

# CROSS-CULTURAL DESIGN INNOVATION THROUGH TECHNOLOGY AND CREATIVITY.

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**ABSTRACT** | Over the past 15 years, a research collaboration has been established between several universities within the Latin Design Network as a Process, involving numerous academic exchanges and participation in international forums on topics such as design, biodiversity, territory, and emergencies. This collaboration culminated in the eighth forum in Bologna in 2022, focusing on “Disrupting Geographies in the Design World.” The project explores innovation at the intersection of design, technology, and traditional craft across Colombia, Brazil, and Italy. Its primary aim is to bridge cultural gaps by incorporating modern technology to breathe new life into traditional art forms, focusing on transformative design practices and cross-border collaboration.

The project reflects the evolution of co-design from user-centered methodologies to co-creation, showing how contemporary technologies such as artificial intelligence, data visualization, and biocreativity can redefine traditional craftsmanship and educational practices. Designers act as mediators between knowledge, emphasizing interdisciplinary contamination to add complexity and developing collaborative and cross-disciplinary skills that foster creative innovation based on cultural diversity.

Through “Design Experience” modules, participants gain hands-on experience with innovative tools and methodologies. These workshops explore the potential of these technologies to enhance traditional crafts and foster new modes of artistic expression. The use of AI allows for unprecedented levels of data-driven creativity, while bio-creativity emphasizes sustainability through circular and local materials.

The outcomes of the workshops indicate a broader potential for AI and technology to reshape design and art fields, fostering unique design practices and creative exploration. The project emphasizes cross-cultural collaboration, uniting students, researchers, and artisans from different countries in shared learning and experimentation, leading to a comprehensive understanding of traditional crafts and innovative design processes.

**KEYWORDS | CROSS-CULTURAL DESIGN, AI DESIGN, TECHNOLOGY, INNOVATION, TRADITIONAL CRAFT**



## 1. Introduction

Over the past fifteen years, a partnership between the research team Advanced Design Unit of the University of Bologna and the Universidad Nacional de Colombia and University of Vale do Rio dos Sinos in Brazil has been consolidated through the Latin Network of Design as Process. This partnership has generated a shared research reflection, characterised by a strong link with the local territorial capital. This territorial capital is defined as a systemic set of material and immaterial factors and resources, including communities, entrepreneurs, landscapes, innovation capacity, traditions, technologies, infrastructures and skills.

For example, the network, through forums such as “Disrupting Geographies in the Design World” (<https://www.forumdesignprocess.org/dgdw22/>), has opened the space for design communities to share design perspectives and transitions, to imagine and create the future of design in accordance with the cultural diversity that characterizes communities around the world.

From this reasoning, a shared reflection has developed in recent years focused on the need to understand how new technologies can support design skills, promoting and enhancing local knowledge with a future vision. The research led to the collaboration of universities in the project “Frontier Design Innovation and traditional craft”: an exploration, in the form of an educational format of a workshop and multidisciplinary nature, of the potential of the innovation process at the intersection of design, technology and traditional craftsmanship applied in Colombia, Brazil and Italy.

The exploration took the form of an international workshop, held between February and July 2023 in Italy and Colombia. The objective was to bridge cultural divides by incorporating technology to breathe new life into traditional art forms. Furthermore, the aim was to explore the potential of these technologies to improve traditional crafts in the three countries and promote new modes of artistic expression and design. In this process, we saw the integration of, on the

one hand, artificial intelligence as enabling unprecedented levels of data-driven creativity, and on the other, biocreativity to emphasise the importance of sustainability using circular and local materials.

The paper aims to reflect on the potential of artificial intelligence technologies through a critical analysis of the results that emerged from the workshop in order to identify which transformative design practices emerge through an approach based on cross-border collaboration. After an indepth review of the literature with respect to the evolution of co-design practices in processes of interdisciplinary contamination and characterised by design cultural diversity, the article presents the methodology applied in the workshop and analyses the results in a punctual manner, highlighting useful design directions to outline design practices, implications and challenges of the introduction of artificial intelligence technologies to reshape the design and the arts fields.

