responsibility for its ethical deployment and refinement. This directly states that yes AI is helping in generating ideas and concepts, but designers have to check its authenticity with their profound knowledge about creative industry. The creativity now shifts, from creating artwork from with your own hands and mind, now the only need to develop a well framed prompt by which AI tools will create novel designs. But this doesn't means that AI replaces human designer, AI can only create design with prompt you enter but AI cannot provide judgement and emotional intelligence that a human designer can provide.

This study defines that the benefit of algorism is not in taking of human creativity, but rather it adds value and act as creative assistant. It has the potential to expand what we think therefore pushing designers to think even broader and out of the boundries. Therefore, the success of algorithmic inspiration totally depends on the designer's capability to use the algorithmic generative concepts harshly, ethically, and with a full knowledge.

LIMITATIONS

This study, being qualitative and exploratory, has inherent limitations. The findings are based on a limited number of case studies and interviews, primarily from designers and AI tool developers. Since qualitative data is based on personal perceptions, its findings might not accurately represent the entire graphic design industry, also AI technology keeps advancing so quickly that the specific tools and features mentioned could become outdated pretty fast, showing just how fast this field changes.

FUTURE RECOMMENDATIONS

Future research directions could look into both design creativity and on the fact of design originality. Long term studies should measure the effect of AI on jobs of artist and graphic designers while exploring how their skills change over time and does AI effects their work roles. There is also a need for ethical investigations, i.e. violation of intellectual property rights, etc.

CONCLUSION

This research study concludes that yes, AI remarkably augments ideation and concept generation in creative art industry. AI significantly influences creativity by giving novel ideas and aesthetic concepts but at the same time some artists express concerns about maintaining the originality of their work and their identity. AI also drives unprecedented efficiency and scalability, as evidenced by its use in personalized design for Nike and large-scale visual content generation for Spotify. The role of the designer is evolving towards strategic direction and curation, requiring new skills. Despite varied personal adoption, experts agree on the critical importance of artists learning AI tools. Ultimately, the coming future of graphic design industry lies in a balanced Human-AI collaboration, where AI enhances human innovation, empower designers to focus on higher-level innovative and ethical side, rather than replacing them.

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- **Tutu Patnaik Sir**, Renowned Sculptor and Artist
- **Anjali Aggarwal**, Assistant Professor, Applied Art Department, Government College of Art, Chandigarh

Their unique insights, particularly their nuanced views on AI's impact on artistic originality, ideation, and the evolving role of the artist, were crucial in providing a rich and balanced understanding of "The Algorithmic Muse" within contemporary graphic design practice. Their contributions significantly enriched the qualitative depth of this study.

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Masks of Memory: A Comparative Ethnographic Study of Chhau Mask-making Practices in Charida and Seraikella

Mr. Debabrata Das, Research Scholar | Dr. Aloke Das, Associate Professor
FDA, Poornima University, Jaipur

Abstract

This research reports on the Chhau mask-making practices of ‘Charida’ (West Bengal) and Seraikella (Jharkhand), focusing on deeply divergent paths for these distinct forms of material culture. Charida (or *"Mukhosh Gram"*) has been supported through institutional and tourism support, and after 2018 Geographical Indication designation, which have resulted in continuity of the craft and findings over 180 artisan families. Women thrive in the decorations of the masks, maintaining intergenerational transfers and good economic livelihoods. The situation in Seraikella is starkly different. The hand-modeled masks, offered by a handful of remaining master artisans, have become akin to museum artifacts – with nostalgic reverence, but limited use in ritual. The masks have been marginalized due to economic impacts, youth moving away from the village surrounds and disrupted transmission due to the COVID pandemic, especially against the reality of almost no ritual use. This discussion employs ethnographic analysis of material techniques, feminine and masculine work, and aesthetic worldviews made through these particularly significant and well-crafted objects. In summation, there is a positive and supporting history of state counter development of Charida's craft and economy - while Seraikella's experiences have resulted in marginalization and loss of meaning of the masks. The latest UNESCO mission includes the concept that heritage conservation must be such that it takes into priority living practices as opposed to just objects. Policies and initiatives that are co-created with, and supported by local communities - that together explore education, livelihood, and identity - should focus on ensuring that cultural traditions evolve as dynamic cultural heritage, instead of going extinct.

Keywords: *Chhau Masks; Mask Making Communities; Charida; Sereikella; Craft Heritage; Material Culture; Cultural Economy; Mask*

Introduction

The etymology of the word ‘Chhau’ illustrates the character of the dance form. The term ‘Chhau’ has evolved from ‘Chhaya’ the sanskrit word, means 'shadow'. The main theme and subject matter of Chhau compositions are dominated by abstraction and symbolism. Chhau is different from the other classical forms of Indian dance in the way it treats the space, and also in the way it communicates the emotional responses of the story. The dancer creates movements where the body is thrust upward away from the influence of gravity. Spiraling turns in the air, jumps and extended leg movement, move the dancer through choreographic patterns across the performance space. Another unique characteristic of Seraikela Chhau is the absolute absence of oral acting (*vachikabhinaya*) through voice support and

(*mukhabhinaya),* since the feature face is entirely screened by the mask. The emoting happens in a kinesthetic manner, though body movement. The masks are an undivided part of this distinct dance form and which crafts are highly sophisticated. There are traditional family units who practice the craft of mask making. These creators of masks work together with choreographers and dancers and after a comprehensive study of the characters for which they are to make masks. A mask may only depict the essential characteristics of a particular character, but devised in conjunction with the dancers qualities of movement.

Figure 6: Chhou Dance: Mahisasura Mardini Pala at Baghmundi, Purulia
Source: Captured by the Author

There are three accepted forms of 'Chhau'. 'Purulia' from West Bengal, 'Seraikella' from the Jharakhand state,and 'Mayurbhanj' from the state Orissa. There is also lesser known 'Kharsawan Chhau', which is waiting to expand the audience's appreciation. There are no clear historical records regarding the form, so it is very difficult to determine how old this unique dance form is. The source of the dance 'Chhau' is also a widely debated content among the researchers. Some scholars say that 'Chhau' is come from '*chhauni',* means 'The cantonment' - which highlights such martial culture. The roots of this dance form links with the soldiers - who may have perform dance as an outcome of their entertainment, or to execute their success in battle. The latter two interpretations appear to highlight, visualization and an important role for the masks, which are a key component of Seraikela and Purulia Chhau.

'Chhau' dance shares an origin with the martial arts called "Parikhanda" ("par" meaning 'shield', and the meaning of "khanda" means 'sword') which is meant to prepare the body for dance. 'Chhau' has '*chaalis'* and 'topkas', which are stylized walks based on careful observations of nature: '*baagh chaali'* (tiger walk), '*mayoor chaali'* (peacock walk), khel - different elements of sword play, and ufli - thirty-six movements representing common human actions. As yet, the rules governing a 'Chhau' is not based on a formal text, so that the dance has been preserved, and passed down from generation to generation, imparted through traditional teachers, and Gurus, while all three forms are based on similar technique, a closer inspection shows vast differences in movement execution, social backgrounds of performers and in relation to masks. (Chattopadhyay, A. & Das, M. Kumar 2022).

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Research Objectives: Some objectives of these findings are:

- To trace and compare the historic trajectories and cultural significance of 'Chhau' mask-making traditions in 'Charida' (West Bengal) and 'Seraikella' (Jharkhand).
- To document and analyze the mask-making processes, stylistic variations, and episode-specific ' *Pala'* typologies in both regions.
- To examine the marketing networks—local, national, and international—through which Chhau masks circulate, along with the role of tourism and institutional support.
- To assess the socio-economic conditions, gender roles, and challenges faced by mask makers in Charida and Seraikella.
- To recommend sustainable strategies, including policy interventions, community initiatives, and cultural heritage programs, for safeguarding and revitalizing Chhau mask-making practices.

Methodology: This study uses a comparative ethnographic framework to examine Chhau mask-making in Charida (West Bengal) and Seraikella (Jharkhand). The methods employed are primarily qualitative, with some quantitative and was organized into the following stages outlined below:

1. **Data Collection and Literature Review:**
   - Gathered locational data, including official maps, to situate mask-making clusters in context.
   - Reviewed scholarly articles, archival documents as an historical, cultural, and socio-economic context.
2. **Field Surveys and Visual Documentation:**
   - Visited Charida and Seraikella and observed communities in an extreme close-up reality.

Figure 2 :Mahisasura Mardini Pala at Seraikella (Jharkhand).

Source: httpsdisco.teak.fiasiachhau-dances-of-eastern-india-derived-from-martial-arts.

- Collected photographs in the process of mask-making, materials, and techniques in the field notes.

3. **Analysis of Dates:**
   - Applied qualitative thematic analysis supplemented by basic quantitative indicators (income, access to markets and scale of production).
   - Developed socio-economic individual profiles.
4. **Comparative Analysis and Reporting:**

   - Constructed a comparative framework on aesthetics, symbolism, economic sustainability, and institutional support.

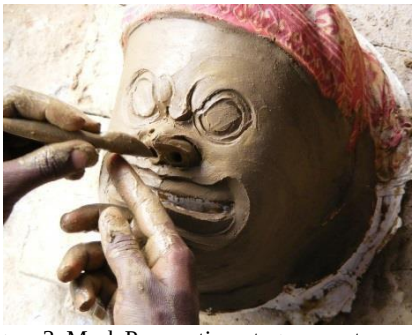

Figure 3: Mask Preparation-stage one, at Charida, Purulia.
Source: Captured by Atuthor

Figure 4: Mask Preparation-stage two, at Charida, Purulia.
Source: Captured by Atuthor

Figure 5: Mask Preparation-stage three, at Charida, Purulia.
Source: Captured by Atuthor

Figure 6: Mask Preparation-stage four, at Charida,Purulia
Source: Captured by Atuthor

Chhau Dance: Chhau appears to have traditionally been performed by male dance performers only. In the 3rd decennary of the 1900s a few lady performers became expert in the style. It is notable that 'Purulia Chhau' performers typically belong to indigenous categories (Mura, Bhumij, Kurmi, etc) and, furthermore, Purulia Chhau does not enjoy significant royal patronage of the kind experienced by the Chhau artists of the Mayurbhanj region. Mayurbhanj Chhau enjoyed some royal family support while it is only Seraikela Chhau that actually had patronage where members of the royal family also participated as dancers and choreographers.

Figure 7: Various Types of Mask Preparation at Charida, Purulia.
Source: Captured by Atuthor

Purulia- Chhau Dance and Masks:

Chhau masks are an essential aspect of chhau performances, which are found in the states of West Bengal. Among three types of chhau, Purulia Chhau is a distinct dance form with vigorous athletic leaps, many impressive flips, and high-energy shaking of shoulders and torso. It is most likely this over-the-top masculine nature that has led Dr. Ashutosh Bhattacharya, an eminent folklorist, to describe Purulia Chhau as a 'racial war dance.' Since most of the practitioners of Purulia Chhau come from tribal communities, and because the royal family of the region did not promote it.

Figure 8: Chhou Masks :Shiva and Parvati from Seraikella, Jharkhand
Source: httpsscontent.fccu9-2.fna.fbcdn.netvt1.6435-931682473_1800541636917710_3024476825511264256_n.jpgstp=dst-jpg_p526x395_tt6&_nc_cat=108&ccb=1-7&_nc_sid=833d8c&_nc_ohc=sZ11robdZ2oQ7kNvwFA8

Intricate masks and elaborate headgear add to the charm of Purulia Chhau. Purulia Chhau. They are made from a thin base of papier-mache that is coloured in vibrant glossy colours, and as well, they have a prominent decorative headpiece (*the mukut*) attached to the top of the mask with embellishments of painted detail. The 'Chhau'Masks illustrates different gods and demons of the Hindu pantheon and maximum masks are manufactured in 'Chorida' village in Baghmundi area. 'Purulia Chhau' masks are more realistic than Seraikella Chhau - mostly red or green with grotesque faces. The Ravana's mask shows his ten heads, a mask of Ganesha, has an elephant's trunk. Performing some stunts in these masks is physically challenging and there are skillful movements required, as they are quite big and heavy to wear in any position. The costumes comprise ornamented jerkins and oversized trousers. The '*Madol'*(Dhol like instrument) *players* of 'Purulia Chhau' sings an introductory song in worship of Lord Ganesha at the beginning stages of a performance. During performances he can be heard shouting encouragement, or urging the dancers to perform with more gusto. (Das, Sayantan. 2024).

Choreographies mainly focus on such episodes that describe battles fought against gods, demons and *'puranic'* (mythological) heroes. Examples are *'Mahishasur Badh Pala'*; which

describes the battle of demon Mahishasura against Hindu Goddess Durga and *'Kiratarjunya Pala'*; describes the battle of 'Arjuna' and 'Lord Shiva' disguised as Kirata the hunter who resides in the mountains.

The 'Padmashree' honor has been bestowed to the Purulia Chhau practitioners 'Gambhir Singh Murha' and 'Nepal Mahato' by the Government of India. The 'Adabana Tarun Sangha Chhau Dance Society,' led by Padmashree awardee Nepal Mahato and his son Subrata Mahato, is one of many troupes performing Purulia Chhau in the villages of Bengal and at festivals catering to urban populations.

Seraikela Chhau Dance and Masks:

'The Seraikella' is the most lyrical and stylized of the three styles of Chhau Dance although some of the dances still retain the martial arts context. The 'mask' is an important part of 'Seraikella'. Since the audience cannot see the performer's face, the performer's character's emotions are portrayed through posture. Postures are supported by the performer, with neck *(griva bheda*) and head *(siro bheda*) movements, and body movements as possible emotional portrayals. Originally masks were constructed with bamboo and gourd but have later been replaced by masks made of paper Mache. When combined with the costume, the masks are lighter than those made of bamboo and gourd. The most significant practical element of the mask is that they cover the whole face of the performer. This means the eyes of the mask have holes for vision and there are nostril holes for breathing. The actors often complain that they cannot see and that breathing is exceptionally strenuous. This may be one reason that the Dance performances of Seraikella generally last under ten minutes. Some masks imply lyrical visual imagery of characters – '*Ratri'* or night, with her eyes closed; the *rage* of a warrior; *'Hamsa'* or swan, with their long beak; or the gorgeous blue-coloured face of Lord Krishna. There are several masks placed in a neutral position but with beautifully stylized eyebrows, allowing for expert dancers to portray various emotions through their bodily movement and eyebrow movement combined. (Das, Aloke, 2025).

The royal family of Seraikella patronized the form, and gave it a boost as dancers/choreographers, from initiation to performance. The younger brother of the former king of 'Seraikella', 'Kumar Bijay Pratap Singh Deo', had arranged many pieces and transposed the dance form of 'paikas' into the poetic and yet emphatic form of 'Seraikela

Chhau' which he was to popularize in India along with Europe also. It was in 1938 that he first travelled to Europe with a group of Chhau dancers, and he likely insisted to hire the first three female dancers of Seraikela Chhau to join the tour. This created an avenue for women dancers like 'Shogun Bhutani', 'Rakha Mitra' and 'Roshni Ghosh' to perform Seraikela Chhau where they combined the dance with male dancers. 'Rajkumar Suddendhra Narayan Singh Deo' is also a notable Chhau dancer from the same royal household, who also received 'Padmashree' Award.

Purulia-Charida Village Chhau Mask –as a Living Craft Hub:

The village of Charida in the Purulia district of West Bengal has transformed into a living craft hub for Chhau mask production primarily due to the intentional encouragement of commercial spirit. The promotion of Charida's craft heritage started with the UNESCO listing that eventually led to the establishment of a 'Rural Craft Hub' in the rural area. The arrival of tourism and the market for Chhau masks were a direct derivative of the process. According to Soumyajit Halder, approximately 85% of the craftsmen producing masks in Charida work directly within the craft itself. The craft village of Charida, which consists of about 180 families, has adapted to the "new normal" of a neoliberal and globalized world. The mask-making community consisting primarily of the 'Sutradhar' community has shifted towards a commercial context by adopting digital and online platforms to reach new audiences for their masks. Ultimately, this commodification could threaten the Chhau masks within the "folklorization" or institutionalization of the art of crafting masks. Nevertheless, by transitioning towards this consumptive model, it has created a form of economic capital and launched a whole new realm of tourism and cultural capital with the complement of craft fairs. The product has moved from

Figure 09: Mask Preparation-stage one, at Seraikella, Jharkhand.
Source: httpswww.orissapost.comchhau-masksreviving-a-dying-art-form

Figure 10: Mask Preparation-Stage Three, At Seraikella, Jharkhand.
Source: VARIOUS-MASK-MADE-BY-THE-Artisthttpswww.Orissapost.Comchhau-Masksreviving-A-Dying-Art-Form

Figure11: Mask Preparation-stage Two, at Seraikella, Jharkhand.
Sourc: httpswww.orissapost.comchhau-masksreviving-a-dying-art-form

a ritualistic or performance context in the extreme to decorative artifacts and souvenirs, and art pieces and created new, stable livelihoods. (Saha, Biswajeet, 2017)

Seraikella Chhau Mask as a Dying Craft:

The mask making art of Seraikella, Jharkhand has reached a stage of extinction now. This is due to its clear association with the patronage system it traditionally relied upon. The Seraikella Chhau as a dance form was born from the patronage of the local royal family. Following India's independence from colonial rule and the dissolution of Princely states, this continued royal patronage drastically reduced, removing the supporting livelihood for its practitioners. Unlike Purulia, this was not followed up by any 'larger-scale' or institutional support from the government to commercially develop the art form, making it economically unsustainable. In the opinion of Soumyajit Halder, only Guru Sushanto Mahapatra and his son, Sumit Mahapatra, to name a few, has carried on the Seraikella chhau as live art. The Seraikella masks themselves, being less overtly rich in color and substance, have not benefitted in the same way from a free market as they were not marketed to be, as the Purulia masks could be. Because of the intensity and nature of the choreography, Seraikella Chhau has taken the focus away from the masks and more towards the performance, driving the mask making machine as a practice, and distinct livelihood as part of practice out of existence.

Comparative Analysis of Chhau Mask-Making: Charida vs. Seraikella

The following chart and diagram provide a visual summary of the comparative analysis between Chhau mask-making in Charida and Seraikella, highlighting key differences in style, technique, usage, and the socio-economic factors influencing their survival.

Comparative Chart: Charida vs. Seraikella Chhau Masks

Feature	**Charida (Purulia Chhau)**	**Seraikella Chhau**
Aesthetic Style	Chhau Feature Bold, expressive, and detailed. Focus on the masks.	Subtle, abstract, and minimalist. Focus on the pure form.
Material & Technique	Material and Technique Papier-mâché, clay, and cloth. Have elaborate painted and decorated masks.	Lighter weight papier-mâché. Painting is fine and elaborate, but understated.

Feature	Charida (Purulia Chhau)	Seraikella Chhau
Usage in Dance	Usage in Dance Integral to characters. Dancers don't facially express.	Obscured the face. All expression and story shown through bodily movement.
Patronage	Patronage Traditionally community driven. Now commercialized through government and NGOs.	Historically patronized through the princely state
Economic Status	Economic Status Active craft hub, sustained through markets and tourism and sales.	A dying craft due to a lack of patronage, economic non-viability.
Cultural Capital	Cultural Capital Commercialization, tourism, national and global recognition.	. Historical ties to courtly tradition; aesthetic purity.
Survival	Living Craft Hub: Commercialization and new markets sustain; Survival: Community identity.	Dying Craft: Economic non-viability deems out play here.

Conclusion

This comparative ethnographic study of the Chhau mask-making practice in Charida (West Bengal) and Seraikella (Jharkhand) reveals many of the cultural similarities and region-specific differences in the two identities and how these identities affect the art. Both locations share roots in a larger tradition of Chhau performance, but their respective practices, aesthetic values, and socio-economic changes are uniquely different and influenced by geography and patronage, demographics and historical climate.

The comparative study also reveals different pathways of marketing and circulation. Charida has a well-established local and international tourist economy backed often by state-sponsored fairs and online websites, meanwhile Seraikella has remained more regionally based, with its reliance on cultural institutions, as well as local sporadic art fairs. This difference highlights the need for equitable support structures to protect intangible heritage from region to region.

Additionally, the study forwards issues around the socio-economic vulnerabilities of mask makers from both locations, encompassing erratic income, limited material sourcing, limited access to health care and education. Despite these long-standing vulnerabilities, the continued

agency of these communities, through thorough innovation and inter-generational transfer of knowledge and skills, restates the continued cultural resonance and importance of Chhau mask-making.

In the end, this study emphasized that masks are not only artistic objects imbued with myths and memories, but are living embodiments of identity, labor and survival. Acknowledging and supporting craft traditions—including enabling policies, sustainable tourism, and community-supported initiatives—will be essential not only to making viable and vibrant craft traditions, but also to the livelihood, dignity and wellbeing of the artisans that make them.

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Artificial Intelligence in Fashion Communication: Transforming Consumer Engagement, Branding, and Media Strategies

Kumar Rahul Mayank | Shivani Sharma | Azahruddin
Asst. Professor, FDA, Poornima University, Jaipur

Rocky Kumar (Asst. Professor)
Department of Computer Application, Poornima University, Jaipur

Abstract

As a revolutionary technology, Artificial Intelligence (AI) has become a change in fashion communication in the digital-first market that is changing brand-consumers, brand-horses and brand-media strategies of brands. A future analytics based on the recommended system, virtual tri-on, generative design and AI allows to create an individual, immersion and skilled brand-conjumer interaction. Such applications go beyond operational effectiveness and change creativity and communication process, algorithm design, virtual affects and AR/VR experiences with stories and branding with experiences. The review is based on the findings of the scholarly literature, quality conference papers, and business case studies to explore the technological, communicative, and ethical aspects of AI in fashion communication. The thematic analysis is based on the following major areas; personalized and consumer engagement; generative and predictive applications in branding; immersive communication using AR/VR; social media dynamics and virtual influencers; and transparency and sustainability in supply chain communication. The practice examples of brands such as Nike, Gucci, H&M, Zara, Stitch Fix, etc. are case situations that demonstrate opportunities and limitations.

Though AI increases personalisation, efficiency and consumer experience, it also raises the most prominent questions, such as data privacy, algorithmic bias, authenticity, labour replacement and environmental cost. The article identifies such tensions and suggests mitigation measures with the focus on responsible and ethical innovation. Lastly, it mentions future directions of research, such as explainable AI, multimodal generative systems, integration into the metaverse, and human-AI co-creation, making AI a technological resource and strategic partner in fashion communication of the future generation.

Keywords— *Artificial Intelligence, Fashion Communication, Generative AI, Personalization, Virtual Influencers, Immersive Technologies, Sustainability*

Introduction

Traditionally fashion is a sector of imagination, art, and rapid flux of fashion among customers, but in the past decade it has experienced a phase of transition into a detailed ecosystem where Artificial Intelligence (AI) is already becoming a source of innovation. Some of the AI technologies that are assisting businesses to streamline processes, anticipate demand, and create distinctly pertinent consumer experiences are computer vision, natural language processing, and generative adversarial networks, which were inconceivable previously. The implementation of AI-oriented recommendation engines and forecasting analytics in fashion retailers has been associated with the quantifiable efficiency and client retention and engagement, which reflects the disruptive potential of these instruments to the customary operations. (Huang et al., 2023; Shirkhani, 2023).[5][14] Besides operation efficiency, AI is also redefining the notion of creativity as such: GAN-based design tools allow creators to design new types of garments prototypes, predict style options, and explore the concept of computational creativity as an addition to human creation (Han et al., 2021; Karras et al., 2020).[4][8] This shift has enabled fashion manufacturers to get out of mass-produced products into hyper-personalised experience whereby the final products are tailored, sold, and engaged with on individualised terms. The applicability of AI also manifests in the physical store, as intelligent mirrors, body scans, and virtual fitting rooms are visible to make the in-store shopping experience easier; a good example of an AI-based solution that not only greatly increased customer satisfaction but also reduced the number of product returns is the Nike Fit sizing applicant (Liu et al., 2022)[9].

Meanwhile, the value of fashion communication during the digital age cannot be reduced. As a result of the emergence of social platforms such as Instagram, Tick Tok, and Pinterest, fashion proliferation is no longer seen as an elite fashion event held twice a year, but as a everyday online environment where consumer-related materials and brand stories live in real time. Current fashion communication is not focused on one-way marketing, but interactive storytelling and engagement approaches, which are operated by AI. Emotion monitoring algorithms, consumer reaction tracking algorithms, and campaigning viral prediction algorithms are used to allow brands to dynamically optimize their communication strategies (payrase and gomez, 2021)[12]. The arrival of the affected people using AI-based images,

including Lil Mikella, has softened the line between reality and simulation, and ignored the authenticity questions, but also opens up the entire new creative possibilities of brand communication (Rodriguez et al, 2020).[13] AR filters, chatbots operated by AI, and virtual showrooms used in the virtual world are also redefined by consumer experience of products, providing a sense of experience before shopping. AI is also critical in cross-cultural communication because, through natural language processing, the campaigns can be customized to the global population, so that the stories become relevant across linguistic and cultural limits. In luxurious fashion, the emphasis of the branding is on exclusivity and heritage, so AI can be used to launch precisely targeted campaigns that cause exclusivity yet attract different demographics across the world. Also, as sustainability is a burning worldwide issue, AI assists fashion brands in monitoring the supply chain transparency and efficiently convey their environmental pledges to consumers (Nguyen et al., 2024).[10]

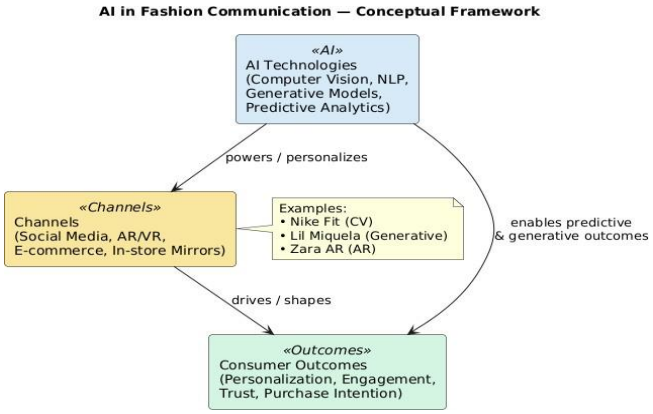

Figure 1. A conceptual framework that links AI technology, communication routes, and consumer results

It is on this basis that the current review intends to critically analyse how AI is revolutionizing fashion communication by altering consumer communication, branding, and media approach. Though the literature on AI application has been done on the application of AI to retail, logistics, marketing, and also separately, no literature has examined fashion communication as an interdisciplinary field that connects design, consumer psychology, media, and ethics. The given paper aims to close this gap by summarizing the results of various fields as well as explaining them with real-life examples of such brands as Nike, H&M, Gucci, and Stitch Fix, which have already taken the lead in using AI-driven consumer communication tactics. The review is conducted on three levels: to understand the technological basis of AI applications in fashion communication, such as recommendation systems, generative design, AR try-ons, and

social media analytics; to study practical applications through the cases of industry, which outline the opportunities as well as limitations; and to analyse challenges associated with the use of AI-mediated communication, including data privacy, algorithmic bias, authenticity, and ethical dilemmas. While offering a combination of theoretical knowledge and practical vision, the review combines educational discussion on the digitization of the consumer interaction process and provides practical implications to fashion brands, which needs to work in the cycle of the AI-managed era of communication.

Literature Review

The adoption of Artificial Intelligence (AI) in the fashion industry has been a widely studied concept in scholarly and business literature, especially in relation to consumer relations, branding, and communication. This review is based on the experience of peer-reviewed journal articles, high-quality conference proceedings, and case studies in the fashion industry, with a focus on the technological, communicative, and ethical aspects of AI in fashion communication. The thematic structure of the literature is based on the primary areas of development: personalization and consumer engagement in AI, generative and predictive AI in design and branding, immersive technologies in fashion communication, social media and virtual influencers, and operational communication in sustainability and supply chains

AI Technique	**Primary Use in Fashion Communication**	**Typical Benefit**	**Example Brand**
Recommender systems (CF, hybrid, deep)	Personalized product suggestions, emails, homepages	Higher CTR, lower returns	Stitch Fix, Zalando
Computer vision (pose, segmentation)	Virtual try-on, visual search, product tagging	Better fit visualization, search relevance	Nike Fit, Zara AR
Generative models (GANs / diffusion)	Campaign imagery, virtual influencers, design ideation	Rapid content prototyping, creative variants	Gucci (virtual influencer), Levi's pilots

NLP & chatbots (transformers)	Conversational commerce, product copy generation	24/7 service, scalable content	Fashion chatbots, product descriptions
Predictive analytics (time-series, causal)	Demand forecasting, dynamic messaging, pricing	Reduced overstock, targeted promos	H&M, Amazon Fashion
AR/VR (with AI)	Immersive try-ons, virtual shows	Engagement, experiential storytelling	Zara AR, Balenciaga virtual show

Table 1-— AI Techniques & Applications in Fashion Communication

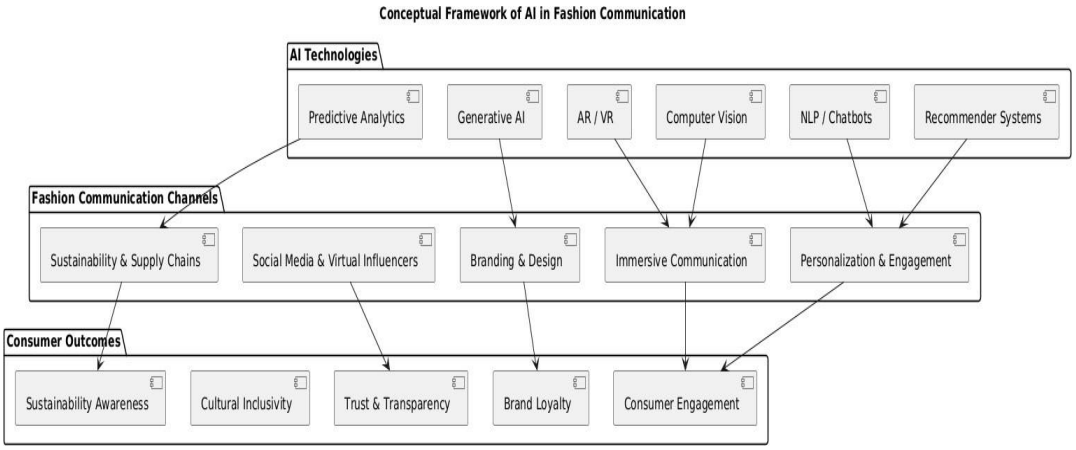

Figure 2. Conceptual Framework connecting AI Technologies, Communication Channels, and Consumer Outcomes

AI-Driven Personalization and Consumer Engagement

Personalization is one of the most important additions to fashion communication made by AI. Initially, the recommender systems were based on collaborative filtering, yet deep learning models have already increased the accuracy and relevance of the product recommendations (Deldjoo et al., 2023)[2]. When it comes to brands providing them with personal shopping experiences, consumers are more and more demanding; AI can help with it because it not only checks browsing history and processes, purchases, social media use, but also bio-detta. Stitch fix is one of the most paradigm cases: the recommended engine that appoints the company, combines machine learning models with stylistic feedback, provides each millions of

customers with curated clothing boxes. Research on the hybrid approach adopted by Stitch Fix throws light, which causes algorithm forecast to increase consumer satisfaction without losing the spirit of individual connections (Onitiu, 2022)[11]. In a similar vein, Zara has been able to take advantage of the power of AI-based demand, which has been aligned with inventory and audience to ensure that the message is aligned with stock and customer preference at any time (Choi, 2021).

Communication-wise, the concept of personalization enhances the chances of consumer interaction since a message and product recommendation touch on individual needs. Studies indicate that personalization is also a driver of the emotional loyalty, since tailored suggestions are perceived as indicators of brand sensitivity by the consumers (Shirkhani, 2023)[14]. Personalization is however accompanied by privacy issues as discussed later.

2.2 Generative and Predictive AI in Design and Branding

Generative AI has facilitated novel creative communication in fashion. Designers can use GANs and diffusion models to experiment with different patterns, color palette, and texture and thus, speed up the design process and present new aesthetics (Han et al., 2021)[4]. Predictive AI is an extension of this, in which past data is used to predict future trends in the fashion industry and brands can then shape their branding and narratives accordingly to match the interests expected in the consumer.

H&M, as an example, has utilized AI to develop a better design strategy and communication strategy. Through sales and social media predictive analytics, the brand will be able to tailor the campaigns by focusing on eco-friendly lines when consumer interest in sustainability is at its highest point. This model combines both product innovation and communication concepts by not creating a gap between design and branding stories (Nguyen et al., 2024)[10].

Researchers claim that generative AI is no longer a back-end technology but a communicational instrument as itself since the fashion items produced through an algorithm have become the constituent of the brand and narrative. Gucci is one of the best examples, with its digital campaigns being AI-enabled and experimenting with AI-generated fashion photography and digital avatars, as the brand communicates its innovativeness and creativity to stay culturally relevant (Rodríguez et al., 2020)[13].

2.3 Immersive Technologies in Fashion Communication

The aspect of fashion communication is changing to incorporates the enhanced reality (AR) and virtual reality (VR) applications, where consumers can interact with their products using immersive techniques. These techniques are supplemented with the use of artificial intelligence (AI) algorithms to increase the view of fit, predict consumer behavior and increase the view of real -time modification of experiences. This trend is painted by the Nike Fit application. Nike fit the user to scan the legs with a smartphone to get the right size suggestions with the aid of computer vision and AI. It reduces the rate of return, in addition to increasing brand-consumer communication, as it is one of the historical pain points, the accuracy of the size. Similarly, luxury brands like Dior or Barbari have already implemented AR TRAI-on features in their applications and social media marketing campaigns in which customers can actually test and buy a fashion product. With the help of AI, immersive technologies are placed in an academic context as an tool of experience in communication. They replace shopping to become a story, where consumers will shop as a statement instead of a business (Paraze and Gomez, 2021)[12]. It has been identified as a change, leading to high emotional response, purchase and brand loyalty.

2.4 Social Media, Virtual Influencers, and AI Communication

The emergence of social media has increased the status of AI in communication strategies. Visibility, relevancy, and interaction in platforms like Instagram, Tik Tok and Pinterest are controlled by algorithms. The fashion industry is also most likely to use AI-based social listening programs to measure the mood, monitor trends and optimize campaign messages.

Examples of how brands use artificial personas to market themselves include virtual influencers like Lil Miquela who were created using AI. The AI-generated characters, in contrast to human influencers, will give brands all control over narratives, aesthetics and frequency of communication. Educational literature indicates some opportunities and challenges in the field: on one hand, virtual effects become an engine of interaction and innovation, on the other hand, they doubt the commitments of authenticity and consumer belief (Onitiu, 2022)[11]. The company has tried to marketing an AI-based impressive impressive marketing such as Gucci and Balman, who have virtual models to advertise a collection on social media. The above examples show how AI helps to regulate brands, but interesting communication patterns that match changing digital aesthetics.

2.5 AI in Operational Communication: Transparency and Sustainability

In addition to consumer-facing communication, AI is becoming important for operating transparency and stability activities. Since the issue of stability has become a distinctive feature of consumers, fashion brands should not only practice stability, but it should also be described in a efficient way. Supply chain data analysis AI-based equipment and carbon footprints assist brands such as H&M and Patagonia to convey their stability achievements in ways that are easy to understand and factual. The combination of blockchain and AI will ensure that consumers are capable of tracking the origin of products, while the AI-based dashboard will change the technical information on stability in a way, which can be easily converted into a campaign. The literature of scholars shows that the openness of stability of stability practices with the help of AI can contribute to an increase in consumer trust and brand equity (Chen, 2023)[1].

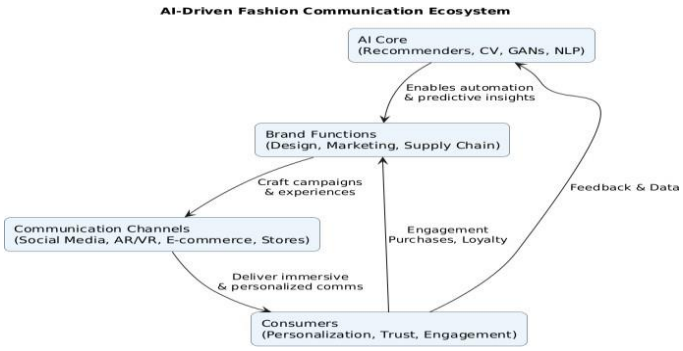

Figure 3. AI-operated ecosystem is showing interaction between AI core, brand functions, communication channels and consumer engagement

2.6 Synthesis of Literature

All reviewed sources prove that AI is a cross-deception in fashion communication and includes creative design, consumer privatization, immersive experience, social media dynamics and stability. Another topic present in all these articles is that AI can complete a technical role as well as communication completely: it runs back-end consumer insight and creates front-end consumer experiences. Although literature cannot refer to adequate evidence of AI efficacy in consumer participation and branding, it also notes new obstacles, especially in the context of morality, authenticity and inclusion, which will be mentioned later in paper.

Brand	AI Application	Communication Goal	Observed/Reported Outcome (metric)	Ref.
Stitch Fix	Hybrid recommender + stylist loop	Personalized storytelling & retention	↑ Repeat purchases; ↓ returns (company reports)	Stitch Fix (2023)
Nike	Nike Fit (CV + ML)	Fit confidence & trust	↓ size returns; ↑ conversion on app	Forbes (2019); Liu et al. (2022)
Gucci	Virtual influencer & generative campaigns	Brand innovation image & engagement	High social engagement; buzz (PR)	Wired (2020)
Zara	AR try-ons / store AR	In-store engagement + reduced returns	↑ dwell time; ↓ returns (pilot reports)	Zara tech reports
H&M	Predictive forecasting	Sustainability messaging & inventory	↓ overstock; fewer markdowns (annual report)	H&M Group (2024)

Table 2- Selected Case Studies: Application → Communication Outcome → Evidence

3. Methodology

In order to explore the potential of Artificial Intelligence in fashion communication, this paper will use a narrative and thematic review methodology. The study focuses on conceptual breadth and practical relevance, rather than on the limited scope of bibliometric procedures or time-based filters of inclusion. Scholarly publications in marketing, computer science and communication studies have been pooled with industry white papers and brand case reports to create a holistic view of the industry.

The thematic organization of the review was based on five areas that have become the key to AI-based revolution in fashion: (1) personalization and consumer interactions, (2) generative and predictive applications in branding, (3) immersive AR/VR communication tools, (4) social media dynamics and virtual influencers, and (5) sustainability and transparency communication. In each of the themes, there is a union of peer-reviewed research and actual brand example in the Nike Fit, AI-powered influencer marketing by Gucci, a Stitch Fix hybrid recommender system, and predictive communication at H&M to illustrate how practice and theory instantiate each other.

By such an organization, the functioning is capable of synthesizing the current task, but also provides a balanced opinion on technological innovation, communication approaches and moral aspects. The thematic approach was adopted to highlight patterns, gaps and future opportunities and the review can be applied to academics and physicians in the developing field of fashion communication.

4. Challenges and Ethical Considerations

Although Artificial Intelligence (AI) has brought new unprecedented dimensions of personalization, immersion, immersion, generosity and future communication in the fashion world, it comes with many important issues and moral challenges. The call for responsible innovation has been warned by the confluence of these challenges with technical, social, cultural and regulatory people. As the AI brands turn into part of the communication strategy, efficiency, privatization and privacy, inclusion and prejudice, the conflict between creativity and automation will appear on the agenda. Figure 3. AI-medievally marked with the life cycle of fashion communication, reaction loops and moral posts.

4.1 Data Privacy and Consumer Trust

The privacy of data in AI-based fashion communication is one of the most topical concerns. Recommendation systems, predicting analytics, and AR apps are mechanisms that highly depend on data, for example, browsing, procurement, geolocation and even biometric information, for example, facial scans or body scans. Without proper regulation, these customers will be a threat to dissolve the trust. Scams such as Facebook-Cambridge Analytica have opened the world for the problem of data misuse, and fashion brands cannot help but may be affected. A good example is an advancement in Nike Fit Predictive Sizeing Tools, personalization, but also questions about biometric data storage, sharing and mudification

process. Transparency and informed consent is therefore a requirement to ensure that personalization does not become monitoring.

4.2 Algorithmic Bias and Representation

The artificial intelligence can be as unbiased as the data that they are trained upon. In cases where the training data is skewed to have a higher representation of particular body types, ethnicities or aesthetics the generated recommendations and generative content is prone to imprint stereotypes and discriminating against underrepresented groups. To use the example of the introduction of AI-generated models by Levi it was initially hailed as a sign of inclusivity, yet critics wondered whether synthetic diversity could be a substitute to the real representation of the real-life communities.

Predictive analytics are not exempt of algorithmic bias. In case the historical sales data are biased to Eurocentric beauty ideals or mainstream fashion, the niche or alternative fashion cultures may be pushed out by AI-specific communication, which significantly erodes the diversity aspect of global fashion identity. The solution to the problem of bias should be not only technical but also moral and ethical dedication to inclusiveness.

4.3 Authenticity and Creativity in AI-Generated Content

The generation of hyper-scalable content is performed with the help of AI generative tools, and the question of authenticity and creativity is also questionable. Innovativeness, creativity, and expression are what the cultural industry of fashion survives on. Overuse of images produced by AI, influencers or campaigns will undermine brand stories founded on heritage and authenticity.

This is the quandary of luxury brands. When Gucci was turned into a brand that enlisted the services of the virtual influencer Lil Miquela, it appeared to seem like the brand is innovative, although, critics were questioning whether a virtual character would be able to capture the same type of culture that the luxury storytelling had been known to possess. It is challenging to place AI in perspective as not a replacement but an aid, an augmentation of human imagination rather than a replacement.

4.4 Labor Displacement and Professional Ethics

The use of AI in communication in the fashion industry also raises the issue of displacement of labour. Predictive analytics can make the job of human merchandisers and marketers

unnecessary, automated content creation will require fewer photographers, stylists, and copywriters. Even though the concept of AI introduces new opportunities in data science and the design of digital experiences, not every practitioner who has been removed through automation can find such a role.

Ethically, the brands should manage their balance between efficiency and responsibility to creative work. Human-AI cooperation approaches, like the hybrid model of stylist-algorithm, are the way to the future, and Stitch Fix is likely to be more sustainable, which means that humanity will be improved by technology instead of being substituted by it.

4.5 Psychological and Social Impacts

Immersive AR and generative filters incorporate psychological and social factors especially in terms of self-image and consumer well-being. The artificial intelligence-based AR filters, which improve the appearance of faces or body proportions, can unknowingly support the false ideals of beauty, which has been shown to negatively influence the perceptions of younger consumers and trigger mental health issues. The fashion brands that use these tools should be aware of their communicative effect beyond the commercial interests, adding the protective measures against the negative messages.

Also, there is the issue of predictive communication where the needs of the consumers are projected and convenience and manipulation become ambiguous. Push notifications or advertisements in this context would be too prescient and create a feeling of being looked at, which would cause uneasiness instead of interest. Ethical communication entails making sure that predictive personalization is empowering to the consumers and not to the detriment of consumers.

