CO-Creation with Digital Tools and Haute Couture Principles—Experiences of Creative Agency and Interactions with an Automated Computer Agent

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ABSTRACT This paper focuses on digital agency in fashion and textiles design, presenting a case study using a digital drawing tool to gain insights into the experiences of creative agency and interactions with an automated computer agent. This study is positioned within the wider Neo Couture research project, which aims to develop a digital hand embroidery learning tool for fashion and textile practitioners. The paper draws upon a

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developing project framework, grounded in principles informed by haute couture as a lens to articulate the data analysis and findings. Centring on the framework's aspects of Material Agency and Interactions, in particular the agency of the tool, this study finds a nuanced interplay between human practitioners and the tool developed for this study. Further quantitative insights are drawn from the workshop tool itself to give a richer understanding of both user experience and creative interactions synchronously. Theory in digital craftsmanship is discussed in relation to this study, highlighting the need to account for the ways that fashion and textiles practitioners relate to materials in their work when developing supportive digital applications in this space. This research supports future work to be undertaken with more diverse cohorts of practitioners in fashion, textiles, and haute couture practice. The findings are particularly relevant for interdisciplinary fashion and textile practice in conjunction with HCI and digital design, towards the development of pedagogical AI tools for craft learning in fashion and textiles.

KEYWORDS: Haute couture pedagogy, digital fashion and textiles, digital agency, human computer interaction (HCI), digital craftsmanship

Introduction

Neo Couture Project and Objectives

The Neo Couture project aims to integrate traditional haute couture craftsmanship with advancements in Artificial Intelligence (AI), specifically through developing pedagogical tools to enhance haute couture craft learning. Recognising both fashion and textile design as interwoven within haute couture, the project values each for its distinct yet complementary role in the fields creative ecosystem.

This study contributes by developing a method for understanding interaction dynamics between human participants and a creative drawing tool, an approach intended to inform a developing co-creative digital learning platform for hand embroidery. By focusing on human-computer interaction (HCI), particularly *digital agency*—the capacity of digital tools to co-create with users—this research captures insights into how a small group of fashion and textiles students experience co-creation with a digital drawing tool exhibiting different interaction behaviours. Quantitative and qualitative analyses, guided by a framework grounded in haute couture values, illuminate interaction dynamics that could shape future HCI practices in digital haute couture learning contexts.

This work represents a critical step towards supporting digital learning environments in fashion and textiles, grounded in the particular considerations and values of haute couture. The interrelations among this study and other aspects of the Neo Couture project are

further detailed in section Research Design—Digital Hand Embroidery Platform.

Introducing Digital Technologies in Haute Couture

Haute couture can be seen as a custodian of rare, specialised skills, shielding them from the commodification and industrialisation typical of mass-produced, ready-to-wear fashion (Liucci-Goutnikov 2011). Despite haute couture's role in preserving historical craft, the number of skilled artisans has steadily declined, with couture houses and ateliers far fewer than their mid-20th-century peak (Majima 2008). This exclusivity, while maintaining a level of rarity, restricts broader access, as traditional techniques are primarily transmitted through limited in-atelier apprenticeships (Gwilt 2012; Dimitrio 2016).

The constraints of this existing context highlight the opportunity for digital technologies to play a supportive role in creative education, where access to haute couture skills can be broadened while maintaining core haute couture values. Montagna, Sousa, and Morais (2018) propose that digital tools could expand these skills beyond traditional boundaries, potentially enriching the educational landscape in fashion and textiles. Addressing a research gap, this paper investigates how Material Agency and Interactions, drawn from a developing framework (section Data Analysis–Research Framework), informed by haute couture values (Alderson-Bythell et al. 2023),[1] could inform HCI research in fashion and textile design pedagogy. These values, foundational to our approach, include:

Humanness: Centring haute couture on human presence and individual body metrics.

Interactions: Emphasising the collaborative nature of couture through interactions among craftspeople, clients, and materials.

Hierarchy: Operating within a structured atelier hierarchy that may shift as digital technologies introduce collaborative practices.

Material Agency: Recognising materials as active agents in the creative process, shaping outcomes in tandem with designers.

Bespoke/Rarity: Maintaining haute couture's commitment to uniqueness and rarity, even as digital tools broaden design possibilities.

In haute couture, creative agency emerges from dynamic interactions among couturiers, skilled craftspeople, clients, and materials (Montagna, Sousa, and Morais 2018: 3–6; Armitage 2023). Material agency, as Givenchy described, reflects a complex, responsive interaction where materials "guide" the creative process (Wilcox 2008: 118). This interaction and a conception of the agency of materials is

pivotal in haute couture and becomes particularly relevant when considering how artisans engage with both physical and digital materials in co-creative processes. Understanding this nuanced interplay within digital contexts is critical to the broader Neo Couture project, which envisions computation not simply as a tool but as an accountable material practice, in line with Cheatle and Jackson (2023) concept of "*computational craft*," which recognises computations craft heritage to encourage practices that are materially attuned and embody a collaborative ethos that traditional crafts possess.