## 2. Literature review

### 2.1 Co-design evolution

The evolution of co-design reflects a shift from user-centered methodologies to co-creation. Over the years, co-design has incorporated various theories and models, such as design thinking and the user-centered design approach. This has led to a greater emphasis on collaboration and participatory innovation (Brown, 2008; Sanders & Stappers, 2014).

Recently, co-design has seen greater integration with digital technologies and expansion into sectors such as healthcare, education, and urban development. Sustainability and inclusivity have become central themes, with particular attention to the participation of marginalized communities (Bason, 2010; Björgvinsson, Ehn & Hillgren, 2012). As an approach that involves stakeholders in the design process, it fosters listening and responsive interactions between stakeholders and the design team, ensuring outcomes in line with community needs (Interaction Design Foundation - IxDF, 2023).

Co-design practices include collaborative workshops, brainstorming sessions, rapid prototyping, and the use of digital tools to facilitate remote collaboration. These methodologies have evolved to adapt to different contexts, such as the design of services, products, and public policies (Steen, Manschot & De Koning, 2011).

This evolution demonstrates how the integration of contemporary technologies, such as artificial intelligence, data visualization, and bio-creativity, can redefine traditional craftsmanship and educational practices (Davis et al., 2021; Light et al., 2022; Sanders & Stappers, 2008, Singh et al., 2018).

The evolution of co-design reflects a growing awareness of the importance of collaboration and user participation in the design process. Co-design practices and methodologies will continue to evolve, influenced by new technologies and the emerging needs of society.

## **2.2 Interdisciplinary Contamination: Importance of cross-disciplinary skills and cultural diversity in design**

Interdisciplinary contamination emphasizes the importance of cross-disciplinary skills and cultural diversity in design. It involves the blending of knowledge from various disciplines to foster innovation and creativity. This approach is particularly valuable in design, where different perspectives can lead to more comprehensive and innovative solutions. The literature highlights several successful examples of interdisciplinary contamination, where the integration of diverse skills and cultural insights has led to groundbreaking design solutions (Augsburg, 2014). Thompson (2014) raises the concept as a possibility to transcend from reliable scientific knowledge to socially robust knowledge, through alliances between different stakeholders.

The paper aims to address precisely how new technologies can help implement cross-cultural processes in order to practise inclusive non-discriminatory analyses.

## **2.3 Technology in Design: overview of AI in enhancing traditional craftsmanship**

The integration of Artificial Intelligence (AI) into traditional craftsmanship represents a transformative intersection between advanced technology and age-old artisanal techniques (Eglash et al., 2020). This fusion not only preserves but also enhances the unique characteristics of handmade goods, providing a contemporary edge while maintaining cultural authenticity. In recent years, AI has been leveraged across various facets of design and craftsmanship, from initial conceptualization to the final production stages.

Applications of AI in traditional craftsmanship ranges from the realm of design optimization for functionality and aesthetics (Wang et al., 2024) to the customization process, making personalized craftsmanship more accessible (Deng et al., 2024), passing through the preservation and documentation of traditional skills and knowledge (Ghaith et al., 2024).

Hence, the incorporation of AI into traditional craftsmanship is not about replacing human artisans but augmenting their capabilities (Buš, 2024). It offers a bridge between the past and the future, ensuring that the essence of craftsmanship is preserved while embracing the efficiencies and possibilities of modern technology (Garvin et al, 2023).

As AI continues to evolve, its role in the craftsmanship sector is likely to expand, offering new tools and techniques that further enhance the artistry and precision of handmade goods.

### 3. Methodology

The project's methodology was developed through three main phases: Design Modules, Cultural Probes and context mapping, and Technological Integration. Each phase was designed to maximize participation and interaction between Italian and Colombian students, fostering an environment of co-design and mutual learning.