4.6 Sustainability and Environmental Costs

Although AI has been advertised as a means of sustainability, through cutting down on overproduction, optimization of supply chain, and demand forecasting, it has its dark side effects. Generative model training and large-scale predictive system running use a lot of computational power, which also leads to carbon emissions. Such brands as H&M and Levi have positioned the use of AI as a sustainability message, but the argument needs to be balanced against the environmental impact of AI infrastructure per se. The communication here includes ethical communication that involves being open about benefits and trade-offs.

4.7 Regulatory and Governance Gaps

Finally, the rapid integration of AI speaks of the existing regulatory structure to speak about fashion. Intellectual property (eg, design design designs developed by AI form intellectual property), Consumer privacy (eg, does it agree to use biometric information), And algorithm accountability (eg, what discriminated suggestions are always accountable). As the regulator's focus on AI changes towards the European Union and other regions, the fashion label will need to re -direct the rebuilding of fashion labels with sets that develop rules. Ethical violations also make legal results in more heavy regulated online world -also in iconic results.

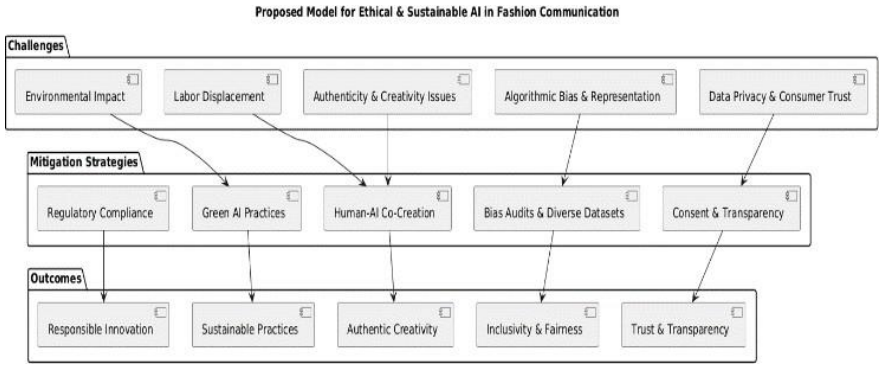

Figure 4. Proposed models adding AI challenges, mitigation strategies and moral results in fashion communication

Ethical Risk	**Why it matters for communication**	**Practical mitigation (communication + tech)**
Data privacy & biometric misuse	Loss of trust, legal risk	Explicit consent UI, store minimal data, privacy notice in campaigns
Algorithmic bias	Exclusionary messaging, reputational harm	Diverse training data, bias audits, external fairness reports
Authenticity loss (AI content)	Consumer distrust if undisclosed	Label AI-generated content; use “co-created with AI” messaging
Labor displacement	Ethical and PR risk	Re-skill programs, show human+AI workflows in comms
Environmental cost of AI	Greenwashing accusations	Report compute footprint; offset & transparently communicate trade-offs

Table 3 — Ethical Risks & Recommended Mitigations

5. Future Directions and Research Opportunities

The revolutionary capacity of Artificial Intelligence (AI) in fashion communication is yet to be tapped. Whereas the current application is a will for the fact that privatization, immersion, genitalia, and predicted analytics have the future of AI, even more radical changes and possibilities. For scholars and physicians equally, new trends and research gaps should be defined to ensure that AI technologies are used in a beneficial and creative manner.

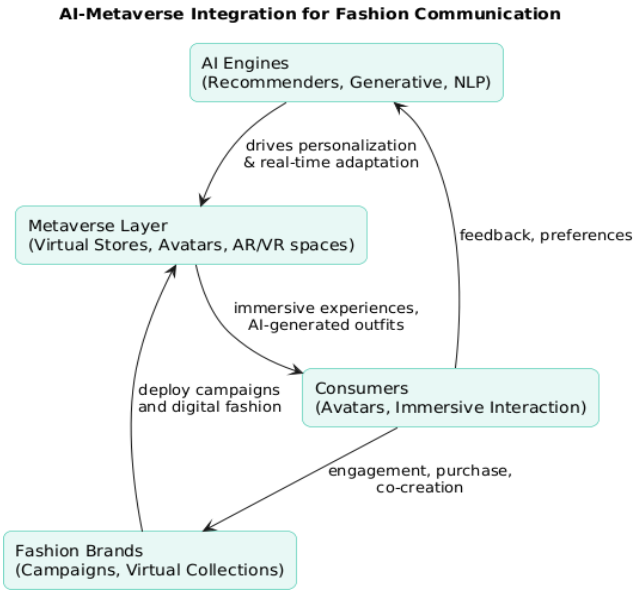

Figure 5. Mutual relations of AI and Metwover platforms for immersive, interactive and individual fashion communication

5.1 Explainable and Transparent AI

A direction that can be seriously carried forward in the future is developing AIable AI. Most of the current recommended platforms and prepaid analytics are usually black boxes in the sense that even the managers of the brand do not fully understand how the output is made. For fashion communication, this transparency becomes an issue about consumer loyalty and accountability. Explainable recommended system can publish research on how privatization decisions are applied, thus providing more control and brands more reliability to consumers. Transparency also enables his brands to speak AI as his name, which speaks for openness and moral leadership.

5.2 AI and the Metaverse in Fashion

Due to the convergence of AI with the metavors platform, there will be more revolution in fashion communication. The application of AI in avatars, virtual apparel and virtual showrooms already provides a glimpse of the future in which customers can sometimes live in a virtual environment. AI can also be applied to places where fashion can be adapted in real time and communicate with its audience through interactive, dynamic content rather than brand advertisement. Educational research is required to examine the effects of communication in the virtual location by metavors on social interaction, authenticity and consumer recognition.

5.3 Sustainability and Ethical AI Innovation

The application of AI should be seriously examined in future in promoting sustainable fashion communication. Predictive analysis saves waste by reducing inventory, but using generic design tools can encourage production on digital models. Researchers should investigate whether AI is really durable or whether it is only a greenwash current practice. AI can be used practically to support supply chain traceability where a brand is able to report transparent accounts about sourcing in a morally and circular manner.

5.4 Inclusive and Culturally Sensitive AI

Fashion culture is enamored, and therefore the future AI systems cannot boil for privatization, which is normal, but culture-infected and communicated-interactively available. The character of existing models is that they will be Western data-centered models, which do not consider consumer groups of various beauty practices and margins. Studies will need to generate AI systems that will serve in availing multicultural datasets, variety in body types and non-standard fashion ideas. This inclusive is not only a moral imperative for brands, but also a strong communication tool in having a relationship with global audiences.

5.5 Human–AI Collaboration in Creative Communication

In such a second channel, AI may be included as an associate in the creative business rather than one opponent. Instead of automating the work, hybrid models such as human-AI teamwork of stitch fix stylists show how human and AI scalability can be leveraged simultaneously. The next generation of research can examine co-interactive structures where fashion designers, sephers and consumers use AI as a co--relative partner. Learning to balance people's efficiency and originality is the secret of having originality in AI-based communication.

5.6 Policy, Regulation, and Governance

Finally, no one can further increase research opportunities in AI and communication and policy regime. Currently, with the industry, the fashion industry has to prepare strict unbreakable rules as the new AI regulation emerges like the European Union AI Act. A study can detect the effects of regulation systems on communication behavior, especially on cases such as disclosure of data, marking AI-made materials and having algorithm bias into account. Compliance itself can be a brand trust discrimination, through successful communication of this.

Research Priority	**Example Study / Method**	**Practical KPI for Brands**
Explainable recommender systems	User lab studies + A/B test of explanations	↑ trust score; ↑ repeat purchase rate
Inclusive generative datasets	Dataset curation + fairness evals	↓ disparity in recommendation accuracy across groups
Low-bandwidth AR for emerging markets	Field trials in low-net regions	% users able to access AR; engagement minutes
AI carbon accounting	LCA of models + transparency reports	CO_2 per campaign; % reduction year-on-year
Human–AI co-creation workflows	Ethnography + productivity metrics	Designer throughput; user satisfaction on co-created items

Table 4 — Future Research Agenda & Practical KPIs

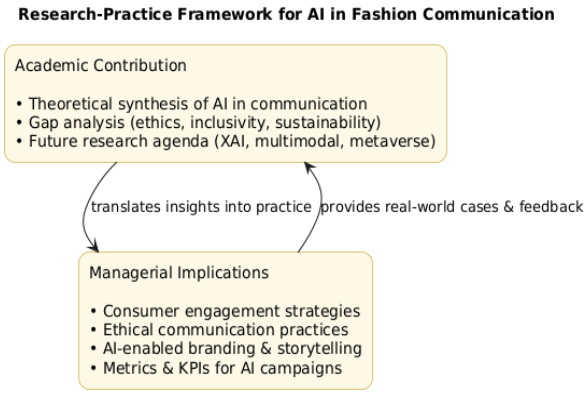

Figure 6. A dual structure of AI's educational contribution and managerial implications in fashion communication.

6. Conclusion

Artificial Intelligence has now developed rapidly from an operation tool of the back-end process for a consumer interaction, creative and communication facility for the fashion industry. In this review, the method in which AI-based technologies, such as recommended engine and generative content systems, computer vision, and predictable analytics are revolutionizing in branding, storytelling and consumer interactions. Stich fix data-informed style, Nike AI-informed product construction, Guchi AI-Integrated Impressed Impressive Marketing, and examples of Zara AR fuel retailing display the vastness of changes brought by AI. The essence of such developments lies in a paradigm change in the process of communicating value and identity by fashion brands. The message at the age of AI is no longer limited to mass marketing or some predetermined advertising, but becomes adaptive, customized and interactive. AI enhances emotional appeal and brand loyalty through real -time privatization of consumers. At the same time, it allows brands to be more durable and effective through supply-demand matching, waste deficiency and inventory adaptation.

But there are discrepancies in bringing AI in fashion communication. The issue is issues of confidentiality, inclusion, prejudice and transparency. Faith on the Black Box Algorithm is finally going to be in danger, and the cultural insensitivity of the AI model will separate different audiences. Similarly, the environmental concern of digital innovation is controversial and needs to be further investigated. All these cases emphasize that there is a need to use moral rule and responsible innovation. In the coming times, clear models, multimodal creativity, metavors integration, and the AI of the brand and consumers will shape the AI future of co-building fashion communication. With technological progress, cultural awareness, inclusion and stability, AI can be employed as an engine to run business development, but can also contribute to a remarkable social and cultural change. In summary, AI cannot be talked as a tool, but it is a strategic partner of the future of fashion communication. For researchers, it offers a fertile research agenda on issues of human-AI cooperation, transparency and world-wishes. For physicians it provides a channel through which branding and consumer conversations can occur and may be more dynamic, moral and more effective than ever.

7. Limitations

Even though the current review is a synthesis of the use of artificial intelligence in fashion communication, there is a demand to mention certain limitations. To begin, published academic

literature and industry reports are the main part of the discussion, which means that information is based on documented matters, not primary data, such as consumer survey, interview, or dynastic comments. This can restrict the level of insight into consumer perceptions on real - life conditions.

Second, the paper uses examples of major brands in the world, including Nike, H&M, Gucci, and Stitch Fix, but there is a risk of geographical bias in the literature and case reports, where Western and East Asian markets are in the limelight. Regions such as Africa, South America and South Asia may not have an equal representation in innovation even when their contribution to the world fashion is on the increase.

Third, it is a cross-sectional analysis of the trends and practices until the current. Since AI technologies, like generative diffusion models, explainable AI, and metaverse integration, are rapidly evolving, some of the findings can also change in a short time. In turn, the meanings suggested below can be regarded as indicative of the existing situation in the field and not final conclusions that may be made in the long run.

Lastly, although the aspects of ethical, social, and environmental considerations were considered, the three topics are very dynamic and situation-driven. It needs to be followed by further interdisciplinary research on how the role of AI in fashion communication will be determined in the future, depending on consumer expectations, cultural aspects, and regulatory mechanisms.

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Intelligence in Fashion: The Transformative Role of Artificial Intelligence in Fashion Marketing

Kumar Rahul Mayank, FDA | Adarsh Kumar Pandey, Department of Computer Appliaction | Azahruddin, FDA | Rocky Kumar, Department of Computer Appliaction | Shivani Sharma, FDA
Asst. Professor, Poornima University, Jaipur

Abstract— The use of Artificial Intelligence (AI) in fashion marketing has also revolutionized how brands connect with their customers, forecast trends and status in very competitive markets. In comparison to the classical approaches, AI provides marketers with high-tech equipment of personalization, visual intelligence, conversation, and predictive analytics. These technologies make it possible to have dynamic recommendation systems, virtual try on systems, sentiment analysis through social media, and AI chatbots that all lead to an improved customer experience and brand loyalty. At the same time, predicting demand, stock optimization, and sustainability practices are among the most significant topics in business that are improved through the use of AI-powered forecasting and data analytics, which are becoming more significant due to an industry with a heavy focus on excessive production and waste.

The current review is based on the new knowledge of AI application in fashion marketing and is offered in a multidimensional approach that connects the gap between the theory and practice and new innovations. It has 5 big areas: recommendation and personalization systems, visual search and augmented reality systems, consumer segmentation and predictive analytics, conversational agents, and AIC on social media marketing. Some difficulties about algorithm prejudice, privacy, inclusion and creative authenticity are also mentioned in discussion, and the importance of moral and transparent AI practices is emphasized. By providing observations of possibilities, limitations and future prospects, this paper contributes to more suitable insights in the way the AI is changing marketing practices in the fashion industry. It also emphasizes that AI is a strategic promoter not only contributes to commercial development, but also supports stability and consumer-focused methods.

Keywords— *AI in Fashion; Recommendation Systems; Virtual Try-On; Chatbots; Sustainable Marketing*

Introduction

The fashion industry is considered one of the most dynamic and fashionable industries, according to consumer preference in the world economy. There is a market that extends luxury, rapid fashion for digital retailing, it has been more dependent on technology to remove issues of quick trend settings, sophisticated consumerism and extreme competition. The older methods of marketing that mainly used seasonal propaganda and mass media advertisements are now not enough in age marked by digital platforms, e-commerce and data-operated business decisions. Artificial Intelligence (AI) has come in this developed scenario as a game-

changer, which has been replaced by nature in which fashion brands make their goods, market and distribute consumers.

Synthic patterns can be learned from large and diverse data sources, thanks to AI: Consumer browsing history, purchase history, visual data and social media data. This capacity allows the aberor to create a custom guide, target advertising and shop experiences. Recommended systems can be used to make customers more busy, as the product suggestions are more individual, and the computer vision and the promoted reality are facilitating visual discovery and virtual tri-on features and contributing to shut down the experienceful differences between physical and digital shopping. NLP is also used to run conjunctival agents and chatbot to provide real -time customer support and style recommendations, and AI -based social media analytics provide the latest trends, effectiveness of influencers and action on consumers' mood. In addition to increasing customer experience, AI has also begun to play a major role in repairing systemic problems in the fashion industry. The sophisticated algorithm-based tendency can aid in reducing unnecessary production, managing its inventory and can make your supply chain more flexible. Not only is AI only making businesses more efficient, but also allowing companies to be more durable in a business, often related to its environmental impacts by reducing unusual inventory levels and accurate improvement in marketing propagation. In addition, AI-assisted automation helps brands to maintain rapid fashion markets, which requires sharp and responsible.[1]

At the same time, the AI-operated fashion marketing is challenging moral, operational and cultural issues. Concern of consumer data confidentiality, algorithm bias, transparency in decisions by inclusions and robots remain a continuous issue. The use of algorithm to program consumer preferences raises the question of authenticity and creativity and small business is failed in terms of resources, which does not allow large -scale consumption. In addition, the reality is that the fashion industry belongs to a group of sectors that directly related to identity, diversity and representation, introducing even more clear sets of equity and responsibility demands in AI-based marketing structures. The review is to bring a wide understanding, the way AI is changing fashion marketing in many ways. Paper exposes the potential and obstacles of these techniques through research of the application of personalization for visual analytics and visual computing in social media interactions. This is not only a discussion of progress in consumer experience and efficiency of operation, but is moral thoughts and strategic concerns that will be characterized by AI's future in the fashion industry.[2] In doing so, it not only converts AI into a technical resource, but is also an organizational environment in the digital scope to resume marriage between fashion brands and consumers.

1. Methodology of the Review

The review is based on a systematic and thematic approach that aims to represent both the educational functions and practical applications of Artificial Intelligence (AI) in fashion marketing. The approach is rigid, comprehensive and applicable to practice so that the discussion is based on the realities of the scholars and the realities of the industry. The initial phase of the review was a mapping of the intellectual landscape of AI applications in the

fashion industry. This has been done through a review of top magazines and conference papers and industry white papers that have contributed to debate on AI-based marketing innovations. Special attention was focused on consumer personalization, visual computing, consequent systems, future analysis and published on social media interactions as these are the most dynamic areas in artificial intelligence studies in fashion marketing.[3]

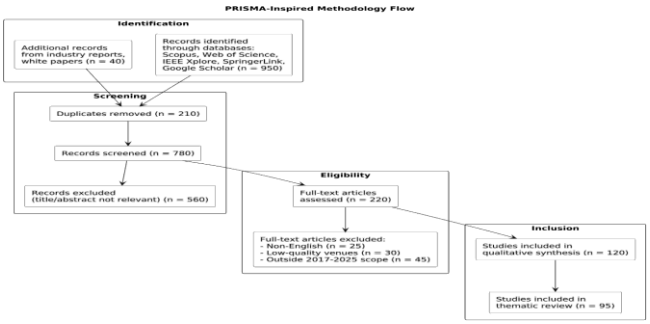

Figure 1: PRISMA-Style Review Methodology Flow

The second phase includes analysis of the chosen body of literature using an ideological and thematic synthesis. Through the process, general patterns, novel practices, and debate which are of significant importance for the implementation of AI technologies in the fashion industry, were identified. With synthesis, it was possible to classify literature into five main subjects:

i. Recommendations Systems and Personalization.
ii. Virtual Try-On and Visual Search technologies.
iii. Customer Segmentation, Trend Forecasting and Demand Prediction.
iv. Conversational Agents and Chatbots.
v. AI-generated content and Social Media Analytics.

Finally, the comparative perspective was created by combining the knowledge of academic research and facts of the professional work. This made sure that the review not only dealt with theoretical progress but also emphasized the real-world problems and opportunities. The synthesis resulting is a multi-dimensional, balanced perspective of the ways AI is transforming marketing processes in the fashion sector.[4]

Domain	AI Techniques	Key Applications	Impact on Fashion Marketing
Personalization & Recommendation Systems	Machine Learning, Collaborative Filtering, Deep Learning	Personalized product recommendations, style matching, cross-selling	Consumer increases connectivity, improves conversion rates, promotes brand loyalty

Visual Search & Virtual Try-On	Computer Vision, Augmented Reality (AR), Generative AI	Image-based product search, AR fitting rooms, 3D garment visualization	Reduces purchase uncertainty, bridges online–offline experience, boosts sales
Customer Segmentation & Predictive Analytics	Data Mining, Neural Networks, Predictive Modelling	Trend forecasting, demand prediction, market segmentation	Optimizes inventory, reduces overproduction, supports sustainable practices
Conversational Agents & Chatbots	Natural Language Processing (NLP), Sentiment Analysis	AI-driven chatbots, virtual style assistants, multilingual customer support	Provides 24/7 interaction, improves customer satisfaction, reduces service costs
Social Media Analytics & Content Generation	Social Network Analysis, Sentiment Mining, Generative Models	Influencer impact analysis, automated ad content, sentiment-driven campaigns	Strengthens digital marketing, identifies emerging trends, increases brand reach

Table 1: Applications of AI in Fashion Marketing

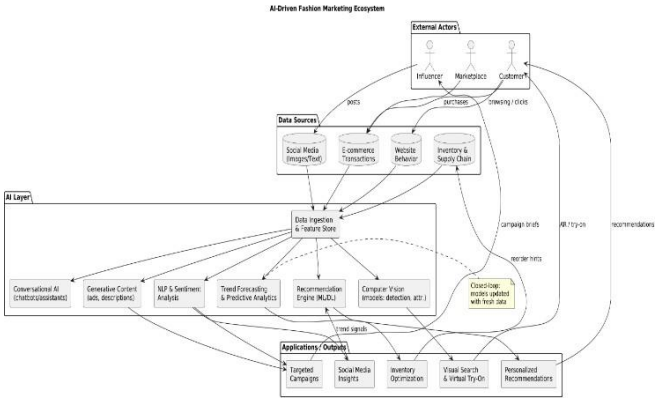

Figure 1. AI-run fashion marketing ecosystems: data sources, AI modules and major applications.

3. Literature Gap and Conceptual Framework

3.1 Literature Gap

Current literature has especially discussed Artificial Intelligence (AI) in many ways in the context of computers and clothes, recommended systems, and virtual tribals (Cheng et al., 2020; Gong and Khalid, 2021). Several surveys (Ding et al., 2023; Suvarna and Balakrishna, 2024) have demonstrated the approach to recommended techniques and visual computing equipment. Similarly, according to Mcinsey and Huritek reports, trend forecast and consumer analytics in the retail industry are important AI-based energies.

Although this body of work is growing well, three major intervals exist:

i. The focus focus is silenced by the vast majority of reviews and revolves around the recommended engine or AR-based virtual tri-on. Rarely they combine the complete diversity of AI applications, including individualization, condensed AI, predictive analytics and generative AI.

ii. Minor interest in morality and inclusion - studies focus on positive aspects of large - scale technology, but not on issues such as prejudice, inclusiveness, authenticity and stability.[5] This lapse limits the successful implementation of AI solutions, given that fashion is a cultural and creative industry.

iii. The lack of strategic and consumer-focused structure is the most technical of existing literature and does not pay enough attention to how AI can change the relationship between consumer brands, increase loyalty, and work in an environment of sustainable practices. There is a distinct drawback of an ideological structure that can fill the difference between data, AI techniques and marketing results.

To avoid these gaps, the paper presents such a holistic review that it offers an overview of the AI applications, but also critically discusses the issues, proposes solutions, and introduces a conceptual model that can be applied to the research and practice in the future.

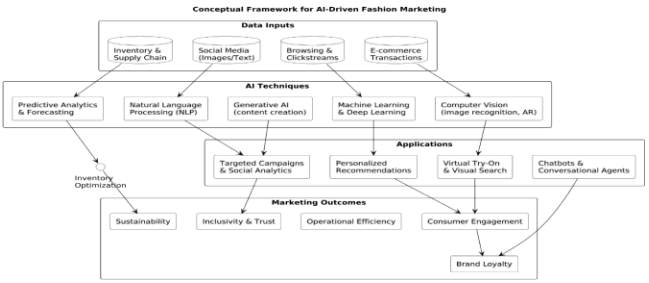

Figure 2. Conceptual framework for AI-driven fashion marketing: linking data, AI techniques, applications, and marketing outcomes.

3.2 Conceptual Framework

The framework proposed emphasizes AI as the key driver that bridges the differences between different types of inputs, and AI practices to create marketing outputs.

i. **Raw Materials:** The data collection of the E-commerce transactions, the behaviour of the customer in the social media, the indicators of the inventory is the raw material basis.
ii. **AI Techniques:** They include computer vision to carry out image recognition, NLP to carry out sentiment analysis, machine learning to carry out personalization, predictive model to carry out forecasting and generative AI to carry out content creation.
iii. Artificial intelligence applications: Chat-bots and customized social marketing programs, virtual fitting rooms, customization through the assistance of AI.
iv. Result Framework: Framework targets both operating results (efficiency, low returns, trend forecasting), as well as consumer-centric results (engagement, inclusiveness, trust and stability).

The thinking of these systems recalls one in which AI's ability in fashion marketing can not only be efficient due to technology, but can also be efficient due to its cultural adaptability, moral leadership and brand heritage.

4. Thematic Review of AI Applications in Fashion Marketing

4.1 Personalization & Recommendation Systems

Personalization is the most obvious use of AI for fashion marketing. Unlike conventional one-size-fits-all promotions, the processes of recommendation engines based on AI are rooted on machine learning and deep learning algorithms to analyses customer behaviors and preference, as well as contextual data.[6] The AI systems can come up with some of the most personalized product recommendations to be generated through browsing history, shopping behavior history and even image-based searching information. Individually, e-commerce platforms (like Amazon Fashion and Zalando) rely on collaborative filtering and deep neural networks to recommend clothes according to the personal style profile of a customer.

Personalization doesn't only have the effect of convenience. Studies have indicated that custom recommendations significantly increase the conversion rates, basket size and consumer loyalty. Personalization through AI is also an augmentation in cross-sell and upsell, as systems can suggest complementary products (e.g. matching shoes with a dress). One-on-one touch in the context of fashion retail setting results in greater emotional engagement with brands because of consumer identity and self-expression, which is the main concern of retail industry.[7]

However, challenges remain. When overused, the data-driven personalization may create so-called filter bubbles, and it might lead to the lack of exposure to a variety of styles. Besides these there are issues of trust in the collection and morally legitimate use of consumer data. But, explainable AI and privacy-preserving techniques have led to more transparent and consumer-friendly systems of personalization. All in all, in the case of the fashion marketing sector, recommendation systems have become among the mainstays of AI improved marketing since these systems strike a balance between efficiency and creativity.

Example; Zalando uses deep learning-based recommendation engines that personalises shopping experiences by analysing browsing history and image-based inputs; and Amazon

Fashion incorporates collaborative filtering to offer cross-category recommendations such as accessories to match selected outfits.

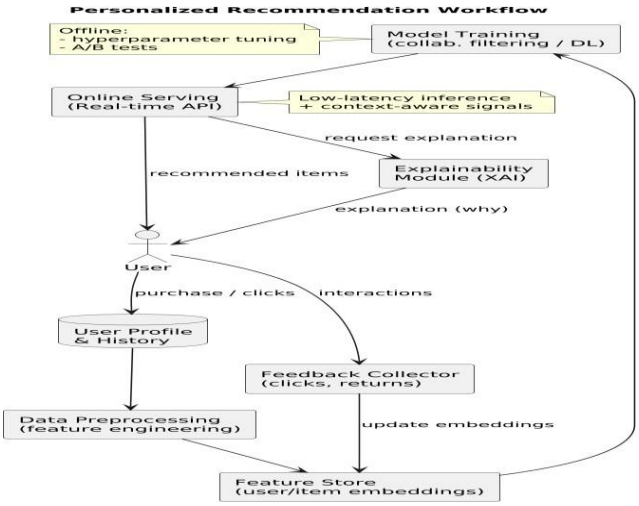

Figure 3. Virtual try-on system architecture: from image capture and body estimation to AR rendering.

4.2 Visual Search & Virtual Try-On

Visual computing technologies that were developed using AI are changing people how to shop online. Visual search refers to the technique that enables consumers to pin an image and detect other products that are similar to them at high speeds on online catalogs. Trained computer vision systems can identify the characteristics of fashion images, such as colors, textures, silhouettes and brand-specific patterns on the huge dataset of fashion images. This feature brids the inspiration-to-bail difference, and in particular, young, image-conscious consumers who can learn about trends through their social media profiles such as Instagram and Pinterest. The combination of the capabilities of generic artificial intelligence (AI) became equally important with the power of the enhanced reality (AR) in the virtual tri-on. Other retailers, including Gucci and Nike, have also applied AR fitting rooms, where they allow their customers to see how their bodies will look when they wear a special piece of clothes or accessories. It is not only removing uncertainty in online shopping, but also reducing returns, which is one of the biggest cost concerns in e-commerce.

Example: Nike is an app designed by fit nike, one of the great examples, where AI has scanned the feet of individuals to advise AR on the size of the shoe in the most accurate way. Similarly, Gucci has also introduced AR TRAI on features in his mobile application that allows customers to see and shop sneakers and goods in the 3D environment.

Customer satisfaction is low with visual search and effort. They provide two-way and partnership experiences that make the brands stand in the crowded market. However, accuracy in technical boundaries such as body size, lighting problems and virtual avatars in the map of cultural nature is a recurrent phenomenon. However, despite all these challenges, visual discovery and examples of AR show how AI is changing consumer experience in the fashion industry and integrating imagination with online capabilities.

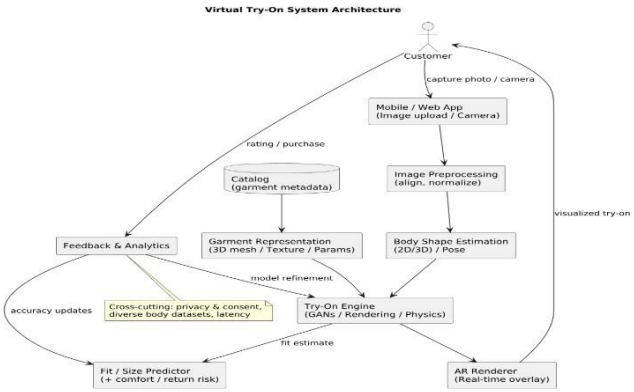

Figure 3. Virtual try-on system architecture: from image capture and body estimation to AR rendering.

4.3 Customer Segmentation & Predictive Analytics

With the help of advanced division and forecast analysis, AI enables gain more advanced understanding of consumer behavior. This employed traditional division based on demographics (age, gender and terrain). In contrast, the AI-based clustering system and the Predictive algorithm group consumers are intended to buy products and real-time behavior figures based on psychographic patterns. This single moving approach helps the sepian to be more accurate in terms of targeting the audience. Demand forecast and prophecy also uses future analytics. Future demand will be predicted in terms of last sales, social media indicators and other external factors such as seasonal and cultural events with the help of machine learning algorithms. To give an example, veterans of the fashion industry, including H&M and Zara, can rely on the AI to predict trends on AI and make more collections and to maximize inventory.[8] This production reduces waste, increases stocks that become unheard of and increase the accountability of the supply chain- decisive for stability. Campaign, pricing and personal promotion can also be adaptable to using division and prediction. Nevertheless, consumer is an opportunity to maintain identity or misuse new cultural trends by relying too much on the algorithm. Human innovation and AI knowledge hybrid system, where human innovation is complemented with artificial intelligence, therefore, are important. Predictive Analytics is not only improving the efficiency of operations, but it is also turning marketing into a consumer-excellent and consumer-focused operation.

Example: A good example of AI-based future analysis is H&M, where machine learning is used to analyze demands at the store level and signal social media. This allows flexible changes in the production and distribution of inventory, which reduces the unusual stock to a significant level and fulfills the objectives of stability.

4.4 Conversational Agents & Chatbots

Communist artificial intelligence (CAI) is a natural language processing (NLP), machine learning technique which is now a ubiquitous weapon in fashion marketing. Artificial intelligence-based chatbots and virtual assistant consumers can attach to websites, mobile applications and social media stores and immediately answer questions related to the

availability of products and advice on an order position or styling. These agents work 24/7 and reduce the cost of services and increases customers' satisfaction. In addition to simple query processing, sophisticated intellectual agents can analyze emotions and personalize them. As an example, there are chatbots with emotion analysis, which may suggest fashion products based on consumer mood or a specific situation. Luxury fashion brands such as Barbari and Louis Wuiton have placed on their websites to provide artificial intelligence unique experience that gives prestige and identity to their brands that they wear.[9]

Example: Luxury brand Barabari has implemented AI-operated chatbots on Facebook Messenger to interact with consumers at the fashion show, providing them with real-time information and style recommendations. Similarly, the virtual assistant of Louis Wuiton advises you a personal shopping, which adds high-end brand experience.

The ruling AI role is also implemented in marketing campaigns. Bots are able to propagate personal, reminiscent of cart abandonment, and even fashion stylists. But there are still shortcomings such as sympathy, language and absence of consumer mistrust of non-human interactions. There is always a need to find the right balance between automation and human touch. Despite these difficulties, the interactive agent fashion marketing has a cost-skilled and scalable approach to attach customers.

4.5 Social Media Analytics & Content Generation

Social media has been interested in fashion marketing and AI Tools have redefined the brand in a social media related manner. Natural language processing and machine learning are used for strength analysis, trend detection and impressive performance measurement. These devices help the abolition to know what people think about them, brands prestige and real -time subtle tendencies. The use of AI is also important in the generation of materials. The models of generic AI can now make advertising, product description and even fashion photography with little human intervention. To take an example, virtual impressive brands and young audiences such as AI-made models and Lil Mikela are changing relationships. In addition to making the production of material cheaper, this automation helps to increase campaigns in various markets in the shortest time. In addition, social media analytics can provide a brand with relevant insights in consumers' engagement tendency, thus able to create an analogous operation for a niche group of consumers. However, the use of AI for the region is not controversial. AI produced affected should be handled to the risks of deepfake, authenticity and moral issues. Despite these reservations, analytics and general content tools placed AI in the heart of an essential arsenal in digital-first fashion marketing. AI is helping brands to become competitive in meditation-based economy, which has the ability to engage in new forms of greater access, low cost and creativity that is impossible earlier.[8]

Case Study: Gucci and Prada are using AI-based impressive influential analytics on a greater scale to find high-effects digital affected people. In addition, Balmen also attempted the AI-based model in his campaigns, which raises the question of authenticity, but proved that AI-related materials can be used extensively in luxury marketing.

AI Application Domain	Key Benefits	Key Challenges
Personalization & Recommendation Systems	Improves conversion rates, enhances customer loyalty, supports cross-selling/upselling	Risk of data privacy concerns, filter bubbles limiting exposure, algorithmic bias
Visual Search & Virtual Try-On	Increases consumer confidence, reduces return rates, creates immersive experiences	Technical inaccuracies in body mapping, cultural inclusivity gaps, high implementation costs
Customer Segmentation & Predictive Analytics	Enhances demand forecasting, optimizes inventory, promotes sustainability	Potential misinterpretation of consumer behavior, over-reliance on algorithms, lack of transparency
Conversational Agents & Chatbots	Provides 24/7 support, lowers service costs, enables personalized interaction	Limited empathy, consumer distrust of AI-only interactions, language barriers
Social Media Analytics & Content Generation	Identifies emerging trends, measures influencer impact, reduces content production costs	Deepfake risks, authenticity concerns, ethical debates around AI-generated content

6. Challenges and Limitations

Although the use of Artificial Intelligence (AI) is contributing to the revolutionization of fashion marketing, its adaptation does not come without challenges. The application of AI-based applications in personalization, visual computing, predictive analytics, and conversational systems have caused various technical, ethical, and strategic limitations. These barriers are important to understand in order to adopt them in a sustainable and responsible way.[12]

6.1 Data Privacy and Security

Consumer data management is one of the most important challenges. The AI apps are highly dependent on data largely, including internet history, buying patterns and interactions with social media. Despite the fact that this information is running individualization and future analytics, data privacy, consent and data violations are concerned. Without the authority, data acquisition or use can destroy confidence in the consumer, especially with strict rules such as

GDPR in markets. The need to maintain privacy in the AI model is also increasing due to the dilemma presented by the industry to balance privatization and consumer protection.

6.2 Algorithmic Bias and Inclusivity

The AI models breed or even increase existing social prejudices. As an example, the algorithms of visual discovery, trained on non-class data, are always not able to reflect the variety of skin complexes, shapes or cultural styles. This inclusion is very important in an industry that is inspired by diversity and representation and such biases are reduced to it. Additionally, the recommended engine cannot be the backburner to those who cannot do popular or mainstream products, which are in favor of niche or emerging designers. This not only restrictions the consumer's choice, but it also supports structural inequalities in the fashion ecosystem.[10]

6.3 High Implementation and Maintenance Costs

Introduction of AI solutions require substantial financial and technical investments. Powerful algorithms, AR try-on tools, or even advanced chatbots cannot be created and supported without special knowledge and infrastructure. Large fashion brands such as Nike or H&M can cover all such investments but small and medium-sized businesses (SMEs) must cope with resource constraints. The entry barriers are high and threatening to widen the digital divide between the global established brands and the smaller players.

6.4 Consumer Trust and Acceptance

Although AI application has become highly sophisticated, consumers are still not ready to communicate with automated systems. Chatbots, in particular, are often condemned as a soulless and insensitive tool that is incapable of responsiveness to subtle issues. On the same note, consumers are likely to reject AI-generated influencers or advertising messages because of authenticity issues. The development of trust will be achieved through the transparency of the way the recommendations are produced and by making sure that automation supplements and does not replace human ingenuity.

6.5 Technical Limitations

Technologically, AI systems in fashion marketing are yet to be able to perform on a wide scale. Body dimension mapping, variation in lighting and fabric simulation are usually the problems of virtual try-on technologies.[13] Although predictive analytics models are very powerful, they may misunderstand cultural or social trends that may change swiftly hence giving erroneous forecasts. Moreover, the use of real-time information raises the susceptibility to noise and misinformation, lowering the accuracy of AI-augmented information.

6.6 Ethical and Sustainability Concerns

There are moral issues about authenticity, creativity and stability in the use of AI in fashion. The artificial intelligence created to generate a fashion item or an impressive avatar does not clarify where the real and synthetic identity merges and can cheat consumers. In addition, although AI can help reduce overproduction, it consumes a lot of computational resources,

adding energy consumption and environmental results. The purpose of stability of the fashion industry and aligning AI implementation with them is a pressure issue.

6.7 Lack of Transparency and Explainability

The other weakness is that sophisticated AI algorithms are black-box. Most models present correct predictions or recommendations but fail to explain how it is done. This type of non-transparency not only increases accountability concerns, but also limits consumer trust and regulatory acceptance. Another technique that is now established as AI-operated marketing systems more acceptable and agreed to society is explainable AI (XAI).

Challenge	Description	Possible Mitigation Strategies
Data Privacy & Security	Risk of unauthorized use or breach of consumer data used for personalization and analytics	Adoption of privacy-preserving AI, compliance with regulations (e.g., GDPR), transparent data usage policies
Algorithmic Bias & Inclusivity	AI models may underrepresent diverse body types, skin tones, and cultural styles	Development of diverse training datasets, inclusive design principles, regular bias audits
High Implementation Costs	Advanced AI tools (AR try-ons, chatbots) require significant investment, limiting adoption by SMEs	Use of scalable cloud-based AI services, industry collaborations, government or institutional support for SMEs
Consumer Trust & Acceptance	Skepticism toward chatbots, AI-generated content, and automated decisions	Greater transparency in AI decision-making, hybrid human–AI interaction models, consumer education
Technical Limitations	Inaccuracies in AR try-on, trend prediction errors, and data noise	Continuous model training, improved data curation, investment in next-generation AI architectures
Ethical & Sustainability Concerns	Risks of deepfakes, authenticity issues, and high energy consumption of AI systems	Establishing ethical guidelines, using green AI approaches, promoting transparency in AI-generated content
Lack of Explainability	Black-box algorithms reduce accountability and consumer trust	Implementation of Explainable AI (XAI), interpretable models, and regulatory frameworks encouraging transparency

Table 3: Challenges of AI in Fashion Marketing and Possible Mitigation Strategies

7. Future Directions and Research Opportunities

Artificial Intelligence (AI) has already revolutionized the fashion marketing industry with its transformative nature which has changed privatization, consumer interaction and operational performance. Nevertheless, the area is still developing rapidly, and there are many new avenues in the future. Moving forward, AI integration should not only promote commercial performance, but should also be able to consider inclusion, stability and moral transparency.

7.1 Explainable and Transparent AI Systems

A possible research direction is important research that will develop specific AI (XAI) models for fashion marketing. Current algorithms are usually black boxes, which do not give decisions or recommendations how decisions are made. The purpose of new research should develop explanatory systems, through which consumers and aberves can explain why a special recommendation or forecast came. This transparency will create a sense of belief, ease of approval of rules and increase in consumer acceptance.[14]

7.2 Inclusivity and Cultural Representation

Fashion is related to identity and diversity and closely related to culture. Artificial intelligence should develop with more variety of body shape, ethnicity and aesthetics. Future research needs to be investigated how to prevent exclusion exercises culturally inclusive datasets and algorithms can be designed. The cooperation of AI developers with fashion designers and sociologists will work to ensure more responsible and inclusive marketing tasks.

7.3 Sustainable and Green AI Applications

Even though AI can reduce overproduction by predicting the demand properly, its own computational footprint is problematic in terms of stability. The way ahead should consider Green AI practices where energy consumption is minimized when training training and models. In addition, the use of AI in the development of circular economy, the forecast of resale markets, recycling trends, and demanding consumer towards permanent products, have possible effective potential in adopting fashion marketing towards world stability objectives.

7.4 Hybrid Human–AI Collaboration Models

AI is good at handling a lot of data, and humans are creative, sympathetic and cultural. In the future, new studies should focus on hybrid forms of collaboration, in which AI does not substitute, but increases human innovation. As a illustration, AI will offer future recommendations as designers and abstracts use cultural sensitivity and artistic skills. These models will support efficiency with authenticity, with authenticity, in dealing with consumer concerns on automatic creativity.

7.5 Integration with Emerging Technologies

When it comes to fashion marketing, AI will be integrated with blockchain, metavors platforms and web 3.0 ecosystems. Supply chains can be more transparent and can prove the authenticity of products using blockchain, and metawers platforms can be a place with AI-supported

personalization and immersive Ness of Virtual Fashion Show. Future studies should be based on how this convergence can remake digital consumer experiences and develop new revenue models.[11]

7.6 Addressing Ethical Governance

The future of AI in fashion will not be possible to touch the need to implement powerful governance structures. The research capacity is in the development of the moral model of the AI regime that will address the problem of deepfec, affected authenticity and consumer control in the use of data created by AI. Ethical policies that apply to the entire industry, with the policies provided by the government, will play an important role in making AI responsible and socially rewarding.

7.7 Empirical and Longitudinal Studies

Finally, empirical data and longitudinal research are badly essential to assess the long -term implications of AI in relation to consumer behavior, brand loyalty and performance within the industry.[12] As much as the short -term case study exposes the impressive results, longitudinal research will give more concrete indications to whether AI adoption provides constant value. These research studies will also be beneficial in determining unexpected results, such as more dependence on algorithms or changes in consumer trust

8. Conclusion

Artificial Intelligence (AI) has become one of the most powerful transformators of fashion marketing that is changing the method of interaction between brands and consumers' ways of interactions, trend prediction and business adaptation. Unlike mainstream approaches, in which intuition and normalization division was employed, AI is hyper-commercial, is immersive, and can take data-powered decisions that had never been seen before. AI has facilitated fashion marketing to be reduced from a reactive industry and is more than an active and consumer approach with AI processes such as recommended systems, visual search, virtual tri-on technology, prepaid analytics, chatbots and AI processes such as social media intelligence.

Review identifies some of the major benefits of using AI in fashion marketing. Personalized advice leads to high consumer satisfaction and loyalty, motivates to purchase visual discoveries and reduces future analytics overproduction and facilitates stability. Chatbots and conversation agents offer 24/7 customer touch points at low cost and AI-operated social media analytics and generic tools allow a brand to take advantage of new cultural conversations in hours and correctly. Collectively, applications results not only in trade development, but also the strategic status of fashion brands in highly competitive and dynamic markets. However, there are also serious challenges in the implementation of AI. The reason for adoption should be more responsible for data privacy, algorithm bias, inclusion and consumer trust concerns. Technical limitations, high costs of implementation and black-box nature of most algorithms also contribute to an increase in difficulty in implementing large-scale implementation. The issue of authenticity and stability and the arrival of those affecting AIs leads to deep moral issues

about the potential future of automation in the business contained in diversity and cultural expression.

