

How GenAI Can Affect Design Work.

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At this point in time, creative practitioners are beginning to encounter AI-powered creativity support tools and, depending on multiple factors, are deciding whether to adopt, reject or continue contemplating whether to use these tools. In this workshop paper, we present two of our studies that explore the appropriation and impact of generative AI on design work. These studies comprise part of the first author's PhD. One of them is described in a paper to be presented at CHI 2024, while the other is work-in-progress. In this paper, we discuss the motivation and rationale behind our work and ideas for future studies into how generative AI will influence professional design work.

CCS CONCEPTS • Human-centered computing • Empirical studies in HCI

Additional Keywords and Phrases: Generative-AI, Design, Creativity support tools, Design fixation

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1 INTRODUCTION

Today Generative AI (GenAI) can turn text into images, generate copy for mock-ups, write that one line of the song a writer couldn't finish, and even help fixing the tone of an email. Despite concerns around the ethics and intellectual property, some professional designers are considering incorporating these tools into their everyday practice. Amongst them is a significant cohort who hope GenAI tools can enhance their design workflow and help them explore creative possibilities [2, 6]. Professionals and pundits speculate that these tools be beneficial in enhancing design work [6, 14, 16] though concerns include the risk of reduced employment opportunities for creative practitioners and the risk of misuse of intellectual property.

Publicly available GenAI tools such as DALL·E by OpenAI, Artbreeder, Stable Diffusion, and Midjourney have made it possible for designers to turn their thoughts into high-quality visuals quickly and at a low cost. As a result, there is a lot of interest in these tools within the creative community. Even vendors of established creativity support tools such as Adobe, Figma, and Canva are now integrating AI features, making it easier for designers to incorporate AI into existing workflows. Some design firms have invented custom AI tools: for example, car manufacturer Audi has created its bespoke GenAI tool called "*FelGAN*" [13] to support their in-house designers to create new rim designs for wheels, and they note it has led to more diverse designs. Likewise, we see a trend of design labs starting to customize GenAI tools for inhouse design purposes by finetuning the publicly available GPT models. Designers believe that AI can enhance productivity when incorporated into their everyday design practice [13, 14].

On the other hand, a debate is developing on ethical considerations for using AI generated content in commercial work, in particular regarding intellectual property [4]. Like professionals in other domains, designers fear that these tools may reduce the need for humans in the workforce. Further there are concerns that creativity may be affected [3] - for example that GenAI tools will limit designers from producing their best and most authentic ideas.

Much current discourse on GenAI is based on speculation, and there is a lack of empirical evidence to test these claims. In our research work, we aim to investigate the impact of GenAI on professional design practice. In this paper we present two relevant studies: one concluded and one on-going and share insights on how generative AI may be impacting design work.

2 BACKGROUND AND RELATED WORK

For decades, designers have envisioned a future where intelligent creative aids are readily available. With recent advances in GenAI, this dream is becoming a reality. GenAI systems can produce new and plausible media, which can help designers perform creative tasks. GenAI systems are trained on vast datasets and enable quick and easy generation of content such as images, text, audio, or video. GenAI tools allow users to create these diverse artefacts by giving instructions in natural languages, called "prompts". Researchers try to understand fundamental principles of co-creativity between humans and GenAI [7, 9]. While humans possess intuitive, emotional intelligence and understanding of context and cultural significance, GenAI offers computational power, pattern recognition capabilities, and the ability to generate a vast array of possibilities from available datasets. Researchers believe that combining these strengths allows for the exploration of new ideas. [11, 12, 14, 16]