The Design Modules were conducted before the trip to Colombia, during a series of initial workshops designed to prepare participants and select the best projects for the next phase. The structure of the Design Modules included:

- Workshop Structure: Each day was divided into theoretical and practical sessions, with specific objectives for each session. The theoretical sessions included lectures on key co-design concepts, artificial intelligence techniques applied to design, and prototyping methodologies. The practical sessions allowed students to apply this knowledge by developing concrete projects;
- Participants: Italian and Colombian students were divided into mixed groups to promote intercultural collaboration. Each group worked on a specific project, using

a combination of digital and analog tools, such as interactive whiteboards, design software, rapid prototyping materials, and brainstorming kits;

- Winner Selection: At the end of the Design Modules, a panel of experts evaluated the projects developed by the students. Evaluation criteria included innovation, feasibility, technology integration, and social impact potential. The project evaluation was conducted by averaging the individual assessments provided by the professors and lecturers, ensuring a balanced and comprehensive review of the participants' work.
- The best projects were selected, and the respective teams had the opportunity to participate in the next phase in Colombia.

#### 3.1 Cultural Probes and context mapping

An important component of our methodology was the implementation of Cultural Probes and context mapping. This phase was conducted directly in the field in Colombia and included:

- Data Collection: Using surveys, interviews, and direct observations to collect qualitative and quantitative data on local practices and stakeholders' perceptions. Use of field guides (see Figure 1) in order to record gestures, smells, sounds, tastes and scenes at some points along the route;

- Context Mapping: Site visits and immersive experiences in cultural identity locations and with local artisans, to gain an in-depth understanding of the local cultural and artisanal dynamics. A route was established in the context by places associated with these dynamics with the use of Google Maps;
- AI Analysis: The collected data were analyzed using artificial intelligence tools. A database was built from a Google Forms survey where responses were entered based on field guides. AI was fundamental in processing a large amount of data and conducting research, eliminating biases from co-designing between two different cultures. Additionally, AI helped break down linguistic and creative barriers, thus improving the quality and effectiveness of the co-design process.

**Tales of the past**  
(La linterna)



**WATCH**

**Trigger questions**

What scenes draw your attention to this place?  
 Of those scenes, identify what you think are the main colors?  
 Describe some of those scenes in your own words?  
 How do you perceive light in these places or scenes?  
 Describe the lighting of the scenes or places that attract your attention?  
 Are these scenes similar to other known ones?  
 Identify recurring shapes in the scenes?  
 Identify recurring scenes?

**Devices for capture**

Photograph  
Videos

What scenes draw your attention to this place?

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Of those scenes, identify what you think are the main colors?

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Describe some of those scenes in your own words?

--	--	--

Use these spaces to answer the others questions

Time _____	Time _____	Time _____

Frontier Design Innovation and Traditional Craft

Figure 1. Observation sheet “Tales of the Past” used to collect visual data during the project. Participants respond to trigger questions about scenes that draw their attention, identify main colors, describe lighting and recurring shapes, and note similarities to other known scenes. Responses are recorded in designated spaces to capture visual and narrative characteristics of the observed location. Devices used for capture include photographs and videos.

### 3.2 The integration of technologies

The integration of technologies, particularly artificial intelligence, was crucial for our project. The main aspects of this phase included:

- **AI Integration:** Implementing AI tools to support data-driven creativity, facilitating idea generation, prototyping, and concept evaluation. AI played a key role in breaking down linguistic and creative barriers, enabling smoother collaboration between participants from different cultures. Moreover, Data collected in various languages were provided as input to a Large Language Model, which democratized access to the information. This allowed all participants, regardless of their spoken language, to have a uniform knowledge base, enabling deeper engagement and idea exchange;
- **Use of Digital Technologies:** In addition to AI, other technologies such as data visualization and bio-creativity were used, allowing for the exploration of new forms of sustainable craftsmanship and design;
- **Remote Collaboration:** Using digital tools such as video conferencing platforms and online collaborative tools to facilitate continuous communication and collaboration among participants, even after the in-person workshop concluded.

The adopted methodological approach allowed us to achieve significant results in terms of innovation and intercultural collaboration. The integration of

contemporary technologies demonstrated the potential to redefine traditional practices and promote new forms of artistic and design expression. Reflecting on the outcomes of the workshops, we were able to identify transformative design practices that develop through a cross-border collaborative approach.