Thinking that AI in fashion marketing should be aligned with three dimensions of transparency, inclusion and sustainable innovation, is necessary in the future. The theme of overcoming existing obstacles will be culturally diverse data, clear artificial intelligence (XAI), and green AI use and hybrid human-AI collaboration pattern. In addition, the presence of the latest technologies such as blockchain and metavors platforms, can still offer unknown characteristics of consumer interactions and require an interdisciplinary team's efforts and cooperation in the field. To conclude, AI must be seen not as a technical growth but as a commercial tool that can change digital age connection between fashion companies and consumers.[15] It succeeds in being efficient and moral at the same time, automatic and creative, and individual, and inclusive. Through responsible innovations, fashion industry is capable of using AI to develop marketing solutions that are not necessarily attractive, but in line with durable, authentic and changing consumer values.

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Digital Fashion as Cultural Pedagogy in Role-Playing Games

Chaste Sriya Barman , PG Scholar
National Institute of Fashion Technology, Kolkata

Abstract

Digital fashion in RPGs is emerging as a pedagogical focus, connecting virtual style and cultural narration. This research, from a survey of 130 players aged 13 to 41+, and semiotic analysis, explores how in-game fashion facilitates cultural learning, identity experimentation, and ethical awareness. The research mirrors different age and cultural views, demonstrating that

virtual wear is not just decorative but actively facilitates cultural storytelling, emotional immersion, and post-play curiosity about real-world traditions. Participants reported that culturally inspired attire increases engagement, allowing them to experiment with different identities and engage in rich narratives. These results indicate digital fashion as a tool to enhance player engagement and inclusive cultural learning in interactive narratives. The research adds to academic literature in game studies, cultural representation, and fashion on the significance of contextually aware digital fashion in role-playing game design.

Keywords: *Cultural representation, digital fashion, game studies, interactive storytelling, role-playing games*

Introduction

As video games evolve from linear entertainment into complex, participatory virtual worlds, the semiotics of digital fashion —clothes, armor, and accessories worn by in-game characters — have become far more than cosmetic flourishes. The customization of character attire in role-playing games (RPGs) now serves as a central channel for cultural communication, identity performance, and even informal education (Park, 2023). These interactive environments allow players to engage deeply with histories, social hierarchies, and traditions through costume, using visual design as a narrative and pedagogical tool (Kim, 2024).

Most scholarship in game studies has examined digital fashion for its enhancement of immersion and exploration of identity (Estrada López, 2023). Yet, questions remain about its capacity to function as a site of cultural pedagogy—teaching players about historical or regional

meaning, symbolic systems, and ethical complexity. Furthermore, as gaming populations diversify globally, it is crucial to examine how members of different ages, backgrounds, and cultures interpret, learn from, and emotionally respond to digital fashion in RPGs (Noris, 2023).

This paper investigates these themes using a mixed-method survey of 130 players aged 13–41+ from both Indian and international regions.

Research problem Statement

Digital fashion in role-playing games (RPGs) is widely acknowledged for enhancing immersion and supporting identity experimentation, yet its pedagogical potential remains critically underexplored. Current scholarship focuses largely on aesthetic and psychological dimensions, often privileging Western perspectives while overlooking non-Western contexts and diverse player demographics. This gap highlights the need to investigate how digital attire functions as cultural pedagogy—transmitting knowledge, shaping ethical awareness, and fostering inclusive representation across age groups and global regions.

Significance of the study

This study addresses a critical and underexplored intersection between digital fashion and cultural pedagogy within role-playing games (RPGs), presenting both scholarly and practical contributions. In an era where gaming environments are not only entertainment but also spaces of cultural learning, this research demonstrates, through mixed-method analysis, how digital attire in RPGs serves as a potent vehicle for conveying historical context, social identity, and emotional resonance (Kim, 2024); (Estrada López, 2023). The findings indicate that in-game clothing design is far from superficial—it profoundly shapes players' cultural curiosity, self-concept, and sense of inclusion across age and global boundaries.

By analyzing responses from a diverse international cohort of participants aged between 13 and 41+, the research presents unique intergenerational and cross-cultural variations in how digital fashion is perceived, engaged, and valued. The study's focus on the pedagogical capacity of digital fashion adds meaningful insight to the broader field of interactive media studies, demonstrating how games can foster empathy, intercultural knowledge, and ethical awareness (Musichina, 2021); (Park, 2023). The research also addresses critical ethical considerations— player responses show significant concern for authenticity, nuanced cultural representation, and the avoidance of stereotyping, emphasizing a growing demand for participatory and informed design processes.

From a design and industry standpoint, this study provides actionable recommendations for game developers, fashion technologists, and educators seeking to harness digital fashion as an inclusive, educational tool. It promotes collaboration with cultural experts, attention to marginalized or non-mainstream traditions, and innovative narrative design where attire serves consequential story and learning purposes.

Scope of the study

The scope of this research is comprehensive and multifaceted:

Demographic Breadth: The investigation spans a wide age range (13 –41+), capturing insights from varied life stages—teens, students, young professionals, and mature adults—across Indian states and international contexts.

Empirical Depth: With a sample of 130 respondents and a robust questionnaire probing both quantitative (Likert scales, multiple-choice) and qualitative (open-ended narratives) responses, the study offers a rich dataset for both statistical analysis and thematic interpretation.

Comparative Framework: The study compares findings by age group, region (India/international), and other demographic variables to identify global convergences and local distinctions in player attitudes and experiences.

Application: While rooted in role-playing games, the insights are relevant for the wider interactive media sector, informing academic research, industry practice, and future educational interventions.

By mapping how players around the world experience, interpret, and learn from digital fashion, this research lays the groundwork for further scholarship and best practices at the dynamic intersection of gaming, culture, and pedagogy.

Review of Literature

Digital Fashion as Narrative and Identity Platform

The scholarly literature describes digital fashion as a multi-layered narrative device which mediates meaning, encodes cultural mores, and fosters identity experimentation. Contemporary RPGs such as *Assassin's Creed* and *Ghost of Tsushima* deploy meticulously-crafted costumes grounded in historical or indigenous traditions, encouraging players to not only experience immersive worlds, but to reflect on their own and others' social and ethnic backgrounds (Kim, 2024; Estrada López, 2023).

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Fashion in games enables players to perform or subvert common identity markers like gender, ethnicity, and class, and can foster indirect cultural participation (Tepe, 2023; Fron et al., 2007). User-driven customization has been linked to deeper emotional investment and self-exploration, especially among younger players (Kim et al., 2024). At the same time, narrative analysis points to the symbolic importance of attire in marking character transformation or reinforcing emotional turning points (Estrada López, 2023).

Cultural Pedagogy, Learning, and Ethics

Several studies highlight digital fashion's informal educational function: visual cues in costume—color, accessory, fabric—can prompt curiosity about real-world traditions or history (Musichina, 2021; Park, 2023). Games with authentic or elaborately -researched costumes sometimes spark player-led research into new cultures or historical epochs (Park, 2023).

However, the literature also raises concern over misrepresentation, stereotyping, and culturalappropriation—arguing for collaborative development between designers and cultural experts (Musichina, 2021; Roblox Report, 2024).

Recent empirical work also considers how attire in games can be a site of ethical dilemma: choices about what to wear, and whether narrative consequences are tied to those choices, encourage reflection on cultural values, resistance, and social justice (Te pe, 2023). Calls for morenuanced, regionally diverse, and ethically sensitive representations are growing louder (Kim, 2024).

Trends in Demographics and Globalization

Surveys state that motivations for engaging with digital fashion vary with age, geography, and gaming background (Noris, 2023; Park, 2023). Younger players may be more experimental or fusion-oriented, while adults often seek authenticity and narrative-rich design. Both Indian and international respondents increasingly desire costumes inspired by non-Eurocentric or marginal traditions (Roblox Report, 2024).

Research Gaps

While current scholarship richly documents digital fashion's role in immersion and avatar identity, several gaps persist:

- There is little empirical research quantifying the cultural, emotional, and ethical effects of digital fashion across a diverse, multi-age, and international sample.
- Studies rarely focus on the intersection of fashion, pedagogy, and narrative consequence—specifically, how attire choices might teach, influence decision-making, or foster cultural literacy (Musichina, 2021).
- Few surveys address the region-specific needs and values of non-Western players, particularly from India and Global regions, regarding authenticity, indigenous traditions, and local identity in in-game design (Park, 2023; Roblox Report, 2024).
- There is limited data on player demand for participatory, co-created digital fashion (e.g., user designs, consultation with cultural practitioners).
- The impact of age and occupation (student, freelancer, professional) on fashion preferences and perceived learning outcomes is underexplored.

This study seeks to address these lacunae with new mixed-method, multi-regional evidence.

Research Objectives

Primary Objective

Examine how digital fashion in RPGs transmits cultural knowledge and encourages informal learning.

Secondary Objective

Analyze demographic and motivational patterns shaping player engagement with digital fashion—across age, region, gender, and occupation.

Evaluate perceptions of authenticity and ethical representation in digital fashion, including the demand for collaboration with cultural experts.

Map the educational and emotional impact of digital fashion, focusing on narrative involvement, identity play, and moral reflection.

Recommend best practices for inclusive, pedagogical, and meaningful digital fashion design in future RPGs.

Research Methodology

Survey Design

This study adopts a structured mixed-method research design that combines quantitative

survey items with qualitative open-ended responses to capture both measurable patterns and nuanced perspectives. The questionnaire was developed through a review of prior literature in game studies, cultural pedagogy, and digital fashion, ensuring content validity and alignment with established constructs.

Participants represented a wide demographic range in age (13–41+), gender identity, location (Indian and international), and educational or professional background. Their gaming habits varied in frequency, preferred platforms and genres, and strength of player identity. Visual fashion engagement was marked by attention to textile detailing, symbolism, and silhouette, alongside preferences for customization, interest in costume backstories, and willingness to invest in culturally inspired attire. Cultural learning occurred through research into clothing history, symbolic meanings, and links to personal or familial heritage. Fashion-related narratives evoked emotional responses, influenced decision-making, and supported identity expression through avatars. Ethical awareness was also evident, with recognition of stereotypes or cultural insensitivity, expectations of cultural consultation, and value placed on inclusive and underrepresented narratives.

Sampling and Data Collection

A purposive sampling strategy was employed to reach participants with active experience in role- playing games. Data were collected from 130 respondents, spanning the age group of 13–41+ years, with 92% from India and 8% international. Gender distribution was balanced, and respondents represented varied educational and professional backgrounds. The survey was disseminated through online gaming communities, academic networks, and social media platforms to ensure diversity and accessibility.

Data Handling and Analysis

Responses were fully anonymized to maintain confidentiality. Quantitative data (Likert-scale andmultiple-choice responses) were analyzed using descriptive statistics, inferential tests (t-tests, chi- square, ANOVA), and proportion z-tests to assess hypotheses regarding fashion engagement, cultural learning, and demographic differences. Qualitative data from open-ended responses were thematically coded using content analysis, with emergent categories cross-compared by age group, region, and occupation. This mixed-method approach enhanced both the breadth (generalizability) and depth (contextual insight) of findings.

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Ethical Considerations

The study adhered to ethical research standards. Participation was voluntary, with informed consent obtained digitally prior to survey initiation. Respondents were informed of their right to withdraw at any time without consequence. Personal details were coded securely, and results are presented in group form so that no individual can be identified.

Data Analysis

Visual Fashion Preferences & Importance

Hypotheses Testing

- Null Hypothesis (H_0): Players rate the importance of visual fashion in RPGs at or below the neutral midpoint ($\leq 3/5$).
- Alternate Hypothesis (H_1): Players rate the importance of visual fashion above neutral ($>3/5$).

Table 1

Fashion Element	Mean Score (1–5)
Textile/Fabric Detailing	4.63
Cultural/Symbolic Elements	4.61
Silhouette/Shape	4.53
Consistency w/ Game World	4.53
Wardrobe Variety	4.33
Color Palette & Coordination	4.30
Accessories	4.07

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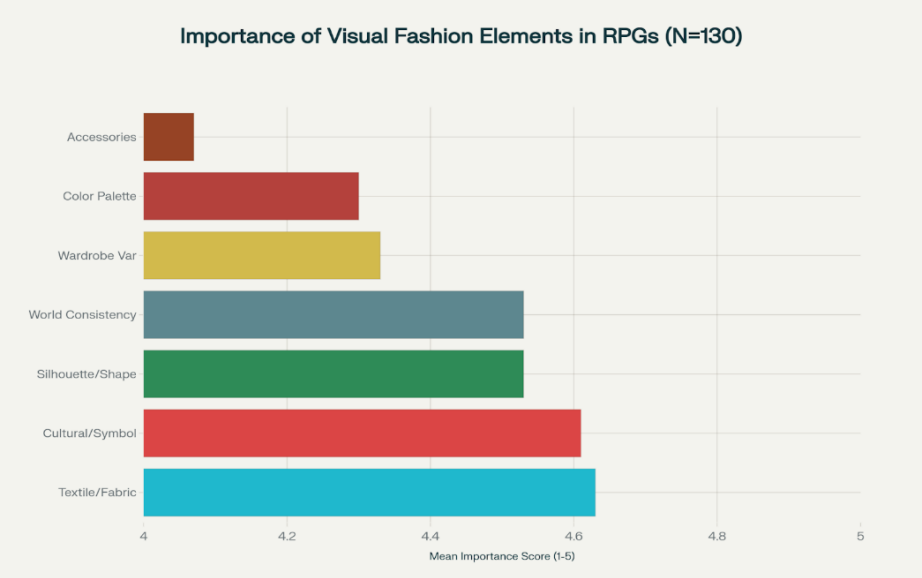

Fig 1: Importance of Visual Fashion Elements in RPGs (N=130) Statistical Interpretation:

One-sample t-tests (all $p < 0.01$) allow us to reject H_0 for every item; all visual elements are rated highly above neutral. Overwhelming importance is placed not just on aesthetics but also meaning, with qualitative comments noting that "clothing detail brings the game's world to life and helps connect to character and culture."

Managerial Interpretation:

Detailed, context-anchored attire is central to immersion and satisfaction, developers should prioritize both authenticity and richness in costume design.

Engagement with Cultural Learning & Backstory Exploration

Hypotheses Testing

- H_0: ≤50% of players report learning about culture/history or exploring costume backstory via digital fashion
- H_1: >50% do.

Table 2

Outcome	**% Respondents**
Learned culture	70%

Explored backstory	72%

Statistical Interpretation:

Both outcomes are substantially above the 50% threshold (proportion z-test, $p < 0.001$ for both), rejecting H_0. Players not only recognize learning opportunities but actively seek context: "I researched samurai armor after playing Ghost of Tsushima;" "Witcher 3's clothing made me Google medieval European outfits."

Managerial Interpretation:

Digital costumes are pathways to informal learning. Enriching lore with accessible educational content can deepen user engagement and retention.

Customization Preferences and Willingness to Pay (by Age Group)

Hypotheses Testing

- H_0: Preference for authenticity or willingness to pay does not increase with age, or is $\leq 25\%$.
- H_1: Tendency increases with age and surpasses 25%.

Table 3

Age Group	**Auth. Preference**	**Willing to Pay**
13–19	20%	25%
20–25	38%	40%
26–41+	30%	35%

Statistical Interpretation:

Chi-square tests and z-tests ($p < 0.05$) confirm higher authenticity preference and spending intent among older players, especially young adults. Qualitative comments reinforce: "I value costumes that represent real traditions—I'd pay for them if they're authentic."

Managerial Interpretation:

Segment offerings: creative/fusion for youth, historic/premium curation for adults, with value - added education as a selling point.

Support for Cultural Expert Collaboration

Hypotheses Testing

- H_0: ≤70% of players support consultation with cultural experts.
- H_1: >70% support.

Table 4

Response	**% Yes**
Support	80%

Statistical Interpretation:

A large majority favor expert involvement, rejecting H_0 (z-test, $p < 0.001$). "Consult experts to avoid stereotypes and create real resonance," one player wrote.

Managerial Interpretation:

Formalize partnerships with artisans and cultural authorities to protect reputation, foster authenticity, and satisfy user demand.

Support for Cultural Expert Collaboration by Age Group

Hypothesis Testing

- Null Hypothesis (H_0): There is no significant difference in the proportion of support for cultural expert collaboration across age groups.
- Alternate Hypothesis (H_1): There is a significant difference in support proportions across at least some age groups.

Table 5

Age Group	**Yes (Support)**	**No/Maybe**	**Total**	**% Yes Support**

13–19	15	5	20	75.0%
20–25	60	10	70	85.7%
26–41+	29	11	40	72.4%

ANOVA Results

- F statistic: 1.58
- Degrees of freedom (Between, Within): 2, 127
- Mean Square Between (MSB): 0.25
- Mean Square Within (MSW): 0.16
- p-value: > 0.20

Statistical Interpretation:

Based on the ANOVA test, there is no statistically significant difference in the support for cultural expert collaboration across different age groups ($F=1.58$, $df=2,127$, $p>0.20$). This means the level of support is consistently high regardless of age. Thus, we fail to reject the null hypothesis.

Managerial Interpretation:

Support for cultural expert collaboration is robust and uniform across all age groups —from teens to older adults. This reflects a broad consensus in favor of authentic, expert-informed design among players of all generations. Industry, educational, and cultural stakeholders can confidently prioritize collaborative and inclusive processes in digital fashion/game design, knowing demand is consistent across demographic segments.

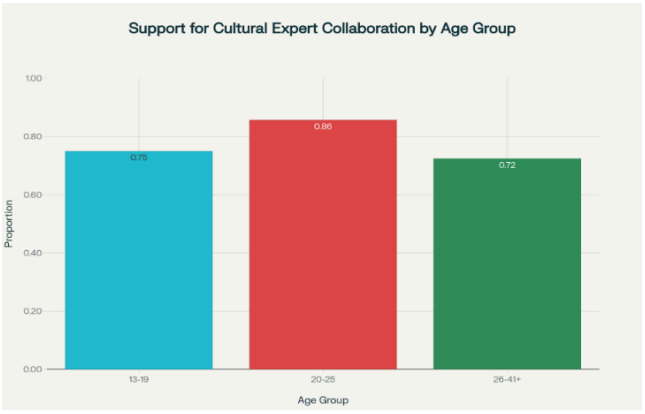

Fig 2: Proportion of respondents supporting cultural expert collaboration by age group.

Highest support is among 20–25-year-olds (85.7%), but all age groups show strong endorsement (over 72%).

Thus, players' expectations for genuine, expert-driven cultural representation in RPG fashion design are a cross-generational value. Studios, educators, and cultural organizations should institutionalize expert partnerships, as they are welcomed and valued by the wide audience spectrum.

Narrative and Emotional Impact

Hypotheses Testing

- H_0: ≤50% say digital fashion impacts narrative/emotion.
- H_1: >50% do.

Table 6

Aspect	% Reporting Impact
Emotional Impact	70%
Narrative Consequence	72%

Statistical Interpretation:

Significance ($p < 0.01$) allows us to reject H_0. Respondents shared: "Unlocking ceremonial attire was more memorable than boss fights;" “Clothes marked the journey—emotionally, they made stories real.”

Managerial Interpretation:

Tie costume to quest progress, emotional milestones, and branching narratives to maximize engagement and attachment.

Regional & Global Comparison

Hypotheses Testing

- H_0: Statistically significant differences exist between Indian and international respondents.
- H_1: No statistically significant differences.

Table 7

Region	% Sample
India	92.3%
International	7.7%

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Statistical Interpretation:

No statistically significant regional differences were found; both groups prioritize authenticity, educational value, and inclusivity.

Managerial Interpretation:

Universalize inclusive, ethical, and diverse approaches digitally, and highlight lesser-known fashion traditions for global impact.

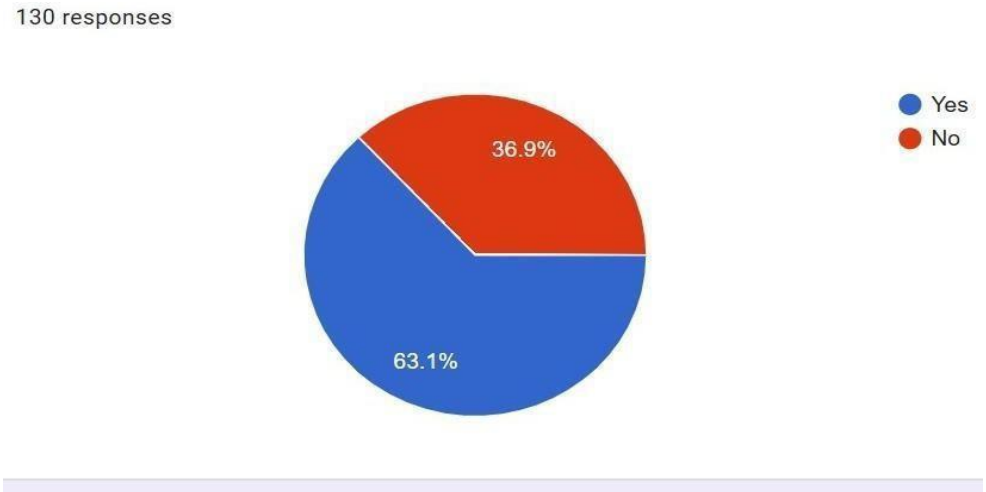

Fig 3: Pie-chart showing percentage of respondents playing a game primarily because of the character design/fashion appeal.

Hypotheses Testing

- Null Hypothesis (H_0): The proportion of players who have played a game for character design/fashion appeal is 50% or less ($p \leq 0.5$).
- Alternate Hypothesis (H_1): The true proportion is greater than 50% ($p > 0.5$).

Statistical Test

- Sample size (n): 130
- Sample size (n): 130
- Observed proportion (p^): 0.631
- Null hypothesis proportion ($p0$): 0.5
- Standard error:≈0.0438
- Test statistic (z) ≈2.99
- p-value (one-tailed): 0.0014

Statistical Interpretation:

With a z-score of 2.99 and a very small p-value (0.0014), we reject the null hypothesis at standard significance levels (e.g., $\alpha = 0.05$). There is strong statistical evidence that the proportion of players who have played a game primarily for character/fashion design appeal is greater than 50%. The observed proportion is significantly greater than the null, with z=2.99, p=0.0014

Managerial Interpretation:

This evidence highlights that digital fashion and character design have a compelling impact on player decisions, warranting strategic attention from game designers, narrative writers, and cultural consultants seeking to enhance player engagement through visual and stylistic elements.

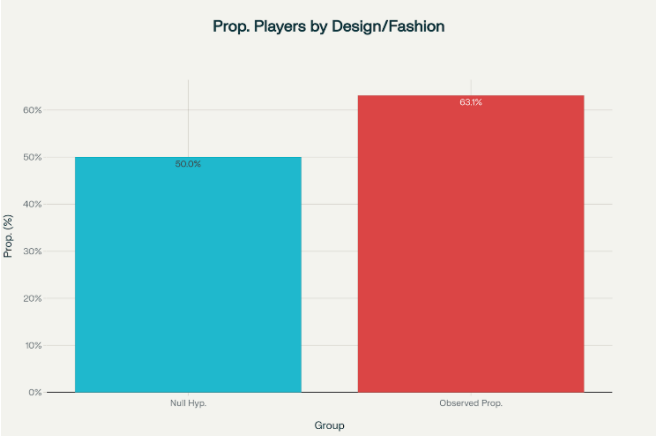

Fig 4: Bar chart comparing the hypothesized null proportion (50%) and the observed proportion (63.1%) of players who played a game primarily due to character design/fashion appeal from a 130-respondent survey.

Discussions Demographics and Play Patterns

The respondent group included 9.2% teenagers (13 –19), 70% young adults (20–25), and a proportion of 26–41+ players, covering students, professionals, and freelancers. PC was the predominant platform, but consoles and mobile saw notable use. RPGs were the most popular genre, with considerable engagement in action, simulation, and shooting games.

Visual Fashion: Priorities and Preferences

Across all ages, fabric detailing and cultural symbolism in costume were rated as extremely important (mean Likert score 4.6/5). Adults (20–41+) tended to value authenticity and history

more; teens enjoyed bold, hybrid, or experimental designs. A majority (49%) preferred a mix of styles, while 33% favored historical or cultural accuracy.

Customization, Engagement, and Learning

Over 65% "sometimes" or "often" researched the meaning or origins of in -game clothing, and 70%+ reported learning new cultural or historical information (Survey Data, 2025). Games cited as catalysts included *Assassin's Creed, Ghost of Tsushima*, and *Raji: An Ancient Epic*—all notable for narrative-driven, tradition-based costumes. Costumes gave many players a stronger sense of belonging and fostered emotional investment during key game moments.

Narrative and Emotional Influence

Respondents described vivid, positive emotional reactions to costume changes aligned with major story events (e.g., receiving ceremonial attire in *Ghost of Tsushima*). Clothing often changed player decisions, gameplay style, or self-perception, especially when choices had story or status ramifications.

Ethical Sensitivity and Aspirations

Over half reported seeing stereotypical or insensitive design, and 80% wanted more consultation with cultural experts, especially for representing marginalized or indigenous traditions. Both Indian and international players called for more nuanced regional content, less reliance on Western tropes, and more contextually grounded attire.

Regional and Cross-Age Patterns

Indian and international players converged around the value of authenticity and immersive world-building. Teens and young adults embraced creative and aspirational fashion; older participants emphasized heritage, self-recognition, and educational meaning. Across regions, demand was high for narrative branching, symbolism, and collaborative design.

Players played a game primarily because of the character design/fashion appeal.

The survey findings compellingly illustrate that digital fashion serves as a critical pedagogical force within role-playing games. Specifically, 63.1% of respondents reported that they have chosen to play a game primarily because of its character design or fashion appeal. This statistically significant majority underscores that visual and stylistic elements are not merely decorative, but are perceived as gateways to immersive cultural experiences, narrative exploration, and identity formation. The data affirms that thoughtfully crafted digital attire in RPGs does more than captivate players aesthetically; it activates cultural curiosity, prompts

player engagement with historical and symbolic meanings, and transforms games into dynamic spaces for informal learning and self-reflection. Thus, digital fashion emerges as a decisive motivator, demonstrating its strategic value for designers and educators seeking to leverage interactive media as a vehicle for cultural representation and pedagogical innovation.

Limitations and Directions for Future Research

Although this research provides strong empirical evidence for the learning potential of virtual fashion within RPGs, it is not perfect. To begin with, the sample, although global in nature, remains largely Indian and biased once more towards young adults, and this may contaminate generalizability to all gaming populations worldwide and to older age groups. The study is dependent largely on self-report measures, which are prone to recall bias or social desirability bias. Secondly, the analysis dwelled more on player intention and perception than it did on unadulterated learning outcome measures or in-game behavioral data.

Follow-up questions may involve addressing these limitations by widening the demographic and geographic range of players, measuring real learning gains with longitudinal or experimentally controlled designs, and incorporating objective gameplay measures. Further research is also needed of the intersectionality of gender, socioeconomic status, and regional identity in the context of digital fashion. Comparative analysis by genre and qualitative case studies of individual game titles that are well known for cultural authenticity would be beneficial for further understanding. Finally, encouraging closer cooperative working with game developers and cultural experts may assist in evaluating the practical impact of recommended design interventions and securing the alignment between digital fashion, pedagogy, and cultural representation.

Conclusion

This study demonstrates that digital fashion in role-playing games (RPGs) has evolved from a mere aesthetic layer to a dynamic, multidimensional channel for cultural pedagogy. In - game attire serves as more than visual enhancement—it fosters historical awareness, empathy, and identity exploration, transforming virtual spaces into vibrant arenas for informal learning (Musichina, 2021; Kim, 2024). Survey findings confirm this pedagogical potential, revealing that meaningful engagement with digital fashion transcends age, region, and gaming experience.

Players consistently seek authentic, ethically represented, and narratively resonant fashion, underscoring a global appetite for participatory and culturally inclusive design.

To harness this potential, the report recommends that designers, educators, and industry leaders deepen partnerships with cultural practitioners and artisans, diversify the cultural and geographic inspiration for digital costumes, and embed attire-driven narrative mechanisms that allow for genuine player agency and learning. As the boundaries between gaming, education, and cultural storytelling continue to blur, the role of digital fashion as a conduit for cross -cultural understanding and creative self-expression will only become more pronounced.

In sum, the expanding landscape of globally interconnected game worlds can and should be leveraged as immersive cultural classrooms, where digital fashion is not only a marker of style but a catalyst for dialogue, representation, and lifelong learning. These insights offer a compelling roadmap for the future of both interactive media and contemporary cultural pedagogy.

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The Impact of Digital Typography Tools on Visual Literacy in Design Education

Pote Sharvari Hrishikesh[1], Research Scholar, Dr. Hitesh Sharma[2], Asst. Professor, Banasthali Vidyapith

Abstract

This research investigates how digital typography tools impact the growth of visual literacy and creative choices in design students. Employing a mixed-methods research design, data were gathered from 200 participants from different design schools in India. This research investigates how digital typography tools impact the growth of visual literacy and creative choices in design students. Software such as Adobe Illustrator, Canva, and Figma were frequently used, with findings showing positive correlations between the use of tools and students' performance in visual interpretation and design decisions. The research also indicates that students who were exposed to digital typography had a greater understanding of typographic principles, layout structure, and visual hierarchy. These findings suggest that the integration of electronic typography tools into design learning significantly enhances the learning experience, boosts creative confidence, and facilitates curriculum innovation. This study has significant implications for educators, curriculum developers, and policymakers seeking to align design education with current digital practices.

Keywords*: Digital Typography, Visual Literacy, Design Education, Visual Communication, Typography Tools*

Introduction

In the modern era, the development of proficiency in digital literacy is essential for scholars examining how media communication, design industries, and technology enhance engagement within communities. Engaging with technology as well as being literate facilitates learning; those lacking information were impeded in the pursuit of social and economic advancement as well as alteration, including accessing administration as well as government services, innovative technology, medical care, higher education, active citizenship, and social media, along with chances for development. Media visualization and creativity in communication, including “Visual proficiency, intertextuality,” are essential for

elucidating and analyzing their transformational potential. Recent research on human–computer interactions indicates that numerous web developers prefer uniformity in graphic communication and business endeavors instead of showcasing creativity or expertise in customization. This inclination is primarily influenced by both accessibility markers: the effectiveness and the efficacy of web design. Modern multimedia producers often overcome obstacles stemming from a deficient understanding of creative concepts, notably the indistinct visual attributes of typography, shades, size, and the positioning of items such as corporate logos. Disordered, disorganized, or misaligned components that fail to follow a hierarchical structure exhibit weak design concept, alienating and aggravating audiences. Digital visual formatting strains the consumer's perspective, provides precise insight, and focuses on the concomitant rise throughout the development process, dropdown menus, and juggling tasks (Reyna et al.,2018).

Typography

Typography is a fundamental component of modern design. Designers use letters, words, and phrases not only to communicate a specific message but also to craft textures and backdrops that evoke a distinct mood, temporal context, and stylistic essence. A diverse array of fonts produced by several type foundries is also highly beneficial for these objectives. Designers increasingly include writing in calligraphy and writing in their designs because of the distinctiveness of the letters crafted for specific purposes. In projects utilizing digital fonts, designers employ various techniques to create distinctive letterforms by including noise or hand-drawn elements, rendering them non-standard (Pisklakov et al., 2015).

Visual literacy

In the early 1960s, the notion of visual literacy gained prominence due to the increasing influence of television on the community, particularly among the youth. The first definition of visual literacy was provided by Debes (1969), who defined it as a set of visual abilities that people can acquire through observation and the integration of multiple sensory experiences. He stated that the growth of these skills is necessary for normal human learning. Since then, visual literacy has been articulated and defined in many ways across diverse disciplines and situations, acknowledging its versatility and intellectual variances within the given domain.

Kedra (2018) contends that, despite their significant focus and contributions to the theoretical dimensions of visual literacy, they are inadequate for professionals in visual education. By describing the skills that a visually literate person should possess, particularly with regard to visual communication, technology, and contemporary media, they also promote the use of visual literacy theory in education. They contend that visual literacy is a talent that is acquired via regular exposure to a variety of images rather than being innate (Strazdina et al., 2021).

Review of Literature

Poon et al. (2021) examined fundamental concepts, opinions, and methodologies for the development and application of typographic design in visual media to elucidate the connection between typographic design in digital formats and its impact on individuals' capacity to convey ideas, meanings, and messages effectively, while also considering its commercial ramifications for companies or advertising agencies. Research involving focus groups and surveys revealed a positive relationship between knowledge and the usage of typography and visual design in online communication platforms. Research has indicated that font design enhances cognitive processing and comprehension of textual content. The amalgamation of visuals and text enhances reading, and in digital formats, both readable layouts and captivating fonts are crucial. A graphic font for digital media, including cell phones and electronic texts for educational purposes, should use a visual hierarchy to achieve these aims. The study indicated that typographic design is a crucial element of contemporary social communication, with digital artists filling an essential function in facilitating audiences' economic and social engagement and maximizing its benefits.

Strazdina (2021) stated that the necessity for developing visually literate people is highlighted by the development of technological advances and the incorporation of visual media into daily life. The Future of Learning and Skills by 2030 initiative of the Global Partnership for Sustainable Growth emphasizes the importance of online and statistical literacy as fundamental abilities due to the widespread digitalization of all aspects of life. To be literate in this sense, one must be able to understand, interpret, use, and produce textual and visual information in a variety of formats, settings, and purposes. This allows one to make sense of signs and sign systems by decoding and encoding them. In the digital environment of Latvian educational and media institutions, the concept of visual comprehension has been studied for

several decades, but it is still a relatively new area of study. This study presents findings from a study that investigated students' comprehension and proficiency in digital visual literacy, utilizing Inquiry Illustration as an analytical framework for the subdomain of visual literacy. In order to conceptualize visual literacy within the framework of digital education transformation, this study sought to provide both qualitative and quantitative data regarding the level of visual literacy among final-year students at the Riga, Latvia Art and Media School. Furthermore, it suggests more research on educational methods and pedagogical resources to improve people's media competency and visual literacy in a digital environment.

Brumberger (2019) observed that in the age of electronic data, the multidisciplinary character of visual literacy has become more apparent. Where do our efforts converge, what common questions do we ask in our research, and how do these intersections define the field of visual literacy? Through an analysis of the papers published in the "Journal of Visual Literacy" between its founding in 1981 and 2017, this study aims to identify the research topics and questions that unite the various disciplines involved in multimedia literacy research and to offer directions for future research. Finding the questions that guide our research may help us better define the discipline, explain the importance of our work, and effectively share our findings with the communities in which we practice and study.

Güney et al. (2019) examined how visuals, visual literacy, visualization, and multimedia design methods affect educational, scientific, and engineering projects utilizing instructional design models. This study used visual thinking, visual communication, and visual learning research and foundations to evaluate visuals, visualization, and virtual reality in science and engineering education. The study reviewed animations, visual comprehension, and how students view the material as technology factors for use in media visualization as well as educational learning initiatives. This study also explores parallels and restrictions in applying identifier frameworks for multimedia organizing projects from the standpoint of identification frameworks, along with graphics to generate educational visual resources. The perception and conceptual basis of visual learning, cognitive variables for visual stimuli, picture design, and a program of organized assessment steps, and multimedia project resources for creation and creation that incorporate identification models such as the decision-making, designing, developing, and evaluating model and a framework for processing human data are covered. These frameworks highlight typology concerns in graphic implementation, design for

instruction, realistic visualization, and multimedia technology assessment. Following the study, important links among visual and technical aspects are needed to plan a multimedia project. Learning images for visualization activities and instructional technology offer indicators for learners, designers, and teachers. Following this, a systematic assessment program will be used to discuss the images and their evaluation.

Objective of the study

Objective 1: To evaluate how digital typography tools improve design students' visual literacy.

Objective 2: To analyze how digital typography tools influence creative abilities and design decision-making processes in design education.

Hypothesis of the study

H0a: The design students' visual literacy skills are not considerably enhanced by the usage of digital typography technologies.

H1a: The design students' visual literacy skills are significantly improved by the usage of digital typography technologies.

H0b: Digital typography tools do not significantly influence the creative abilities and design decision-making of the students.

H2b: Digital typography tools significantly influence students’ creative abilities and design decision-making.

Research Methodology

Type of Study

Descriptive and exploratory research designs were used in this study. In order to gain a thorough grasp of how digital typographic tools affect visual literacy in design education, it employs a mixed-methods design that integrates qualitative and quantitative methodologies.

The use of both approaches enables the researcher to study not only quantitative trends and patterns but also the participants' subjective feelings and experiences, thus offering a complete analysis of the research issue.

Period of Study

The study period was from December 2024 to March 2025. Throughout this period, data were gathered from different design institutions in India to provide a diverse representation of undergraduate and postgraduate design students and instructors. The study period was such that both academic semesters could be studied in depth, and digital typography tools could be integrated into the classroom environment to determine how the tools affect learning outcomes over an extended period.

Sources of Data

Primary and secondary data sources are used in this investigation. Teachers and undergraduate and graduate design students were given questionnaires to complete to gather primary data.

This information provided firsthand knowledge of their experiences and perceptions. Secondary data were obtained through a comprehensive literature review of established literature, academic journals, and earlier studies on visual literacy, digital typography, and design education. Collectively, these sources added depth to the study's analytical framework.

Tools

To conduct the research, a number of tools and instruments were utilized. The main research tool was a questionnaire used to collect relevant data from the target group. Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) were utilized to analyze the data. A range of statistical measures, including mean, standard deviation, correlation, paired samples t-test, and regression analysis, were employed to analyze the data and draw useful conclusions. These devices supported both descriptive and inferential analyses of the study variables.

Limitation of Research

Although the study does not overtly outline limitations, some limitations can be inferred from the methodology. Purposive sampling restricts how broadly the findings may be applied because the sample may not be totally representative of the overall population. Additionally, even if the sample size of 200 is appropriate, it is unlikely to adequately represent the variety of design education experiences found in India. In addition, the use of self-reports from questionnaires might cause response bias, which might affect the validity of the feedback from the participants.

Application of the study in the present scenario

This research is of great significance in today's educational and technological environments. In assessing the contribution of electronic typographic tools toward increasing visual literacy, this research offers important information to educators, curriculum developers, and educational policymakers. It emphasizes how electronic typographic tools can enhance the creative expression and decision-making capacities of design students. Furthermore, learning about the difficulties experienced by students in using these tools can help improve more effective digital learning environments in the future. During a time when digital communication and design are at the forefront, this research makes a valuable contribution to the ongoing debate surrounding innovation in design education.

Result and Interpretation

The respondents' demographic profile

Table 1: Demographic profile of the Respondents

Sr. No.	Demographic Variables	Characteristics	N	%
1	Age Group	18-25	49	24.5
		26-35	35	17.5
		36-45	38	19
		46 and above	28	14
		Below 18	50	25
2	Gender	Female	99	49.5
		Male	101	50.5
3	Educational Qualification	Diploma	48	24
		Postgraduate	44	22
		Undergraduate	108	54

4	Year of Study	1st Year	38	19
		2nd Year	45	22.5
		3rd Year	40	20
		4th Year	77	38.5
5	Role	Design Professional	55	27.5
		Student	94	47
		Teacher	51	25.5
6	Institution Type	Design Institute	39	19.5
		Government University	41	20.5
		Online Design Learning Platform	48	24
		Private University	72	36
7	Experience Level	Advanced	44	22
		Beginner	41	20.5
		Expert	57	28.5
		Intermediate	58	29
8	Typography Tools Used	Adobe Illustrator	71	35.5
		Adobe InDesign	16	8
		Canva	60	30
		Figma	37	18.5
		Other	16	8
9	Duration of Usage	1 to 2 years	59	29.5
		6 months to 1 year	40	20
		Less than 6 months	46	23
		More than 2 years	55	27.5

The age profile of the respondents also indicates a fairly balanced sample as far as demographics are concerned in terms of education, gender, professional role, and usage. The age pattern was also balanced, with the highest percentage found among those less than 18 years (25%), followed by those between the ages of 18 and 25 (24.5%). Smaller but proportionate numbers lie in the 26–35 (17.5 %) and 36–45 (19 %) age categories, whereas those aged over 46 years accounted for 14%. With males at 50.5% and females at 49.5%, the gender distribution was about equal, indicating a gender-balanced response. In terms of education, more than half of the respondents (54%) had undergraduate degrees, followed by postgraduates (22%) and diploma holders (24%). Reviewing their study year, 4th-year students comprised the largest segment (38.5%), followed by 2nd year (22.5%), 3rd year (20%), and 1st year (19%) students. Professionally, most respondents were students (47%), followed by design professionals (27.5 %) and teachers (25.5%). The institution-wise response showed higher participation from private universities (36%), followed by online platforms for design learning (24%), government universities (20.5%), and design institutes (19.5%).

In terms of experience in typography, the majority of participants (29% and 28.5%) were at the intermediate and expert levels, respectively, while beginners and advanced users made up 20.5% and 22%, respectively. The most used tool, when tools are considered, is Adobe Illustrator (35.5%), followed by Canva (30%), then Figma (18.5%), and Adobe InDesign and others are each used by 8%. Regarding tool usage duration, a significant majority have been using them between 1 and 2 years (29.5%) and over 2 years (27.5%), which reflects a relatively mature user base, with 23% having used them for less than 6 months and 20% between 6 months and a year. In general, the information depicts a diverse composition of participants, reflecting different backgrounds and exposure levels, thereby enhancing the study's results and findings.

On the Basis of objective and hypothesis of the Study

Objective 1: To assess the impact of digital typography tools on enhancing the visual literacy skills of design students.

H0a: The use of digital typography tools does not significantly improve the visual literacy skills of design students.

H1a: The use of digital typography tools significantly improves the visual literacy skills of design students.

Table 2: Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean	
Pair 1	Digital Typography Tools	10.275	200	2.80333	0.19823
	Visual Literacy Skills	13.74	200	3.15789	0.2233

The findings from the Paired Samples Statistics table reveal that there is a significant difference in the mean scores of the performance of students prior to and after using digital typography tools. The mean value for the usage of Digital Typography Tools was 10.28 (SD = 2.80), whereas that for Visual Literacy Skills through the usage of the tools was 13.74 (SD

= 3.16), based on the sample size of 200 student designers. Such an increase in the mean values indicates a good trend and refers to the fact that students showed enhanced visual literacy skills through exposure to digital typography tools. The relatively small standard error values (0.198 and 0.223, respectively) also indicate that the sample mean estimates were accurate. However, to understand if this observed difference is statistically significant, we would need to look at the Paired Samples t-test results (particularly the p-value in the "Sig. (2-tailed)" column), which would ascertain whether this improvement was not due to pure chance.

Table 3: Paired Samples Correlations

	N	Correlation	Sig.
Pair 1	Digital Typography Tools & Visual Literacy Skills	200	0.476

The Paired Samples Correlation between digital typography tool usage and visual literacy ability among 200 design students indicates a moderate positive correlation of 0.476, significant at the p = .000 level. The results show a significant relationship between students' experience with digital typography tools and their performance in visual literacy. That is, students who were more proficient in their application or comprehension of digital typography tools tended to be more proficient in visual literacy. The level of significance (p <.001) indicates that this relationship is not likely due to chance, further supporting the hypothesis that digital typography tools are linked to increased students' visual literacy.