By integrating these values, the project advances HCI research in fashion and textiles to consider how digital tools might be applied to the preservation of haute couture skills as well as how these practices can extend into educational settings, to explore the potential of HCI to mediate between traditional craftsmanship and emerging digital methodologies.

Digital Craftsmanship

Digital craftsmanship has evolved as a broader field, where computational tools are positioned as complements to traditional, tactile practices. The Neo Couture project builds on this foundation, seeking to integrate digital methods that enhance, rather than replace, craft-based engagement.

For example, Andersen et al. (2019) discuss how digital tools can enrich human-material interactions, and Sørensen et al. (2022) illustrate how craft mastery in areas like knitting can bridge physical and digital expertise—an approach that aligns with the project's goal to uphold the values of traditional craftsmanship. Digital tools in this context can act as "co-producers" (Devendorf, Wu, and Friske 2023), actively participating in the creative process. While this study emphasises co-creative interaction over direct material manipulation, future applications could integrate tactile interfaces (Gowrishankar, Bredies, and Ylirisku 2017) to further support experiential learning.

Heinzel and Hinestroza (2020) expand this vision by considering textiles as "revolutionary" interactive agents, treating materials as computationally responsive rather than passive. Jacobs et al. (2016) underscore this shift, arguing that traditional HCI metrics, such as efficiency and usability, are insufficient for capturing the nuances of creative expression through digital tools. They advocate for metrics that support creative fulfillment and experimental interaction, key to digital craftsmanship within HCI.

Though tangible material interactions are not the focus of this study, these perspectives in HCI encourage moving beyond efficiency-focused design to develop tools that respect the needs, habits, and desires of craftspeople. This approach promotes the evolution of digital craftsmanship in ways that remain closely connected to the material and relational foundations of traditional craft practices.

Digital Agency

While there is established discourse on the agency of physical textiles (Winters 2017; Piñeyro 2019), discussions of digital agency in creative tools are still emerging, reflecting evolving perspectives in the field (Igoe 2018). Barad's concept of "intra-action"—the idea that entities form and reshape through their relationships—challenges traditional views of isolated creative agents. Within this framework (Barad 2007), agency emerges through interactions that define boundaries, properties, and meanings (Barad 2003). Joseph (2017) extends this to digital tools, seeing them as agents that contribute to "intra-action" with users, an approach echoed in HCI studies by Rutz (2016) and Frauenberger (2020).

These frameworks contribute to understanding agency as a co-emergent property in relational contexts, adding depth to the exploration of digital agency within haute couture-informed practices. Here, agency is viewed as an interconnected process between practitioners, digital tools, and materials, each actively shaping the creative experience. This perspective builds on Bertola and Colombi (2021) call to develop digital skills in fashion and supports Tepe and Koohnavard (2023) advocacy for cross-disciplinary design approaches. The study also highlights how digital agency can evoke varied user responses, from experiences of control to collaborative interaction (Limerick, Coyle, and Moore 2014; Shank et al. 2019).

Our study introduces a method to capture user experiences and behaviors with automated agents, providing insights for future AI-enhanced educational tools in fashion and textiles. As automated agents become more prevalent, understanding their impact on practitioners is essential. For instance, Choi et al. (2023) found that tools like FashionQ externalise tasks, such as creative expansion, while Cai et al. (2023) DesignAID uses AI for creative exploration. However, a gap remains in exploring fashion practitioners' experiences with co-creative AI (Zou, Wong, and Mo 2019), underscoring a need for further study into agency in these tools.

Summary

Here, *digital agency* is considered through the lens of haute couture values, with digital tools positioned as potential co-creative collaborators that engage users in the design process. In this study, digital agency refers to the ability of tools to facilitate meaningful interactions, enabling users to explore creative possibilities within a framework grounded in haute couture principles.

This study draws on HCI methodologies from diverse fields to develop and test methods for capturing the creative and interactive preferences of fashion and textiles practitioners. The project framework provides a unique lens to explore HCI within these contexts. This research considers agency and interactions across fashion, textiles, digital craftsmanship, AI, and HCI, identifying a gap for

interdisciplinary research to inform practice-led HCI and digital tool development in fashion and textiles. This pilot study initiates a broader exploration of digital agency aligned with haute couture values, enhancing educational platforms for future craftspeople.

Project Rationale

Haute couture plays a vital role as a custodian of specialised craft methods in fashion and textiles. However, this tradition faces a significant decline in skilled practitioners and limited access to the environments where these skills are cultivated. To address this issue, this project seeks to create a digital learning platform specifically tailored to traditional haute couture hand embroidery practice. Hand embroidery is a foundational skill in haute couture but also a fundamental technique for producing the bespoke and personalised textiles that define this artistry (Wilcox 2008; Montagna, Sousa, and Morais 2018). Consequently, it represents a critical area ground for preserving and innovating within this heritage craft.