### 3.3 Generative Reasoning and Systemic Mapping in Cross-Cultural Design Innovation

Systemic mapping is a valuable tool in the analysis and development of complex design projects, especially those involving cross-cultural collaboration. The systemic map created during our project (see Figure 2) illustrates the intricate relationships between various elements of traditional craftsmanship and modern technology. This map served as a generative tool, merging AI-driven analysis with group creativity to drive innovation and deeper understanding in our cross-cultural design workshops.

Systemic mapping facilitated the identification of connections between cultural elements and modern design practices, highlighting potential areas of innovation. The visual nature of the map helped bridge language and cultural barriers, making it easier for participants from different backgrounds to contribute equally. By visualizing the design ecosystem, participants could see new possibilities and intersections that were not immediately obvious.

The systemic map created in our project is a rich tapestry of post-it notes and images, each representing a critical component of the design process. Various traditional crafts and local practices were mapped to show their relevance and potential for modernization. Points where AI and other technologies could enhance or preserve traditional methods were highlighted, and central points where cross-cultural interactions were most effective were identified, showcasing successful collaboration.

Post-analysis of the systemic map involved several steps: gathering qualitative data from participants' experiences and insights during the workshops, using AI tools to identify patterns and recurring themes in the data collected, and generating new design concepts based on the identified patterns. This integration of AI analysis and group creativity yielded significant insights and innovations, such as hybrid designs combining traditional craftsmanship with modern design principles, leveraging local materials and sustainable practices, and developing new educational modules that incorporate systemic mapping and AI tools to teach design students about cross-cultural collaboration. Several case studies emerged from the workshops, demonstrating the practical application of insights gained from the systemic map. For example, a project that combined traditional Colombian weaving techniques with Italian design aesthetics created a sustainable product line, directly informed by the systemic map. Another project used AI to analyze and map community data in a Colombian village, providing deeper insights into local needs and

cultural practices. A third case study explored the use of bio-based materials in design, driven by insights from the systemic map about local resources and sustainable practices.

While the systemic map provided numerous benefits, several challenges were encountered, such as managing the complexity of the map, ensuring cultural sensitivity, and overcoming technological barriers. Solutions included conducting interactive sessions to help participants become familiar with the systemic map, holding workshops focused on cultural sensitivity and the respectful integration of technology, and providing additional technical training and support to participants less familiar with the digital tools used.

The integration of systemic mapping into our cross-cultural design project proved to be a transformative approach, enabling generative reasoning that drove innovation and deeper cultural understanding. By visualizing complex relationships and facilitating collaborative creativity, systemic mapping bridged the gap between traditional craftsmanship and modern technology, paving the way for future cross-cultural design endeavors. This section outlines how systemic mapping and generative reasoning can be effectively utilized in design innovation projects, providing a robust framework for future research and practice in cross-cultural design.



Figure 2. Systemic map from cross-cultural design workshops, illustrating connections between cultural heritage, technological integration, and collaborative nodes to identify potential innovation areas.

## 4. Case studies and results

The results reflect the impact of this comprehensive approach, as evidenced by the diverse range of innovative projects and the mutual learning experiences of the participants.

### 4.1 Intercultural design collaboration

In one of the standout projects, Italian and Colombian students collaborated to develop a sustainable product line that blends traditional Colombian craftsmanship with modern Italian design aesthetics. This project exemplified how cross-cultural collaboration can lead to the creation of products that respect and innovate upon cultural heritage. The team used digital prototyping tools and AI-driven data analysis to refine their designs, ensuring both cultural authenticity and contemporary appeal.

Image	Where	Archive name	Extracted objects
	Cali - Mercado	iimg2332.jpg	letters
	Cali - gatos	imgen3633566.jpg	cat bag
	Cali - Linterna	la linterna 1 - Anny Gicela Guerrero Chapal.jpg	person (3) bottle (3) cup (3) bowl (1)

Table 1. AI image analysis

## 4.2 AI-Enhanced Community Mapping

Another significant project involved the use of AI for community mapping in a Colombian village. Participants collected data through interviews and observations, which were then processed using AI tools to identify key cultural and social patterns. This project demonstrated the power of AI in enhancing understanding and visualization of complex cultural contexts, leading to more informed and culturally sensitive design solutions.