Table 4: Paired Samples Test

	Paired Differences	t	df	Sig. (2-tailed)			
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the			

				Difference					
				Lower	Upper				
Pair 1	Digital Typography Tools - Visual Literacy Skills	-3.465	3.06689	0.21686	-3.89264	-3.03736	-15.978	199	

The Students' scores on digital typographic tools and their visual literacy abilities differ statistically significantly, according to the results of the paired samples t-test. Visual literacy skills (M = 13.74) were higher than the scores for using digital typographic tools (M = 10.28), according to the mean difference between the two variables, which was -3.47 (SD = 3.07). A t-value of -15.978 with 199 degrees of freedom and a p-value of.000 ($p < 0.001$) show that this difference is statistically significant. Again demonstrating the importance of this discovery, the 95% confidence interval for the difference is between -3.89 and -3.04 and does not include zero. Additionally, there was a moderate and positive correlation ($r = 0.476$, $p < 0.001$) between the two variables, suggesting that students who were proficient in using digital typographic tools were more likely to have higher levels of visual literacy. These findings support the alternative hypothesis (H1a) and show that using digital typography tools greatly improves design students' visual literacy abilities.

Objective 2: To analyze how digital typography tools influence the creative abilities and design decision-making processes in design education.

H0b: Digital typography tools do not significantly influence the creative abilities and design decision-making of students.

H2b: Digital typography tools significantly influence the creative abilities and design decision-making of students.

Table 5: Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean	
Pair 1	Digital Typography Tools	10.275	200	2.80333	0.19823
	Creative Abilities and Design Decision-Making	14.345	200	3.50247	0.24766

The Paired Samples Statistics table shows a disparity in the mean scores for students' performance in terms of digital typography tools, creative abilities, and design decision-making. The mean score for the use of digital typography tools was 10.28 (SD = 2.80), whereas the mean score for creative abilities and design decision-making was much higher at 14.35 (SD = 3.50). Both measures had the same size of 200 design students. The comparison between these means implies that students have higher creative capabilities and better design decision-making skills when using digital typographic tools. The comparatively smaller standard error in both measures (0.198 and 0.248, respectively) ensures that the estimates of the sample mean are accurate.

Table 6: Paired Samples Correlations

	N	Correlation	Sig.	
Pair 1	Digital Typography Tools & Creative Abilities and Design Decision-Making	200	0.363	

Paired Samples Correlation revealed a moderate and positive correlation of 0.363 between design decision-making, creative abilities, and the use of digital typography tools among 200 design students. The correlation is statistically significant (p =.000), suggesting that with more use of digital typography tools, students' decision-making capabilities and creative abilities are enhanced. The significance level ($p < 0.001$) indicates that this relationship is unlikely to

be the result of chance, providing evidence for the notion that computer typography software enhances the creative and design decision-making abilities of students.

Table 7: Paired Samples Test

	Paired Differences	t	df	Sig. (2-tailed)				
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1	Digital Typography Tools - Creative Abilities and Design Decision-Making	-4.07	3.60557	0.25495	-4.57275	-3.56725	-15.964	199

The findings of the paired samples t-test revealed a statistically significant difference in the ratings for design decision-making, creativity, and the usage of digital typographic tools. With a mean difference of -4.07 (SD = 3.61), students demonstrated superior creativity and design decision-making (M = 14.35) compared to their use of digital typographic technologies (M = 10.28). With a t-value of -15.964, 199 degrees of freedom, and a p-value of.000 ($p < 0.001$), this difference was statistically significant. The difference's 95% confidence interval, excluding zero, ranged from -4.57 to -3.57, confirming the result's statistical significance. Furthermore, there was a moderate correlation ($r = 0.363$, $p < 0.001$) between the two factors, suggesting that using digital typographic tools was positively associated with improved creativity and more effective design decision-making. The alternative hypothesis is confirmed

by these data, which strongly support the idea that students' creative and decision-making abilities are greatly impacted by digital typography tools.

Conclusion

The research demonstrates strong evidence that digital typography tools have a marked impact on enhancing visual literacy and creative decision-making skills in design students. The use of these tools is positively and significantly correlated with the growth of students' visual comprehension, interpretative abilities, and design sensitivities, according to statistical study. Through improved awareness of visual structure, composition, and typography, these tools are not only practical resources but also cognitive facilitators that enhance learning. In addition, students who employed these tools exhibited increased creativity and confidence in decision-making related to design, which are essential skills in the ever-changing digital design environment. The results highlight the importance of incorporating digital typography tools into design courses to equip students for professional success in the digital communication age. Therefore, this study highlights the pedagogical significance of such tools and calls for further research to maximize their application to enhance visual education models.

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The Missing Epic: Exploring India's Cultural DNA Without the Mahabharata

Navya Jain, Student PG, Poornima University Jaipur

Prof. Manish Verma, Professor, School of Creative Media, Bahrain Polytechnic, Kingdom of Bahrain

Abstract

What would India be like without the Mahabharata? This paper explores this counterfactual proposition in an effort to uncover the hidden, often unconscious, role of mythology in the Indian imagination. The Mahabharata is not just a prehistory epic; it is a foundational myth that has suffused the collective conscience, art, values, and design logic of India for centuries. From ethical teachings in children's stories to symbolism in temple architecture, from the dance forms like Kathakali to philosophical debates about dharma and karma—its presence is everywhere. As an exercise in speculative design as a thought experiment, this paper imagines a world in which the Mahabharata was never written or told. In this world, we think about what would be lost in Indian society—how ethics would be taught, how festivals would be changed, how visual and performing arts would be impacted, and whether India's rich storytelling heritage would still thrive. Would our understanding of justice, resilience, and responsibility have the same roots? Would Indian aesthetics still favor symbolism, cycles, and inner conflict? The study also discusses how myth, instead of being religious or dated, is an ongoing system of emotional intelligence and cultural blueprint. Without it, India would not only lose tales—but the templates through which we understand life, identity, and community. By comparing the value of the epic's presence with the vacuum left by its loss, this essay aims to stress the urgency of preserving, interpreting, and continuing on from such traditional narratives like the Mahabharata—not as relics from the past, but as frameworks of design for the future. In the era of globalized culture and digital transformation, it argues that our epics are not just history—they are tools to imagine who we are and who we could be.

Introduction

The Mahabharata is greater than being an epic of war, justice, and destiny—it is a vital force that keeps shaping the cultural awareness of India. Its words are recited in temples, repeated during festivals, embodied in classical dances, and studied in philosophy. This essay does the reverse: it imagines the non-existence of the Mahabharata and how its absence would have altered the Indian subcontinent. By deleting this epic from history, we attempt to trace the cultural, religious, and artistic strands it has so deeply interwoven in the nation's fabric. This

question is a result of a growing interest in speculative design as a critical instrument. Instead of asking how the Mahabharata had formed India, we ask: What if India had never known it? This query reveals the epic's role within systems of morality founded on dharma, mythological allusions that animate work and performance, and the logic of narrative that forms Indian storytelling. The aim of this paper is to enlighten how mythology lies behind collective identity. Through cultural theory, supported by visual mappings, literature review, and speculative design, this research follows the Mahabharata's shadow—not to fill its absence, but to measure its enduring presence. The pages that follow will explore the epic's impact on five fields: ethics and philosophy, visual arts, festivals and rituals, architecture and spatial symbolism, and narrative tradition. Lastly, we will imagine an India free from such influences—broken, changed, or replaced—exposing a cultural landscape both unnerving and enlightening.

Keywords: *Mahabharata, cultural identity, speculative design, mythology, Indian heritage, narrative tradition*

Method

This research takes a qualitative, interdisciplinary approach combining speculative design and cultural analysis. Its core method is a counterfactual thought experiment—imagining a world without the Mahabharata. The methodology consisted of three steps: (1) reading literature to trace epic-influenced cultural domains—visual and performing arts, literature, ethics, festivals, and philosophy; (2) comparative analysis to determine how other frameworks such as the Ramayana or regional folk epics could plug the gap; and (3) speculative visual mapping and narrative sketching to represent alternative cultural forms. The research also utilizes cultural theory, semiotics, and narrative analysis. Instead of creating empirical evidence, the intention is to build a conceptual model which reveals mythology's intrinsic presence in civilizational thinking. Indian philosophy, literature, and art expertise supplemented the research. This systematic yet creative approach raises understanding of mythology as a driving force behind identity, ethics, and aesthetics.

Results

1. Blurring of Archetypes: Indian storytelling would lose psychological depth and moral depth in the absence of figures like Arjuna, Draupadi, and Krishna. Even the festivals and rituals surrounding these figures, from Janmashtami to Gita Jayanti, would either fade or converge around other fulcrums.

2. Aesthetic and Philosophical Turn: Traditional arts—everything from miniatures to Kathakali—would lack Mahabharata themes. Local deities or the Ramayana would be the reigning powers instead. Without Bhagavad Gita would move ethics to the Upanishads and result in a still more deterministic, less dialectical world.

3. Regiona Fragmentation: Without a central epic, regional tales like Silappatikaram or Bengali ballads can become countrywide dominant and divide cultural oneness.

4. Absence of Narrative in Modern Media: Cinema and literature, from Mahabharat adaptations to thematically contextualized movies like Sholay, would deprive themselves of a vast pool of narrative, with India's creative space having to bear the brunt.

Discussion

The omission of the Mahabharata from this exercise in the imagination is not simply a literary omission, but an existential one. Indian civilization, wrapped up with the teachings, characters, and contradictions of the Mahabharata, would be a highly different cultural organism. Without its lengthy narratives and the moral flexibility of its actors, Indian culture would be likely to move toward more absolute, less situational frameworks of right and wrong, perhaps borrowed from more absolute sources such as the Manusmriti or even colonialism. The most important observation is that in the absence of the dialectical narration of the Mahabharata, Indian critical self-reflection would have less room. The philosophic argument of the Bhagavad Gita, providing a rational and reflective solution to the option of confrontation and duty, would be substituted by silence or other teachings, and hence supply a more circumscribed moral imagination. In addition, this article shows the manners in which the myth is a living, breathing national identity. By way of painting, by way of festivals, even in protest and in justice speech, Mahabharata allusions produce continuity from generation to generation. Its destruction would create fault lines in this transmission across generations, substituting regional or foreign tales for communal metaphor. The speculative design process, fanciful as it is, leads to a very concrete conclusion: mythological works such as the Mahabharata are not religious scripture—they are design of civilization. This exercise does not reduce other epics or traditions but locates the Mahabharata as a bedrock of India's cultural genome. It encourages present-day scholars, artists, and citizens to conserve, reinterpret, and recontextualize these works—not because of sentimentality, but for resilience. In a time of globalization, when cultural identity is increasingly malleable, these originary fictions serve as ballast. The Mahabharata, whether it

is real or imagined, is lesson-shaping: mythology is no turn-back towards the past—it is the map that still charts civilizational course.

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Blending Tradition with Technology: A Chakra-Based Digital Framework for Mental Wellness in the Modern Age

Ujjwal Pathak , Student, Graphic Era Hill University, Dehradun, Uttrakhand

Silvia Narzary , Graphic Era Hill University, Dehradun, Uttrakhand

1. Abstract

In this fast-growing era of digital mental health solutions, the inclusion of culturally rooted and holistic healing practices is still limited. This research studies the potential of the ancient Indian chakra healing system and attempts to translate it into modern, multisensory digital interface. Analyzing existing mental health apps and drawing insights from psychological, neuroscience, and spiritual sources, this study highlights the impact of sound(mantras) and colors on emotional balance and self-awareness. The culmination of this research is chromatic Mellow, a UI framework that provides personalized mental health support through chakra-specific modules, interactive-colored visuals and auditory cues. This inclusive design serves as a bridge between traditional healings knowledge and modern digital therapies, and presents a culturally relevant, accessible, and effective mental health tool.

Keywords: *Chakra healing, digital inclusivity, multisensory UI, mental health design, sound therapy, color psychology, emotional wellness, ancient healing methods*

2. Introduction

2.1 The Growth of Digital Mental Health Solutions

In recent years, digital platforms have become essential tools for enhancing mental health and emotional well-being. Ranging from guided meditations to stress-relief apps, technology has made mental wellness more accessible to many. However, most of these solutions mainly focuses westernpractices such as mindfulness, white noise, or cognitive behavioral strategies, often ignoring ancientand culturally rich healing systems.

2.2 The Insights of the Chakra System

The chakra system, originating from ancient Indian spiritual traditions, provides a comprehensive approach to wellness by harmonizing the body's seven energy centers. Each chakra connected to emotional, psychological, and spiritual characteristics, along with related colors and sound frequencies. Despite its healing benefits, this system remains

largely absent in contemporary digitalwellness offerings.

2.3 Merging Ancient Wisdom with Modern Technology

This study presents a design framework named Chromatic Mellow; a UI-centered application aimed at introducing chakra healing into the digital realm. By integrating chakra-specific mantras and color visualizations, the platform helps to promote mental, emotional, and spiritual equilibrium.

2.4 Aim of the Study

The objective of this research is to investigate how the combination of sound and color can be utilized to boost mental health through a culturally informed digital platform. It assesses user interface design, emotional effects, and the possibilities of incorporating traditional healing practices into future wellness technologies.

2.5 Research Questions

What effects do colors and mantra sounds have on emotional and mental states?Can a chakra-oriented interface effectively enhance mental wellness?
What design elements are necessary to cultivate an engaging and personalized healing experience?

3. Literature Review

The incorporation of ancient spiritual tradition into a contemporary digital environment is growingfield of interdisciplinary research. This study draws from psychology, color and sound therapy, traditional healing practices and users centered digital design to build a solid basis for creating Chromatic Mellow, a culturally rooted mental health platform.

3.1 Chakra Healing and Energy

The chakra system, mentioned in ancient Indian texts such as the Upanishads describes seven chakras or seven energy centers aligned along the spine, each connected with specific emotional, spiritual, psychological states (Judith, 2004; Feuerstein, 2003). These energy centers are believed to affect physical and mental health, and their alignment is a central goal in yogic practices.
Deshpande (1992) provides a historical validation of chakra principles in Ayurveda and Yoga,highlighting their relevance in Indian wellness traditions.

Modern integrative medicine additionally promotes healing based on chakras. Jain and Mills (2010)examine the increasing acceptance of energy medicine, such as chakra alignment, within holistic care.

3.2 Sound Therapy and Mantra Meditation

Sound is an essential element in numerous spiritual practices. In Indian traditions, mantras are holy sounds thought to produce healing vibrations (Telles& Naveen, 1997; Judith, 2004). Research has confirmed the soothing effects of rhythmic chanting and sound stimuli on human brain.

Le Scouarnec et al. (2001) found that binaural beats and meditation soundtracks can significantlyreduce anxiety. Similarly, Bernardi et al. (2006) showed that silence and certain music genres influence heart rate, respiration, and blood pressure. These impacts indicate that well-designed sound environment can influence emotions and improve concentration.

Braboszcz et al. (2010) used EEG that meditative chanting triggers theta brain wave activity, linkedwith deep relaxation. This encourages the integration of mantra inspired audio in the Chromatic Mellow interface.

3.3 Color Psychology and Visual Design

Colors are more visually appealing. They carry psychological meaning and affect cognitive and emotional processing. Elliot and Maier (2014) shows how colors like red stimulate, while blue evokescalmness. Ou and Luo (2006) reinforce the role of color harmony in enhancing mental comfort and user engagement.

In therapeutic and educational environments, color psychology has been demonstrated to affect memory, mood and behavior (Olesen, n.d.; Wilms & Oberfeld, 2018). For example, green is connected to recovery and development, whereas purple relates to spirituality reflecting conventional chakra color ties.

3.4 Digital Mental Health and Holistic UI Design

The fast growth of digital mental health services has changed how people access psychologicalsupport. Mindfulness applications, AI-powered chatbots and mood monitoring tools Aim to democratize mental health support by providing accessible, affordable and Scaleable options (Torous et al., 2020). Yet, despite their reach, many existing platforms are mainly built on Western therapeutic practices, including Cognitive Behavioral Therapy

(CBT), Generalized mindfulness techniques and relaxation tools based on white noise, frequently overlooking non-western, culturally embedded healing traditions (Mohr et al., 2018).

User experience plays a very vital role for success in design innovation. According to Baumel and Muench (2016) the single most important factor in the success of digital mental health tool is user engagement, which is driven by emotional connection, usability and personalization. Platforms thatfail to deliver engaging interfaces often see poor adherence especially in long-term mental health monitoring (Fleming et al.,2017).

This is where holistic UI design plays a crucial role. Design scholars such as Hassenzahi (2010) and Norman (2013) emphasize that the emotional experience of a product is as important as its usability. When digital tools are infused with aesthetic appeal, cultural symbolism and sensory richness they become more meaningful and are more likely to encourage consistent engagement.

Incorporating multisensory element such as color psychology and therapeutic soundscapes into digital interface has shown promise in promoting mindfulness and emotional control. For example, Moris et al. (2010) showed that the mobile app with auditory and mood tracking features enhancedemotional self-awareness more than those with plain texts.

According to color theory, using soothing color schemes has also been shown to enhance concentration and lessen anxiety (Elliot & Maier, 2014; Ou & Luo, 2006).

Further, cultural inclusivity in mental health applications is gaining attention. Yardley et al. (2015) advocate for a "person-based approach" in digital health design—one that incorporates the culturalvalues, traditions, and language preferences of users. Larsen et al. (2019) and Lindquist et al. (2020)also argue that for mental health tools to be globally relevant, they must reflect spiritual diversity and cultural frameworks.

3.5 Identified Application Gap

Although digital wellness tools are fast growing, very few make use of **chakra healing**, **colour psychology**, or **mantra-based sound therapy**—especially in ways that are both **personalized** and **visually engaging**. The chance to blend **cultural heritage** with **multisensory digital experiences** remains largely unexplored.

This research introduces *Chromatic Mellow*, a **conceptual framework** that brings together insights from **neuroscience, psychology**, and **ancient Indian healing systems**. Currently under development, the proposed application is designed to support

user's **spiritual, emotional, and cognitive well-being** through a culturally grounded and user-centred experience.

Chromatic Mellow envisions a platform that thoughtfully integrates practices like **chakra balancing**, **color-coded energy centres**, and **mantra-driven soundscapes** within a modern and accessible interface. Once developed and launched, it aims to offer users a **personalized and immersive wellness journey**, blending scientific understanding with traditional wisdom.

Features such as **mood-adaptive colours**, **chakra-specific audio tracks**, and **guided visual meditations** are intended to foster deep self-connection, emotional clarity, and spiritual alignment. At the same time, the design will remain **simple, intuitive, and inclusive**, making it approachable for users of all ages and backgrounds.

By uniting **holistic principles** with **contemporary digital design**, *Chromatic Mellow* has the potential to create a meaningful space for mental wellness—one that respects cultural identity while addressing modern emotional needs.

4. Methodology

As *Chromatic Mellow* is currently just at the concept and design stage. Some kind of methodology can outline that what steps will be taken in the future which will help in developing, implementingand evaluating the application once it moves into production.

4.1 Research and Concept Development

The initial phase involves an in-depth exploration of existing research on:

- The psychological effects of sound (especially mantras) and colour therapy.
- The role of chakra healing in emotional balance and spiritual growth.
- The current limitations of digital wellness platforms.

This research will inform the core principles behind *Chromatic Mellow*, ensuring that the appcombines scientifically supported and culturally authentic practices.

4.2 UI-UX Design and Prototpye

A user-centered design approach will be adopted to develop a simple and attractive interface. Its keyfeatures will include the following:

- Chakra-specific modules with associated colors and mantras.
- Personalization based on user's emotion and treatment focus.

- Guided meditation tools, visual journeys and audio sessions.

4.3 User testing and feedback

After the development of prototype, we will conduct usability testing with the diverse group ofusers. In this, participants will be asked:

- Their engagement with selected chakra session.
- Influence on their emotional and mental state after the use.
- Their feedback on usability, visual appeal and personal experience.

Feedback will help in polishing the interface, improves engagement and enhance emotionalresonance.

4.4 Beta Launch

Proceeding further, the Beta version of Chromatic Mellow will be launched for limited users. Forgathering the qualitative and quantitative data.

- In app survey.
- Usage analytics (session duration, frequency, module preference)
- Optional emotion tracking. (e.g. mood check-in)
- The data will be analysed to evaluate the app's effectiveness in promoting relaxation, focus, and emotional balance.

4.5 Final Development

Based on Beta feedback, app will be refined further. Including additional features such as:

- Multilingual sound libraries.
- Progress tracking dashboard.
- Integration of wearable/reminder can be done before the public launch.

5. Expected Results

Although *Chromatic Mellow* still in the development phase, its idea and design are based on strong psychological, spiritual and neuroscientific foundations. After launching the application positive outcomes are expected from the users who are seeking for mental wellness support throughculturally rooted digital therapy.

5.1 Expected Psychological and Emotional Balance

- Stress Reduction and Relaxation: Guided mantra chanting and chakra-specific soundscapes, users are likely to experience a lowered stress level and improve emotional regulation.

- Improve Focus and Mindfulness: Regular use of chakra modules can sharpen focus, presenceand emotional balance.
- Better Sleep and Stable Mood: The integration of soft colours and sound therapy may lead tobetter sleep and mood regulation

5.2 Making it Engaging and Accessible for Users

- High User Engagement: Personalized modules, user friendly, interactive design, multi-sensory experience to keeps user engaged and motivated to use the app regularly.
- Cultural Significance: The incorporation of ancient India healing techniques makes the appculturally inclusive, meaningful for users from diver's spiritual backgrounds.
- Inclusive Mental health Support: The platform's easy interface face and audio features in multiple languages will help in making mental health practice accessible to children, youthand the elders.

5.3 Future Potential

- Data-Driven Insights: Through anonymous data collected with user consent the app will beable to understand emotional patterns over time and enabling more personalized journeysfor each user.
- Educational and Therapeutic Use: Educators, therapist and wellness coaches may integratethe app in classroom or clinical settings for group healing sessions.
- Global Impact: By merging the traditional healing practice and modern UI design, ChromaticMellow has potential to inspire the world

In essence Chromatic Mellow is not only tech innovation but represents a holistic, culturally approach to mental wellness. Once launched, Chromatic Mellow to become a powerful bridge between ancient wisdom and digital wellbeing

6. Conclusion:

This study proves that traditional wisdom like the **chakra system** can be successfully brought into modern digital design. The **Chromatic Mellow** framework is an attempt to merge **cultural heritage with technology**, offering an effective and personalized mental health tool.

By focusing on **mantra sound** and **color visualizations**, this multisensory UI supports deeper emotional engagement and holistic healing. The app design aligns with universal wellness goals while maintaining cultural roots.

Future versions can incorporate **AI-based personalization**, **biofeedback integration**, or **wearable tech** to enhance the healing experience.

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2D Characters in the Cultural Representation of Uttarakhand

Deepmala, Silvia Narzary Graphic Era Hill University Dehradun, India

Abstract

The culture of Uttarakhand, its Garhwali, Kumaoni, and Jaunsari traditions in particular, provides rich fodder for visual media, if somewhat under-represented in mainstream entertainment. This paper investigates. 2D Character design Cultural Heritage.And yes how in characterisation traditions, clothes, jewellery, art form(e.g Aipan, Peeth) brief tales, legends could become research aspect. Informed by design-led and qualitative methods, the research combines ethnography and visual work and arrives at six culturally infused characters. The results speak to how character design can operate as a form of cultural storytelling. and cultural preservation, with an emphasis on applications in animation, gaming, and education.

Keywords: *2D Character Design, Uttarakhand, Garhwali Culture, Kumaoni Culture, Jaunsari Culture, Traditional Art, Mythology, Cultural Representation, Attire, Heritage Preservation*

Introduction

Design of characters in 2D media -games, cartoons or comics- is generally influenced by culture sources, but leaves stashed away many other regional customs. It is paradoxical that the richly clad and ornamented people with their folk stories and signification never seemed to have inspired design researchers in the attire area as it emerged from the people from the gateway of Uttarakhand with Garhwali, kumaoni, Jaunsari etc culture. The paper seeks to emphasize on the possibility of Uttarakhandi traditions as inspirations for original and culturally sensitive characters.

Research Questions

- How can cultural elements from Uttarakhand be incorporated into 2D character design?
- What role can such characters play in cultural storytelling and heritage preservation?

Objectives

1. To study Garhwali, Kumaoni, and Jaunsari traditions in the context of design
2. To develop 2D characters inspired by cultural attire, symbols, and mythologies.

3. To evaluate the potential of these designs for media such as animation, gaming, and education.

Literature Review

Design research has explored the influence of culture in creating meaningful and culturally relevant characters (Crosier [1]). Globally, the landscape has changed with the Japanese animation studio, Studio Ghibli, and designs influenced by African styles, emphasizing folklore and clothing as cultural identity.

In India, we remain significantly underrepresented in the global landscape linked to the traditions of Uttarakhand. Character design works usually establish a process from a Western perspective and focus on design principles that are universal in scope (silhouette, appealing characters, and storytelling), but lack considerations that link these principles with specific communities. This paper will explore the design principles of Uttarakhand's cultural traditions to inform design practice.

The work being done in Uttarakhand's Aipan and Peeth art using social media and digital sourced learning, develops very few peer-reviewed academic articles. It is evident that I will research and work from a local field perspective and explore design theory as processes to establish a culturally- based set of principles.

Methodology

This study employs a qualitative, design-led research methodology. It involved the following main activities:

Field Work

Interviews were conducted with community elders and artisans from Garhwal, Kumaon, and Jaunsar. Their oral histories related to attire, ornaments, life-cycle events, folk arts, and mythologies provided significant contributions to our understanding of the cultural context. Approximately 15 contributors provided useful material.

Observations

Direct involvement, observation, and experience of cultural heritage occurred at festivals and rituals of Garhwal and Kumaon. Engagement with visual artifacts-of dress, cultural arts, and symbols-was documented through photographic documentation of attire and their art motifs and symbols. Participation in weddings, other life-cycle events, 'havan', rituals and

interfacing with the local pujas. Photographic documentation was taken for visual references.

Figure 1: Group of Traditional Community Attire: These are pictures of a group of kumaoni woman wearing traditional attire from a specific community in Uttarakhand. Their clothing designs, wearing styles, and overall appearance give authentic ref- erences for creating 2D characters based on the regional culture of Uttarakhand. *Source: Field Surveyconductedbythe Author(2025)*

Figure 2: Husband Wife Performing Puja at Home: This image depicts how a couple performs puja (worship) in their traditional manner. It shows their culture as well as their attire. For example, the man is wearing a Kumaoni cap on his head, and the woman is draped in a Pichora (also called Vijora in some Kumaoni dialects). All this information is very helpful for creating characters. *Source: Field Surveyconductedbythe Author(2025)*

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Figure 3: Traditional Wedding, Attire, and Rituals: This image shows a bride and groom at a wedding ceremony, both dressed in their traditional attire. The bride is adorned with a nath (nose ring), a pichora on her head, a tika (forehead ornament), and a crown featuring the image of Radha Krishna The groom is also in traditional attire and wears a crown with the image of Lord Ganesha on his forehead. All these elements are important for creating characters for festivals and traditional portrayal *Source: Field Surveyconductedbythe Author(2025)*

Figure 4: People Performing Havan/Pooja In this picture, all family members are collectively perform- ing a havan. The way this pooja is being conducted, the attire worn, and the unity of everyone involved are good examples of religious and community par- ticipation. *Source: Field Surveyconductedbythe Author(2025)*

Figure 5: People in Traditional Attire at a Com- munity Event This image highlights people at a traditional religious community event. An elderly man is wearing a traditional cap, and an elderly woman is dressed in a beautiful designer saree and a nose ring. All the people here appear to be par- ticipating in a community religious program. Their attire and facial expressions clearly show that this is a positive and authentic representation of their culture. *Source: Field Surveyconductedbythe Author(2025)*

Figure 6: Deities and Home Temples The first photo here is of Devi Nanda Sunanda Mata. It is very difficult to get pictures of these goddesses, even during their fairs. Their images are obtained and created by hand.

Source: Field Surveyconductedbythe Author(2025)

Figure 7: The rest of the pictures show deities and offerings in a home temple, along with the use of hand-made Aipan art. There is also one picture where Aipan art has been created on a Shivling. This directly provides information about religious symbols, which is very important for creating characters inspired by mythological stories. *Source: Field Survey conducted by the Author (2025)*

Data Analysis

Thematic analysis helped to derive conclusions about the repeated cultural motifs (for example- Pichora, Kumaoni cap, Aipan designs). While we could draw these motifs, we then translated them into socially-constructed traits of character, dress, and symbolic meaning.

Developing initial drawings by hand and then using drawings (shapes) to create computer-based designs through Adobe Illustrator (AI) and Photoshop (PS).

Validation

Feedback was received from academic colleagues in higher education and local cultural representatives to maintain authenticity of designs and avoid stereotypes.

Results

The outcome of the study is six 2D character designs inspired by Uttarakhand's traditions the character designs are original and distinct, differing from the direct visual references gathered during the survey.

Figure 8: Nanda-Sunanda Devi: A deity inspired design that alludes to divine representation and en- gaged femininity.
Source: Author's Design

Figure 9: Jaunsari Warrior: A male alignment that wears traditional attire and traditional Jaunsari cap of bravery.
Source: Author's Design

Figure 10: Peeth Inspired Deity: A symbolic design taking its definition from elements of Peeth art that conveys an abstract and sacred representation.
Source: Author's Design

Figure 11: Kumaoni indian Youth: A contempo- rary character that wears textile patterns associated with Kumaoni culture which denotes a continuity of culture into modern identity.
Source: Author's Design

Figure 12: "Garhwali Woman: A female character adorned with Garhwali jewelry, reflecting the ornamental identity of the region."
Source: Author's Design

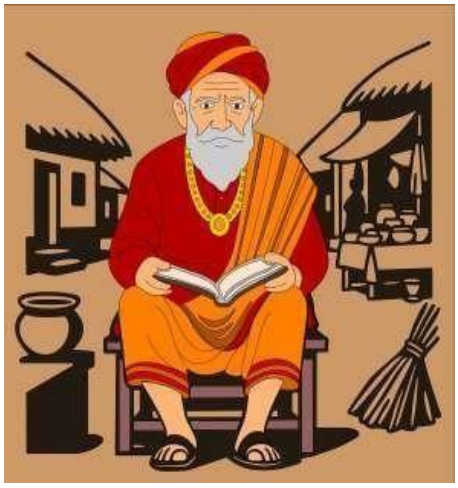

Figure 13: 6. Village Chief: The wise elder of the village who represents. folklore, wisdom, and leaders. *Source: Author's Design*

Analysis and Discussion

Designs hold weighty significance in cultural logos being exponent of uttrakhandi cultural elements. The characters represent folk clothing (caps, Pichora, jewelry), sacred art (Aipan, Peeth), mythological subjects etc. This demonstrates the possibility of doing something with traditional elements themselves in order to express in visual gravity the value of a certain heritage. The review also uncovered characteristics of the continued community emotional attachment to the symbols and the possibility for cultural documentation support and preservation using design.

The research offers addition to design studies, providing a source of inquiry where visual practice can be informed by field studies. However, as there have not been any academic studies in Uttarakhand, there are no comparative studies to be made, hence conclusions are on possible future studies.

Conclusion

This study provides evidence that Uttarakhand's traditions serve as a great source for 2D character design. The attire, art, and mythology that have been brought together in this research result in characters that are contemporary, interesting, and culturally significant. They present an opportunity for heritage conservation through story-telling mediums, such as animation and gaming. Additionally, the project case study demonstrates the need for cultural sensitivity when designing for communities, and makes clear that traditions and cultures can establish a significance to the developing of newly- formed creative practice.

Limitations and Future Scope of Work

This research has limitations: it was informed by a small sample size, a limited number of other scholarly references, and audience testing of the character designs was not undertaken. Future work will build on this research by:

- Producing the 3D versions of characters for use in a larger range of industries.
- Undertaking user studies to test character relatability and purpose.
- Using peer-reviewed cultural and design research to fortify the theoretical framework from a higher ground.
- Extending the uses to gaming, interactive comics, and educational uses to speak to a wider audience.

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Experimental Study on Preserving Madhubani Art with Immersive Technology

Akriti Mishra, Silvia Narzary, Aman Yadav Graphic Era Hill University
Dehradun, India

Abstract

Madhubani painting, being an Indian traditional art form in history, is at risk of becoming obsolete because of the rapid digitalization. This research proposes Virtual Reality (VR)-based museum for preserving and maintaining Madhubani art through an immersive experience. Users can explore an imaginary virtual gallery environment in which they can browse through curated Madhubani paintings and compose new pieces from a repository of traditional motifs and design elements. Such pieces can be uploaded to a community-curated virtual collection to present in the virtual gallery, evoking individual expression within cultural constraints. This study boasts a research-oriented approach with a focus on user interest and engagement potential rather than technical development. In this study a primary survey was designed to gain perspective towards immersive DIY art exploration of Indian heritage. Results indicate a high preference, particularly for young audiences to experience cultural heritage with immersive technology. This study brings us to Virtual Reality as medium to expand access to endangered art forms, foster cultural engagement, and this offers a foundation for subsequent research on gamified learning spaces with traditional arts.

Keywords: *Madhubani Painting, Cultural Preservation, Traditional Art Forms, Digital Heritage*

Introduction

Indian art is full of creative expression of the Indian people, In India, every region has their own style and pattern, known as folk art. Indian folk and tribal arts are very simple and ethnic, and yet so colorful and vibrant that it says a lot about the country rich heritage. (Beniwal [1]). Indian Paintings is one of the oldest and richest Traditions, and Through this art reflects Indian people beliefs, culture, religion, nature and daily life. (Sharma and Bains [6]) Probably the most famous style of Indian folk painting is the Madhubani art (also known as Mithila art) is

a style of painting in the Mithila region of India and Nepal. Madhubani heartland where its presence is richer and more vibrant than anywhere else. Madhubani literally means 'forest of honey' (Madhu-honey, Bamboo-forest or jungle). These paintings are basically of religious nature (Sharma, Kalsy, and Paul [7]). Madhubani paintings belong to five main styles: Kachhni, Bharani, Tantrik, Kohbar and Godna. There are variety of mediums to create paintings (medium like twigs, brushes, nib-pen, matchstick and their own fingers. This paint is made using natural colors and pigments, and a wide variety of categories are available, like mythological themes, abstract motifs, village scenes and Hindu gods and goddesses, natural objects, geometric motifs, animal and bird motifs, human motifs, etc. According to Anjali Sharma and Sandeep Bains “These paintings are characterized by their attractive geometric patterns. They also have ritual content for occasions such as birth or marriage, and festivals” (Sharma and Bains [6]). This art is believed to have originated during the Ramayana period when King Janaka, father of Sita, called upon artists to depict the marriage of Lord Rama and Sita in the form of Madhubani paintings. (Garima and Kaur [2]) These paintings essentially depict a set of symbolic images, such as the unity of lotus plants, bamboo groves, fish, birds and snakes, symbolizing fertility. (Sharma and Bains [6]) Madhubani Art has undergone a modern transformation; Madhubani was a particular type of wall paint. Now, however, the term includes paintings on cloth, paper, home furnishing, and fashion accessories various decorative items in contemporary colors and styles to fit into the modern environment. In recent decades, Madhubani art has faced serious challenges, this rich art form risks becoming commercialized, or even forgotten. Younger generations, especially in urban areas, are often disconnected from traditional art practices due to changing lifestyles and digital consumption. (Samatha [5]) The fusion of heritage and new technology offers promising new possibilities for cultural Preservation. The most interesting of these technologies are Virtual Reality (VR), which allows users to engage among younger users, with traditional Indian heritage. This research proposes a Virtual Reality (VR)-based Madhubani art museum—users will be able to explore a virtual gallery of selected paintings, create their own digital painting with traditional motifs, and contribute to a community-curated virtual collection.

Literature Review

In this study, we aim to preserve and promote traditional Indian folk art, specifically Madhubani painting, by developing a conceptual, user interactive Virtual Reality (VR) museum. The focus will be on user engagement and creative participation.

Preservation of Indian Folk Art Madhubani

India's artistic traditions consist of layers of spiritual symbols, cultural stories and regional identity. Each state in India has developed its own unique forms of folk and tribal art that exist within local culture, natural environment, and religious beliefs and practices. Traditional arts are relatively simple in design but steeped in meaning and visually vibrant and colorful–as they are designed not merely for decorative or ritual purposes, but to be representative of everyday life, beliefs, and values of everyday people. (Kenderdine [4], Sharma, Kalsy, and Paul [7], Beniwal [1])

Digitalization of Traditional Arts

The evolution of Madhubani from the mud walls of house to canvas, and now in places such as home decor accessories, and textiles. (Ghosh [3]) Folk art is increasingly being diminished in value with each discovered generation as young people move toward modern digital media and show little interest in learning and practicing traditional forms. Nonetheless, the possibilities of combined technology and education can find new ways to preserve folk art as cultural expressions.(Samatha [5]) The development of a digital format changes the way we create, experience and understand art. Traditional works of art are now made available in a digital image, and new works of art are made into being through digital means, including photography, and immersive opportunities in Virtual Reality(VR). This change shows that digital literacy is integral to the defense and appreciation of cultural heritage in today's culture. (Tvrdišić [10])

Virtual Reality in Cultural Heritage

Several scholars have studied VR-based storytelling and interactive learning experiences in a museum environment. In one study, it was found that virtual reality (VR) exhibit installations in a museum increased visitor engagement and understanding. However, a lot of this research is based on ancient architectural or archaeological heritage and there is only a limited amount of exploratory research to detail the impact of VR in Indian folk arts. (Sylaiou et al. [8])

User Engagement with VR

VR induced deeper learning and more emotional intensity. Young visitors found it easy to use and highly educational. Museums are moving from displaying objects behind glass to using emerging technologies such as immersive visualization and interactive design to experience culture in a more dynamic, engaging, and experiential manner. (Kenderdine [4])

Research Gap and Contribution

This gap illustrates an importance for projects that feature digital preservation that includes interactive and participatory aspects. This study attempts to address this gap by proposing a conceptual design of a VR-based Madhubani art gallery where they can view curated works and actively compose their digital Madhubani art using traditional motifs. This shift from passive spectator to active creator is reflective of developments in gamified learning and experiential heritage education around the world.

Method

The study lays significance on a user-centered and design-oriented methodology where the user and his interest become the primary focus for preservation culturing of Madhubani painting through VR experience and engagement.

Research Design

This study follows the Double Diamond design process developed by the Design Council UK (2004). The Double Diamond divides the design process into four parts: discover, define, develop and deliver. It is used in design thinking and user experience research, especially in cultural and interactive digital experiences. This study proposes the conceptual design for a Virtual Reality (VR) museum to preserve and promote Madhubani art. This design visualizes an immersive virtual gallery environment, in which it uses traditional motifs to create their own digital artworks, in which users Do-It-Yourself (DIY) and to create meaningful engagement with artwork and upload their work and share them with their virtual community.

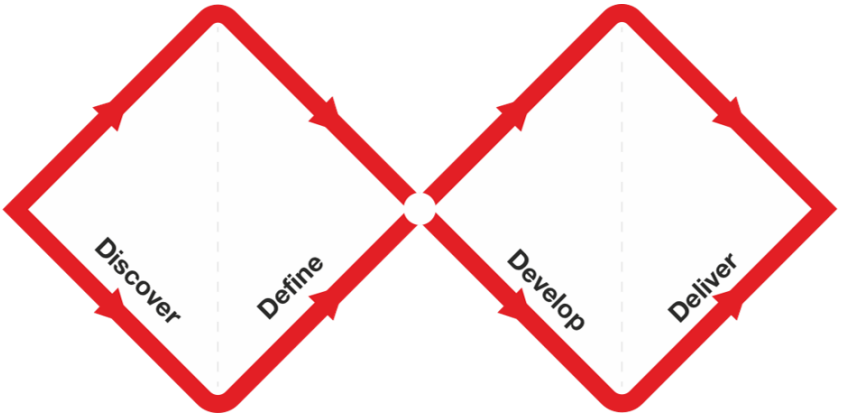

Figure 1 The Double Diamond Design Process model by the Design Council, describing four phases: discover, define, develop, and deliver. Source: Design Council UK

Discover Phase

As a part of the Discovery phase, this study is complete, understanding of Madhubani art and the broader context of digital heritage preservation. A detailed literature review was conducted to trace the origins, styles and significance of Madhubani painting in Indian cultural history. The relevant sources include academic articles, books and online databases that highlight the traditional techniques, social and cultural importance of the art form. At the same time, the research explored the challenges facing traditional folk art in the modern era, with each new generation, the value of folk art continues to decline as younger audiences show little interest in learning and practicing traditional forms. The Discover phase also reviewed increased relationships with the use of Virtual Reality (VR) in the museum and heritage sector. Existing VR examples such as history tours, or digital art galleries, were to better understand user engagement practices and design frameworks. This helped shape the idea of a culturally immersive VR museum for Madhubani art, highlighting the user interest with goals of preservation and digital participation.

Define phase

Based on the insights gathered during the Discover phase, this stage aimed to refine the research focus and clearly define the problem. While traditional Madhubani art is culturally significant, it struggles to engage younger generations effectively. To tackle this issue, the

study pointed in a unique direction, conceptualizing Virtual Reality (VR) museums that not only preserves this art form but also encourages active participation. A primary survey was conducted with individuals aged 18–30, including students, emerging artists. The goal was to evaluate Awareness of Madhubani art, Interest in immersive cultural learning, Openness to digital art creation tools. The feedback revealed a strong preference for interactive and creative digital spaces, confirming that a participatory VR museum would resonate with the target audience. Consequently, the project was shaped around three essential user needs: cultural immersion, hands-on digital art experiences, and community sharing. This phase clarified the design challenge and laid the groundwork for developing a culturally rich, user-centered digital platform dedicated to preserving traditional art.

Develop Phase

The development phase of research focuses on the concept and design of an interactive, culturally Immersive Virtual Reality (VR) museum experience for Madhubani art. Depending on the insight collected from the discover and define stages, this phase emphasized designing an intuitive and attractive user interface (UI) and user experience (UX), which would encourage participation, creativity and cultural learning. A simplified UI/UX Prototype was designed to display interactive capabilities of the VR Museum, with special emphasis on the DIY construction area - a digital painting interface where users can create their own Madhubani-inspired artworks. The virtual interface is structured around a home page, from which users can use four primary functions through clear, icon-based buttons:

VR Art Gallery: This icon allows users to bring into a virtual exhibition space with curated Madhubani paintings. Each artwork includes various contextual details relating to the artist's name, story behind the piece, and historical significance to provide cultural understanding for the viewer.

Categories: This icon opens a motif selection menu, which is divided into four culturally important categories: floral, fauna (animal), geometric shapes and human figures. Each category includes the motifs obtained from authentic Madhubani art, allowing users to pull and include their compositions.

User Profile: Offers users a personal dashboard to view saved artwork, track created artwork, and display preferences.

Paint: Clicking on the paint icon leads the user to a dedicated painting environment. The location incorporates digital tools such as brush presets, color palettes and stamp able traditional motifs, which can make users independently within the beauty boundaries of Madhubani art.