The aim of the research is to explore how digital tools and artificial intelligence can contribute to the development of a new, digital pedagogy for haute couture craft education. By focusing on haute couture hand embroidery, the project aims to create user-centred learning tools that support early-stage craft practitioners.

The project recognises the complex relationship between AI and Human-Computer Interaction (HCI) (Grudin 2009), where AI often models human cognition through rationalist approaches while HCI emphasises iterative, user-centred design (Winograd 2006) and seeks to balance these dynamics, in this study, the focus on user feedback is pivotal in shaping future AI functionalities within a proposed digital hand embroidery learning platform.

Research Design—Digital Hand Embroidery Platform

The digital learning Platform is conceived as a three components platform to support creative ideation, contextual learning, and skills development in hand embroidery. Together, these components are intended to converge digital technology with traditional and digital craftsmanship holistically, these attributes are:

Creative Draw Function

This feature allows users to sketch embroidery patterns directly on a capacitive touch interface. It augments creative exploration during design development through interactions with computer agents, offering real-time suggestions and enhancements based on design principles, pattern logic, or contextual factors, such as stitch types. The capacitive surface supports hybrid physical/digital interactions, enabling co-creative play to help users diversify and refine designs before and during stitching while respecting their intent and agency.

A rudimentary web-based version has been developed for this study, gathering insights into participants' creative styles and co-creative experiences. As the function evolves, its design and capabilities will be refined collaboratively with stakeholders to explore creative and technical applications in hand embroidery education. These insights will guide the development of the platform's creative functions.

Embroidery Archive and Technique Generator

Envisioned for future development, this component will utilise a specialist archive to recommend stitch types and techniques. By leveraging AI-driven contextual feedback, it will offer recommendations that are informed by traditional craft principles while augmenting user creativity through dynamic coaching. The design and application of this component will be informed by future consultations with embroidery practitioners and educators, whose insights will guide the contextual feedback mechanisms and archive functionality.

Gesture Recognition and Coaching

Planned for later phases, this function will employ AI models trained on expert craft knowledge captured through gesture and stitch motion data recording. The specific implementation of this function will be grounded in further research with expert stakeholders, whose craft knowledge and learning needs will be integral to shaping these capabilities, intended to support and enhance craft training in digitally contexts (Figure 1).

These planned functions sit within four specific phases of the research:

Phase 1: Testing of basic digital creative tools with fashion and textile practitioners to gain HCI insights that inform future work.

Phase 2: Targeted stakeholder studies with haute couture artisans and hand craft training providers.

Phase 3: Technical studies to capture and analyse haute couture artistry to develop learning assets for applications within the pedagogical tool (AI).

Phase 4: The development of a proof-of-concept learning platform that integrates the three components.

The current phase (1) establishes an initial methodology for studying HCI, agency, and interactions with fashion and textiles practitioners. Insights gained will inform future work, extending to studies with haute couture artisans and a broader range of fashion and textile designers. Ultimately, the project seeks to synergise HCI insights with

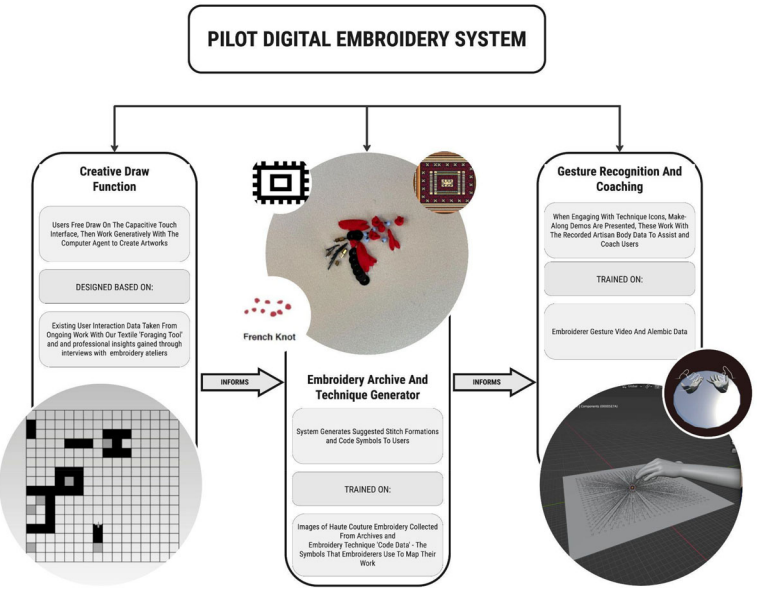

Figure 1
Diagram of the proposed three component "digital hand embroidery platform."

AI functions trained on haute couture practices to create a user-centred learning system enriched by digitised craft knowledge. The phased structure of this research reflects a commitment to iterative development, with functions being refined in response to insights gained through stakeholder research with ateliers, haute couture artisans, and hand embroidery educators and learners.

Case Study

This preliminary study applies HCI methods to analyse creative interactions using an interactive digital drawing tool, tested with early-stage textile and fashion design practitioners. Building on existing literature that explores agency within the textile and fashion design process, this research introduces the emerging field of digital tool agency. The web-based drawing tool employed here is designed to gather insights into user behaviour relevant to developing the Neo Couture project, particularly towards the AI functionalities anticipated in future phases.