Figure 2. Image labelling examples

## 4.3 Bio-Creativity in Sustainable Design

A third case study focused on the integration of bio-creativity techniques with local materials. Italian and Colombian students worked with local artisans to create sustainable design prototypes using bio-based materials and techniques. This project not only highlighted innovative uses of local resources but also provided new economic opportunities for the artisans involved. The outcomes of these collaborative efforts were multifaceted, showcasing the potential of blending traditional and modern practices through advanced technology and intercultural teamwork.

## 4.4 Innovation in Design

The collaborative process resulted in several innovative products and design solutions that were both culturally relevant and technologically advanced. For instance, the sustainable product line project combined traditional weaving techniques with modern materials, creating a unique blend of old and new that appealed to both local and international markets.

## 4.5 Enhanced Understanding through AI

The use of AI tools in data collection and analysis proved to be highly effective. AI helped break down language barriers and provided deep insights into cultural nuances that would have been difficult to discern through manual methods alone. This led to more accurate context mapping and better-informed design decisions.

The projects not only fostered innovation but also emphasized sustainability. The use of biomaterials and the focus on local craftsmanship helped promote environmentally friendly practices. Additionally, the economic impact on local communities was significant, as the projects opened up new avenues for income generation and skill development.

## 4.6 Digital tools and AI technologies

Throughout these projects, various digital tools and AI technologies were employed to enhance the participants' perceptions and capabilities. Digital tools were used to generate new information from the collected elements in the systemic map, such as identifying key concepts from text documents, transforming audio interviews into text, recognizing entities in images, converting ambient sounds into numerical data, and generating images from text using tools like DALL-E.

Text processing involved using AI, in particular ChatGPT, for topic modeling to reveal the main topics in extensive texts, identifying

entities such as people, objects, and places mentioned in the texts, and performing keyword extraction to list all keywords and create co-occurrence tables of keywords found in the same sentences or paragraphs.

Image processing was conducted using YOLO (Redmon et al., 2016), where images were analyzed to label and identify key elements. This process included uploading images, running scripts to process them, and obtaining labeled outputs.

Interview transcription was facilitated by Otter.ai (Corrente et al., 2022), which transcribed audio files into text, making it easier to analyze and identify keywords. Sound processing involved converting sounds into numerical representations, similar to the image labeling process but using audio-specific tools.

Ethical considerations were paramount in the use of AI tools. All AI applications complied with ethical standards, ensuring the transparency of training databases and using local languages to avoid cultural biases. This integration of digital tools and AI technologies enabled a more comprehensive, inclusive, and non-discriminatory approach to design, significantly enhancing the quality and impact of the collaborative projects.

By leveraging these advanced technologies, we were able to achieve a deeper understanding of cultural contexts, foster innovation, and promote sustainable practices. This comprehensive and inclusive

approach has shown how modern technology can be harnessed to support and enhance traditional craftsmanship and intercultural collaboration in design.

## **5. Learnings from the Workshop: key insights and challenges faced during the project.**

The workshops showed the strong potential of combining new technologies with traditional craftsmanship in a cross-cultural setting. We found that technology, when used carefully, can connect different cultural expressions rather than separate them. Using AI and digital tools highlighted the importance of preserving the essence of traditional methods while enhancing them with modern innovation. This balance was achieved through ongoing discussions and iterative design processes, promoting a sense of shared ownership and mutual respect among participants from different cultural backgrounds.

However, the process was not without its challenges. Working with diverse cultures required sensitivity and adaptability. Language barriers and different levels of comfort with technology among participants sometimes slowed progress. Yet, these challenges also became opportunities for growth, as they required the development of new communication strategies and teaching methods that could accommodate various learning styles and cultural perspectives. The workshops underscored the value of patience and the need for flexible, inclusive approaches in co-design projects.