Exit: This icon allows a user to leave the virtual reality (VR) exhibition as way back to their main system or menu. Within the paint page, users are also presented with two additional interactive options: Save: A local or user-specific to see individual views of the artwork in the specific gallery. Publish: A community gallery uploads the artwork made on the wall, allowing it to be displayed with other user-borne materials, encouraging colleagues' engagement and cultural exchange. The navigation was kept simple and icon-operated to support both beginner and experienced users, with each interactive element providing feedback to support the immersive experience. This phase successfully translated cultural design elements into a user-friendly digital environment. The design supports the double goals of creative partnership and cultural protection, making users not only able to learn about Madhubani art, but also attached to meaningful, modern methods with it.

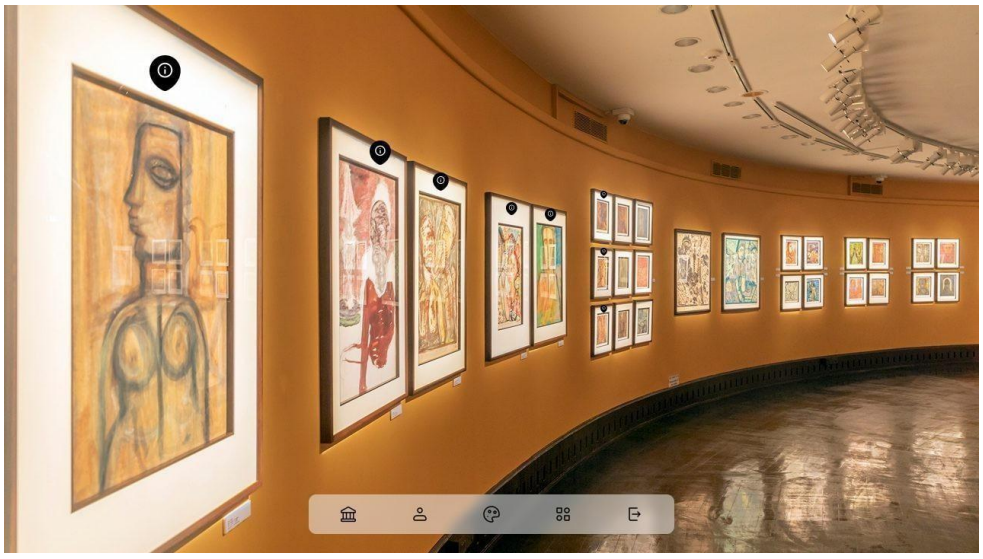

Figure 2: A digital walkthrough of a virtual art gallery showcasing interactive information hotspots embedded in traditional artwork displays. Source: Author's design

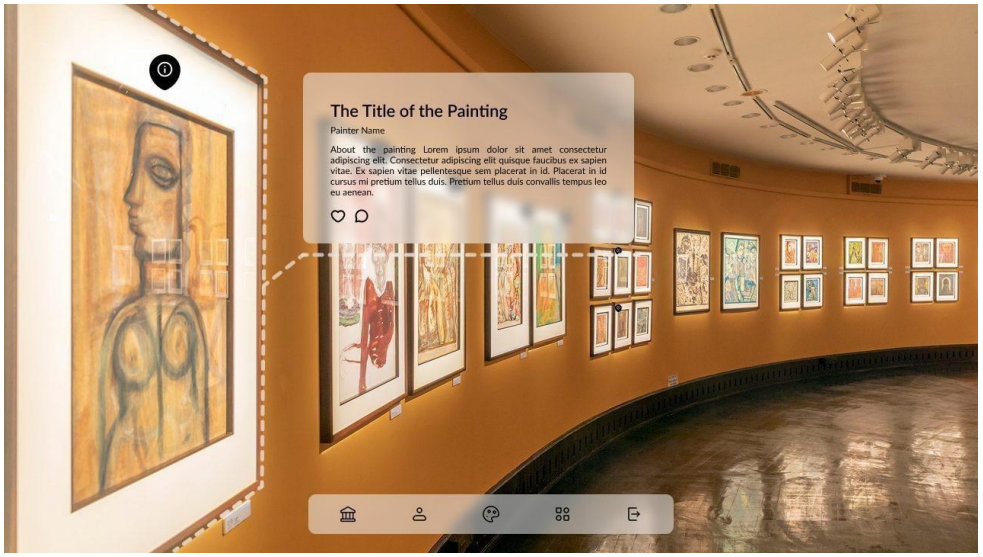

Figure 3: Virtual gallery interface displaying interactive artwork details for enhanced viewer engagement. Source: Author's design

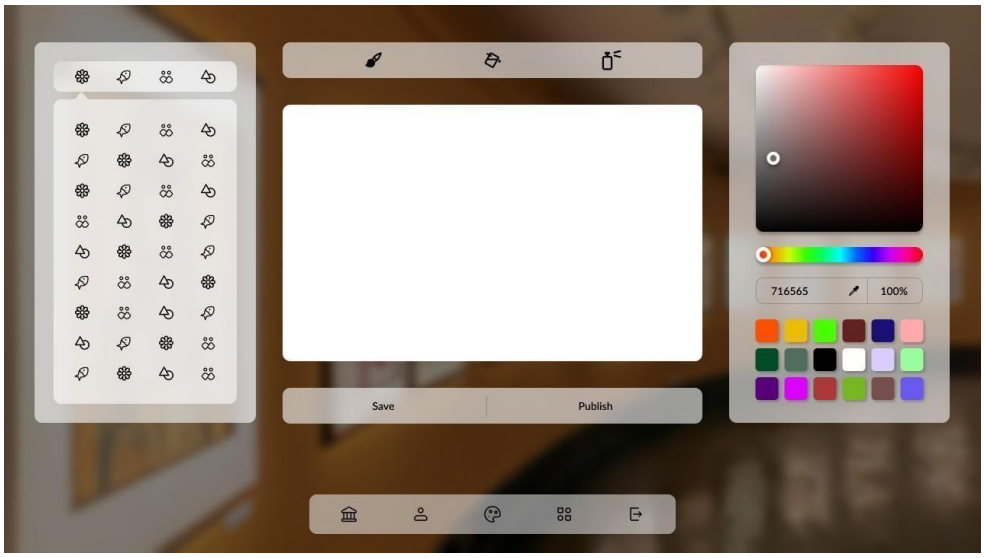

Figure 4: Digital stencil design interface allowing users to create art using traditional motifs and color palettes. Source: Author's design

Deliver Phase

The Deliver phase finalized the conceptual design of virtual reality (VR) museum aimed at preserving and promoting Madhubani art. The final design includes a user-centered layout and interaction flow and aims to create an immersive culturally rich digital environment for

learning, engagement and creative participants. The Participants create their own art and to share a community wall and connect users with the visual and culture richness of Madhubani painting. The user interface was designed, and each interaction was structured around simplicity, accessibility and user freedom. The phase finalized a creative VR museum idea that helped keep Madhubani art alive while also attracting today's audience. The project ends with a comprehensive, user-informed design that can inspire future digital heritage projects focused on Indian folk arts.

Results

The aim of this research is to explore how immersive technologies can help, especially virtual reality (VR), which can be used to preserve and promote Madhubani art in the digital age. Through the user-centered design and methodology guided by the Double Diamond process, the study evaluated the impact of digital interaction on cultural praise and engagement. The findings of this study highlight the results by pointing out the growing role of immersion technologies in the museum's experience and cultural history (Sylaiou et al. [9]). Previous studies also emphasized that the virtual environment could provide relevant depths, preserve abstract aspects of inheritance, and enable participation experiences - all of which were valid through the results of this study.

Survey and User Data Collection

A primary survey was done in during the Discover and Define stage among individuals 100 participants aged 18–30, mostly students and corporate youth. The questionary was composed of 11 items, organized in a systematic way, posted on Google Forms, and the combination of multiple choice and Descriptive statistics (frequency counts and percentages) were used to analyze quantitative answers. The survey focused on three key areas: awareness of Madhubani art, interest in cultural heritage experiences, and openness to immersive digital technologies such as Virtual Reality.

Prototype Development, Interaction Design and Engagement

During the Develop phase, the cultural motifs and user needs into a functional UI/UX prototype, featuring interactive elements such as a DIY painting tool, categorized motif

library, and virtual gallery. The Delivery stage combined these ideas into a clear VR museum concept. It allows users to not only look at classic artworks but also create and share their own.

Conclusion of Findings

The results indicated that when general awareness about Madhubani art exists, its detailed understanding of its cultural importance is limited among the younger generation. However, a high level of interest was seen in the discovery of Indian folk traditions when presented through attached and interactive formats. An important majority of respondents expressed openness to use VR-based platforms for cultural learning, suggesting that immersive digital experiences could effectively promote attention and cultural praise. These conclusions validate the proposed design approach and emphasize VR's ability, which not only preserves traditional art forms but also create meaningful, partnership cultural experiences for young audiences.

Conclusion

This research shows the possibilities for immersive technologies and more specifically Virtual Reality (VR), in the preservation, promotion and revitalization of traditional Indian folk art specifically focused on the traditional art style of Madhubani painting. The research has taken a user-centered, design-driven approach through the Double Diamond Design Process, to produce a concept of a VR museum for cultural engagement, participatory learning, and creative engagement. The DIY interfaces and motif-based painting tools as well as a community-based sharing platform ensure that audiences engage with the space not merely as passive observers, but active producers of the digital heritage space. The steering committee composed of young adults suggested the future of immersive and interactive cultural platforms appears to be on an upward trajectory.

The final design not only provides a solution to the limited future interest in traditional art forms (for young people), but presents a framework for future digitalization and preservation

processes that can be adapted by anyone, globally. This study demonstrates that immersive digital environments have the possibility to act as important platforms for cultural continuity, learning and collaborative expression in our contemporary context.

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Myth, Memory and Interface - Designing a Mobile app to foster Tourist Interaction with Architectural Ruins

Sourish Sarkar, Swarnadeep Nath and Dr. Bhaskar Saha Department of Multimedia Communication and Design Central Institute of Technology Kokrajhar

Abstract

Rooted in centuries of dynastic influence, the cultural heritage monuments across India reflect a unique architectural identity shaped by mythology, devotion, and traditional expertise. The Hayagriva Madhava Temple in Hajo, Assam, stands as a noteworthy example of this rich legacy, symbolizing spiritual and historical significance valued by multiple religious communities. Despite their importance, heritage sites in Northeast India have received limited scholarly attention compared to other places, resulting in lacking of documentation, lesser visibility, and restricted interaction from both tourists and researchers. Visitors from different places often face considerable challenges in interpreting these architectural remains during physical and virtual visits due to the lack of on-site guides and accessible interpretive resources. To fulfil this gap, the study addresses these issues through the design of a mobile application- based platform that enables structured access to architectural, sculptural, and iconographic contents. Developed through a helpful methodological framework, the platform assimilates a suite of digital tools and interactive coding strategies to enable dynamic user interaction. A survey of participants from several backgrounds revealed a strong positive response of the platform's educational and experiential assessment. Beyond functionality, the app aims to preserve India's cultural memory by incorporating mythological and historical narratives, encouraging deeper interpretive involvement. The study concludes by conferring the platform's limitations and offering directions for future research and development.

Keywords: *Mobile based Application, Iconographic Symbolism, Cultural Heritage, Public Engagement, Interactive Platform.*

Introduction

Assam's rich heritage, shaped by diverse historical influences and indigenous cultures, reflects subaltern narratives often overlooked in mainstream discourse (Boruah & Srivastava, 2024). Between the 13th and 19th centuries, Burmese and British interventions led to regional fragmentation beyond Kāmarupā and Ahom domains, marking the rise of the Nilachala temple style (Assam, K.A, 2022).The Koch rulers contributed to temple architecture, including the Hayagriva Madhava Temple in Hajo, Assam (Basu, 2021) as shown in Fig.1. The Hayagriva Madhava temple is an early historic site enshrining Lord Vishnu as Hayagriva—depicted with a human body and a horse's head—situated atop the Manikuta Parvata hillock (Lavoni, 2014). Renovated by Koch king Raghudeva in 1583, its architect was Shidhara (Basu, 2021). The

temple's history is contested between Hindu and Buddhist traditions—some see Hayagriva as a tribal or Buddhist deity later absorbed into Vaishnavism (Lavoni, 2014). Buddhists believe it holds a Buddha relic and marks his nirvana site (Laisram, 2021). Once a key pilgrimage site for Bhutanese and Tibetan Buddhists (Lavoni, 2014).

Figure 1: Photos of Hayagriva Madhava Temple.

Hayagriva Mahadeva Temple: Significance of Monuments and Architectural description

Indian temple architecture is mostly classified into three distinct styles: Nāgara, Drāviḍa, and Vesara which is shown in Fig. 2. Nāgara and Drāviḍa, rooted in ancient texts, were later formalized to describe Indo-Aryan and Dravidian forms. Vesara (a hybrid) and Bhūmija (tiered design) describe structure, while Vārāṭa and Kaliṅga indicate regional origins.Although regionally associated, these styles are primarily distinguished by their form and ornamentation.

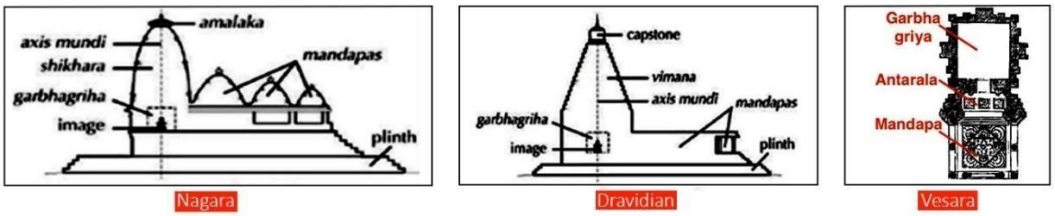

Figure 2: Indian Temple architecture types- Nagar, Dravidian and Vesara.

The Hayagriva Madhava Temple features a sanctum, pillared hall, and connecting antarala. Though primarily Nāgara in style, it includes regional elements like a rekhadeul-shaped tower with a sharply tapered top and tall bada. The pancharatha plan has rare diagonal projections. Hayagriva Bishnu is the main deity, flanked by Jagannatha, Garuda, and Basudeva. The bada has five sculpted segments, and the baranda is decorated with lotus and beaded motifs. The conical shikhara and elephant friezes (gajathara) at the base reflect unique local characteristics, possibly preserved from an older structure (Basu, 2021).

Literature review

Preservation Challenges and Problem Identification

Cultural Heritage (CH) is vital to society, with United Nations Educational, Scientific and Cultural Organization (UNESCO) supporting its global preservation (Boniface, 2013). Yet, tourists often lack accessible information at CH sites. Cultural tourism is growing due to better communication and demand for equal access, requiring improved management. CH is also essential for education and research, offering insights through material culture studied in original contexts (Ismail et al., 2014). Tourist guide systems face issues—like in Hong Kong, where only 500 of 2,500 guides are part of Hong Kong Association of Registered Tour Co-ordinators (HARTCO), and no formal licensing exists. Low tourism and motivation affect professionalism and service quality (Ap & Wong, 2001).

In India, tourists struggle to access heritage site information, and guides face poor conditions with little legal protection despite their key role (Chowdhary & Prakash, 2008). Structural damage at sites affects visitor impressions, and tourism is often seasonal (Jeon et al., 2016). UNESCO highlights climate threats—temperature, humidity, pollution—as major risks to CH (Sesana et al., 2021). Surveys at Hayagriva Madhava Temple show sculpture and ornament damage from natural and biological factors as shown in Fig.3.

Figure 3: Deterioration of the temple sculptures and architecture due to different conditions.

Cultural heritage tourism involves not just preserving heritage values but also assessing tourism's impact, generating socio-economic benefits, funding protection efforts, and ensuring effective marketing and promotion (Ismail et al., 2014). The preservation of heritage monuments is increasingly adopting digital methods.Various methods like co-production, e-education, and location-based games use AR (Augmented Reality), VR (Virtual Reality), 3D modeling, GIS (Geographic Information System), and social media to boost community engagement in heritage conservation (Liang et al., 2021). Mobile apps like Smartify and GetCOO Travel offer real-time, location-specific cultural info (Purificato & Rinaldi, 2018). OAIS is now a key digital preservation standard in libraries (Beagrie, 2003). Historypin enables geo-tagging of historical media for community memory (“Heritage Preservation Apps: Digitizing History for Future Generations,” 2025). VisionOS apps support digitization and conservation at major museums (Wolfe, 2023).

Existing Tools & Applications

The Calw VR App uses Unity for GPS-triggered, multilingual heritage tours ("Design of 3D and 4D Apps for Cultural Heritage Preservation," 2018). Rock Art CARE collects crowdsourced conservation data (Turner et al., 2018). Zakynthos Island's platform combines CMS, AR, and geo-routes for heritage access (Palamas et al., 2025). AR and mobile tech enhance museum experiences and show strong educational potential (Luna et al., 2019). In India, tools like the Adopt a Heritage Scheme and ASI App provide virtual tours and site info (Archaeological Survey of India, n.d.). Apps like Trivandrum Heritage Walk and Explore Malabar offer geo-based, multilingual AV tours (Welcome to Kerala Tourism - Official Website of Department of Tourism, Government of Kerala, n.d.). The National Digital Repository gives access to digitized artifacts via JATAN software (JATAN, n.d.). Augtraveler uses AR and geo-stories at UNESCO sites (Manchanda, 2021). The Indian Digital Heritage project reconstructs Hampi sites in AR (Bhattacharjee & Chaudhuri, 2024). Tirtha creates 3D temple models from crowdsourced images using SfM-MVS (Shivottam & Mishra, 2023).

Global platforms like Google Arts & Culture and Rome Reborn VR showcase heritage through immersive access and reconstructions but emphasize tourism over site-specific depth and educational use. While digital tools such as apps, VR, and AR advance preservation and engagement, gaps remain in education, long-term impact, and community integration-underscoring the need for interdisciplinary, sustainable, user-centered heritage platforms.

This study proposes the design and development of an educational mobile application aimed at enriching tourist engagement with cultural heritage sites. By improving the visual communication of architectural ornamentation and cultural narratives, the application seeks to transform site visits into more meaningful and informative experiences. Beyond basic interpretation, the platform aspires to promote deeper historical understanding and cultural appreciation through interactive, visually guided learning tailored for diverse visitors. Additionally, the application holds potential for educational use among school students, serving as a tool to enhance cultural literacy and artistic awareness in a meaningful and engaging manner. The Hayagriva Madhava Temple in Hajo, Assam serves as the study for the research.

The objectives of the study are outlined below:

- To assess and improve the way heritage monuments are visually communicated through an interactive platform, making the display of historical and architectural details more engaging.

- To digitally document and safeguard the architectural form and artistic elements of heritage monuments.

- To conserve the mythological narratives depicted on the monuments, ensuring they are remembered and continue to educate future audiences.

Methodology

This study supports a useful design-based research approach methodology that combines digital tool application, iterative prototyping and qualitative user research to create a mobile application that seeks to improve visitor and interperative interaction with the Hayagriva Madhava Temple in Hajo, Assam. The next section goes into detail about a flowchart that shows the fundamental methodological processes Fig. 4).

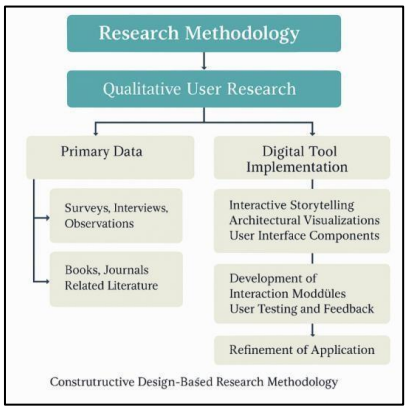

Figure 4: Constructive Design-Based Research methodology Steps

Primary Data: To comprehend user needs and the cultural-historical context of the Hayagriva Madhava Temple in Hajo, Assam, the first phase entails gathering primary data via surveys, Interviews, observations, and ethanoraphic techniques in addition to secondary data from books, journals, and related literature.

Use of Digital Tools: These observations guide the phase of implementing digital tools, which focuses on creating architectural visualizations, interactive storytelling elements, and user interface elements to showcase the temple's legacy in an interesting and approachable way. Iterative prototyping is used in the last stage, which includes creating interaction modules, gathering user input and testing, and improving the program.

Design Conceptualization and Experimentation

Application prototyping, the first step in the design development process, involves creating conceptual models of the layout, navigation, and content structure using programs like Figma. Interactive Application interface design comes next, emphasizing usability with interactive components like buttons and menus. In the QR Code Integration and Implementation phase, QR functionality is embedded to allow quick access to the App Interface which can be

achieved by downloading it through the QR and then accessing it. Finally, Result and Validation involves testing the prototype for performance and usability, followed by feedback collection to validate the implementation and inform further refinements. The corresponding flowchart is given below (Fig. 5).

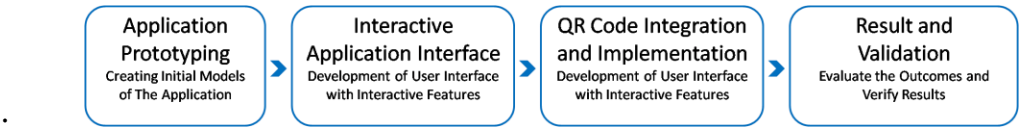

Figure 5: Visual representation of the design experimentation workflow

Application Prototyping: Despite their cultural and religious significance, many sculptures and architectural remains at the Hayagriva Madhava Temple are often overlooked due to limited scholarly engagement. The absence of tour guides at certain locations further limits the effective communication of the site's heritage and narrative to visitors. The user interface of the application is designed to facilitate self-guided exploration of the Hayagriva Madhava Temple through a structured and interactive layout. Starting with options for Maps or Temple Selection, users can navigate to temple- specific content. The main sections include About the Temple (featuring temple images, sculpture images, and architectural style), Sculptures (offering individual pages on deities such as Rama, Varaha, Kali, and Kalki), Temple Plan and Direction (with the temple's ground plan and measurements), Maps (linking to the temple's location on Google Maps), and More About the Temple (redirecting to its Wikipedia page). Each section is designed to provide both visual and textual insights, combining historical context with spatial understanding and external references to enhance user engagement. The user interface structure of the digital application for the Hayagriva Madhava Temple is presented in Table 1.

Table 1: User Interface structure of the digital application for the Hayagriva Madhava Temple

Main Category	***Sub-Sections / Features***	***Description***
Start	Maps- Temple Selection	Entry point of the application; users can either view maps or proceed to select a temple.
Temple Selection	Hayagriva Madhava Temple	Selection directs users to the temple-specific content and interactive modules.
About the Temple	Temple Images- Sculpture Images- Architectural Style	Offers contextual and visual information about the temple, its sculptures, and architectural features.
Sculptures	Rama- Varaha- Kali- Kalki, etc.	Provides individual sculpture profiles of deities with iconographic and architectural details.
Temple Plan and Direction	Temple Ground Plan- Temple NAT Mandir Measurement	Displays the spatial layout and structural measurements of the temple complex.
Maps	Opens in Google Map	Directs users to the temple's location on Google Maps for navigation and travel assistance.

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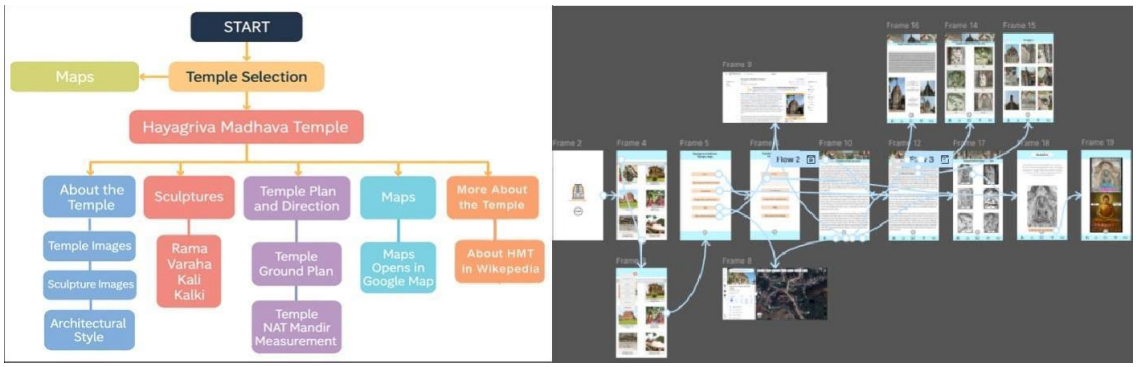
More About the Temple	About HMT in Wikipedia	Redirects users to the Wikipedia page for extended historical and cultural background.

The application supports non-linear exploration through dropdown menus, categorized icons, visual resources, and integrated external links. Its user interface is designed to balance clarity, accessibility, and depth, making the heritage of the Hayagriva Madhava Temple more approachable. By combining architectural facts, sculptural insights, and navigational tools, the application functions as a comprehensive digital guide for both virtual and on-site visitors. The information architecture and interface prototyping of the application flow is illustrated in Fig. 6.



(a) (b)

Figure 6: Information Architecture of the Application (b) Interactive Application Interface flow

Interactive Application Interface: To enhance user engagement, the second phase of the application, titled IconoHeritage, introduces a user-centric interactive interface developed using Figma software. This phase is designed to offer an informative and guided experience of sacred spaces, ensuring that users can access accurate and detailed information even without a physical guide.

QR Code Integration and Implementation: A virtual QR code, linked to the mobile application, has been placed within the premises of the Hayagriva Madhava Temple, allowing visitors to instantly download the app by scanning it with their smart phones as shown in Fig. 7. This application offers self-guided access to comprehensive information on the temple's history, sculptures, and architectural features, significantly enhancing the visitor experience in the

absence of a physical guide. The system enables a convenient, interactive, and informative mode of exploration for all tourists.

(a) (b) (c)

Figure 7: (a) QR code developed for users to download the application; (b) graphical representation of QR code implementation within the temple premises; (c) visualization of QR code placement at the temple entrance.

Result and Validation

To assess the effectiveness of the mobile-based application developed for the Hayagriva-Madhava Temple, a structured user survey was conducted with two age-specific participant groups representing distinct learning stages. Group 1 consisted of 30 school-level students aged 9–15, while Group 2 comprised 15 young adults aged 16–27 pursuing higher studies as shown in Fig. 8. Participants were recruited through local schools and colleges using convenience sampling. Data collection was conducted in controlled sessions in which participants engaged with the application before responding to age-appropriate questionnaires. The evaluation focused on four key metrics: (i) User Engagement, (ii) Clarity of content, (iii) Interface Usability, and (iv) Educational Value.

Group 1 (Ages 9–15): Responses revealed that only 13.3% of participants had prior knowledge of the temple, underscoring low baseline awareness. Following the interaction, 73.3% reported finding heritage exploration engaging, and 86.7% recognized the importance of preservation through the application. Interactivity was particularly effective, with 76.7% enjoying the virtual tour features. However, perceptions of educational value were divided: 46.7% considered the interface effective for learning, while 53.3% did not perceive significant educational benefit. This suggests that younger users were highly engaged by visual and interactive elements but less convinced about structured learning outcomes.

Group 2 (Ages 16–27): Results demonstrated stronger appreciation for clarity and functionality. A significant majority (88%) agreed that the application effectively communicated cultural and historical narratives, while 93.3% found the UI layout, icons, and labelling clear. Interactivity was endorsed by 80% as enhancing engagement, and 73.3% identified the platform as easy to navigate for heritage learning. The integration of maps and external links was valued by 86.7%. However, visual appeal and overall design received more

mixed responses, with only 40% expressing strong approval and the remainder suggesting refinements.

Cross-group comparison: The findings highlight age-specific variations. Younger users were motivated primarily by interactivity and gamified features, while older participants emphasized content clarity, usability, and navigation. This divergence suggests that the application holds dual potential: serving as an engaging entry point for younger audiences and as a structured resource for older learners. However, the findings also highlight areas that need improvement, specifically the incorporation of more explicit pedagogical scaffolding for Group 1 and better visual design for Group 2.

Validation and limitations: The survey's overall findings support the application's potential as a digital heritage teaching tool, showing that users of all ages can interact and learn from it. However, generalizability is still limited by the study's small sample size and dependence on descriptive statistics. Future assessments will include educators, heritage professionals, and casual tourists, as well as bigger and more varied participant groups. To find important trends across demographics, statistical procedures like variance testing and chi-square will be used. These actions will offer more thorough verification and a step forward to this study.

Future Work

Figure 8: Survey and Feedback Session.

In order to provide immersive cultural learning experiences, future development will concentrate on broadening the application's use using cutting-edge technologies like AR and VR. Community involvement will guarantee inclusion by incorporating local tales, and perspectives, and partnerships with academic institutions and historical authorities will assist match the app with conservation and educational objectives. The platform will be positioned as a scalable model for additional heritages sites through long-term deployment studies that will further evaluate its role in tourism, awareness, and sustainable heritage management.

Conclusion

By offering interactive access to the history and sculptures of the Hayagriva Madhava Temple, and the smartphone application protects cultural treasures. Without guides, its easy-to-use design improves tourism and education. Cultural preservation efforts will be strengthened by future advancements that guarantee broader gadget compatibility and adaption for additional heritage locations.

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Designing with Cultural Memory: The Impact of Cultural Integration in Visual Identity Systems

Disha Trivedi**,** Student, UID, Karnavati University

Abstract

In today's global design landscape, many Indian design festivals tend to follow international aesthetics, often missing a deeper connection to the culture they represent. This paper looks at how cultural memory, the stories, symbols, and visuals passed through generations can bring authenticity and meaning back into visual identity systems. Through research and reflections from a graduation project, the study explores how cultural elements like indigenous storytelling and Indian semiotics can shape more rooted and memorable branding. By comparing global and Indian design festival identities, the research highlights how often Indian design festivals' visual identity lacks a sense of place. The findings show that integrating culture isn't just about looking inward, but about creating visual identities that speak to both local and global audiences in a more honest and powerful way.

Key Words : *Cultural Memory, Visual Identity, Design Festival Branding, Cultural Heritage*

1. Introduction

The visual identities of Indian design festivals today largely follow global design trends, often adopting aesthetics that lack a direct connection to India's rich cultural heritage. While these festivals could showcase India's incredible diversity and rich traditions, their branding often looks similar to international events, making them feel less authentic. There's also a lost chance to draw on the strength of cultural memory, the legends, symbols, and customs that are handed down from generation to generation, which would really give a festival's identity its soul. This absence of a distinctive, culture-specific visual language does not allow Indian design festivals to be distinctive and special.

By incorporating cultural memory into visual identity systems, Indian design festivals can build more authentic, evocative, and distinctive brands. Currently, most festival identities rely on international trends, which may make them appear distant from their cultural backgrounds. Cultural memory, the symbolism and narrative transmitted across generations, can be used to make design stand out, appear more familiar, and emotionally connect to individuals. This

approach not only makes the branding to stand apart in a crowded global scene by embracing the richness of India's cultural heritage.

2. Literature Review

Jan Assmann (1995) introduced the idea of cultural memory as a long-term, symbolic system that societies use to transmit values, norms, and collective identity. He distinguishes between communicative memory (short-term, conversational) and cultural memory (institutionalized, long-lasting), both essential to how communities understand themselves across generations. Pierre Nora (1989) contributed the concept of lieux de mémoire or "sites of memory," referring to deliberate spaces, monuments, texts, traditions, that preserve memory in a society where natural remembrance is diminishing. According to Assmann (1995), cultural memory is often visualized and preserved through tangible forms like architecture, art, and symbols , acting as vessels of shared meaning that reinforce group identity. Design semiotics, as explored by Krippendorff (2006), investigates how visual signs and symbols communicate meaning. Heritage cues in design, like motifs or traditional forms, enhance user resonance and cultural connection (Lin, 2016). According to Klein (2000), brands function as cultural texts that convey deeper meanings about identity and aspiration. Branding, when grounded in cultural memory, can preserve shared stories and emotional ties with an audience (Abravenew, 2022).

India's visual culture provides a rich canvas of visual stories. According to Mathur (2007), Indian rituals and crafts are imbued with symbolic meanings, providing a fertile field for design interpretation. Visual symbol-bearing storytelling forms such as Pattachitra, Kathakali, and shadow plays depict philosophical and social stories through symbols (Singh, 2013). Yet, meaningful integration involves not only borrowing aesthetically, but comprehending the cultural meaning embedded in these forms (Ramaswamy, 2010). In spite of the richness of theory and cultural material at hand, there exists a disconnection between these models and their actual use in Indian design festival branding. Most festivals continue to bear a globally homogenized look, with few visual signs that signal local memory or storytelling (Mukherjee, 2020).

3. Methodology

There is a structural lack of culture-based strategies within Indian design festival branding. Deep cultural memory systems exist, yet they are not being converted to visual identity frameworks.

In order to comprehend audience perception regarding cultural memory and its position in the visual identity of Indian design festivals, a primary survey was conducted with the assistance of Google Forms. The objective was to observe how individuals perceive the applicability of cultural heritage in today's festival identities and whether or not there is a need for greater cultural integration. A total of 50 participants responded to the survey. The demographic was primarily composed of design students (78.6%), followed by design aspirants, industry professionals, and art/culture enthusiasts. The survey included 9 questions, using a mix of multiple choice, Likert scale, and checkbox formats, and was designed to extract feedback on festival branding, cultural representation, and aspirational preferences.

To understand the current state of design festival branding, the identities of both global and Indian festivals were studied, such as the London Design Festival, Dubai Design Week, Ahmedabad Design Week, Pune Design Festival, and Kyoorius Designyatra, looking closely at their structure, themes, visual language, and the impact they create. Wanting to explore culturally grounded examples, the Odisha Design Week identity was reviewed as a case that attempts to integrate Indian context more directly. A look at cultural festivals across India was taken to see how they showcase heritage through branding. Finally, circling back to international festivals and it was observed how they localize their global presence by integrating cultural nuances into their design approach. These observations now form the base of design exploration and research direction.

4. Findings and Analysis

The survey results revealed a clear gap between current festival branding and cultural rootedness, alongside strong public interest in more culture-driven design experiences. While 100% of respondents attended festivals to learn and get inspired, 64.3% attended for networking and 57.1% for workshops and discussions. This suggests that festival branding

should reflect a depth of knowledge-sharing and experience, not just surface-level visuals. A significant 64.3% of participants felt that the festival's identity did not reflect the cultural or architectural roots of the location. Additionally, 78.6% felt the branding was more influenced by global trends than by local heritage. When asked if the visual identity evoked India's cultural heritage, 42.9% said no, and 28.6% were unsure, suggesting a large portion of the audience felt disconnected from the identity. Even more critically, 78.6% said the branding did not connect with them on a deeper or emotional level. An overwhelming 92.9% of participants said Indian design festivals should incorporate more traditional elements from Indian culture (motifs, scriptures, artforms, etc.). The same 92.9% expressed strong interest in attending a culturally rooted design festival that could connect with them more deeply. 42.9% felt that current festivals are "somewhat but still lacking" in combining traditional values with modern principles, showing there is effort being made, but not enough. 21.4% said No. These insights highlight a deep demand for change in the way Indian design festivals communicate their identities. The findings strongly support the preliminary hypothesis: cultural memory, when embedded into identity systems, can significantly enhance emotional connection, authenticity, and differentiation in a saturated, globalized design landscape.

After exploring a range of design festivals, both in India and around the world, some patterns, gaps, and opportunities were noticed, that really stood out. One of the most striking observations was how Indian cultural heritage often feels underrepresented in our own design festivals. Many of them adopt a more global, modern aesthetic that could belong anywhere, making it hard to tell what makes them distinctly Indian. This made me wonder: what would it look like if our identities celebrated the richness of Indian traditions more openly? It was noticed how technology and tradition aren't at odds, they can actually work together beautifully. Dubai Design Week, for instance, showcases projects that mix cutting-edge tools like 3D printing and AR with cultural craftsmanship. This lead to thinking about how Indian design could also evolve in a way that's rooted in heritage but expressed through modern, interactive means. Finally, something that kept resurfacing was this lack of a strong, cohesive identity in many Indian design festivals. There's often no clear story or connection to our cultural roots, and that disconnect makes the visual language feel generic. This really reinforced the potential to rethink how identity systems can be used, not just to make something look good but to help tell a story that connects past, present, and future in an authentic Indian way.

5. Key Challenges of Cultural Integration in Indian Design Festival Branding

From my own research and comparative review of both Indian and global design festivals, certain common problems were revealed, notably in relation to how or if culture is embedded (or not) into their visual identity. Perhaps the most significant issue is the absence of genuine cultural anchoring. Most Indian festivals have a tendency to borrow a visual aesthetic that follows international trends, resulting in branding that lacks a sense of place and ends up being generic, with minimal emotional or cultural connection. Whereas most design festivals are international- focused, Indian festivals rarely invest the time to engage meaningfully with the local community. This leaves a void, where the international appeal of the festival can be highlighted, but the local significance is never addressed. Indian visitors, designers, and craftspeople tend to feel marginalized or disconnected from the event if branding, themes, and content do not connect with the Indian culture and heritage. Local representation isn't merely a matter of demonstrating talent; it's about resonating with individuals on a different level, and making them feel seen, heard, and empowered by the festival's identity. The other persistent issue is the excessive emphasis on Western design norms. Indian festivals tend to borrow Western visual clichés instead of growing their own set of regional languages, and this leads to branding that looks nicely put together but emotionally disconnected. Besides, sustainability and the revival of traditional craftsmanship, although meaningful global themes, are still not meaningfully communicated in the majority of Indian design festivals. Sustainability is pushed into the background in favor of innovation, and revival of crafts is done as an afterthought and not a focus issue, causing disconnection from cultural memory. Current design festivals also focus more on trends, technology, and functionality, forgetting the emotional and spiritual qualities of design. Indian design comes with a legacy of symbolism, spirituality, and interpretation, but these aspects are never seen in festival branding. By moving to a more interpretive, dynamic path of design, festivals are able to make more emotional connections to the viewer. Instead of continually looking east or west, there can be an observation of a sense of festivals looking inward and to India's rich heritage of philosophy and spirituality on which to base a deeper, more engaging experience.

6. Possible Design Approaches

Indigenous storytelling can be a powerful tool for creating a robust and emotionally charged design identity. Most of these stories contain archetypes, symbols, and motifs that can be utilized to guide visual aspects such as logos, patterns, color schemes, and typography. The stories can then be written down in the form of stories that can be applied in the marketing content of a festival or the visual language, giving it meaning. Folk character- or mythic imagery-based illustrations or icons, storytelling convention-inspired motifs, and typography inspired by historical scripts can develop an effective identity. The Ramayana and Mahabharata, for instance, provide complex characters and motifs such as the Garuda or Chakra which are easily translatable to contemporary forms. Rituals, textiles, and crafts are intimately related to cultural identity and have the ability to generate emotional responses. Designers can incorporate visual and sensory elements such as kalamkari, ikat, god-inspired geometries, natural textures like jute or silk, or sacred ritual hues like red and yellow. The Pattachitra school, for example, offers border designs and divine motifs that can be used in logos and backgrounds. Cultural semiotics, the science of signs and symbols in a culture, enables visual systems to be constructed around embedded cultural artifacts, buildings, and rituals. Iconography drawn from the Chhatra or Dholak, temple architecture such as step wells, or Vastu-based geometries can lend identities an ageless cultural appearance. The Odisha temple Torana, for example, may be used as a frame element in branding.

Usage of Indian arts and crafts inspiration in terms of material textures could provide a sensual, tactile essence to design. Such digital textures as imitating terracotta, carvings, or paintings like Warli or Madhubani, or subdued layers reminding one of weaves and embroideries, could be employed. A festival brand might employ handloom-inspired backgrounds or incorporate Madhubani patterns into logo design. Memory-mapping involves cultural codes that evoke sentimental memories and emotional association with rituals and heritage. Designers can employ rangoli designs, ritual objects, and color palettes associated with common experiences (such as saffron or green) to create retrographic trends. Festival identity can convey local or familial heritage employing symbolic colors, font styles, or typography. Indian cinema, oral history, and mythology provide rich storytelling material that can make the brand more memorable. By employing visual translations such as Lord Ganesha's symbolism, Krishna's flute, or folk stories as motion graphics, one can create cultural depth. Raj Kapoor's "Awaara" tramp characters or epic moments from the Ramayana

and Mahabharata can create feelings of nostalgia, dharma, and victory, rendering the branding rich with emotional appeal and empathy.

7. Limitations and Scope for Future Research

The study primarily focuses on secondary data and personal design observations. Due to time and resource constraints, it does not include extensive user testing or interviews with festival attendees, designers, and cultural practitioners. While the research aims to explore Indian cultural memory, India's diversity means that fully capturing its depth across regions, languages, and traditions is challenging. As the study highlights the importance of cultural memory in visual identity systems, it also opens up new directions for future exploration. While this paper focuses on identifying design gaps and proposing possible approaches, several areas remain ripe for deeper investigation, particularly in understanding user responses, experimenting with new media, and fostering collaborative creation. One key area is exploring how users actually perceive and emotionally respond to branding grounded in cultural memory. Another direction is using motion and interactive storytelling as a medium to carry cultural identity. Finally, there's value in collaborating directly with craftspeople or regional experts to co-create more authentic and rooted identity systems.

8. Conclusion

Throughout the duration of this research, there has been one central discovery: designing with cultural memory allows for the generation of richly layered, significant, and rooted visual identities. Once identity systems are grounded in the emotional, historic, and sensorial layers of culture, they transcend being mere aesthetics, they become narratives. The comparative analysis of current design festivals showed a pronounced gap in how Indian cultural heritage is being promoted. Although increasing focus is placed on sustainability, experiential formats, and technology integration, the distinctive storytelling of Indian tradition, symbolism, and ritual is not yet adequately leveraged. Visual identity systems can do more than chase trends, they can adopt indigenous narratives, cultural semiotics, and visual markers that elicit memory and feeling. In the end, the study confirms that India's cultural memory is a rich design asset that can turn branding into an act of preservation, celebration, and innovation.

This study is a gentle nudge for designers to look within, to our own cultural heritage, memories, and traditions as strong sources of inspiration. Rather than chasing global trends disconnected from local realities, there's the chance to make work that feels more personal and rooted in context. Designing with cultural memory isn't just about aesthetics, it's about telling stories, evoking emotion, and building deeper connections. For that to happen, we need stronger frameworks that guide how we engage with culture, ethically and with intention. This shift can help create identity systems that are rich in meaning, rooted in history, and relevant to the world today.

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Remediating Immersive Media in India: Cultural Desires and Anxieties

Greeshma Sharma

School of Design, Rishihood University, Sonipat, Haryana

Abstract

This paper explores the remediation of immersive media technologies—virtual reality (VR), augmented reality (AR), and mixed reality (MR)—within India's multifaceted cultural landscape. It reveals a dual narrative of desire and anxiety. While immersive media offer many new opportunities, they also raise important questions that we need to address carefully. The study emphasizes that India's unique culture and history shape its relationship with immersive media, not just the technology itself. We need to use these technologies thoughtfully, balancing their advantages with the challenges they bring. In the end, the paper describes India's path as a balance between new technology and old traditions. It stresses the importance of open conversations between everyone involved so that technology can strengthen culture instead of weakening it.