Description of the Workshop Tool

Our tool, inspired by protocols from Noy et al. (2012) and Hart et al. (2017), is a tile-based drawing application developed using JavaScript and the Three.js library. Unlike earlier adaptations, this tool removes constraints on tile numbers, allowing for more free-form drawing. Hosted on GitHub Pages, the software features a 16×16 grid for creative exploration. Users can draw, erase, and reset their

work, with a save function that allows for storing inputs in a gallery. The tool supports both solo drawing and collaborative activities, the latter incorporating a randomisation algorithm to introduce an element of creative agency. Clear colour delineation helps users distinguish between their inputs and those generated by the computer, as shown in Figure 2.

This tool was designed to provide a simple yet effective means of understanding interaction dynamics between a human user and a digital tool. Rafner et al. (2022) suggest that constrained exercises like these can yield significant insights into user experiences with digital tools. Our focus differs slightly from theirs, in this context, we are particularly interested in how digital tools impact individual creativity and how such insights are understood in the context of fashion and textiles.

Methodology

This study employs a mixed-methods approach to capture behavioural interaction and user experience data, allowing us to reflect on these findings with specific users from the fashion and textiles fields. Due to the limited pool of participants, broad conclusions should be approached with caution. However, the learnings from this experimental setup will inform future studies with a more diverse participant cohort.

The study was conducted through a one-day workshop at Hong Kong Polytechnic University (HKPU), which involved digital tool testing, workshop facilitation, participant questionnaires, and thematic data analysis using both qualitative and quantitative approaches. The workshop centred on human subjects, exploring participants' sense of agency and shared agency through "intra-active" phenomena

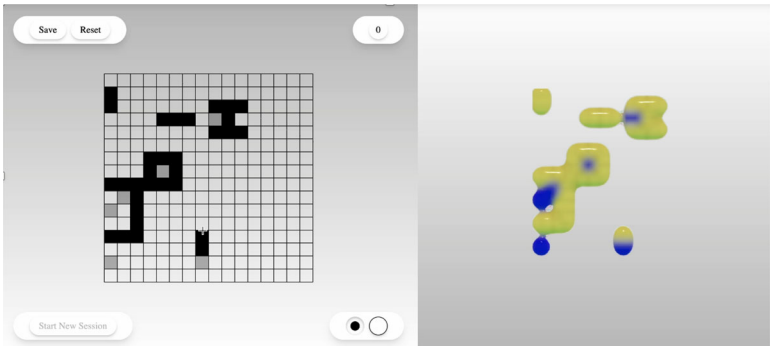

Figure 2
Screenshot of the workshop tool.
Source: Authors own—This image shows the digital interface from the second activity with the "computer agent," to the left is the drawing canvas, where workshop participants place their marks. To the right is the visualisation canvas. Computer inputs are delineated in light grey on the drawing canvas and blue on the visualisation canvas. To the top left, a toolbar holding a "save" and "reset" function are available to users.

(Barad 2007). Drawing from Joseph (2017) and Montagna, Sousa, and Morais (2018), we examined multi-agent interactions, specifically focusing on the agency of the digital tool within this dynamic.

Our analysis of data collected from the tool is informed by Guilford (1966) and Guzdial and Riedl (2019), with a focus on interactions and agency outlined within the Neo Couture project framework. We utilised quantitative methods, including Likert scale ratings, mean, and standard deviation (*SD*) calculations, as well as paired sample *t*-tests. Qualitative data was gathered from direct questionnaire responses. This mixed-methods strategy allows us to parallel user feedback with statistical insights.

Participant Selection

In this initial phase, we selected students at an early-stage of fashion and textile practice to test the research method. Participants were recruited from the fashion and textile department at HKPU. This early-career group was chosen due to their familiarity with many digital tools, which is discussed further in section Results.

Time Allotment

The workshop consisted of five activities spread over 2 h:

Activity 1. Introduction to the Study: 30 min.

Activity 2. Pre-activity questionnaire: 30 min.

Activity 3. Solo Digital Tool Activity: 20 min. Participants design shapes or patterns using a browser-based tool. Multiple designs can be saved to the gallery.

Activity 4. Tandem Digital Tool Activity: 20 min. Participants collaborate with a computer agent to create and save designs.

Activity 5. Post-activity questionnaire and image selection: 30 min.

Participants were encouraged to create multiple designs during both solo and collaborative activities, with the option to save their work in a gallery.

Data Collection

Data was collected through pre- and post-activity questionnaires administered *via* Google Forms, and through recordings of user interactions, including saved design outcomes and interaction metrics captured by the workshop tool.

Data Analysis—Research Framework

The analysis framework is grounded in haute couture values (Alderson-Bythell et al. 2023), focusing on humanness (agential experience), interactions, hierarchy, material agency (vitalism), and bespokeness/rarity.