## **5.1 Comparison with existing literature: how the findings extend or challenge current understanding of cross-cultural design and AI integration.**

Our findings provide a detailed perspective that both supports and extends current discussions on cross-cultural design and AI integration. While existing literature often emphasizes the theoretical benefits of interdisciplinary and cross-cultural collaboration (Augsburg, 2014; Thompson, 2014), our project offers concrete evidence of these benefits in practice. The use of AI tools not only facilitated more inclusive and unbiased design processes but also revealed new dimensions of cultural synthesis and innovation that had not been fully explored before.

Moreover, our project challenges some prevailing assumptions about the role of technology in design. Contrary to the view that technology might overshadow traditional practices, we found that AI and digital tools can enhance and preserve cultural heritage when used thoughtfully. This finding prompts a re-evaluation of the perceived divide between tradition and innovation, suggesting instead a mutually beneficial relationship where each can enrich the other.

## 5.2 Broader Implications: potential for AI and technology to reshape the design and art fields.

The broader implications of our project are significant, suggesting that the strategic integration of AI and technology can change the fields of design and art. By facilitating deeper cultural understanding and fostering innovative practices, these technologies have the potential to transform how we approach creativity and craftsmanship.

AI proved to be a powerful tool in this transformation. Its ability to process and analyze large amounts of data quickly and accurately provided insights that were previously unattainable, enhancing the design process's depth and precision. Additionally, the use of digital platforms for remote collaboration broke down geographical barriers, enabling continuous and dynamic interaction between participants from different parts of the world.

Furthermore, the project highlighted the potential for AI and technology to support sustainable practices. By optimizing resource use and promoting eco-friendly materials, these tools can help designers and artists create works that are not only beautiful and culturally significant but also environmentally responsible.

However, the reliance on technology also introduced certain drawbacks. For instance, the need for continuous access to digital

tools and platforms could create disparities among participants with varying levels of technological access and expertise. Additionally, the integration of AI raised ethical concerns regarding data privacy and the potential for algorithmic biases, which require careful consideration and ongoing oversight.

## 5.3 Conclusion

This research underscores the transformative potential of integrating contemporary technologies, particularly artificial intelligence (AI), with traditional craftsmanship in a cross-cultural context. The project's methodology, which combined design modules, cultural probes, context mapping, and technological integration, facilitated a dynamic and inclusive environment for co-creation and innovation. Through this approach, we observed significant advancements in design practices, fostering an environment where modern technology and traditional craftsmanship synergistically enhance each other.

The findings highlight several key insights. First, AI and digital tools are not merely adjuncts to traditional methods but can actively preserve and amplify cultural heritage. By providing unprecedented levels of data-driven creativity and sustainability-focused innovations, these technologies bridge the gap between the old and the new, ensuring the continuity of cultural narratives in contemporary design contexts.

Second, cross-cultural collaboration, as evidenced by the diverse and innovative projects generated through this initiative, is pivotal in enriching the design process. The integration of different cultural perspectives and expertise led to the development of products and solutions that are both culturally resonant and technologically advanced. This collaboration not only fostered mutual learning and respect but also unveiled new dimensions of cultural synthesis and innovation, challenging prevailing assumptions about the role of technology in design.

However, the project also illuminated the challenges inherent in such interdisciplinary and intercultural endeavors. Language barriers, varying levels of technological proficiency, and the need for adaptive communication strategies emerged as critical factors requiring careful navigation. These challenges, while significant, also offered opportunities for growth and the development of new, more inclusive methodologies.

The broader implications of this research suggest that the strategic integration of AI and technology in design can profoundly reshape the fields of art and craftsmanship. By enabling deeper cultural understanding and fostering innovative, sustainable practices, these technologies can transform traditional design processes, making them more inclusive, precise, and environmentally responsible. Nonetheless, it is essential to

address the ethical considerations associated with AI, such as data privacy and algorithmic biases, to ensure that technological advancements do not perpetuate inequalities or cultural insensitivity.

In conclusion, the project's outcomes reaffirm the value of blending traditional craftsmanship with contemporary technology within a cross-cultural framework. This fusion not only enhances the creative process but also promotes a richer, more inclusive understanding of design. The insights gained from this research provide a robust foundation for future explorations into the integration of AI and other advanced technologies in design, advocating for a balanced approach that respects and leverages cultural diversity to foster innovative and sustainable design practices.

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