Keywords: *Indian Culture; Immersive Education; Immersive Media; Remediation; Technological Anxiety*

Introduction

Immersive media technologies (such as VR, AR, and MR) are rapidly being remediated into India's cultural landscape. Remediation, as theorized by Bolter and Grusin, refers to how new media refashion and absorb older media forms (Bolterand Grusin). In India, VR, AR, and MR technologies do not develop on their own. They connect with existing cultural spaces like cinema, religion, heritage tourism, education, and personal identity. This blending brings both excitement and worry. People are eager about the new opportunities these technologies offer, such as better storytelling, preserving culture, enhancing religious practices, improving education, and finding new ways to express themselves.

At the same time, there are serious concerns. People worry about whether these digital experiences are real, whether traditions might be lost, how cultural identity could change, and

how personal data will be protected. When these technologies mix with India's social and cultural life, they raise important questions about who has power, who controls the stories, and how community and identity are shaped (Jacobsen and Myrvold). By examining key thematic areas—cinema, religion, heritage, education, identity, and data privacy—this paper analyzes how India's cultural desires and anxieties are expressed in the remediation of immersive media. All discussions are rooted in scholarly perspectives, ensuring academic rigor in understanding this contemporary phenomenon.

Cinema: Immersion and Innovation vs. Tradition

Indian cinema has long been a site of technological adoption, from early sound and color to today's visual effects and digital streaming. VR and AR now represent the next frontier in Indian film and entertainment. The industry is exploring immersive media both as a creative storytelling tool and a marketing strategy. For instance, film studios have begun deploying VR experiences and 360° videos to promote movies, allowing audiences to "enter" a film's world as a form of advanced advertising. In a qualitative study on extended reality in movie marketing, Basu (2022) found that Indian film school students are enthusiastic about leveraging VR/AR to engage viewers, seeing it to deepen spectator immersion and revitalize theatre attendance in the post-pandemic era. Audiences today desire an immersive experience within the narrative, and Bollywood continually elevates standards with striking graphics. Certain large cinemas have established VR lounges in their lobbies, allowing individuals to experience brief VR films or games (IANS, 2017).

These initiatives demonstrate that India's film industry perceives immersive media, such as virtual reality, to rejuvenate the cinematic experience by combining communal theatre engagement with individualized, advanced immersion. The adoption of this new technology simultaneously generates concerns about the alteration of cultural customs and equitable access for all individuals.

In India, viewing films is a communal culture in which individuals partake in cinematic experiences together. Concerns exist that the usage of VR headsets, which immerse individuals in distinct virtual environments, may diminish the unique communal experience that renders cinema significant in Indian culture (Sawhney). Experts assert that if cinemas

adopt new technologies such as virtual reality, they must integrate these innovations with traditional practices to ensure that older individuals or others uncomfortable with technology do not feel excluded.

There are also practical worries: high costs and the nascent stage of VR content mean that penetration is limited largely to urban elite venues, potentially widening the urban-rural gap in media access. In essence, India's film industry desires the fresh infusion of VR/AR to remain cutting-edge, yet it is anxious to preserve cinema's accessible mass appeal and communal ethos. Academic discourse urges mindful integration—treating VR as a complement to, rather than replacement for, the traditional cinematic experience (Basu; Ghosh). By doing so, Indian cinema's remediation of immersive media can enhance storytelling without eroding the social and cultural functions that films serve.

Religion: Virtual Devotion and Authenticity Dilemmas

The push and pull between excitement and concern is especially strong in religion. In India, religious practices—whether Hindu, Islamic, Sikh, or others—are a central part of cultural life. Now, technology is becoming part of these sacred traditions.

Immersive media offer new avenues for religious experience: VR pilgrimages and AR darshan (viewing of deities) have emerged to serve devotees who cannot be physically present at holy sites. Virtual tours let people "visit" famous temples like Vaishno Devi or Tirupati through 360° panoramic views and live video of rituals (Biswas et al.). In 2022, the government started a program called "Temple 360" that offers online VR darshan of many important temples. This helps worshippers all over India and abroad join in aarti and puja using digital tools (Kukrety). These projects aim to include everyone and keep traditions going, so no one misses out on spiritual experiences because of distance, health problems, or pandemic rules. Studies show that virtual darshan keeps people connected by letting them visit temples anytime, not just during regular hours (Ghosh). Also, VR tours of pilgrimages like the Kumbh Mela or the Hajj help young people learn about these important rituals in a more engaging way, helping to preserve religious heritage in a modern style (Berry; "Religious Education and Virtual Reality: Temple Tech: Innovations in Religious Education through VR").

In this way, using immersive technology in religion helps keep traditions alive by adapting them to modern times. It allows faith practices to continue, even as the world changes. But this mix of technology and spirituality also brings deep worries. Religious scholars warn that making sacred experiences virtual raises tough questions about what is real, who has authority, and what gives these rituals meaning. People wonder if a virtual pilgrimage can ever feel as meaningful as actually going to a holy site. Temple leaders and theologians also debate if digital darshan is just a helpful tool or if it can truly replace traditional religious experiences.

Bringing commercial and media methods into worship can also turn sacred rituals into products, making them feel like just "content" to be consumed instead of deep, meaningful practices (Jacobsen and Myrvold). The edited volume Religion and Technology in India (2018) emphasizes that as technology and devotion intersect, they "transform and open up new religious practices," but not without "questions about … how religious agency, information, and experience are mediated [and] commodified." There is fear that virtual rituals might dilute the aura of sanctity—for example, a live VR aarti might lack the communal energy and personal conviction of being physically present amid incense and chants. Furthermore, issues of authority arise: Who controls the digital religious platforms, and are they guided by proper spiritual oversight or merely tech entrepreneurs? Such concerns are not merely theoretical. In practice, some devotees use VR tours to augment their faith (as a preview or preparation for an eventual visit), but few would claim it fully replaces the pilgrim's spiritual journey—touching holy waters or receiving prasad in person. Thus, while the cultural desire is to enhance and broaden participation through immersive tech, the anxiety centres on maintaining the authenticity and sanctity of religious experience. The challenge moving forward is finding a respectful synergy: using VR/AR as tools for devotion and education, without undermining the profound, embodied communal aspects that are the soul of Indian religious life (Jacobsen and Myrvold).

Heritage: Preservation through Presence vs. Preservation of Reality

India's rich cultural heritage—like its ancient monuments, sites, and traditional arts—is a great source of national pride. Immersive media are now being used more to help protect and share this heritage, making it both safer and easier for people to experience. New digital projects are using advanced technology like high-resolution 3D scanning, photogrammetry,

and virtual reality (VR) to make detailed digital copies of historical sites. This lets people explore these sites interactively from anywhere, without visiting or damaging them (Buragohain et al.). For example, the Ajanta Caves, a UNESCO World Heritage site, were recently captured in VR. Now, anyone can "walk through" the caves online and see their famous Buddhist paintings and sculptures up close.

These virtual museums help preserve history by keeping a permanent digital record even if the original artwork fades or breaks over time. Museums are also using AR (augmented reality) apps—when visitors point their device at an artifact, they can see extra information or even see what a broken statue would look like if it were whole, along with narration.

The idea of the "metaverse" is being used for heritage too: new research shows that groups of people can gather in immersive, shared virtual spaces, like a digitally rebuilt ancient temple, where they can explore and learn as a community (Buragohain et al.).

People can now use VR to take a virtual walk through a rebuilt Indus Valley city or watch a historical event acted out at the Red Fort. The purpose is to make heritage easier for everyone to see and enjoy. By exploring these places virtually, immersive media helps people become more interested and feel connected to history—especially young people, who might not find regular museum displays as exciting. It also mitigates the heavy footfall that threatens fragile sites; a virtual visit can satisfy some of the demand and reduce the ecological and physical strain on monuments. In short, India is embracing immersive media to safeguard cultural heritage while also rejuvenating public engagement with it in the digital age. Yet alongside these opportunities lie anxieties about the nature of experiencing heritage. Critics argue that a virtual tour, no matter how detailed, is still a mediated experience and may lead to complacency regarding the real sites. If people feel they have "seen" the Ajanta caves in VR, will they be less motivated to support the protection of the actual caves – or worse, will authorities see digital replication as a substitute for difficult conservation work? There is also the question of authenticity and aura: the "you are there" feeling of VR can be powerful, but it may also create an illusion of knowledge without the context and ambience of the real location (the sense of scale, the climate, the pilgrim's journey to a remote cave, etc., which all inform the experience of Ajanta) (Tribhuvanand Binnaser). Heritage scholars caution that digital models must be framed as complements, not replacements, to real-world heritage, lest

we risk what one might call a "virtual complacency." Another anxiety concerns the bias in curation: who decides how a historical site is presented in VR? The choices of what to include, what year or state to recreate (pristine original vs. present ruin?), and what narrative to overlay can be contentious. For example, virtual reconstructions of disputed heritage sites (like recreating a temple or a mosque in a contested area) could become politically charged.

However, because of technical and money limits, most projects focus on famous sites. This means that local and lesser-known heritage might get ignored, making the gap bigger between popular, digitally preserved sites and those that are forgotten. People living near heritage sites also worry that digital tourism could hurt their income. If visitors can explore places like a Rajasthani fort from home, fewer may travel there, affecting local jobs. These issues show that using technology to preserve heritage is not always neutral or fair. The remediation of heritage through immersive media must strive for ethical stewardship: accurate representation, inclusive narratives, and strategies that keep the link between virtual experience and real-world conservation alive. Even with these worries, most experts remain cautiously hopeful. They believe that if used wisely, VR and AR can help teach about and protect cultural heritage. However, they stress that these technologies should support—not replace—the real, physical heritage that makes India unique (Jiang et al.).

Education: Immersive Learning Potential vs. Practical Barriers

Education is one area where VR and AR have generated a lot of excitement in India. Policymakers, teachers, and students all see the promise of these technologies to make learning more interactive and engaging—bringing subjects like history, science, or language to life in ways textbooks can't. A recent survey of 25,000 Indian students showed that most have a very positive view of VR in education. Many believe it has great potential to improve learning in Indian schools and offers a bright future for immersive education (Swargiary). Students reported that virtual environments could help them understand complex concepts by visualization and simulation, whether that means exploring a 3D model of the solar system, conducting a virtual chemistry experiment, or walking through the Indus Valley Civilization as part of a history lesson. Innovators are also excited about using VR and AR to solve long-standing problems in Indian education, like crowded classrooms, too much memorization, and not enough hands-on learning. By making lessons more interesting and appealing to different

learning styles, VR can help students pay better attention and remember what they learn, instead of just memorizing facts (Jindal et al.).

Importantly, immersive tech is also being used to teach culture and languages: developers have created AR apps for learning Sanskrit or regional languages by overlaying text and graphics in the real environment, and VR simulations that let children virtually visit historical monuments and perform folk art forms. A recent project found that using AR and VR in cultural education can help students feel more connected to their culture and history, making them proud and more involved in preserving heritage (Shah et al.). This fits well with India's national education policy, which emphasizes staying connected to Indian culture. Thus, immersive media plays a supporting role in sustaining traditional educational values.

However, there are some big worries and challenges with using immersive media in schools. One major concern is the digital divide: VR might make the gap bigger between rich city schools and poorer rural or government schools. Teachers say the high cost of VR gear, weak internet, and lack of electricity in some areas are the biggest problems to solve. Even if schools have the VR equipment, many teachers don't feel ready to use it well. They need more training so VR becomes a real learning help, not just a fun gimmick. There are also worries about children's health when using VR headsets for a long time—things like eye strain, motion sickness, and mental effects. Experts say VR should be used carefully, with age-appropriate content that avoids dizziness or confusion. Some teachers are also concerned that relying too much on virtual learning might weaken real-world experiences and social time. For example, while a VR science lab is helpful, it should add to, not replace, hands-on experiments with real materials. Traditional educators sometimes fear that VR "fun learning" could distract students or lower standards. This reflects a bigger concern about keeping education serious and effective (Swargiary).

Students and parents alike voice concerns about data privacy (addressed in the next section) and screen time: VR might intensify the already contentious issue of excessive gadget use among youth. Lastly, while pilot programs and private schools forge ahead, the government's role is pivotal in scaling solutions. If policies do not keep up—by updating curricula, providing grants, and setting guidelines—VR in education could remain an elite novelty. Thus, the cultural anxiety is that without systemic support, the promise of immersive learning

will create isolated islands of excellence, leaving much of the population behind. Closing this gap will need thoughtful planning, teamwork between public and private groups, and ongoing research to see what really works. There is a lot of excitement about using VR in Indian education, but real success will depend on how well these practical and cultural challenges are handled.

Identity: New Expressions and Representation vs. Erosion of Self

The advent of immersive media has also given Indians new ways to explore and express identity—be it personal, communal, or national. For example, people can create avatars, tell stories, and share ideas that might be hard to do in real life. India's social life is diverse and structured by norms of caste, gender, and age. Virtual reality lets people step outside these scripts by choosing any avatar. A user might appear as a mythological figure, a celebrity, or an animal, experimenting with self-presentation beyond real-world constraints (Prakhar and Rawat).

Such freedom supports well-being and creative expression. It creates psychologically safe spaces for marginalized communities to articulate identity. Adolescents and young adults can experiment with roles and ideas that offline norms—often rigid and traditional—may otherwise inhibit.

Indian developers are working to make virtual worlds and augmented reality (VR/AR) reflect Indian culture by including Indian places, clothes, and languages. This helps ensure the metaverse doesn't become only about Western symbols. Examples include virtual Ganesh Chaturthi festivals and AR filters that add traditional Indian jewellery or face paint to users. These immersive media tools help strengthen cultural identity online. Educators report that AR especially helps students feel proud of and connected to their culture by showing it in engaging ways (Shah et al.).

Similarly, Indian communities abroad create virtual gurudwaras and temples, letting people stay connected to their religion and culture even when far from home. This supports two goals: it helps people, especially young ones, express their culture freely, and it builds a strong Indian cultural presence in the global virtual world.

While 2D social media was about Indians finding their voice on platforms like Facebook and Twitter, the new XR era could be about creating Indian identity spaces in 3D—making sure Indian culture stays visible and vibrant in the growing metaverse (Jacobsen and Myrvold). For many, this is empowering: a new medium to celebrate who they are, whether that's showcasing one's regional dance via a VR performance or simply hanging out in a virtual café that feels like Mumbai. However, this malleability of identity in immersive media also triggers significant anxieties. A big worry is that spending more time as avatars can blur the line between real life and the virtual world. Experts are concerned about how this might affect people's sense of identity and mental health. Some people might get too attached to their perfect online selves, which can make them unhappy with their real life or confused about who they really are. Being able to hide or change who you are online can also cause bad behaviour, like being rude or mean. This has happened in online games and is now happening in VR communities too.

In India, where family and community are very important, the idea of a family member having a separate virtual life can worry parents. They may wonder what their children are becoming online. Some traditional people fear that virtual worlds, mostly made by Western companies, might bring values that don't fit with Indian culture. This is similar to old fears when mass media brought worries about Western influence. Now, the global metaverse might make youth culture all the same.

There is also a big question about who controls how people look and what places are shown in VR. If mostly companies from Silicon Valley make the avatars and worlds, Indian faces, skin colors, and clothes might be left out or shown in a wrong way. Because of this, many people want more Indian developers to create VR spaces that show India's real diversity and culture. Another worry is about privacy. When VR accounts are linked to social media, your digital self can become like a product, and your private information might be watched or misused. For example, if someone explores personal or sensitive topics in VR, like religious questions or sexual orientation, and that data is tracked, it could put them at risk of judgment or harm in real life. This is a serious worry in some social settings. There's also a debate about community. Some hope that VR will build strong new virtual communities—like online kirtan groups or immersive language classes—while others fear it could make people more isolated,

as they spend time alone in VR instead of joining real- life groups. This could weaken the social connections that are so important to identity in India.

Academic observers note that technological change in India often forces a negotiation of values; as one study on religion and tech put it, these intersections can "alter and negotiate religious spaces, practices, and authorities—by extension", all social identities face such negotiation (Jacobsen and Myrvold). The challenge, therefore, is to harness the liberating aspects of identity play in immersive media (creativity, pluralism, and connection) while mitigating the risks to psychological and cultural stability. This requires digital literacy campaigns, inclusive design, and perhaps most importantly, open societal dialogues about how much of ourselves we entrust to the virtual realm.

Data Privacy: Promise of Innovation vs. Perils of Surveillance

At the heart of all these issues is a major concern: data privacy. As more Indians use immersive technologies, they're becoming more aware of how much personal data they share and how it might be misused. VR, AR, and MR devices collect a lot of sensitive information—much more than older types of media. For example, a study on VR security found that these devices can track things like how you move, your body signals, and your habits just by the way you use them. For example, motion sensors record how you walk and move your hands. Newer headsets can track where you look and for how long. Some AR apps can even scan your room or read your facial expressions. These intimate details can reveal personality traits, health conditions, or emotional states. Giarettahas shown that just a few minutes of VR motion data can help algorithms figure out who you are or what you like. In India, where many people are new to the internet and may not know much about digital rights, this is a serious concern. The cultural desire for cutting- edge tech is strong, but it is matched by an anxious public discourse on digital privacy and sovereignty—essentially, who owns and guards the data produced by Indians. Recent years have seen heightened concern, partly due to unrelated but salient events like the Aadhaar biometric ID debates and high-profile data breaches. This has set the stage for privacy to be a key consideration as immersive media rise. For example, parents are cautious about children using AR apps that use camera and location data; professionals are wary of using VR collaboration tools that might record conversations or workspace imagery. Privacy scholars point out that immersive platforms could become a surveillance nightmare if

left unchecked, potentially monitoring not just our words but body language and even neuro-response (imagine future VR reading brainwaves).

The regulatory environment in India is evolving in response to these anxieties. After years of deliberation and comparisons with global standards like the EU's GDPR, India passed the Digital Personal Data Protection Act (DPDPA) in 2023. This law is the country's first comprehensive framework for personal data protection, mandating requirements for consent, data minimization, and user rights in how data is collected and processed (Prakhar& Rawat). The DPDPA explicitly calls for "free, specific, informed, and unambiguous consent" for data processing, aligning with global best practices. However, as legal analysts note, the Act is still awaiting full enforcement, and it is not explicitly tailored to emerging tech like VR. In fact, currently any crimes or disputes in VR fall under the aging IT Act of 2000, which is ill-suited for modern challenges.

Laws move slowly; headsets move fast. That gap makes people nervous: If something goes wrong in a global AR game or a VR chatroom, am I actually protected? News about harassment and "virtual groping" abroad reaches India and leaves users wondering what remedies exist here.

As millions try "metaverse" apps, the need for clear safety rules only grows. There's also the worry about truth itself. If social media can spread fake news, VR could stage entire fake environments that nudge how we feel and think. And if web ads already feel intrusive, imagine targeted prompts delivered inside your headset—more immersive, more persuasive, and potentially more harmful without safeguards. Despite these concerns, strides are being made to address them. Technologists are researching privacy-by-design solutions, like algorithms that can mask or add noise to eye- tracking data to preserve anonymity (Aziz and Komogortsev; Giaretta; Ren et al.). Advocates call for clearer content moderation and personal safety features in VR apps (such as Meta's "personal boundary" setting to prevent avatar harassment, which was covered even in Indian news after a virtual assault case). Importantly, digital literacy initiatives by NGOs and even some government programs now include modules on privacy and security, teaching new internet users how to safeguard themselves – this need updating to include AR/VR contexts as well. The tension is evident: India wants to ride the wave of innovation that immersive media represent (for economic

growth, digital leadership, and societal benefit), yet it is acutely aware that without strong privacy protections and user empowerment, this wave could engulf personal freedoms. In a nation that values the concept of "jara sochiye" (think a little) in its public campaigns, there is indeed much thinking to do about how to enjoy the fruits of VR/AR without sacrificing the right to privacy—a right the Indian Supreme Court in 2017 affirmed as fundamental. Ultimately, resolving this will be part of a global conversation, but India's huge user base means it cannot be a passive player; its approach to immersive tech privacy may well set precedents for other emerging economies. Currently, individuals exercise caution while remaining receptive to the utilization of immersive media such as virtual reality and augmented reality. They remain enthusiastic about emerging opportunities while diligently instituting appropriate safeguards and regulatory frameworks to mitigate harm

Conclusion

Immersive technologies like VR, AR, and MR in India are met with both excitement and caution. People are curious to try what's new, but also careful about protecting traditions. Across different parts of Indian life, these tools are being reshaped to fit the country's culture and needs. In cinema, they add fresh ways to experience films while keeping alive the joy of watching together as a community. In religion, they allow remote participation in worship, though believers and leaders alike pause to ask what "virtual worship" really means. In heritage, immersive experiences bring history to life and make it interactive—yet questions of authenticity remain: is the virtual version truly the past? In education, the potential is huge, especially for remote learners, but challenges like patchy internet and limited devices keep the benefits uneven. In terms of identity, VR and AR open space for creativity and freedom of self-expression, but they also make people wonder how these virtual selves shape real-life values and relationships. And across all of this runs a vital concern: safety and privacy. How do we protect people while they explore these powerful new spaces? India's story is unique because of its long history, many languages, massive population, and sharp contrasts between cities and villages. Young people are eager to step into the global future, while many others work hard to keep what feels authentically Indian alive. The country's journey with immersive technologies, therefore, is not just about gadgets—it's about balancing modern possibilities with cultural depth.

There are also stronger worries in India because of the country's past with colonialism, community tensions, and challenges in infrastructure. India's approach is often creative and practical ("jugaad"), finding local ways to use immersive tech that fit the culture and solve problems. Scholars say that adopting new media always involves working with old traditions, not replacing them completely. In India, VR, AR, and MR are being adapted to support traditional stories and customs—but this also changes those traditions a little as they evolve. In movies (cinema): They bring new fun ways to watch films but also keep the traditional feeling of watching together as a community. In religion: They help more people join in worship remotely, but religious leaders and followers think carefully about what virtual worship really means. In heritage: These tools show history in interactive ways and help keep the past alive, though some wonder how real these virtual experiences feel. In education: They offer hope for better learning, especially in far- off places, but problems like poor internet and lack of equipment make it hard for everyone to benefit. In identity: People can express themselves in new imaginative ways online. This gives freedom but also raises questions about how it affects real-world values and relationships. In movies (cinema), they bring new fun ways to watch films but also keep the traditional feeling of watching together as a community. In religion, they enable more people to join worship remotely, though leaders and devotees alike pause to reflect on what "virtual worship" really means. In heritage, immersive storytelling makes history come alive and keeps the past present—but some wonder whether the digital version feels authentic enough. In education, the promise is immense, particularly in remote areas, but unequal access to devices and the internet limits the reach. In terms of identity, immersive media offers imaginative freedom and playful self-expression yet also raises deeper questions about how virtual roles reshape values and social ties in real life. The outcome of this dynamic is still unfolding. Will VR one day be as common in India as the mobile phone? Possibly—but if it happens, it will carry distinctly Indian flavors: from Bollywood musicals in VR to virtual Kumbh Melas. At the same time, anxieties will evolve too. Today the concerns are about privacy and authenticity; tomorrow they may expand to spiritual or philosophical debates about the very nature of reality if VR becomes indistinguishable from life. This is why dialogue among stakeholders is crucial. Academics, technologists, policymakers, educators, artists, and community leaders must keep working together to set the terms of adoption. The research already available—both empirical studies and critical reflections—offers valuable warnings as well as possibilities. By foregrounding

Indian voices and cultural values, India can develop an immersive media ecosystem that enriches rather than erodes.

In the end, India's negotiation with VR, AR, and MR is not just about adopting another wave of technology. It is about how a society with a deep past and a vibrant present imagines its future. Whether immersive media becomes a force for cultural enrichment and empowerment—or for disruption—will depend on how India balances its desires with its anxieties. Like a well- directed film or a carefully performed ritual, the goal is a harmonious synthesis, ensuring that technology ultimately serves the people and their culture, not the other way around.

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Ainuai: Song of the Waves – Memory of Migration

Jeannete Lauren Mocodompis1, Vinod Kumar2, Koes Yuliadi3
1,3 Faculty of Performing Arts, Indonesian Institute of the Arts, Yogyakarta, Indonesia
2 Faculty of Design & Arts, Poornima University, Jaipur, Rajahsthan, India
jeannetelauren@gmail.com 1, vinod.kumar@poornima.edu.in 2, koes.yuliadi@isi.ac.id 3

Abstract

Beyond Documentation: Crafting Collaborative Experimental Filmmaking with Art in Action Research (AiAR). This paper discusses the methodology underlying the creative process of the experimental documentary film Ainuai: Song of the Waves, as a form of collaborative cinema that transcends conventional documentary practices. The film departs from the memory of the Ansus people's migration from Papua to Guaeria, West Halmahera. This migration is not merely a geographical relocation, but a formative process that seeps into the body, the rhythm of the sea, and ancestral songs. The production process was guided by the Art in Action Research (AiAR) framework and approach within art research, enabling art practitioner researchers to select their theories and methods according to their suitability for each project.The project-fitting theories employed include Bergson's time concept of durée, Gilles Deleuze's aesthetics of the time-image and Andrei Tarkovsky's conception of cinema as the art of sculpting in time. The methods encompassed data collection, informal conversations, collaborative storytelling, and audio-visual recording. This paper contributes to the discourse on experimental documentary cinema by emphasising the importance of collaborative, affective, and context-sensitive approaches in filmmaking rooted in communal experience.

Keywords: *Experimental documentary film, Art in Action Research (AiAR), Migration, Time-Image.*

Introduction

This text discusses the approach and methodology of the experimental documentary Ainuai: Song of the Waves. The experimental documentary traces the Ansus diaspora from Papua to Guaeria, West Halmahera. The migration of the Ansus people from Papua to Guaeria, West Halmahera, is rooted in the historical dynamics of Eastern Indonesia. Following the arrival of the German missionaries Carl Ottow and Johann Geissler in Mansinam, Papua, in 1855 (Rutherford, 2012), and the subsequent pacification policies carried out by the Dutch colonial administration from the late 19th to the early 20th century (Kamma, 1972), intertribal wars and slave raids gradually declined, opening safer maritime routes. At that time, Papua remained under the influence of the Sultanate of Tidore until the early 20th century (Andaya,

2015), which required local chiefs to bring tribute to Maluku. This practice became the entry point for the Ansus community's early encounters with Maluku and eventually spurred their migration. Several clans such as Ayorbaba, May, Kirihio, Woria, and Heipon, settled in Guaeria. Today, the Ansus diaspora constitutes about 60% of the 113 households in Guaeria, amounting to approximately 270-340 individuals.

Migration leaves traces not only in maps or archives but also in bodies, voices, and memories. These traces are not static records but living forces, constantly reshaped by movement, longing, and return. The experimental documentary Ainuai: Song of the Waves attempts to follow these traces, departing from the lived memory of migration as it surfaces in intergenerational encounters, sea rhythms, and ancestral song. Our interest in this project stems from long-standing conversations with members of the Ansus diaspora and from our shared position as artist-researchers at the Indonesian Institute of the Arts (ISI) Yogyakarta. The film was not initiated as an external documentation project, but as part of a collaborative research practice that we co-authored with community members.

Central to this collaboration is Melson Kirihio, a third-generation descendant of the diaspora who grew up in Guaeria yet longed to reconnect with his ancestral home in Ansus. His desire to return, shaped by stories from his late father, Thomas Kirihio (Kirihio, 2022), became the pivotal entry point for the research. Fieldwork was carried out in two main sites: Ansus, Yapen Islands, Papua, and Guaeria, West Halmahera, between 2020 and 2025. It involved engagement with Melson Kirihio, the Woria family, and the broader Ansus community.

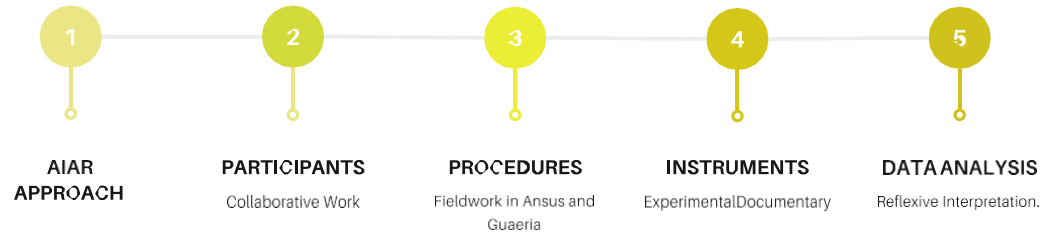
The characteristics of this particular migration, marked by inter-island mobility, strong kinship ties, and the preservation of ancestral songs such as Ainuai, Bewi, and Cege, render it distinct from other migration narratives in Eastern Indonesia. Here, migration is not experienced as rupture but as rhythm, interwoven with the sea, the body, and oral traditions. Conventional documentary modes, whether ethnographic (MacDougall, 1998) or observational (Nichols, 2017), prove insufficient to capture such lived temporality. What is required is a method that does not reduce migration to an object of study but allows it to emerge as a shared temporal experience. This demanded a research framework that could respond to lived memory through artistic practice while fostering collaborative and situated ways of knowing. For this reason, the project drew on the framework of Art in Action

Research (AiAR) (Lämmli, 2022), which enables the development of a methodology that supports art practitioner research perspectives and rejects hierarchical dynamics between researcher and subject. AiAR emphasizes collaborative engagement, embodied presence, ethical dialogue, and situating art not as external representation but as co-created inquiry. Through this lens, Ainuai: Song of the Waves is not simply a film about migration but a collaborative act of dwelling in time, where cinema itself becomes a vessel of memory and relation.

Fig. 1. Gagah Inawan, Ansus Village, Yapen Islands, Papua, April 2025

Fig. 2. Jeannete Lauren, Guaeria Village, West Halmahera, April 2025

Overview



The diagram above provides a visual overview of the methodological framework employed in this project. It adapts the Art in Action Research (AiAR) approach into five interconnected components:

1. AiAR Approach – emphasizes collaboration and situational methodology.

2. Participants – the Ansus diaspora community, particularly Melson Kirihio and the Woria family.

3. Procedures – fieldwork conducted in Ansus (Papua) and Guaeria (West Halmahera) between 2020-2025.

4. Instruments – the experimental documentary, functioning both as research method and outcome.

5. Data Analysis – reflexive interpretation highlighting embodied memory, temporality, and collaborative relations.

This overview provides a concise entry point to the methodology, bridging the visual representation of the research process with detailed explanation in methods section.

Framework: Art in Action Research (AiAR)

This filmic research employs Art in Action Research (AiAR) as its methodological framework, understood as an approach within art research, to develop its methodology. AiAR supports collaboration, reflexivity, and the co-creation of knowledge through artistic practice (Lämmli, 2014). Rather than treating the community solely as research objects, AiAR allows the researcher and participants to enter into a dialogical process in which lived experiences, memories, and artistic forms are woven together. AiAR doest not require pre-established protocols and allows the methodology to be configured in line with corresponding artistic objectives (Lämmli, 2022). AiAR also offers flexibility in selecting project-specific theories and methods while integrating diverse forms of knowledge (Lämmli, 2023). Particular attention was given to three AiAR principles: approaching research from the perspective of

the art practitioner; embracing pluriperspectivity in the conduct of research; and selecting theories and methods from different disciplines according to their fitness for purpose (Lämmli, 2022). This orientation calls for triangulating the researcher's perspective with attention to how the research is conducted and configured through practice, while centering the collaborative contributions of the community as co-creators of knowledge (Lämmli, 2014). Ultimately, AiAR underscores that the community is not positioned as passive research subjects but as active collaborators, whose lived experiences and creative expressions shape the research process itself.

The Researcher's Role and Ethical Presence

The researcher's position combined that of practitioner and collaborator. Rather than directing participants, the researcher facilitated spaces where narratives could emerge organically. When Melson Kirihio and the Woria family shared stories, we and the team responded by re-engaging through additional recording sessions, emphasizing reciprocity rather than extraction. This situated role highlights AiAR's principle of "working with" rather than "working on" communities (Lämmli, 2022).

Selected narratives and visual materials were approved by participants, while sensitive or mystical stories were excluded at their request, reflecting the commitment of AiAR to participant agency and ethical boundaries (Lämmli, 2022; 2023). Ethical practice in this project was rooted in informed consent, co-decision making, and participant agency, with participants retaining the right to withhold material from public presentation.

Withholding certain stories became an ethical practice of respecting opacity (Glissant, 1997), allowing the community to set the boundaries of representation. This resonates with Haraway's (1988) notion for situated knowledges, which acknowledges its partiality and relationality of knowledge. The project demonstrates how AiAR fosters ethical presence not by "capturing" reality but co-existing with it, echoing Minh Hà's insistence that documentary ethics lie in acknowledging the impossibility of full representation (Minh Hà, 1991). In this sense, the film embodies an ethics of presence where absence, silence, and opacity are as important as what is revealed.

Theories

This section outlines the theoretical aspects that guided the research, selected for their relevance to the film's exploration of time, memory, and filmic image-making. To capture the Ansus community's understanding of time, the film draws on Bergson' s concept of durée (Bergson, 1910), an affective flow embodied in song, sea rhythms, and intergenerational encounters. Deleuze's notion of the time-image (1989) provides the cinematic ground, where image resist causal narration and instead open spaces for reflection and memory. The aesthetics of time-image enable documentary practice to move beyond representation toward

shared temporal dwelling. In this context, cinema becomes less a window onto the world than an act sculpting with time itself, an idea resonant with Tarkovsky's Sculpting in Time (1986). Like Tarkovsky, who conceived cinema as the art of "sculpting in time", the film does not simply depict the past but allows time to flow into the present, shaping perception through rhythms, silences, and songs. Through this approach, documentary becomes a collective act of experiencing time, bridging memory, imagination, and ancestral continuity.

The collected material was not only documented but also shaped through filmic form. Inspired by Deleuze's concept of the time-image, the method privileged nonlinear temporality, affective resonance, and the rhythm of lived experience. The analysis thus emerges not from detached interpretation but from the embodied, collaborative, and temporal unfolding of images and sounds within the documentary itself.

Methods

Data Collection and Documentation Data collection was conducted through:

• Collaborative storytelling sessions with Melson and the Woria family.

• Informal conversations recorded during daily interactions, without the use of scripted interviews or transcriptions, to preserve the authenticity of local speech and memory.

• Audio-visual recording of dialogues, songs, environmental sounds, and embodied practices connected to migration and ancestral memory.

All recordings were archived and backed up on two separate SSDs, ensuring secure storage of research data.

Result and Discussion

Collaboration and Reconfiguring Authorship

A significant challenge during was that Melson Kirihio did not know the exact identity or whereabouts of his ancestral relatives. Equipped only with the surname of his great-grandfather, Woria, Melson and the research team began tracing his kinship ties by asking local children and adults about the Woria family. This process eventually led to the discovery of the Woria household, where Melson and the team were warmly welcomed. The spontaneous conversations that unfolded, ranging from everyday matters to ancestral stories Melson had heard from his late father, formed the basis of the film's narrative.

Fig. 3 Gagah Inawan, Potrait with the Woria family - Melson holds the honor sword from the Sultan of the Tidore - a symbol of legacy and dignity, April 2025

This collaborative authorship resonates with Rouch's idea of shared anthropology (Rouch, 2003) and Trinh T. Minh-ha's notion of speaking nearby" rather than "speaking about" (Minh Hà, 1991). The film thereby resists the extractive gaze of conventional documentary, repositioning the community as active agents in the storytelling process. Such a shift redefines authorship within AiAR: instead of the filmmaker claiming role authority, authorship is redistributed across dialogical and embodied encounters (Pink, 2009).

Migration Memory as Affective Experience

Fig. 4. Ainuai: Song of the Waves, scene of Melson playing with his children along the shore in Guaeria, 2025

The memory of migration among the Ansus diaspora does not surface as linear chronology but as affective and embodied presence. In Guaeria (West Halmahera), Melson's body became a site where memory was inscribed and re-enacted: lying on a swaying boat, playing with his children along the shore, and crossing the sea with his children to visit his father's grave. These gestures are not staged performances but lived actions in which memory circulates between body and environment.

Fig. 5. Gagah Inawan, A Father with his children on the boat in Ansus, 2025

In Ansus (Papua), collective gestures such as boat-making, paddling, and children running across the tidal flats surfaced as carriers of ancestral memory. The boats anchored to stilt houses, seemingly mundane scenes of communal work, and children's laughter are fragments that reveal what Deleuze calls the time-image, where cinematic temporality privileges duration, waiting, and resonance rather than linear progression (Deleuze, 1989).

This finding contrasts with conventional ethnographic film that often privileges verbal testimony or historical reconstruction (Heider, 2006). Instead, memory here is conveyed through affective fragments, what Marks (2000) describes as haptic visuality, where images appeal to embodied and sensorial recall.

AiAR as Situational Methodology

The methodological contribution of this project lies in showing how AiAR operates situationally. Research choices were not fixed in advance but emerged dynamically from encounters. In Guaeria, the method took the form of embodied action, Melson lying on the boat became a performative articulation of migration memory. In Ansus, it shifted toward collective participation, documenting the rhythms of boat-making and communal life.

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Fig. 6. Ainuai: Song of the Waves, Scene of Melson and the Sea, 2025

Fig. 7. Jeannete Lauren, Communal Boat-Making in Ansus, 2024

This situational adaptability contrasts with conventional ethnographic or observational film methodologies, which often rely on predetermined frameworks (Nichols, 2017). Instead, AiAR functioned as what Lämmli (2014) calls a methodology of action, where practice and reflection are inseparable, and outcomes are co-constructed rather than extracted. Thus, the research not only produced a documentary but also enacted a collaborative mode of knowledge production that blurs the boundaries between researcher, participant, and artwork.

Conclusion

This paper reveals how Ainuai: Song of the Waves demonstrates the potential of Art in Action Research (AiAR) to generate new forms of collaborative documentary practice that go beyond representation. Three key findings emerged from this work. First, collaboration reconfigured

authorship by positioning participants not as subjects of observation but as co- authors of meaning. Second, migration memory appeared less as an archive of facts than as an affective experience, embodied in songs, gestures, and rhythms that sustain ties across time and sea. Third, AiAR proved to be an effective situational methodology, enabling research to unfold in dialogue with the community practices rather than through pre-established protocols.

Ultimately, Ainuai: Song of the Waves articulates a mode of inquiry where research and filmmaking converge as a shared ethical practice. It is not to extract knowledge, but to dwell with it. It is not to master time, but to inhabit its multiplicities. In doing so, the work affirms that the most vital knowledge of migration emerges through the fragile, affective, and co-created traces of being together.

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Unfolding the creative aspect of Truncated dodecahedron : Exploring visual aspects of geometry and solids

Hiral Patel | Harsha Shamnani

Abstract:

An in depth exploration of Archimedean solid, a semi regular polyhedron, with a specific focus on truncated dodecahedron, used as a base medium for form and structure. It explores and understands the geometry of a truncated dodecahedron with the help of vertices and faces. Various form generation techniques such as slicing, cutting, intersection, creates the dynamism into regular polyhedron through the play of void and solid. Aesthetics and functionality are also integrated as a part of form generation.

Material exploration plays a key role in grounding the understanding of the practical making process. Study looks into the detail and integrity of making the concept with the material understanding of metal and glass. Metal is explored as a structural material used for framework and surface aesthetic material enhancing the strength of the product, while glass is perceived as functional material, allowing the play of light and transparency. Joinery, finishes, surface treatment are seen as part translating functionality with aesthetics.

Thus, the exploratory process brings out the creative aspects of form generation addressing technical, functional and aesthetic aspects.

Key words: *Archimedean solid, Exploration of Geometry, Form making, Truncated Dodecahedron*

Introduction

Looking into creative aspects of Archimedean solids and breaking into the elegance of geometry. Deciding Truncated dodecahedron as base medium for conducting an in depth study about Archimedean solids and their properties. Building an understanding of how symmetrical geometry plays an important role while revealing the unseen elegance of Truncated dodecahedron inculcating its structure into our surroundings and enhancing the space through its presence. Developing the structure and form of Truncated dodecahedron by using different manipulative techniques or by adding an extra element which will help in enhancing the aesthetic value of the solid.

Understanding an Archimedean solid

What is an archimedean? This question is frequently raised and difficult to answer easily, as term'Archimedean'being utilized across various disciplines each with distinct context and

complexities. An incredible discovery of archimedes is the archimedean solids. Before diving deep into the sea of archimedean, polyhedron is a major term which needs to be understood. Polyhedron is a closed three dimensional shape made of flat polygons. Lets understand it through an example, a cube is considered as a polyhedron whereas a cylinder is not a polyhedron as it is made of curved faces. Vertices,edges and faces are the main characteristics which are considered for a polyhedron. Think of polyhedrons as a large family of 3D shapes.

Archimedean solids are a selected group within that family- the ones that follow special symmetry rules. More than one type of polygon can be used, the same arrangement of faces meet at every corner and all the edges are straight, their faces are flat and match the criteria of a polyhedron with adding spatial complexity and aesthetic variation.Fig.01 represents all these 13 Archimedean solid which includes Truncated Tetrahedron, Cuboctahedron, Truncated Cube, Truncated Octahedron, Small Rhombicubotahedron, Great Rhombicuboctahedron, Icosidodecahedron, Truncated Dodecahedron, Truncated Icosahedron. For example, the truncated Icosahedron which is made of 12 regular polygons and 20 regular hexagons.It is renowned for its structural resemblance to a soccer ball and also found in some natural forms. Another example is the Cuboctahedron which consists of 8 triangular and 6 square faces, which features an identical arrangement at each corner. Understanding the general principles of a polyhedron provides a clear lens to appreciate the complexity of archimedean solids and explore its creative beauty.

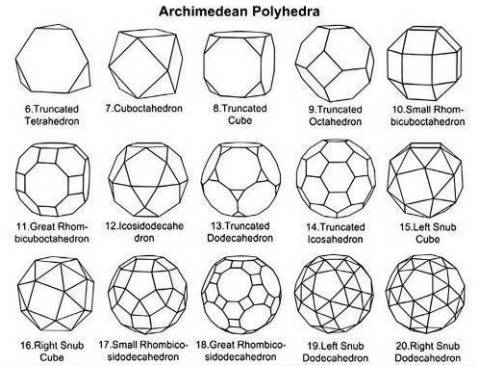

Fig.01 Shows 13 Archimedean solids, Credits: Haghnazar, R., Nooshin, H., & Golabchi, M. (2014). Platonic and Archimedean polyhedra [Figure 16].

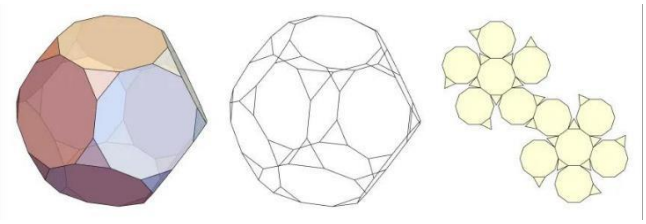

Fig.02 Shows truncated dodecahedron with its open layout Credits :Truncated Dodecahedron, MathWorld – Wolfram Research.

Tangible aspects of Archimedean solids

Archimedean solids are composed of two or more types of regular polygons arranged in such a way that the same pattern of faces meet at every vertex. This characteristic of archimedean solid is known as vertex transitivity, which means each corner of the solid looks exactly like every other corner.