This study specifically centres on material and human agency, as well as interactions, which inform the thematic analysis of the data. The aim is to embed haute couture values within HCI research in fashion and textiles, providing a nuanced understanding of digital tool experiences for this group of practitioners.

Data analysis entailed a thematic review of questionnaire responses, aligning them with the framework. Quantitative data, including Likert scale responses from 1 (Not Important) to 10 (Very Important) were analysed for mean and standard deviation (*SD*). To assess creative output, we employed Guilford's Alternate Uses Test (AUT) (Guilford 1966) to evaluate fluency, flexibility, and originality, and to determine how the presence of an agent impacts these aspects of user creations.

Fluency was determined by calculating the average time for each submission, while flexibility and originality were assessed using the Hamming Distance (Hamming 1950), comparing each participant's submissions with those of others and their own previous submissions.

To validate our findings, hypothesis testing was conducted based on three null hypotheses (H0):

- H0(Fluency): There is no significant difference in time spent per submission between tasks completed with and without agent intervention.
- H0(Flexibility): There is no significant difference in flexibility, as measured by Hamming Distance, between the "with agent" and "without agent" groups.
- H0(Originality): There is no significant difference in originality, as measured by Hamming Distance, between the "with agent" and "without agent" groups.

Visualisation tools, including heat maps and box plots, were used to present the data, while these tests allowed us to explore the impact of the digital tool on creative practices.

Transparency and Ethical Considerations

This study adhered to the Royal College of Art's ethical guidelines. Participants were informed about the study's objectives and gave voluntary consent to participate. Data was anonymised and securely stored on RCA servers, accessible only to the research team. The ethical aspects were reviewed and approved by RCA's Ethical Review Board.

Results

Participant Demographics

A total of 13 participants, with a mean age of 25, were recruited from the fashion and textile departments at HKPU. To form the study group, participants predominantly comprised fashion and textile students, at both Masters (MA) and PhD levels, alongside one senior fashion lecturer and one data scientist.

Data from Pre-Activity Questionnaire

Before the workshop, to gain an understanding of digital receptivity, a pre-activity questionnaire was employed to probe the participants' comfort and reliance on digital tools by asking: "how important is the digital in your practice?" A mean score of 7.9 (*SD* 1.9) was reported suggesting a comparatively high importance in the use of digital tools to this group.

Participants were also asked for their views on the future of fashion and textiles with AI involvement. Responses were categorised as positive (46.2%), negative (15.4%), or neutral (38.5%). Generally, the group expressed largely positive expectations for AI in the future of fashion and textiles. Written responses can be found in Supplementary Appendix 1.

Data From Post-Activity Questionnaire

These results were grouped into the interactions and agency considerations of the project framework (Figure 3). We argue that this offers a useful method for reflecting on HCI considerations in digital fashion and textile discourse, as it relates to the values explored through this research project in the developing space of digital fashion and textiles explored through haute couture values.

Agency

To evaluate this value area, we focused on four key questions from the survey which can be found in Table 1 where all participants reported a high score on the Likert scale. Participants predominantly felt extremely comfortable when asked to use the tool independently, with a mean score of 7.8 (*SD* 2.2). Participants felt slightly less comfortable when asked to work on the activity with the computer agent with a mean score of 7.2 (*SD* 2.7). In the analysis of participant interactions with the workshop tool, a moderate positive correlation was observed between behaviours in the "withoutAgent" and "withAgent" conditions. This suggests that while the agent influenced decision-making, participants retained some inherent creative habits.

As shown in Table 1, participants expressed that working with the agent employed in the tool might enhance some attributes in a design process, such as by encouraging variation. This could be

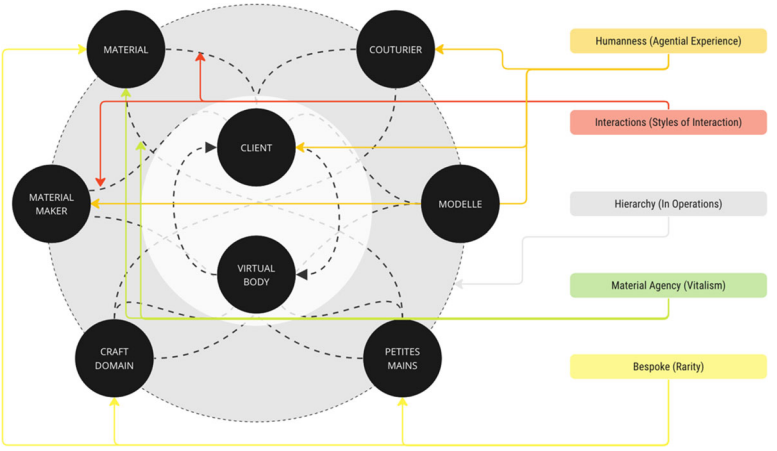

Figure 3
Project framework.
Source: Authors own—This diagram overlays the critical values in Neo Couture within a speculative digital/physical atelier, emphasising not just the technological but also the human dimensions within the framework.

Table 1. Post-activity questionnaire results.