According to the research study of archimedean solids truncated cube, truncated octahedron and truncated tetrahedron are least complex whereas rhombicuboctahedron, the icosidodecahedron, the rhombicosidodecahedron, the snub cuboctahedron and the snub icosidodecahedron are most complex among the 13 archimedean solids. The remaining five Archimedean solids the truncated icosahedron, truncated dodecahedron, cuboctahedron, truncated cuboctahedron, and snub icosahedron differ in their index values, which means variations in their geometric properties such as vertex configuration, symmetry, or complexity.

The very first solid is the Truncated tetrahedron. The word truncated means truncating that is cutting off. A truncated tetrahedron(Fig.03) is formed by truncating the corners of a regular polygon tetrahedron. It consists of 8 faces which are made of 4 equilateral triangles and 4 regular hexagons.18 edges and 12 vertices. Vertex configuration 6,6,3 which indicates 2 hexagons and 1 triangle is the arrangement of polygons in each vertex. It has a tetrahedral symmetry which is inherited from tetrahedra. The above polygon is convex meaning it has no indentation and all interior angles are less than 180 degrees.

Cuboctahedron, as the name suggests, consists of 14 faces which includes 8 triangles and 6 squares. This makes its vertex configuration to 3,4,3,4 . The total number of edges is 24 and vertices are 12. Cutting of corners which gives it a name of truncated cube is a combination of 14 faces made out of 6 octagons and 8 triangles. Having a vertex configuration of 3,8,8 and 36 edges with 24 vertices makes its archimedean solid an identical and distinctive solid.

Similarly the study also talks about solid having 14 faces, a mixture of 6 squares and 8 hexagons with 36 edges and 24 vertices. Vertex configuration 4,6,6. Each vertex is surrounded by a square and 2 hexagons. Archimedean solids are composed of two or more types of regular polygons arranged in such a way that the same pattern of faces meet at every vertex. This characteristic of archimedean solid is known as vertex transitivity, which means each corner of the solid looks exactly like every other corner.

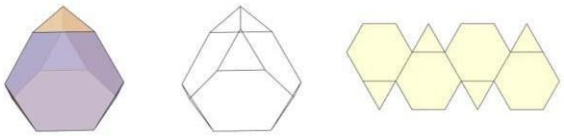

Fig.03Truncated Tetrahedron, credits :Truncated Tetrahedron, MathWorld – Wolfram Research.

Intangible aspects of Archimedean solid

Archimedean solids are not just a symmetrical, balanced, and solid structure; they are also a graceful, abstract shape. With the visual balance, Archimedean solids are also balanced between complexity and order, a place where their aesthetic beauty lies. Their property of consistency gives them a refined, cohesive appearance which makes them appealing to the human eye.Archimedean solids inspire a sense of detailed and deliberate design that is both full of creative potential and tied to mathematical logic, in contrast to chaotic or irregular form. They are distinct and identical due to their sharp edges, delicate lines, proportionate distribution, and arrangements with rhythmic geometry. These features also enable them to be recognized as an exquisite, accurate, and complex design in addition to a logical, mathematical structure. They are a source of inspiration for furniture, architecture, and product design because of their elegance.

This study utilized a truncated dodecahedron as a case study to apply several analytical tools for the exploration of form generation. Furthermore,The study highlights how architectural structures or interior elements share a relationship with Archimedean solid because of their balanced structural properties,modularity and symmetrical geometry, tessellating nature and visual harmony. For example, the UFA cinema center located in Germany is inspired by a truncated cube. This relationship between architectural and mathematical form underscores the universal applicability and inherent logic of geometric principles.

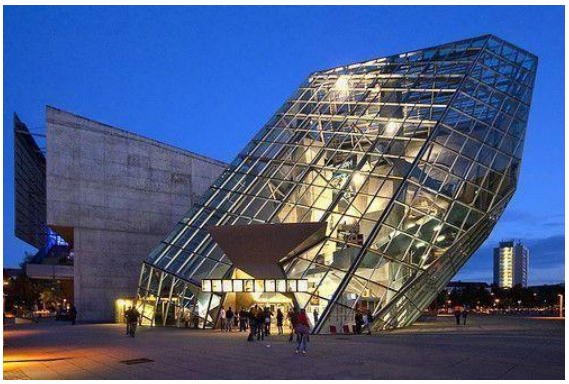

Fig.04 Shows UFA cinema center, Germany, Credits :Archello. (n.d.). UFA Cinema Center.

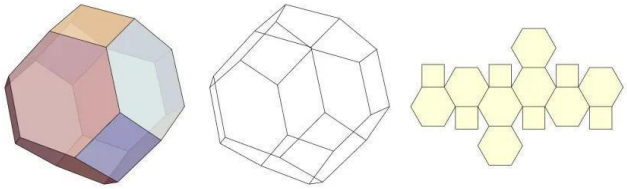

Fig.05 Truncated Octahedron, Credits : Wolfram Research. (n.d.). Truncated Octahedron. MathWorld

Thus, Archimedean solids represent a fascinating intersection of mathematical symmetry, spatial complexity and natural aesthetics. For example,Truncated Octahedrons(Fig.0.4) are perfect for developing modular constructions and models because they are archimedean solids that tessellate without gaps and are a great example of spatial complexity. Archimedeans solids like cuboctahedron and rhombicosidodecahedron provide complex yet a very balanced geometry which inspires to explore these forms in the field of furniture and product design like many decor elements like planters, stools and seating elements. Furniture pieces use frameworks inspired by these polygons which provide both appealing structure as well as structural strength. These forms show potential in architecture and design, modular constructions, and aesthetically pleasing structures are revealed by exploring them through the prism of form development.It also allows to think about the creative aspect of geometry which can be incorporated into design world as a medium of serving aesthetically appealing products with mathematical logic.Considering truncated dodecahedron as a base form provides a focused yet flexible medium for investigating structural patterns, contributing to a broader aspect of these extraordinary geometric figures.

Research Methodology

Carrying distinctive characteristics, each solid stands out and has its own identity. These solids are a medium of enriching geometric properties as well as carrying its own aesthetic value. This study adopts combining geometric analysis, practical aspect, ergonomic evaluation, and form development. The study involved exploring these mathematically rich solids that can be transformed through a variety of design techniques to achieve a functional, human friendly and usable product. Each solid was digitally modeled using 3D software, which allowed us to visualise the geometric form and manipulation.

Formation of Archimedeans

Formation of Archimedeans solids is based on certain parameters. These are the basic stages involved in formation of Archimedean solids:

A. Truncation of Solids

Solid Truncation involves cutting off corners for formation of new solids. For example, Truncating that is cutting off gives the truncated cube (with 8 triangular and 6 octagonal faces)

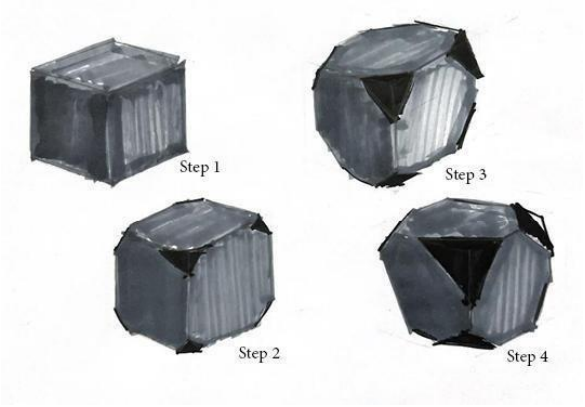

Fig.06 Represents the truncation process of a cube, Credits: Author

The above figure illustrates the truncation process of a cube in stages. The first image shows the original cube, followed by a ¼ truncated cube, then a uniformly truncated cube, and finally a ¾ truncated version, each progressively altering the original geometry.

B. Expansion process

Solid expansion means expanding faces or edges of a platonic solids outwards, forming new polygons in a gap. Let's say, for example, an expanding cube resulting in a cuboctahedron.

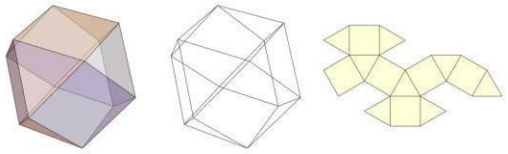

Fig.07 Shows the Cuboctahedron, Credits: Wolfram Research. (n.d.). Cuboctahedron. MathWorld – A Wolfram Research

C. Snub Operations

Solid snubbing involves twisting of polyhedron and extra triangles are involved. For example, Snub cube, Snub dodecahedron.

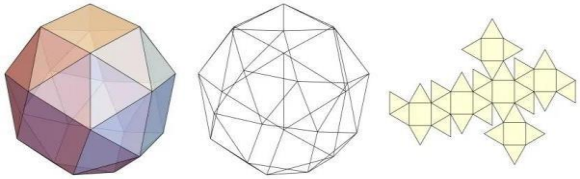

Fig.08 Shows the Snub Cube, Credits: Wolfram Research. (n.d.). Truncated Octahedron. MathWorld Dodecahedron

Fig.09 Shows the Snub Dodecahedron Credits: Bostanci, A. (n.d.). Coding the Snub

Physical aspects of Truncated Dodecahedron

From all these enriching solids (Fig 0.1) Truncated Dodecahedron (Fig.02) was used as a base medium during the form development process. In depth research about its physical and creative properties, the structure and mathematical concepts were carried out on the truncated dodecahedron. Due to the unique combination of geometric precision and visual harmony, The truncated dodecahedron is a unique and elegant shape formed by truncating the corners of a regular dodecahedron, one of the five Platonic solids. This process transforms its 12 pentagonal 5faces into 12 decagons, and adds 20 equilateral triangles at the points where three pentagons originally met. As a result, the solid has 32 faces (12 decagons and 20 triangles), 90 edges, and 60 vertices, making it highly symmetrical, visually balanced, and aesthetically pleasing.

Diving deep into the physical properties of the truncated dodecahedron it was seen that each vertex is surrounded by 2 decagons and 1 triangle, providing it a vertex configuration of 3,10,10. This configuration states that each vertex of a truncated dodecahedron meets each other at this specific order that is 1 triangle and 2 decagons which makes it 3,10,10. Being a convex this solid exhibits icosahedral symmetry found in regular dodecahedron and icosahedron. A distinctive feature of this solid was that the structure doesn't have the property to tessellate or fill any 3D space without leaving space in between.

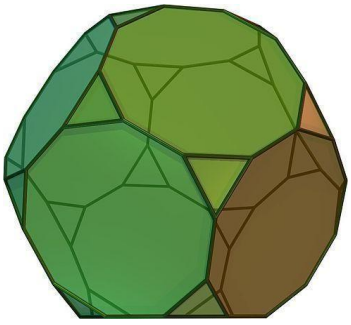

Fig.0.10 Shows the Truncated Dodecahedron, Credits: Wiktionary contributors. (n.d.). Truncated dodecahedron.

Creative aspects of Truncated Dodecahedron

This study encouraged the enhancing geometry and introduced the usage of this solid 'Truncated Dodecahedron' in any surrounding element supporting in enhancing the visual and aesthetic value of the place. Not restricting the structure of the truncated dodecahedron, various manipulative techniques were combined with the solid. The truncated dodecahedron is sturdy and has a visually balanced structure.Its ability to evoke both order and variety makes it particularly compelling in creative disciplines. The solid seeks its attention towards its multifaceted structure and reveals its new patterns making it a dynamic form.Due to its physical properties like sturdiness, symmetrically balanced and visually appealing it frequently serves as a framework for statement pieces, pendant lighting, geometric lampshades, stools, tables or modular structures where the angular form yet rhythmic form creates a visual interest and evokes a sense of modern sophistication.

Fig.0.11 Furniture piece made out of an archimedean solid form structure wireframe Credits: Andrew Lurker

Fig.0.12 Pendant light made out of archimedean Credits: Maker Marketplace. (n.d.). Custom lighting [Web page].

Because of its faceted geometry, a play of light and shadow is also an integral part of it. Lighting within or upon the form allows in creating distinctive and impactful patterns, which makes it particularly effective in creating immersive spatial experience.Moreover, its stable structure allows for a variation and diverse use of materials, whether fabricated from glass to highlight transparency or inculcating use of metal to show off its sharp edges and angles.

In all, its rich combination of mathematical depth and intricacy in form brings in design adaptability and offers endless possibilities for innovation in a variety of fields.

Form Evolution

This study encouraged the enhancing geometry and introduced the usage of this solid 'Truncated Dodecahedron' in any architectural structure, interior element or any light fixture. Not restricting the structure of truncated dodecahedron, various manipulative techniques like twisting, bending, slicing horizontally, vertically and diagonally were combined with the solid for form exploration. The truncated dodecahedron is sturdy and has a visually balanced structure. To maintain its visual symmetrical balance, slicing horizontally was the manipulative technique used. Various explorations and iterations were carried as shown in the below Fig.11 to Fig.17

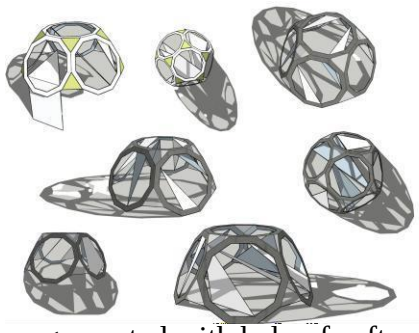

Fig.0.13 Iterations generated with help of softwares, Credits: Author

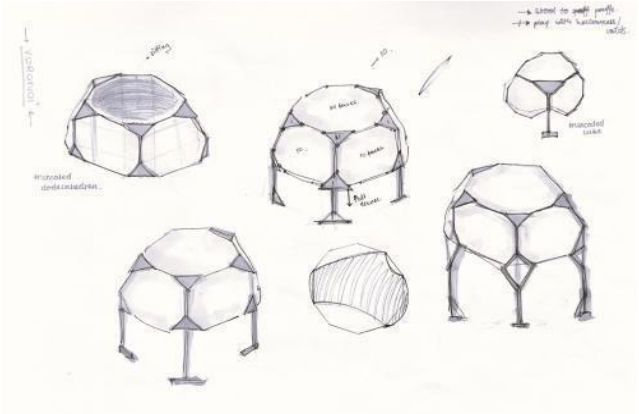

Fig.0.14 Exploring its structural balance Credits: Author

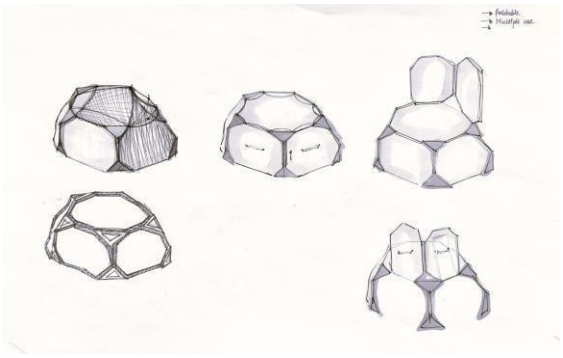

Fig.0.15 Perceiving the structure as a seating element Credits: Author

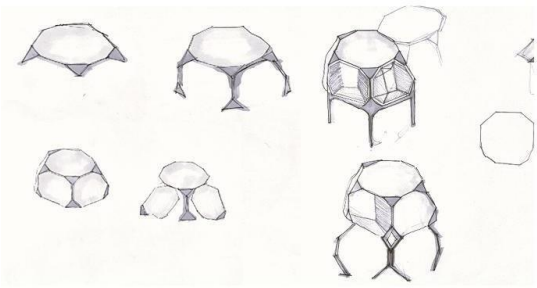

Fig.0.16 Using different techniques to achieve form Credits: Author

From Fig0.13 to Fig0.16 represents the sketches of the iterations based on the structure of the truncated dodecahedron. The explorations particularly represent a furniture element that is a side or accent table. To break the firm structure of the truncated dodecahedron, shadow play of light was brought in by incorporating perforated panels. A 3D model was created digitally and physically to understand the depth, scale, proportion and distribution of materials.

The research discussions involved in-depth discussion based on usage of the geometric aspect of archimedean solids in architectural structures, furniture pieces or any interior element. Comprehending Archimedean and manipulating it using the many form-altering techniques as already stated. It is noted that the solids are balanced symmetrically and are sturdy.An excellent blend of well-balanced geometry, aesthetically pleasing design, and practicality can be found when Archimedean solids are explored in furniture or any other interior element.These semi-regular solids provide both structural clarity and visual intricacy due to their uniform structure and mix of two or more regular polygons. They are perfect for modular, scalable, and aesthetically dynamic applications in a variety of design disciplines due to their inherent symmetry and space efficiency.

The tessellating nature of some of the archimedean solids allows the creation of modular structures, which enables easy assembling which is proved to be an extremely important factor

in building sustainable practice. In furniture design utilization of these kinds of structures offers aesthetics and stability. Solids like truncated dodecahedron or truncated cube are involved .

Material selection in this case plays an extremely crucial role to particularly understand the look and feel of the product with its load bearing capacity. As these solids have sharp edges and accurate angles these structures often demand precise fabrication and proper surface treatment. Ultimately, the incorporation of archimedean solids into architectural aspects or furniture design represents more than just geometry,it is part of design which merges mathematical precision with a creative aspect.When these solids are paired with appropriate material they offer innovation in spatial design. The future of this kind of design won't be just an idea or thought but would be a need for it. Discovering more of such structures and eco-friendly yet balanced and aesthetically pleasing structures. As the structure is modular there are higher possibilities of assembling anywhere with any context.

The Making Process Stage 1

After form selection, parallel understanding were driven from primary research and secondary research. The primary research was conducted by conversing with local vendors and material stakeholders while the secondary source of reference was done through referring to standard dimensions for the table.Things that were considered were functions of an accent table, usage, placement, materials used were also a part of the research study. Commonly an accent table is a small, elegant and more decorative piece of furniture which is particularly designed to compliment the overall decor of the space, while serving its function. Unlike the other tall dining tables and other coffee tables, the accent table adds a character, style and a touch of balanced symmetry and elegance. Particularly accent tables are placed in hallways, living rooms, bedrooms, used as corner tables to attract the attention and be the enhancing element of the space.

Most accent tables are designed for interior spaces, but the one mentioned above incorporates shadow play and is intended for outdoor use, like lawns or gardens, alongside benches or puffets. These tables are valued not only for functionality but also for aesthetic appeal. Based on its outdoor placement, scale and material were carefully selected. A weatherproof, strong material was essential—leading to an elegant combination of metal and glass. Material study was crucial; metal's shiny, reflective, and malleable nature allows for sturdy forms. In contrast, glass adds transparency and delicacy. Their combination offers visual contrast—metal brings rigidity and polish, while glass offers lightness and clarity—balancing strength with elegance.

Fig.0.17 Shows the placement of table in indoor space Credits: Author

Fig.0.18 Shows the placement of table in outdoor space Credits: Author

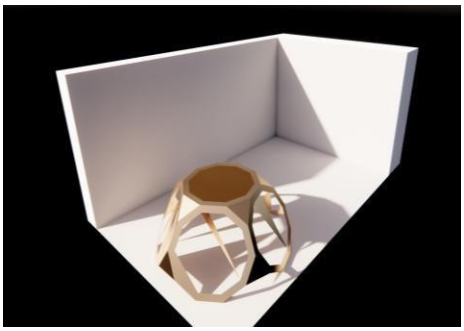

Fig 0.19 Option 1 : Glass is placed from below Credits:Author

Fig 0.20 Option 2: Glass is placed from top Credits : Author

Stage 2 Ergonomics

Scaling plays a crucial role in making any product. Ergonomics is one of the essential aspects which needs to be considered. The product needs to favour the human ratio as it has to be functional to a human. Consideration of material is another important aspect which needs to be considered. Understanding the material and usage or distribution of the material in a product helps in understanding the overall weight distribution of the product and its weight carrying capacity. It also provides an insight of the joinery requirements of the product. Scaling of the accent table was considered on the basis of standard measurements of an accent table. The height of the table was 1`8`` (500mm). The table possessed the structure of a sliced truncated dodecahedron each side of a decagon was 4`` (100mm) An open structure was made using the digital softwares available with accurate scaling to ease the process of making of the product.

Ergonomics plays a crucial and important role while considering its functionality and usage. Ergonomic study helped in ensuring that the furniture supports human interaction effectively. These tables may serve various purposes like holding books, drinks, serving as a resting surface beside seating and also helps in enhancing the overall space.Some key aspects which were included in ergonomic study are as follows:

The height elevation: As its an accent table the standard height considered was 1`8`` which was a lower than the ideal height of any table when compared to human height but as the purpose of this table was more of an pleasing element and less of functionality this height was considered. The height factor was also affected by the placement of the product, that is it was also affected by the nearby seating furniture placed .

Reachability and Placement: Reachability and placement was considered to be one of the major concerns as the placement of the table decided the reach of the user, allowing users to interact naturally without any strain. Proper placement also accounted for circulation paths and visual balance within the space, ensuring the table did not obstruct movement yet remained easily accessible.

Clearance space and movement flow: As the structure of the truncated dodecahedron is wider at base and has a tapering structure at top, space occupied by the table is more. Therefore, space around 2` was necessary to allow a smooth movement flow around the table.THIS spacing not only ensures smooth circulation around the table but also provided sufficient leg room for seated users. Additionally, the angled geometry of the base had to be considered in relation to the

user's posture, ensuring that the structure did not interfere with natural leg positioning or create discomfort during interaction.

Material usage: Ergonomic study also involved material study to understand the comfort and interaction between the user and material. The textures , edges and distribution of material throughout the product helped in determining the weight as well as visual balance. The material selection whether smooth or matte or glossy not just affected the way light interacted with the product.

Surface area and Stability: The nature of accent tables is that they are smaller in height and yet require a good surface area to be stable and hold objects without tipping, ensuring comfort and confidence in use.

Scaling plays a crucial role in making any product. Ergonomics is one of the essential aspects which needs to be considered. The product needs to favour the human ratio as it has to be functional to a human. Consideration of material is another important aspect which needs to be considered. Understanding the material and usage or distribution of the material in a product helps in understanding the overall weight distribution

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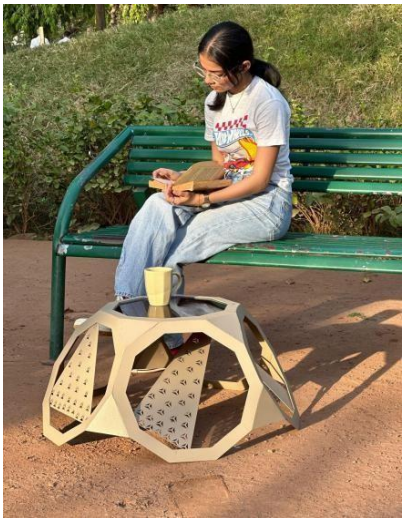

Fig.0.21 Shows the Interaction of Human with the table Credits:Author

Fig.0.22 Shows the placement and object interaction Credits:Author

Stage 3 : Final making of the product

To achieve the form of the sliced truncated dodecahedron in metal, various different forms of metal were explored. Pipes of metals, sheets of different thickness,L sections ,C sections were looked upon where a metal sheet of mild steel was considered the most appropriate for table construction as it was easier to bend and mold it to the desired structure and achieve stability as well.

The CNC method was chosen to construct the basic structure. A 2mm sheet of mild steel type of metal was used. CNC is basically a metal cutting laser machine. Further , the CNC cut out of the structure was then hammered and brought to the structure of sliced truncated dodecahedron. A metal joinery , spot welding was then used to achieve the firmness of the structure. Spot welding is a type of resistance welding which is used to join two or more metal sheets together by applying heat and pressure at some joining points.

Grinding the excess of spot welding was the next step in the process in creation of the product. Grinding, finishing was a crucial part. Restricting corrosion was an important concern as the placement of the product was between air and moisture that is outdoor space. To achieve a smooth and matte texture on the framework Powder coating was used. Powder coating involves a durable, protective , attractive coating of metal.Powder coating offers a durable and long lasting finish which is ideal in outdoor furnishings for uniform and attractive appearance.

As it is available in many colors, textures and finishes which helps in increasing the aesthetic value.

An initial phase in product creation is the glass fixing.3D softwares made it easy to decide where and how the glass needs to be placed as glass would totally enhance the design Glass sampling and choosing an appropriate glass was an essential step with the help of silicone; the glass was fixed from inside. Taping was done to let the glass get firmly attached with metal. Its ability to evoke both order and variety makes it particularly compelling in creative disciplines. The solid seeks its attention towards its multifaceted structure and reveals its new patterns making it a dynamic form. The commonly truncated dodecahedron is used as a furniture piece because of its structural stability and symmetrical balance. It frequently serves as a framework for statement pieces, pendant lighting, geometric lampshades, stools, tables or modular structures where the angular form yet rhythmic form creates a visual interest and evokes a sense of modern sophistication.

Because of its faceted geometry, a play of light and shadow is also an integral part of it. Lighting within or upon the form allows in creating distinctive and impactful patterns, which makes it particularly effective in creating immersive spatial experience.Moreover, its stable structure allows for a variation and diverse use of materials, whether fabricated from glass to highlight transparency or inculcating use of metal to show off its sharp edges and angles.

In all, its rich combination of mathematical depth and intricacy in form brings in design adaptability and offers endless possibilities for innovation in a variety of fields.

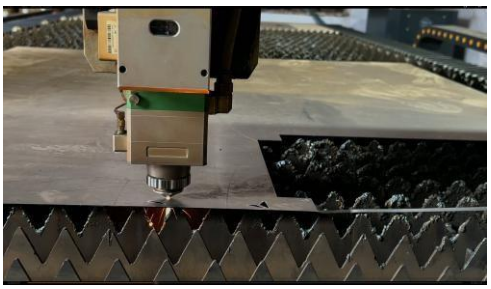

Fig.0.23 Shows the Cnc cutting of the layout Credits: Author

Fig.0.24 Shows the welding process after bending into the structure Credits: Author

Fig 0.25 Shows sliced truncated dodecahedron structure after Welding Its shadow play Credits: Author

Fig 0.26 Shows Powdered coated framework Credits: Author

Fig.0.27 Final Product flaunting in sunlight in outdoor space.Credits: Author

Learnings:

Through this exploration a deeper understanding of Archimedean solids, not just as geometric forms but also as dynamic forms full of creative potential. Unfolding the shapes allowed to see beyond their rigid symmetry and appreciate the creative and spatial possibilities embedded within geometry. Engaging with material handling and fabrication techniques into tangible outcomes, where precision and accuracy works hand in hand. Working through each angle, edge and face helped me uncover the mathematical and creative aspects of it.

Implications and Conclusions

As the field of design continuously seeks for innovative approaches which are efficient and sustainable in nature . Archimedean solids prove to have a vast scope as their geometric properties suggest uniformity, sturdiness, balance, sharp and fine edges makes them suitable candidates for being the future of architecture and product, furniture or any interior element.

Throughout the course we looked upon solids through the lens of geometry and creativity. Archimedean solids offered a profound and enduring scope for creative exploration in design. Their intricate form, balanced structure and mathematical precision helped in moving towards exploring the creative aspect of Archimedean solids and forming a conceptual journey.

This journey when executed into furniture design, spoke how structure and aesthetics can coexist together. How every vertex and edge can act functionally as well as like an enhancing medium. The voice of material further elevated the conceptual meaning and created a bridge between geometry and sensory experience, enhancing structural logic with aesthetics.

In every furniture design context, Archimedean solids based design transcend mere function to become objects of spatial storytelling. Thus, this creative application of these solids stands out as a dynamic framework for material- led and concept centered design.

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Guest-Host Relations in Art Residency: Driving Social Transformation in Jatiwangi art Factory

Ade Ahmad Sujai, Jatiwangi art Factory / IPB University

Abstract

This paper examines how Jatiwangi art Factory (JaF) strategically transforms the dynamics of "guest" and "host" within its residency program, utilizing this relationship as a fundamental artistic method to address socio-economic and cultural crises. Situated amidst the massive industrial expansion in Jatiwangi, JaF employs residency practices not merely as an art facility, but as a social laboratory. Adopting an autoethnographic methodology, this paper argues that the guest-host relationship at JaF functions as a complex social technology for reclaiming communal agency. The analysis identifies three primary functions of this practice. Firstly, as an enactment of radical hospitality, JaF cultivates a kinship-based relational economy that challenges the logic of extractive capitalism. Secondly, pedagogically, this practice embodies Freirean praxis, creating dialogic spaces for the equal co-creation of knowledge between artists (guests) and the community (hosts). Thirdly, as a decolonial political action, JaF activates an "Epistemology of the South" by elevating Tanah-based knowledge to the global stage, exemplified through performative projects such as the New Rural Agenda.

Keywords: *Jatiwangi art Factory, Art Residency, Guest-Host Relationship, Social Transformation.*

Introduction

A distinct aroma lingers in the memory of anyone who has spent significant time in Jatiwangi: a fusion of freshly worked wet clay, the acrid scent emanating from the firing process within jebor (traditional roof tile factories), and the red dust suspended in the air. For over a century, since 1905, this sensory landscape constituted the lifeblood of the community, signifying the identity of a region renowned as Southeast Asia's largest producer of roof tiles. Clay, for the people of Jatiwangi, transcended mere commodity status; it was the material that shaped livelihoods and formed the foundation of a communal culture sustained through generations of collaboration (gotong royong).

In recent decades, these socio-economic and cultural foundations have faced severe erosion. The 1998 monetary crisis, coupled with intensified globalization, precipitated a decline in the traditional tile industry. This crisis was exacerbated by a far more massive transformation: the designation of Jatiwangi as part of the 'Rebana Triangle' Strategic Industrial Area. This policy opened the floodgates for large-scale factories from foreign investors, particularly in the textile sector. Dewi & Boediman (2024:237) state that the large wave of modern industrialization

profoundly impacts all societal facets, even endangering the original culture of Jatiwangi, namely clay. Rice fields yielded to concrete, and the once-smoking jebor fell silent, replaced by the imposing smokestacks of modern plants. This shift represented more than an economic change; it was a profound social and cultural disruption. The rhythm of life, once synchronized with the cycles of tile production, was supplanted by rigid factory schedules, creating generational gaps and eroding informal social spaces. Within Paulo Freire's framework, this condition constitutes a "limiting situation"–a reality perceived as a closed world with no exit (Freire, 2005:49), where a future dictated by external forces threatens to erase a deeply rooted identity.

Emerging from within this limiting situation, the Jatiwangi art Factory (JaF) was founded on September 27, 2005, by siblings Arief Yudi Rahman and Ginggi Syarief Hasyim, and Loranita Damayanti, known as Yuma. Established in the yard of their mother's house–a former tile factory–JaF arose as an organic, creative response to the crisis. From its inception, JaF resisted a strict "collective" model, viewing itself instead as a "community" embedded in daily life, where one of JaF's members Ismal Muntaha said "what we do here cannot be separated from our daily life context because we are living here" (Kolb & Richter, 2022:210). Its fundamental aim is to utilize contemporary art and cultural practices as tools to rebuild collective action and forge a new identity. Rather than lamenting the demise of the tile industry, JaF endeavors to cultivate clay with more dignity, elevating it from commodity to a symbol of cultural pride. A core strategy has been to invite artists, curators, and thinkers from outside to reside and create alongside the community through residency programs.

This paper focuses on this residency program not as mere infrastructure, but as the central artistic practice itself–a social laboratory where the concepts of "guest" and "host" are actively deconstructed and reimagined. The research question is: How does JaF strategically utilize and transform "guest-host" dynamics within its residency, not solely for cultural exchange, but as a fundamental artistic method for confronting crisis, reclaiming communal agency, and building the community's future? I argue that this practice functions as a sophisticated social technology, consciously dismantling traditional power dynamics to create a space of radical hospitality and dialogical learning, ultimately driving decolonial action.

Methodology

To capture the essence of JaF's deeply personal and context-bound practice, this paper adopts an autoethnographic approach. Autoethnography seeks to understand cultural experience by systematically analyzing personal experience, legitimizing the researcher's subjective involvement as critical data (Ellis et al., 2011:273). It frames inquiry as a politically engaged act, challenging the canonical divide between researcher and subject. This methodological choice is particularly suited to this study, as an external, detached observer would lack the immersive access necessary to decipher the nuanced micro-dynamics of JaF's guest-host

relations. Consequently, my insider status is treated not as a bias to be mitigated, but as the primary analytical lens for generating a deep, contextual understanding of the phenomenon.

Within this framework, my positionality is explicitly not that of an external observer. As a practitioner actively engaged in JaF's activities, my experiences both shape and are shaped by the phenomenon under study. Autoethnography here is both process and product (Ellis et al., 2011:273); the process of ongoing personal reflection throughout the engagement serves as the method, and the resulting analytical narrative constitutes the research product.

Methods of collection data in autoethnography, as described by Duncan (2004:31) include participant observation, reflective writing, interviews, and the collection of documents and artifacts. Data is drawn from two streams. Primary data comes from my direct participation in JaF activities: participant observation during workshops, the triennale Rampak Genteng festival, monthly discussions, and daily interactions at Jebor Hall, JaF. This core data was enriched through informal conversations with JaF members, resident artists, and local villagers, alongside personal reflections. Secondary data includes analysis of JaF archives, relevant scholarly articles, and theoretical literature on hospitality, pedagogy, and decolonial studies. This approach allows me to analyze how micro-dynamics within JaF's guest-host relationships reflect and challenge broader macro-level phenomena.

Results and Discussion

The analysis reveals that the guest-host relationship at JaF is strategically deployed as a multi-functional "social technology"–a primary artistic method to address the community's "limiting situation". In the modern understanding of social technology, it was referred to any application for various purposes, especially to support a decision making process (Tamošiūnaitė & Skaržauskaitė, 2012:265). In this context, social technology operates on three distinct yet interdependent levels: as radical hospitality, dialogical pedagogy, and decolonial praxis.

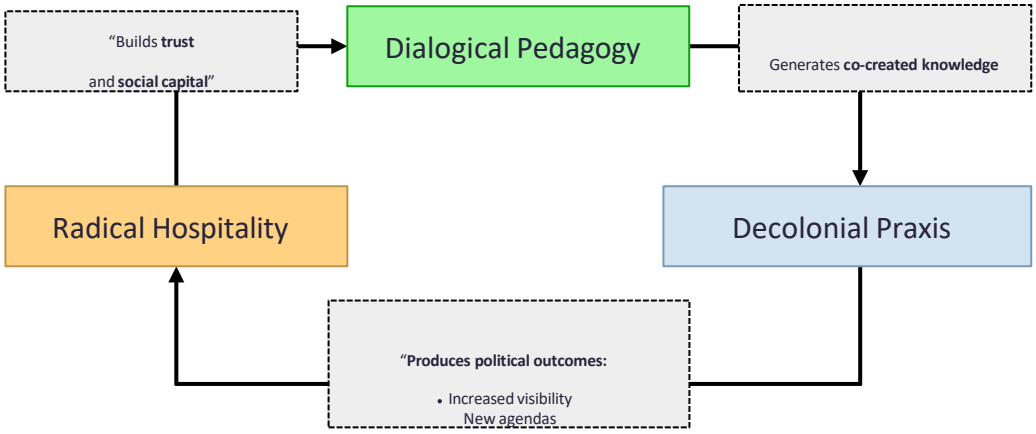

Figure 1: The JaF Guest-Host Dynamic as a Transformative Engine

Reconfiguring Guest-Host Relations at JaF

Contemporary art residencies often operate on a transactional logic. JaF subverts this framework entirely. Its economy is grounded not in finance but in persaudaraan (brotherhood) and kekeluargaan (kinship). This kinship model extends to its civic engagements; JaF itself has strong links with the local government, or in their own words, the local government is part of the ecosystem (Liu, 2024:117). As Sujai states, "We are essentially a family" (Museum of Care, 2022 https://museum.care/in-a-conversation-with-ade-ahmad-suja-i-from-jatiwangi-art-factory/). Resident artists are not tenants renting studio space; they are participants in a shared life-world, immersed in the daily rhythms of the community. This transforms the residency from a service into a practice of building "sociability," fostering communal cohesion.

The "hospitality as a social lens" theory proposed by scholars like Lashley, Lynch, and Morrison offers a pertinent perspective. They argue that host-guest relations can function as a mirror that reflects social norms, values, beliefs and ideologies (Lashley et al., 2007:173). At JaF, the mirror reflects a community resisting the capitalist industrial logic that disregards local wisdom by foregrounding gotong royong (mutual aid) and relational economics. This practice constitutes an assertion of identity, resisting the reduction to the exploitation of their living space in Jatiwangi. As Causevic & Lynch, (2009:121) argue that the guest-host relationship is a social phenomenon, and at JaF, this phenomenon becomes the primary arena for producing and renegotiating values amid ongoing change.

This dynamic embodies what Derrida identified as an absolute antinomy or aporia of hospitality: the conflict between the unconditional law of welcome (offering everything to the stranger) and the conditional laws that regulate it (Kakoliris, 2015:145). At JaF, this tension is productive. Conditional laws exist–there is an application process and fixed durations. Yet, the unconditional law constantly interrupts them. Guests are not strangers bound by rules but are swiftly integrated into the family. They do not merely "visit" but "dwell". I recall several artists who, shortly after their arrival, not only worked on their projects but also immersed themselves in the daily life of Jatiwangi–helping out at a local kindergarten, attending a neighbor's wedding, and participating in other aspects of community life.

By navigating this tension, JaF creates a fertile space for innovation and cross-boundary relations. In a context of historical and present economic exploitation, this hospitality functions as an alternative economy. When co-founder Arief Yudi asks, "what is the currency of poor people?" (You, 2024:27), the answer is embodied in their practice: relationships, trust, and solidarity. By building an economy based on social capital and the spirit of lumbung (collective sharing), JaF transforms welcoming guests into an investment in resilience. This is economic resistance enacted through social practice.

Co-Creating Knowledge Between Guest Artists and the Local Community

The JaF model is the antithesis of what Freire criticized about the "banking concept of education", where knowledge is a gift bestowed by those who consider themselves knowledgeable upon those whom they consider to know nothing (Freire, 2005:72). JaF radically inverts this dynamic. The core purpose of inviting external artists is so "we would learn something from the invited artists, curators, or musicians" (Ghorie in Kolb & Richter, 2022:210). This is a foundational stance: both guests and hosts positioning themselves as learners.

This relational parity enables Freire's authentic dialogue, which requires love, humility, and faith in human potential (Freire, 2005:89). JaF's physical infrastructure, such as the Jebor Hall–a freely accessible space for gathering, discussion, and informal interaction–and a communal kitchen open to all, from local neighbors to artists-in-residence, who can exchange knowledge as equals over the dining table, is deliberately designed to nurture this ethos. Here, hierarchies dissolve, enabling a "co-construction of knowledge" that validates all expertise. This practice embodies Josep Beuys' radical idea that "everyone is an artist" and "everyone is an expert" (Yuliana & Lämmli, 2023:150). Through JaF, individuals from diverse professions–pedicab drivers, baristas, village heads–engage in creative reinvention (Jannah et al., 2025:69), For example, based on my empirical observation at Documenta Fifteen, JaF integrated non-artists–including local business proprietors, community leaders, and government officials–into their artistic production process in collaboration with other artists.

Beyond discourse, JaF's collaborations materialize Freire's core concept of praxis–the indivisible cycle of action and reflection. As Freire asserts, action and reflection occur simultaneously (Freire, 2005:128) to generate transformation. For instance, when artists co-create terracotta designs with local artisans, dialogical reflection on materials and traditions unfolds through making, experimentation, and failure. Similarly, the Terracotta City project, was not designed from the top down by experts based on a fixed blueprint. Instead, the concept emerged organically through a process of reflection on the predominantly extractive models of development, as well as through intensive interaction and dialogue among the invited resident artists, local communities, government entities, and external collaborators over many years. This envisioned Terracotta City is more than just a dream; it is a testament to the community's aspirations (Sudarmanto, 2024:125-126) fostered through collaboration that has led to collective action in building a city identity. Through such praxis, guests and hosts cease being passive objects and become active subjects.

A crucial, often overlooked outcome is the decolonization of the guest artists. Many arrive from global art centers carrying "epistemic privilege"–an assumption that their frameworks are universally superior. JaF's pedagogy compels them to relinquish the expert position. Positioned as equal collaborators, they must listen, value, and learn from vernacular knowledge. This necessitates an "unlearning" of assumptions about "art" and "knowledge". They can no longer exoticize or merely represent the community. Thus, the guest-host relationship becomes a bidirectional pedagogical intervention, driving all toward more ethical and equitable practices.

Guest-Host Relations as JaF Cultural-Political Action

JaF's guest-host relations must be understood as conscious decolonial praxis. Jatiwangi's history mirrors Indonesia's own trajectory: from exploitation under Dutch colonialism–Ismal Muntaha (JaF member) remarked that the shift from rice fields to sugar cane fields, driven by sugar factories, has changed our landscape (Kolb & Richter, 2022:211) to neo- colonial pressures from global industry. JaF's struggle, therefore, transcends opposition to textile factories; it confronts coloniality: a global power structure systematically rendering non-Eurocentric worldviews as inferior or irrelevant. JaF's residency practice, with its hospitality dynamics and dialogical pedagogy, constitutes a frontline of this cultural practice.

JaF operationalizes sociologist Boaventura de Sousa Santos "Epistemologies of the South"–a concept denoting ancient and contemporary knowledges held by social groups as they resisted against modern Eurocentric domination (de Sousa Santos, 2021:1). It recenters local knowledge of tanah (earth), communal rhythms, and gotong royong as valid foundations for imagining futures. This is "epistemic decolonization", which challenging the idea that certain aesthetic values or artistic criteria are universally applicable (Sustainability Directory, 2025).

The residency program incubates this agenda. By inviting "guests" from diverse global contexts, JaF builds transnational solidarity networks from the "Periphery", not seeking validation from the "Center". This stands in stark contrast to 'parachute' art practices that extract local culture for external gain, because JaF is a art community that was born, lives and works for its own region. The apex of this strategy is evident in their New Rural Agenda (NRA) project, presented at the prestigious contemporary art event documenta fifteen in Kassel, Germany. This project transcends mere artistic display; it constitutes an overt political intervention. The New Rural Agenda explicitly challenges the UN's New Urban Agenda, which, according to JaF, perpetuates the view of the rural as something that is supporting the urban, not something that is a place with many values (Kolb & Richter, 2022:211), The New Rural Agenda Summit is a planetary conference that brings together international policymakers, institutions, artists, village representatives, and other-than- human entities to establish a common future agenda. Conceived as an alternative to top-down conferences initiated by large nations or institutions, the summit emphasizes bottom-up frameworks and their performative potential (https://www.youtube.com/watch?v=TmLQm7mGneQ&t=1458s).

Furthermore, JaF astutely leverages global art infrastructures to advance its decolonial agenda, effectively turning international platforms into stages for its local discourse. At documenta 15, they were not "exhibited" as exotic objects from the "Global South". They came to act as hosts of a trans-local summit, JaF turned the New Rural Agenda Summit into a space for coordinating trans-local solidarity on issues of land, rural life, and development, which are of concern to many lumbung artists. The summit critiqued the developmental policies of industrialisation and urbanisation, drawing attention to the importance and urgency of creating a more ecologically sustainable rural future (Liu, 2024:117). They collaborated with local Kassel communities,

replicating their Jatiwangi model. In this move, they transformed from passive "guests" on a global stage into proactive "hosts" of a new agenda, reversing flows of power and knowledge from periphery to center. Through art and the guest-host relational practice, they achieved a core objective of decolonial struggle: renegotiating their territory not merely as an "industrial area", but as a "cultural territory" (Kota Terakota), reclaiming what Lefebvre called the "right to the city" (Dewi et al., 2024: 215)–or in this case, the right to the rural and its future.

Conclusion

Analyzing Jatiwangi art Factory's residency through the "guest-host" framework reveals a sophisticated, multi-layered strategy of survival and imagination. This relational dynamic is the core of JaF's artistic methodology for confronting oppressive realities. The synthesis identifies three fundamental, interconnected functions: (1) As Radical Hospitality, it constructs a relational economy of kinship and mutual aid, acting as a subtle resistance against extractive capitalism. (2) As Dialogical Pedagogy, it materializes Freirean praxis, creating spaces for equal knowledge co-creation that empower the local community and decolonize guest artists. (3) As Decolonial Action, it produces and validates Epistemologies of the South, leveraging global networks to assert cultural sovereignty and advance a rural agenda.

This practice represents JaF's successful transformation of a "limitative situation" into a "generative situation"–a fertile space of new possibilities. At JaF, the conventional boundary between "guest" and "host" is productively dissolved and reconstituted as kinship, creating a new model for relationality within art residencies. The art residency thus transforms into "home": an ideological and social foundation for building shared worlds. JaF offers a valuable model for how art–rooted in an ethics of hospitality and dialogical courage–can function as an instrument to imagine and materially forge a more just and humane future.

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Echoes of Tradition: Indian Tribal Art and Contemporary Society

Apurva Thosar, Research Scholar | Dr. Jitendra Sharma, Professor
FDA, Poornima University, Jaipur

Abstract

The formulation of a policy and program for protecting and regenerating tribal art forms in India requires addressing fundamental questions. The very term tribal has been constructed over the past two centuries, whereas in pre-colonial contexts such groups were referred to as First Nations, Aboriginals, or Indigenous Peoples. Processes of detribalisation disrupt the balance between nature and culture, while modernisation has often been equated with westernisation and globalisation. These transformations have led to anomalies, such as third-generation beneficiaries of tribal reservation policies who may be far removed from their original habitats and artistic practices. A central question arises: is tribal art unique, existing outside conventional histories of past, present, and future, or does it reflect a broader continuum of shared meaning? This inquiry highlights how tribal art forms, despite their regional variations, often share common ideational frameworks, purposes, and inspirations that constitute a universal cultural vocabulary.

Key Words—*Art, Detribalization, Modernization, Westernization, Globalization*

Introduction

Anthropology has been studying tribal art since the works of Franz Boas (1927) and Claude Levi Strauss (1963). Both anthropologists emphasised the importance of mental processes and cultural phenomena in studying art. Art, derived from the Latin word ars, is often associated with aesthetics and the study of beauty in human culture through diverse forms such as sculpture, painting, music, dance, and theatre. Anthropology, with its interdisciplinary approach, offers a comprehensive framework for understanding art in relation to society and culture. Yet disengagement from art remains a significant concern, particularly in the Indian context, where anthropological interest in art has been comparatively limited when set against other domains of anthropological study. [1][2][3]

An Inquiry into Tribal Arts

Tribal arts, encompassing dance, music, painting, and sculpture, exhibit a distinct sophistication, though not in the same manner as mainstream classical traditions. Many of these practices are rooted in religious rituals, while others have developed into performing arts. Their study requires attention to the socio-cultural contexts in which they are produced, as well as a detailed analysis of elements such as human movement, form, shape, time, and energy. Such

inquiry also calls for recognition of the differing levels and expressions of artistic sophistication across cultures.[4]

Art and Its Levels of Refinement

Sophistication in art refers to the processes of improvement, refinement, and heightened quality across different forms, including dance. Within anthropology, the concept of cultural relativism, introduced by Franz Boas in 1887, has provided an important ethical standpoint. It emphasises the need to study a culture from the perspective of its own members, rather than judging it through the lens of external cultural assumptions. When applied to the analysis of tribal art, however, this perspective encounters challenges. Evaluating the "perfection" or refinement of tribal art inevitably raises questions about the limits of cultural relativism and the tension between internal meaning and external judgment. [4][5]

Aesthetics through the Lens of Culture

Aesthetics is culture-centric, as the appreciation of beauty varies according to individual perception and cultural background. It is concerned with notions of the beautiful and the ugly, but it cannot be reduced to a precise standard, since it is shaped by broader cultural frameworks. Morphy and Perkins (2006) argue that art must be understood within its specific cultural contexts, as the meanings of ritual practices and performing arts differ across societies.

Art and Its Qualitative Dimensions

The study of tribal art, a qualitative branch of anthropology, has developed more slowly than other areas of the discipline. Its focus lies in understanding art, aesthetics, and the structural analysis of music. Major tribal art forms include dance, music, painting, and sculpture—forms that demonstrate sophistication, though not in the same way as classical traditions. The refinement of dance, for instance, is reflected in its genre, artistic expression, costumes, ornaments, and the rhythm of musical accompaniment. Yet cultural relativism becomes problematic in the interpretation of tribal music and dance, as universal systems of musical notation and composition challenge locally situated meanings. Aesthetics, more broadly, concerns the study of beauty across human cultures, encompassing sculpture, painting, music, dance, and theatre. Within anthropology, the study of tribal art has emerged as a significant field, one that this paper approaches through both the anthropology of art and structural anthropology. Boas's assertion that aesthetic pleasure is experienced by all of humankind offers a fitting reminder of the universal dimensions underpinning the study of tribal art. [6]

Literature Review

Morphy (1994), as cited in Morphy and Perkins (2006), defines art as objects with aesthetic and/or semantic attributes used for representational or presentational purposes. This highlights that art conveys both beauty and meaning, with the "signifier" (form) and "signified" (semantics) working together. This framework is particularly useful for analyzing tribal art, where objects often serve ritualistic, symbolic, and aesthetic functions, linking material forms to their broader cultural and social contexts.[7]

Gell (1998), in Art and Agency An Anthropological Theory, theorizes art from an anthropological perspective rather than traditional art history. He notes that while some art objects may serve no practical function beyond aesthetics, aesthetic value itself can be considered a function. Functional interpretation is particularly relevant in performing arts, linking artistic practices to cultural context and patterns of transmission. Gell also emphasizes that the disappearance of art often occurs when its functional relevance declines, highlighting the urgent need to document vanishing art forms.[5]

Hughes (2017) notes that the anthropology of art has traditionally focused on material objects, giving less attention to performing arts such as music, dance, and theatre. Unlike performance studies, anthropologists examine the relationship between society and its artistic or dramatic representations. This approach positions the study of tribal art, including its performative aspects, within a broader socio-cultural and anthropological framework[9]

Methodology

This study adopts a qualitative approach, relying on secondary sources such as scholarly books, journal articles, government reports, and anthropological studies to examine Indian tribal art and culture. Document analysis and comparative study are used to explore differences in artistic sophistication, cultural context, and socio-economic challenges. Case studies of specific tribal art forms, including art forms the impacts of globalization, commercialization, and resource depletion. The research is guided by cultural relativism and structural anthropology to analyze tribal art in its local context while recognizing broader aesthetic principles.

Key Challenges

Globalization has triggered the gradual attrition of tribal art and culture. Many tribal art forms are now endangered, with some on the verge of extinction. The far-reaching impact of globalization has introduced multiple challenges, ranging from cultural assimilation to the decline of traditional practices. As a result, the survival of several tribal art forms is increasingly under threat.

Turning Art into a Commodity

Globalization has led to the commercialization of many aspects of life, including tribal art. The artistic styles and cultural ethos of tribal communities are increasingly threatened by market forces, as artisans are compelled to sell their products for livelihood. Because these works are often undervalued, many artisans have abandoned traditional crafts in favor of factory-based production, causing age-old practices to decline. The intrusion of market-driven ideas has also shifted the perception of art itself—tribal artists no longer view their creations as primarily aesthetic, resulting in a loss of originality and, in some cases, the disappearance of entire art and cultural forms.[11]

Commercialization

New economic reforms have increased commercialization and the influence of a market economy, profoundly affecting tribal art and culture. Traditional religious rituals are increasingly replaced by mass entertainment and popular cultural forms, contributing to a decline in tribal art practices. Commerce has transformed skilled artists into mere artisans, and since the late 1960s and early 1970s, the quality of work from regions such as Bastar has noticeably deteriorated. As a result, many artists face identity crises and social marginalization under market pressures. Numerous tribal artists are compelled to shift occupations, and in some cases, this has led to dissent and unrest that challenge social cohesion. Careful intervention is therefore essential to preserve and sustain tribal art and culture.[13]

Dwindling Resources

Tribal communities are often subjected to injustice and exploitation by the government in the name of development. Modernization and developmental programs frequently target areas of high biological diversity, uprooting tribes from their traditional habitats. While such initiatives may benefit mainstream society, they disrupt tribal ecologies that are rich in resources and traditional knowledge. Government rehabilitation measures can inadvertently lead to the depletion of natural resources, affecting the production of tribal art forms such as wall paintings, which rely on specific raw materials. Consequently, the availability and demand for these art forms have declined, threatening their continuity. [10] [12]

Approaches to Overcome Challenges

Globalization poses significant threats to tribal art and culture. Several measures can be taken to prevent these art forms from becoming endangered and to ensure their preservation.

Tribal Art and Culture: A Call for Protection and Promotion

- Protecting the inherent beauty, quality, and core ideology of tribal arts is essential.

- Conducting adequate campaigns and publicity to popularize tribal arts.

- Modifying and adapting the presentation of tribal and folk art to meet contemporary recreational and cultural demands.

- Encouraging education about tribal culture and worldviews in schools, colleges, and universities.

- Providing special allowances and incentives to prevent indigenous communities from abandoning traditional occupations.

- Implementing urgent amendments and raising awareness regarding Intellectual Property Rights and patent protections for indigenous communities.

- Developing mechanisms to integrate traditional indigenous knowledge into modern life.

- Enhancing the skills and knowledge of relevant government departments and agencies involved in preservation.

- Expanding government initiatives to provide space and infrastructure for the preservation of tribal artifacts.

- Ensuring artistic freedom, allowing tribal artists to develop their work without compulsion from markets or external agencies.

Conclusion

Tribal art and culture in India represent a rich tapestry of aesthetic expression, traditional knowledge, and social identity. However, these art forms face multiple challenges, including globalization, commercialization, resource depletion, and the pressures of modernization. Protecting and promoting tribal arts requires a multifaceted approach—preserving their inherent beauty and cultural significance, integrating traditional knowledge with modern opportunities, ensuring fair economic support, and fostering awareness through education and public engagement. By implementing strategic measures, including legal protections, market support, and institutional initiatives, it is possible to sustain the vitality of tribal art forms and empower indigenous communities. Ultimately, safeguarding tribal art is not only a cultural imperative but also a means of preserving India's diverse heritage for future generations.

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Analyzing the Effect of Gold Karatage and Alloy Composition with respect to Glass Enamels in Kundan Meena Jewellery Design Manufacturing

Anish K K, Research Scholar | Dr. Gunja Soni, Professor

Faculty of Design and Arts Poornima University, Jaipur, Rajasthan, India

Abstract

The overall quality, durability, and visual appeal of the glass enamels applied during the Meena (enameling) process are significantly affected by the karatage of gold and the aloys used in Kundan Meena jewellery. The way the gold alloy and glass enamel interact can have an impact on the jewellery's final look is based on how effectively the enamel adheres, and how it acts throughout the heating process. This paper examines the impact of gold and alloy composition on glass enamel application in Kundan Meena jewellery, focusing on adhesion, durability, color, and quality, offering insights for optimizing the enameling for better results.

INTRODUCTION

The classic Indian jewellery method known as Kundan Meena blends two separate techniques: Enameling or Meenakari, a process of applying colorful enamel on the metal surface; and Kundan, a process of setting gemstones on gold. Gold jewellery may be adorned with vibrant colors and patterns using the enameling method, also known as Meenakari, which is a complex and extremely skilled technique that produces an appealing contrast with the precious gemstones [1]. A brief description of the enameling procedure used in Kundan Meena jewellery is described below:

1. Preparation of Base (Ghat Making and Jadai): Making the components of the Jewellery out of fine gold is the first stage in the Kundan Meena procedure. In order to create the desired design, artisans first shape individual elements of the jewellery item, which can be a necklace, pendant, or earring. Precious gemstones (such diamonds, emeralds, rubies, or pearls) are meticulously placed onto the gold base using the Kundan, before to the enamel application. The stones are then set into the base, the Kundan i.e pure form of thin strips of gold is pressed around them that creates a bezel to securely hold the gemstone.

2. Preparation of surface for enameling process (Meenakari): After finishing the kundan setting the surface of the jewellery is prepared for enameling. In order to remove dust, oil, or deposits that may cause problems to apply enamel, the surface is filed and cleaned. Enameling or Meenakari Process begins with drawing the motifs and patterns, often floral or geometric, are drawn on the jewellery surface with fine detailing. The sections that need to be enameled are marked out, engraved, and then filled with enamel colors. The design-defined sections are meticulously painted with particular enamel powders, which are mixture of glass, metal oxides, and colors. The colors, which are frequently mixed to produce shading effects, might be vibrant tints of red, green, blue, white, or yellow. The object is heated over a flame or in a furnace after the enamel has been applied. The enamel melts and fuses with the gold during the firing process, producing a smooth and long-lasting surface. To make sure the enamel adheres correctly and doesn't crack, the Jewellery is heated many times [2].

3. Filing and finishing: The product's surface is polished to provide a smooth, glossy finish when the enameling is complete and it has cooled. Additionally, the gold is polished around the enameled sections to emphasize the contrast between the enamel's hue and the valuable metal. In the end, the Jewellery item is cleaned and any finishing touches are applied to improve its overall appearance. This could involve adding more detail, polishing the edges, or refining the Kundan settings to make sure the gemstones are safe and have a brilliant sheen.

   A careful inspection of quality is carried out after the completion of the enameling and polishing processes to ensure that the enamel is applied uniformly, the design is constant, and the gemstones are firmly set.

PRELIMINARIES

In traditional Kundan Meena manufacturing process, understanding the main elements that producing vibrant colors requires knowledge of enameling colors and their chemical compositions. The colors used in Kundan Meena (Meenakari) are usually produced with glass enamels that incorporate different metal oxides and other substances [3]. When combined with the base metal, which is typically gold or silver, these metals and chemicals produce the beautiful, durable hues that define the craft.

TABLE 1. *Enamel color and composition chart*. Kundan Meena Enameling Colors and Their Chemical Composition

Color		Chemical Composition	Common Metal Oxides	Description
Red		Cadmium Sulfide (CdS)	Cadmium oxide (CdO), Sulfur (S)	Deep crimson, with shades varying from deep to dazzling.
Blue		Cobalt Aluminate ($CoAl_2O_4$)	Cobalt oxide (CoO), Aluminum oxide (Al_2O_3)	Rich blue is frequently used to produce deep blues.
Green		Copper (II) Oxide (CuO)	Copper oxide (CuO), sometimes with lead or zinc	Depending on the amount of copper, it can be light to dark green.
Yellow		Lead Tin Yellow (Pb_2SnO_4)	Lead oxide (PbO), Tin oxide (SnO_2)	Vibrant yellow, used to produce effects that resemble gold.
White		Zinc Oxide (ZnO)	Zinc oxide (ZnO)	Pure white enamel is frequently used for highlights or as a base.
Purple		Manganese Phosphate ($Mn_3(PO_4)_2$)	Manganese oxide (MnO), Phosphorus (P)	Manganese is used to create this light to deep purple.
Black		Iron Oxide (Fe_2O_3)	Iron oxide (Fe_2O_3)	For outlines and detail work, deep black is utilized.
Pink		Gold Sulfide (Au_2S_3)	Gold, Sulfur	Gold sulfide is used to give light pink to magenta tints.
Turquoise		Copper Aluminum Silicate ($CuAl_6Si_6O_{18}$)	Copper oxide (CuO), Aluminum oxide (Al_2O_3)	Similar to turquoise stones, it's a light blue-green hue.
Orange		Cadmium Sulfide (CdS) with Zinc Oxide (ZnO)	Cadmium oxide (CdO), Zinc oxide (ZnO)	Orange hues that are warm and vibrant.
Brown		Iron Chromite ($FeCr_2O_4$)	Iron oxide (Fe_2O_3), Chromium oxide (Cr_2O_3)	Deeper, more subdued hues are frequently achieved with earthy brown tones.
Ivory		Calcium Phosphate ($Ca_3(PO_4)_2$)	Calcium oxide (CaO), Phosphate (PO_4)	Light off-white, used frequently for intricate or background areas.
Golden Yellow		Cadmium Sulfide with Lead Oxide (PbO, CdS)	Cadmium oxide (CdO), Lead oxide (PbO)	Often applied in Kundan settings, this deep yellow color has a metallic luster.
Turquoise Green		Copper Silicate ($Cu_5Si_4O_{16}$)	Copper oxide (CuO), Silica (SiO_2)	A vibrant color of light greenish-blue that is similar to turquoise stones.

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Chemical Composition

TABLE 2. *Chemical composition chart*. Kundan Meena Enamel's Chemical Composition

Cadmium Sulfide (CdS):	Frequently used to make enamels that are orange, yellow, and red. To get the right hue, it needs to be carefully controlled because it is sensitive to the firing temperature.
Calcium Phosphate ($Ca_3(PO_4)_2$):	Calcium phosphate is the primary component for ivory and cream tints, resulting soft and light tones for intricate work.
Cobalt Aluminate ($CoAl_2O_4$):	the cause of the blue hue of enamel. Cobalt is a strong coloring ingredient that gives enamel rich, deep blue tones.
Copper Aluminum Silicate ($CuAl_6Si_6O_{18}$):	Copper and aluminum silicate are frequently used to produce turquoise hues that resemble turquoise gemstones.
Copper Oxide (CuO):	used to produce shades of green. Depending on the proportion of copper to other ingredients in the mixture, copper oxides can have a light green to dark green color.
Gold Sulfide (Au_2S_3):	Gold sulfide is frequently used to create pink and magenta hues, which give enamel a soft and gentle hue.
Iron Oxide (Fe_2O_3):	Iron oxide, which produces a rich, dark hue utilized for outlines or detail work in Kundan Meena, is frequently used to make black enamel.
Lead Tin Yellow (Pb_2SnO_4):	Lead and tin oxide are both need for this vivid yellow color. Is one of the most popular shades of yellow in Kundan Meena.
Manganese Phosphate ($Mn_3(PO_4)_2$):	The purple hues utilized in Meenakari are caused by this chemical. These purple colors are the result of a reaction between manganese oxide and phosphate.
Zinc Oxide (ZnO):	Zinc oxide is frequently used to create white enamel as it offers an opaque base and complements with vibrant colors as well.

Often used over intricate patterns, these colored enamels are applied on the base of gold or silver. In order to show vibrant, rich colors, the enamel is layered over the metal, fired in a furnace to melt and fuse the glass, and then polished.

Kundan Meena's artwork is well known for its vibrant, glowing colors, which are produced by using particular metal oxides and meticulous temperature control.

Analyzing the effect of enameling on 24k vs 22k vs 20k vs 18k vs 16k

The purity of the gold and the composition of the alloy will affect the behavior of the enamel, adherence, durability, and overall finish when comparing enameling outcomes on various karatages of gold (24K, 22K, 20K, 18K, and 16K) [4]. While using techniques like Meenakari or Champlevé, the unique characteristics of each karat of gold influence how it interacts with glass enamels.

Factors Affected by Gold Karatage in Enameling:

1. Adhesion and Surface Smoothness

24K Gold (Pure Gold)	22K Gold	20K Gold	18K Gold	16K Gold
The purest type of gold is 24K, and its surface is exceptionally smooth. Its smoothness makes it a great choice for Meenakari since, when prepared properly, enamel adheres to it nicely. Because it is pure, the enamel's ability to adhere is unaffected by other metals like copper or silver. Bonding the enamel without extra preparation (such putting a flux layer) can occasionally be difficult, though, because 24K gold is non-porous and lacks the roughness of alloys made of other metals.	A mixture of copper and silver (or occasionally zinc) makes up the remaining composition of 22K gold, which has 91.6% pure gold. The surface is significantly more rough than 24K gold due to these extra metals, which improves enamel adhesion. Considering that copper has a somewhat rougher texture than 24K, the inclusion of copper to the alloy helps to improve the enamel's binding.	The composition of 20K gold is composed of copper, silver, and other metals, with 83.3% pure gold. The surface is further roughened by the higher copper concentration, which creates a great foundation for enamel adherence. Compared to 22K gold, this alloy provides superior enamel adherence, particularly for intricate Meenakari motifs.	Seventy-five percent of 18K gold is pure gold; the rest is copper, silver, and sometimes nickel. The surface of this gold is notably rougher than that of golds with higher purity. It is not as efficient as 22K or 20K gold, but it still provides fair enamel adhesion.	There is only 66.6% pure gold in 16K gold; the rest is made up of a higher proportion of copper, silver, and maybe nickel. Because of its considerably rougher surface, this gold works well for improving enamel adherence but is not ideal for making intricate, fine-grained designs.

2. Compatibility for thermal expansion

24K Gold (Pure Gold)	22K Gold	20K Gold	18K Gold	16K Gold
Because of its comparatively modest rate of thermal expansion, pure gold can be fired with glass enamels. It lowers the chance of peeling or cracking since it expands and contracts with heat at a rate similar to that of enamel [5].	Compared to 24K gold, 22K gold has a little higher rate of thermal expansion due to its copper and silver component [6]. It still falls within a range that is suitable with glass enamel, though. Enamel has a higher chance of peeling or breaking than 24K gold, but it is still comparatively low.	Compared to 22K and 24K gold, 20K gold has a higher thermal expansion rate due to to the higher copper content in the alloy. This can somewhat raise the chance of enamel delamination or cracking during the firing process.	An increased thermal expansion rate caused by the addition of nickel or copper to the alloy may enhance the possibility of enamel cracking during firing [6]. Compared to purer gold alloys, the variation in expansion rates between the enamel and the gold is more noticeable with 18K.	Because 16K gold contains more copper, its thermal expansion rate is significantly higher, increasing the possibility of enamel cracking during burning. Because of this, enameling on 16K gold is difficult.

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3. Brightness and Appearance of Color

24K Gold (Pure Gold)	22K Gold	20K Gold	18K Gold	16K Gold
The warm, rich yellow tone of 24K gold goes well with vibrant enamel hues like reds, blues, and greens. The underlying gold does not affect the enamel colors, and the finish is usually glossy and shining.	Compared to 24K gold, 22K gold has a somewhat less vibrant yellow hue, but it still has a rich, warm tone. Because of the little alloying, the enamel color on 22K gold may appear a little less vibrant, but it still makes for a beautiful contrast.	Compared to 22K gold, 20K gold has a darker yellow tone, which could make the enamel appear a little duller. The enamel's vivid colors might not seem as brilliant as they would on 24K or 22K gold, but the overall effect can still be beautiful.	Compared to 22K or 24K gold, 18K gold has a softer, more muted yellow tint, which could make enamel's brilliance seem less vibrant. There is less of a contrast between the enamel and gold hues.	The pale yellow hue of 16K gold makes it challenging to create a striking contrast with enamel hues. The enamel may seem less vivid, particularly in lighter hues.

4. Durability as well as wearability

24K Gold (Pure Gold)	22K Gold	20K Gold	18K Gold	16K Gold
Comparing 24K gold to alloys like 22K or 18K, it is softer and more prone to scratches and dents. However, enameling helps to protect the surface, and it keeps its purity and shine for a long time.	The inclusion of copper and silver makes 22K gold stronger than 24K gold. Because of its greater strength, it is more resistant to deformation and scratches than 24K gold, which makes it an excellent option for worn for wearable jewellery.	Compared to 22K or 24K gold, 20K gold is stronger and more resilient, making it less likely to bend or scratch. It is an excellent option for Jewellery that will be worn regularly.	Compared to 22K, 20K, and 24K gold, 18K gold is much harder and more resilient, which makes it perfect for everyday use. It is more resistant to dents and scratches due to the higher alloy content.	Because 16K gold is tougher than 18K, 20K, and 22K gold, it is more resilient to wear and more long-lasting. However, compared to higher karat golds, it is less valued due to its comparatively low gold content.

5. Ease of Workability and Malleability

24K Gold (Pure Gold)	22K Gold	20K Gold	18K Gold	16K Gold
Since 24K gold is ductile and malleable, it can be easily shaped into delicate, detailed layouts. Craftsmen can deal with pure gold more easily because of its flexibility, which is crucial for producing intricate Meenakari artwork.	The presence of additional metals makes 22K gold less malleable than 24K gold. It can support more detailed enameling without deforming, though, and is still relatively easy to work with while creating complex designs.	20K gold is harder and less pliable than 22K or 24K gold, working with it for elaborate designs can be slightly more difficult. It is still possible to shape it to fit intricate enameling work, though.	Intricate Meenakari designs are more challenging to form and work with since 18K gold is harder and less pliable than higher karatages. Although it can tolerate heat better, the Jewellery piece may be more difficult to work with during making due to its harder texture.	Working with intricate patterns is more challenging with 16K gold since it is more harder and less pliable.

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This chart examines the enameling results on 24K, 22K, 20K, 18K, and 16K gold and analyzes the main elements that affect enameling quality, such as workability, durability, color brightness, compatibility with thermal expansion, and adhesion.

TABLE 3. *Enameling result on Gold Karatage*. Analyzing result on Gold Karatage that Affects Enameling Quality

Factor	24K Gold	22K Gold	20K Gold	18K Gold	16K Gold
Gold Content	99.9% pure gold	91.6% pure gold	83.3% pure gold	75% pure gold	66.7% pure gold
Enamel Adhesion	Excellent	Very Good	Good	Fair	Poor to Fair
Thermal Expansion Compatibility	Excellent	Very Good	Good	Fair	Poor
Color Brightness & Appearance	High	High	Moderate	Moderate	Low to Moderate
Durability & Wearability	Low	Medium	Medium	High	Very High
Workability (Malleability)	Very High	High	Good	Fair	Low to Fair
Risk of Tarnishing	Low (due to high purity)	Medium (slightly alloyed)	Medium (more alloyed)	Higher (more alloyed)	High (due to high alloy content)

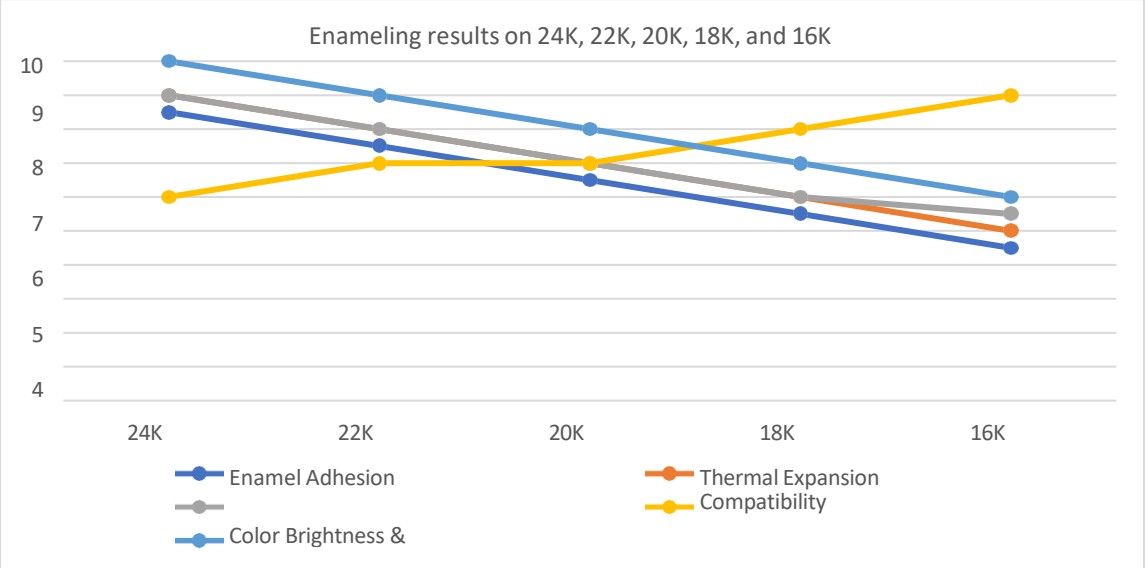

FIGURE 1. Analyzing result on Gold Karatage that Affects Enameling Quality

CONCLUSION

In conclusion, 24-karat gold has exceptional thermal compatibility, is highly resistant to oxidation, offers a rich aesthetic that enhances the brilliance of the enamel colors, and makes the ideal surface for the enamel to adhere onto, it is considered to be the best for Kundan Enameling. Enameling i.e. Meenakari can be used in a variety of intricate and complex techniques due to its malleability. Despite being softer and more prone to deterioration over time, pure gold is the gold standard in traditional enamel work due to its beauty, durability, and cultural significance. Regarding the peculiar characteristics of the process, which involves adding glass enamel to the surface of gold Jewellery prior to it being fired at high temperatures, 24K gold (pure gold) is regarded as the best material for enameling for a variety of reasons. Considering enamel adhesion, due to its smooth surface and high purity, 24K gold has excellent adhesion. Enamel therefore sticks to surfaces well, making it ideal for enameling. As the gold concentration decreases (from 22K to 16K), adhesion decreases. Enamel adhesion may be hindered by the presence of various alloyed metals (such copper, silver, or zinc) in lower karat gold.

In terms of thermal expansion compatibility, 24K gold has a high thermal expansion compatibility with enamels, which reduces the possibility of chipping or breaking. It expands and contracts with enamels during firing. Due to less ideal thermal compatibility brought on by the presence of various alloy metals with different rates of thermal expansion as the gold percentage decreases, enamel is more prone to break at lower karats. Comparing color brightness & appearance, 24K gold creates the richest and brightest hues, especially for vibrant reds, blues, and greens, without affecting the enamel's color quality. Lower karat gold (such as 22K, 20K, and 18K) may appear relatively dull when alloys are added. This might reduce the brilliance of the enamels, particularly if the colors are more transparent or lighter. 16K gold may result in even duller enamel colors because of the significant impact that a higher alloy percentage has on color appearance.

Evaluating durability & wearability, 24K gold is not as durable for everyday usage and is brittle and easily scratched. Its softness may weaken the enamel's resistance to scratches and other damage. As the karat decreases, the gold becomes harder and more durable, especially in 18K and 16K gold, which are more resistant to dents and scratches and are therefore better suitable

for Jewellery intended for daily use. Although 16K gold is the most durable metal, it may not stick to enamel well due to its high alloy percentage. In terms of malleability & workability of gold, the most pliable and malleable metal is 24K gold, which allows artisans to create delicate designs and accurate enamel work. 16K gold is the most difficult to work with because of its high alloy proportion; as karat decreases, workability decreases.

Considering the factor of tarnishing, 24K gold doesn't tarnish since it is so pure. Since 16K gold contains the highest proportion of non-gold metals (such copper and silver), it is more susceptible to tarnish over time. The likelihood of tarnishing rises as karat decreases and alloying increases. Because 24K gold is the most flexible and malleable metal, jewelers can create intricate patterns and precise enamel work. Because of its high alloy percentage, 16K gold is the hardest to deal with, and its workability decreases with karat.

Summary of Results

TABLE 4. *Summary of Result of Gold Karatage*. Analyzing the result of 24K, 22K, 20K, 18K and 16K

24K Gold	22K Gold	20K Gold	18K Gold	16K Gold
Ideal for intricate designs requiring vibrant enamels and high-quality finishes, but less suitable for high-durability pieces due to softness	Slightly less durable than 24K, but still suitable for exquisite Jewellery with beautiful enamels.	Reasonably good, however compared to higher karat gold, it has less adherence and somewhat less vibrant colors.	More durable for daily use, but because there is less gold in it, color brilliance decreases.	Ideal for long-lasting, useful patterns, however the high percentage of alloys may degrade enamel quality and adherence.

24K gold is perfect for creating intricate and vibrant Kundan Meena designs, whilst 16K gold works best for durable, practical objects that don't need strong color brilliance or delicate enamel work. The karat should be selected based on how durability and aesthetic quality are to be balanced. For this reason, Meenakari ornaments are best made with 24-karat gold.

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Fast Fashion and Personal Identity: An Analysis of the Interplay between Clothing, Choices, Personality, and Sustainability in the Era of Fast Fashion

Megha Shisodiya[1], Manjari Varma[2], Prem Kumar[3]
School of Design, MRIIRS

Abstract: Fashion is a primary medium of self-expression, conveying identity, mood, and values. However, the explosive expansion of fast fashion—projected to hit $317.98 billion by 2032—raises essential environmental and social issues. The industry accounts for almost 10% of worldwide carbon emissions, as textile manufacturing has doubled since 2000. This research considers the conflict between identity-based clothing decisions and sustainable consumption in a time of intensifying trend cycles. The findings demonstrate an imbalance between consumer intent and action, with affordability and online convenience perpetuating fast fashion consumption over environmental issues. It also analyzes cultural and technological impacts, the impact of AI in fashion marketing, and new European regulations. It concludes that real change needs policy intervention, creative solutions, and reconstituted relationships between clothing and identity.

Keywords: Fast Fashion, Personal Identity, Sustainability, Clothing Choices, Personality, Fashion Consumption, Consumer behavior, Environmental Impact.

Introduction: Fast fashion, identity, and sustainability are more intertwined with each other in today's life. Fashion has evolved beyond comfort and beauty to a strong medium for expressing oneself and creating identity. The global fast fashion market, worth $148.23 billion in 2024, is expected to grow to $317.98 billion by the year 2032 ("Fast Fashion Market Size, Share, Trends"), indicating increased demand and fashion as a driver of individuality and social affiliation.

Unlike old-fashioned fashion cycles, which used to take months to roll out new collections, fast fashion companies today put out products in just days. Shein, for example, posts almost 6,000 new products every day (Long), radically shifting consumer behavior and attitudes toward clothing. Yet this explosive growth comes with great environmental costs. Fashion contributes almost 10% of the world's carbon emissions (Maiti)—higher than the sum of all international flights and sea shipping. Every second, a load of textiles is incinerated or sent to landfills, and as laundry is washed, approximately 500,000 tons of microfibers are released into oceans every year, equivalent to 50 billion plastic bottles (Geneva Environment Network).

Fashion's increasing connection to personal identity, fueled by social media (Daizy), complicates this issue in particular. Although consumers voice concern for the environment, price and ease push them to fast fashion—a mismatch termed the "attitude–behavior gap." Bridging this gap is key to bringing about meaningful change.

To examine this issue, current literature regarding fast fashion, sustainability, and consumer behavior was examined. Findings from peer-reviewed research and reports clarified persistent themes and knowledge gaps, informing research direction. This research examines the way that fast fashion overlaps with identity, behavior, and sustainability and why consumers persist with unsustainable behaviors in spite of awareness. The research also looks at recent policy interventions like the EU's sustainable textiles plan and France's anti–fast fashion legislation to situate the necessity for systemic responses.

Environmental Impact: The True Cost of Fast Fashion: The ecological destruction wrought by the fashion sector is today very well known, as recent research points to its magnitude. Production of textiles has almost doubled since the year 2000 and rose from 58 million tonnes in 2000 to 116 million tonnes in 2022 and may reach 147 million tonnes by 2030 if trends persist ("Materials Market Report 2023"). Water usage is among the biggest issues of the industry. Fashion is the second-largest consumer of water in the world, with one cotton t-shirt taking around 2,700 liters—the quantity an individual consumes in two and a half years (European Parliament). Dyeing and finishing operations additionally put pressure on water resources and emit harmful chemicals into rivers that tend to serve local populations (European Parliament).

Microplastic contamination has also become a cause for concern. More than 430 million tonnes of plastic are manufactured annually, most of which is used once and disintegrates into microplastics (Kumar). Microplastics have been found in human lungs, blood, and even breast milk and have been associated with diseases like cancer, respiratory disorders, and cardiovascular ailments (Kumar).Garment waste makes the issue worse: fewer than 1% of disposed-of clothes are used to make new fabric, whereas some 85% get incinerated or sent to landfills (Geneva Environment Network). Combined, these concerns indicate how rapidly fashion consumes water, contaminates ecosystems, and proliferates toxic microplastics, not only threatening the environment but human health as well. Fashion, in other words, needs to be recognized no longer simply as an issue of taste but one of environmental stewardship.

Psychology of Clothing and Identity Construction: Fashion is central to identity and self-presentation. Russell W. (Belk 1988) proposed the concept of the "extended self,"

whereby items like clothing are incorporated into who we are, expressing and constituting our social roles. By the same token, Adam and Galinsky's "unclothed cognition" reveals clothing can affect thought and action, as observed when participants accomplished tasks better with lab coats representing attentiveness—provided they felt that symbolism (Singhal).

With social media sites such as Instagram and TikTok, fashion has been more broadly democratized, providing people with new means of self-presentation. But this exposure also brings with it the pressure to keep up with rapidly shifting trends, usually making it challenging to distinguish between genuine self-expression and social conformity.

Therefore, fashion today transcends functionality or beauty—it is a vehicle of identity governed by internal desires as well as outside forces.

Consumer Behaviour and the Attitude-Behaviour Gap: One of the major challenges of contemporary fashion is the "attitude–behaviour gap," where customers voice environmental concerns but still buy unsustainable garments (Tetik and Cherradi). For example, a Philippine study established that 86% of youth consumed fast fashion despite realizing its negative impacts (Picazo). Affordability, convenience, and style usually trump environmental considerations when making a purchase. Social media also expands the gap. Instagram and TikTok facilitate fast fashion cycles and impulse purchases, with which consumers are urged to indulge in what researchers describe as "digital fashion pressure" (Ahmad and Decombe). Pressure to present novel online outfits discourages sustainable decision-making.

The gap indicates that mere awareness will not be enough to bring about change. Actual progress is necessary through understanding the drivers of consumer behavior and devising systemic solutions that make sustainable fashion both more desirable and more convenient.

Market Dynamics and Industry Growth: Even though more people are becoming aware of environmental issues and some governments are setting stricter rules, the fast fashion industry is still growing fast. According to reports, the market is expected to rise from $141.23 billion in 2024 to $163.21 billion by 2025, which means it’s growing at a steady rate of 15.6% each year (Research and Markets Ltd.). This kind of growth shows why fast fashion remains so common, even when people know it causes harm to the environment. A big reason behind this is how the industry is using new technology. Many companies have started using tools like virtual reality, augmented reality, and artificial intelligence to design clothes and improve customer experience (Research and Markets Ltd.). These changes might also help solve some environmental problems, although the main goal seems to be faster and more appealing production.

On the other hand, sustainable fashion, even though it's smaller in size, is growing quickly too. In 2024, it was worth around $8.1 billion, and it's expected to grow to $33.1 billion by 2033, with an annual growth rate of 22.9% (Customer Market Insights). This growth seems to be driven by people who are more aware of environmental issues and by stricter government rules that push brands to be more responsible.

Policy Responses and Regulatory Frameworks: Governments around the world are now taking stronger steps to make the fashion industry more sustainable. What used to be mostly voluntary actions by brands is changing into rules that companies have to follow. These new laws are affecting how the industry works, especially when it comes to cutting down environmental damage and making sure workers are treated better.

The European Union is leading the way with its Strategy for Sustainable and Circular Textiles, introduced in 2022 (European Commission). This plan aims that by 2030, all clothes sold in the EU should last longer, be recyclable, mostly made from recycled materials, free from harmful chemicals, and made in ways that are good for both people and the planet ("Legislative Train Schedule"). In March 2024, the French National Assembly also passed strong laws to stop ultra-fast fashion (Sarracco). The law allows the government to decide what is counted as fast fashion on the basis of how many clothing items a company makes each year. Companies that make too many new products can face fines, while those who follow sustainable practices earn rewards. These policies show that sustainability is no longer just a nice idea or a marketing tool, but a legal and moral responsibility.

Emerging Research Directions

a). Technology and Consumer Behaviour Integration

AI and machine learning are starting to change how people shop, especially in fashion, but their full impact is still being studied. These tools can help brands cut waste by predicting demand and improving production. At the same time, they also enable highly personalized marketing, which often leads to more buying. One report shows that 73% of consumers want brands to understand their preferences. This has led to AI-driven recommendations, increasing repeat purchases by up to 56% (Team, SGA Knowledge). While such tools may improve efficiency, they also risk encouraging overconsumption.

The challenge now is using AI in ways that support sustainability, without pushing people to buy more than they need.

b). Cross-Cultural Perspectives on Sustainable Fashion

Cross-cultural research reveals significant variations in how different societies approach the relationship between clothing, identity, and sustainability (khan et al.). Studies comparing consumer behavior across countries demonstrate that cultural dimensions such as collectivism and long-term orientation significantly influence sustainable fashion consumption patterns. One study comparing Italian and Russian consumers found that Italians are more likely to buy sustainable fashion due to strong group values, while Russian consumers are influenced by future-focused thinking. This suggests that sustainability efforts should be adjusted to fit specific cultural contexts (Khan et al.).

Global surveys from 2025 also point to clear regional trends in sustainable fashion. In France, about 44.9% of consumers reported buying eco-friendly clothing within the year, helping the country reach a market share of 23.1% in 2024 (Global Market Insights, 2025). This growth is driven by increasing eco-consciousness and demand for transparency and durability in apparel (Global Market Insights, 2025). Meanwhile, the Asia Pacific region is rapidly expanding its sustainable fashion market, supported by greener manufacturing practices and ambitious sustainability goals, especially in countries like China and India (Global Market Insights, 2025). These regional variations underscore the complex and diverse landscape of sustainable fashion adoption worldwide.

c). Long-term Behavioral Change Strategies

One recent research shows that solving the problem of unsustainable fashion habits takes more than just making people aware of the environmental damage caused by the industry (Sustainability Directory). Although awareness is important, studies have found that the most effective way to guide consumers toward better choices is by actually offering sustainable options. People are more likely to change what they buy when those options are visible and easy to access. At the same time, providing information and reinforcing social norms around sustainability still play a useful supporting role (Sustainability Directory). Education efforts should not only highlight environmental issues but also explain social impacts and offer practical ways to make better choices.

Conclusion:

This study shows that fast fashion is much more than just a way to follow trends—it's deeply connected to how people express who they are. While many want to make sustainable choices, the reality is that affordability, convenience, and social pressures often lead them back to fast fashion. The gap between what people believe and what they do remains a big

challenge. At the same time, we see promising signs that governments and industries are starting to take responsibility, especially through new laws and technology that encourage better practices. But real progress will only happen if these efforts are matched by changes in culture and consumer habits. Understanding the emotional and social reasons behind clothing choices is key to closing the gap between values and actions. If we want a more sustainable fashion future, it's not enough to just raise awareness. We need to offer people practical options, support from policies, and a shift in how we think about fashion as part of our identity.Ultimately, this research highlights that creating lasting change requires everyone—consumers, brands, and policymakers—to work together. By recognizing the complex reasons behind our fashion choices, we can move toward a system that respects both people and the planet.

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