Survey questions	Mean (*SD*)
How important is your agency in your design process?	7.7 (1.6)
How comfortable were you when asked to work on your own in the first activity?	7.8 (2.2)
How comfortable were you when asked to work with the "computer agent" in the second activity?	7.2 (2.7)
How creatively engaging did you find working with the initial tool in the first activity?	6.6 (2.4)
How creatively engaging did you find working with the "computer agent" in the second activity?	7.1 (2.3)
How frustrated were you by the decisions in placement made by the computer agent?	5.5 (3.2)
In the second activity, how much conflict was there between you and the "computer agent"?	6.9 (2.7)
In the second activity, how often did the "computer agent" distract or interrupt you?	6.9 (2.8)
How different do you feel the outputs made with the "computer agent" were compared to your solo outputs?	7.3 (2.2)

viewed by participants as a means to challenge an existing design process and to bring more options to users. This is shown as a difference in outputs and was measured with a mean score of 7.3 (*SD* 2.2). Generally, participants saw their joint creative outputs with the computer agent as distinct from their solo efforts.

In analysing interactions with the workshop tool, we observed significant differences in flexibility and originality[2] (measured by the Hamming distance). Upon conducting a paired sample *t*-test for

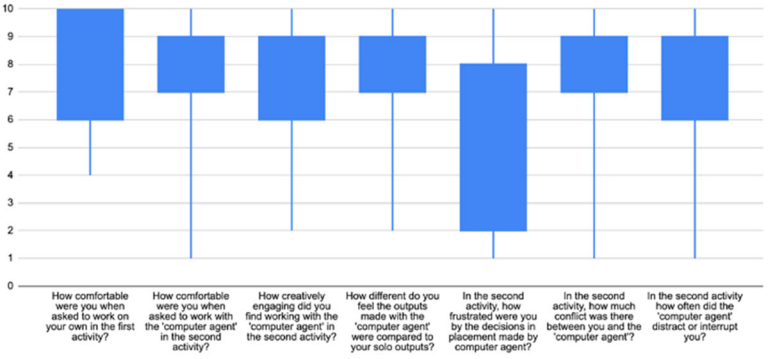

Figure 4
Box plots for average hamming distance with and without agent.

flexibility, we obtained a statistic of 3.826 and a *p*-value of 0.0014. Similarly, a Wilcoxon signed-rank test for originality yielded a statistic of 67.0 and a *p*-value of 0.0134. These findings indicate that participants exhibit markedly higher flexibility and originality when interacting with the agent (Figure 4).

In addition to these observations of agency and interactions, 32.35% of participants indicated a co-creative experience with the tool. Users either allowed the tool to influence and inform their decisions, or were motivated competitively by the interaction. Additionally, in some of the responses participants ascribed anthropomorphic qualities to the computational tool.

Interactions

We investigated user interactions with the drawing tool, finding that participants generally experienced higher engagement when collaborating with the computer agent, though responses varied (as detailed in Table 1). Many participants were intrigued by the agent's unpredictability and keen to understand its logic, indicating mixed experiences. While some found it frustrating or limiting, others viewed it as inspirational or motivational.

In terms of decision-making time (Figure 5), a paired sample *t*-test showed a significant difference (t-value $= -2.85$, p-value $= 0.02$, $df = 11$) when the agent was involved, leading to longer decision times. This increase may stem from the agent's unpredictable nature, necessitating more time for participants to consider their choices and adapt to the agent's unexpected decisions, adding complexity to the creative process.

Additionally, the average exploration rate was marginally higher with the agent (97.04%) compared to without (96.26%). However, the data's non-normal distribution, possibly influenced by the small sample size, limited exploration space, and participants' diverse backgrounds, made parametric statistical tests inapplicable, thus preventing a conclusive assessment of its significance. Some

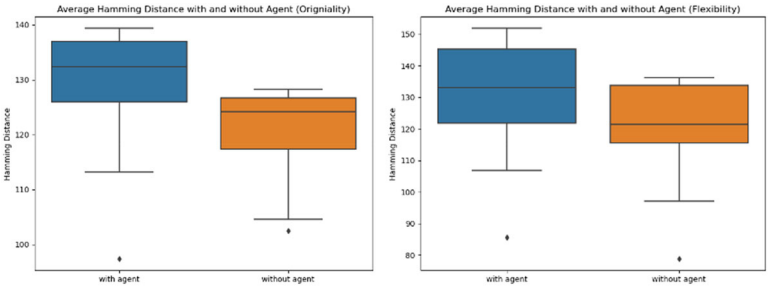

Figure 5

Comparison of decision times for participants with and without agent (fluency).

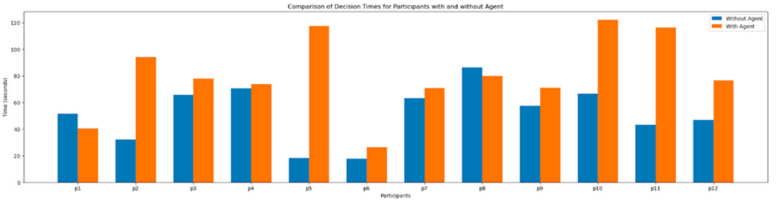

Figure 6

Post-activity questionnaire results, shown here plotted on the Likert scale.

participants found it distracting when the agent's decisions did not match their desired placements, while others liked to work with the agent in a competitive or collaborative manner (Table 1, Figure 6). Overall, the responses were quite mixed with a relatively high deviation in experiences (Figure 7).

The heatmaps derived from these aggregated interactions provide insights into user behaviour. The scenario without agents reveals a pronounced clustering of interactions in the central region of the grid, suggesting that users may prefer or feel more comfortable exploring the core area. A similar methodology was applied to the scenario with agents, where all drawing interactions were included, including both from participants and agents. In both cases, regions with more frequent interactions appear lighter in colour, corresponding to the higher engagement levels. The heatmap for the scenario with agents displays a more even distribution of interactions across the entire grid. This broader spread of engagement suggests that the presence of agents encourages users to explore a wider range of options, moving beyond the central area and leading to a more diverse pattern of exploration. These visualisations thus serve as a tool for comparing user behaviour under varying conditions, offering valuable insights into how the presence of agents can influence exploratory actions within digital environments.

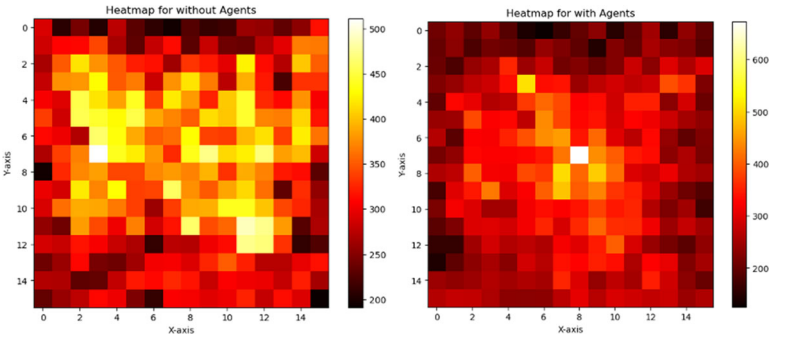

Figure 7

The heat maps visually depict user interaction patterns in both with agent and without agent scenarios, illustrating the spatial distribution of user activities. These visualisations highlight regions of concentrated interaction *vs.* areas with minimal engagement. To create these, two 16 × 16 matrices were initialised to record the frequency of user interactions across the grid. In the scenario without agents, drawing placement interactions that occurred independently of any agents influenced by participants were recorded.

Discussion

This study aimed to explore interaction dynamics in fashion and textile practice to inform the development of co-creative learning platforms tailored to haute couture pedagogy. Through this approach, we investigated how digital agency impacts user experience and creative agency within a controlled environment. With the growing proliferation of automated digital agencies, understanding these interaction styles is increasingly vital for developing bespoke digital solutions tailored to fashion and textile design pedagogy.

Experiences of Agency

The concept of material agency is well established within haute couture, where the interaction between designer, material, and tool is central to the creative process. However, digital material agency, whilst gaining increasing attention in recent years is less fully articulated (Joseph 2017; Winters 2017; Igoe 2018; Piñeyro 2019). Our study with this group of practitioners has revealed a significant, albeit complex experience of agency when working with the digital tool. 32.4% of participants attributed a degree of agency to the computational tool, akin to Barad's (2007) notion of "intra-action," where human and digital agencies are understood as interdependent and co-emergent. While some participants were open to sharing creative agency with the tool, 29.41% resisted this idea, indicating a tension between control and collaboration. Considering arguments regarding the emotional dimensions of working with computational tools, where a sense of a loss of control can impact on user experiences (Limerick, Coyle, and Moore 2014; Shank et al. 2019; Mahmud, Hong, and Fong 2022), our findings in contrast indicate that

participants largely maintained a sense of control during their interactions with the drawing tool in the co-creative activities.

These varied reactions reflect the haute couture values of bespoke creation and material agency, where human and material interactions are constantly re-negotiated, this added complexity challenges the uniformity suggested in previous research by Oh et al. (2018), emphasising the need for transparency in tool actions since participants expressed a desire for greater clarity regarding the agent's behaviour and intentions. Interestingly, participants maintained their creative habits during interactions with and without the agent, despite a uniform randomisation algorithm being used. This consistency suggests that even when digital tools introduce new variables into the creative process, users retain a core set of creative behaviours. This finding underscores the importance of designing digital learning platforms that support the user's inherent creative style while offering opportunities for experimentation and growth. The analysis suggests that practitioners are willing to allow digital tools to influence their creative decisions suggesting an openness to more collaborative, AI-assisted design processes, particularly as this research develops within the fashion and textiles domain. These findings are important in developing digital platforms for fashion and textile pedagogy, especially for users looking to break away from established creative patterns or seeking to understand their own creative proclivities better.

The complex reactions observed among participants—who alternated between sharing creative agency and maintaining control—This insight aligns with our framework's goal of designing digital tools that respect the user's creative preferences while introducing new possibilities.

Interaction Styles (Engagement and Interactivity)

The study's findings extend the broader discourse on human-computer interaction (Oh et al. 2018; Mahmud, Hong, and Fong 2022; Rafner et al. 2022) to the specific context of fashion and textile practice. The participants' varied reactions to the workshop tool in this study—ranging from frustration to inspiration as a creative catalyst—echo research by Rosenberg et al. (2022) regarding the dynamics of collaboration, but in the context of craftspeople, we must consider arguments in digital craftsmanship. The web-based drawing tool used in this study, though useful for testing basic interactions and collecting data, lacked material familiarity to fashion and textiles practitioners. Digital tools designed for craftsmanship should not merely prioritise efficiency or usability but should also foster creativity and expression and should aim to engage with the material and cognitive processes of the crafts they aim to support (Jacobs et al. 2016; Sørensen et al. 2022).

This inability to fully engage with the material aspects of fashion and textiles suggests that future iterations building on this study must be more attuned to the physicality and materiality of fashion and

textiles to more deeply explore creative cognition in the field. This is revealed by participants needing for additional deliberation when working with the computer agent suggests that the tool's design introduced complexities that did not necessarily enhance the creative process. However, the agent's presence often led to a wider range of outcomes, as participants invested more time in activities when interacting with the agent. This was observed in both the qualitative data and quantitative data from the workshop tool indicating a more nuanced impact that potentially subdues some creative traits whilst widening design diversity in participants. These considerations are important in the context of our proposed embroidery learning environment, where the balance between traditional skills and digital augmentation must be carefully managed to maintain the integrity of the craft.

In Synthesis, the results highlight the potential role of digital agencies as a catalyst for creative exploration and co-creative interactions; however, considering the limited pool of study participants, more research is needed to thoroughly understand how fashion and textile design practitioners balance their agency with that of digital tools in their work.

Limitations and Recommendations

This study has several limitations that affect the transferability of its findings. The participant pool was predominantly composed of fashion and textile students, not experienced haute couture professionals. This may have limited the depth of insights, as comparative analysis between experts and novices could have provided more nuanced findings. Additionally, the participants were mostly around 25 years old and digitally adept, which likely influenced their interaction with the tool. Given the limited and specific demographic of participants, this research cannot draw definitive conclusions about potential differences in engagement and attitudes across varying skill levels or backgrounds therefore future studies should target a broader demographic, including both novice and experienced practitioners, to better enrich insights in this field.

The digital tool used in this study was basic and governed by a randomisation algorithm, which simplified its behaviour and did not fully represent or integrate with the material dynamics of fashion and textiles practice. The study also employed even-numbered Likert scaling to gain initial insights into participant experiences, which may have introduced ambiguity in the responses. While qualitative feedback helped to enrich these insights, future studies should refine questioning methodologies to capture more precise experiential data.

Contributions and Future Work

This study provides valuable insights into the integration of digital tools within the creative processes of fashion and textile practitioners

as well as demonstrates a pilot data collection methodology to explore this. It underscores the importance in the future of aligning these tools with the material and cognitive practices central to haute couture. While digital tools can enhance creative exploration and, in this case, are useful for drawing important HCI insights, they must be carefully designed to respect and elevate traditional craftsmanship and material familiarity.

Future work will focus on refining the tool to better integrate with haute couture learning practices and expanding testing to a more diverse cohort, including seasoned haute couture artisans which will be particularly valuable for comparative analysis, shedding light on the differences in creative habits between novices and experts. This study acknowledges its limitations, such as the small and homogeneous participant group, and will address these by involving a broader range of practitioners in subsequent research.

The next phase will focus on developing the tool to capture more detailed quantitative and qualitative data, enabling a deeper analysis of creative habits and preferences across different skill levels and exploring how the tool could more effectively engage with material processes of fashion and textiles and exploring how AI can further support creative exploration and skill development. Moreover, we will work on integrating this developing tool with other applications across the wider Neo Couture project and explore the utility of the proposed learning platform with industry-specific stakeholders in haute couture and fashion and textiles craft pedagogy.

In summary, our study stands as an important contribution to the growing HCI research in fashion and textiles. Despite the limitations, we have presented a relatively simple method to explore the evolving role of digital tools and the considerations in their development specific to digital fashion and textile pedagogies and have proposed a way of exploring these insights through a framework grounded in haute couture values, marking an initial step in the wider Neo Couture project.

Notes

1. The developing project framework introduced in Alderson-Bythell et al. (2023) draws influence from haute couture principles, and is grounded in five key areas: Humanness, Interactions, Hierarchy, Material Agency, and Bespokeness/Rarity.
2. We note that the "originality" assessed by this method is from the perspective of a machine, which quantitatively compares pixel differences. Although this is a viable quantitative method, it diverges from comparisons that involve more semantic interpretation outputs.

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