GenAI has shown promise in helping designers overcome challenges that arise during the design process. One of the early examples in HCI for incorporating AI to mitigate design fixation is the Creative Sketching Partner (CSP) [3, 9], an AI-based creative assistant that generates inspiration for creative tasks. Through multiple studies, Davis et al. [3] suggest that CSP helped participants in ideation and in overcoming design fixation. Hoggenmueller et al. have also explored how generative text-to-image tools can support overcoming design fixation in the field of Human-Robot Interaction [5]. They conducted a first-person design exploration. They noted that AI-generated images have the potential to inspire new robot aesthetics and functionality and also claimed that the designer's AI-co-creativity can help to eliminate biases and expand imagination. In a different case, Lewis [10] reflects that a digital assistance tool like "ChatGPT" helped her by acting as an art teacher and providing instructions. Lewis points out that it is challenging to distinguish between inspiration and copying when utilizing GenAI. Rafner et al. [12] conducted an in-the-wild study to examine the effects of AI-assisted image generation on creative problem-solving tasks, aiming to investigate the effects of GenAI on problem identification and problem construction. They developed a human-AI co-creative technology that combines a GAN and Stable Diffusion model to support AI-assisted image generation. They found that this intervention enabled participants to facilitate idea expansion and prompt engineering, suggesting that AI can "aid users in generating new ideas and refining their initial problem representations" [12]. Given that the domain of AI-powered creativity support is still in its infancy, the available literature provides only a nascent understanding of the effect of AI on creativity and design fixation. Our work extends the literature by using established HCI techniques to better understand how GenAI affect design practices.

3 AIMS OF OUR WORK

As GenAI is still in its infancy, our goal is to make use of this opportunity to propose interventions that contribute to a safer and more optimal world of GenAI. To achieve this, potential pitfalls need to be identified early on and minimized in the future. Pinpointing potential benefits and improving these tools will expedite the progress and evolution of this field.

In supporting the overall vision of our research work, we aim to answer the high-level question, *"How can we utilize and design AI-powered CSTs to assist designers to become better and responsible creative professionals?"* In doing so, we investigate the specific questions,

RQ 1: What are the effects of AI-generated imagery as a source of inspiration in an ideation task?

RQ 1a: How does the exposure to AI-generated images affect design fixation and divergent thinking during ideation, compared to using commonly used sources of inspiration and no inspiration support?

RQ 1b: How do different ways of interacting with AI image generators impact participants' effectiveness in an ideation task?

RQ2 What are professional designers' perceived benefits, challenges, and concerns regarding using AI-powered creativity support tools (AI-CSTs) in visual design?

RQ3: How might we design effective AI powered creativity support tools to overcome barriers in design process?

4 WORK TO DATE:

In this section, we present two studies, one which has concluded and will be presented at CHI'24, and the other being work-in-progress, with preliminary findings to be presented at the GenAICHI workshop.

4.1 Study 01: Lab experiment – The effects of GenAI on design fixation and divergent thinking

** This work will be presented at CHI'24: Please read the full paper for more information. (Reference obscured for anonymous review.)*

In answering RQ1, of our overall project, we conducted an experiment to find the effect of GenAI on design fixation and divergent thinking. The design literature dubs this phenomenon design fixation—the “blind adherence to a set of ideas or concepts limiting the output of conceptual design” [8]. This is a common experience in any creative task and happens when exposure to one idea anchors and biases subsequent ideas, restricting exploration of the design space.

Objectives of the study: We explored the effects of exposure to AI-generated images on measures of design fixation and divergent thinking in a visual ideation task. Following established experimental methods on design fixation, we used four divergent thinking measures from prior literature (design fixation score, fluency, variety, and originality [8, 15, 17, 18] to assess different facets of their creative output.

Method: We conducted a between-participants experiment (N=60) where participants involved in a visual ideation task for sketching ideas for a chatbot avatar. We manipulated participants' access to sources of inspiration: none, access to Google Image Search, or access to Midjourney (an image generation AI tool). The independent variable was the Inspiration Stimulus: none: (**Baseline**), Google Image Search (**Image search**), or Generative AI (**GenAI**). The dependent variables were the **Design Fixation score** (the number of features in each sketch in common with the example), **Fluency** (the number of sketches produced), **Variety** (the number of different types of sketches produced), and **Originality** (how infrequently other participants devised the same type of sketch).

Participants: University students with previous experience in visual design. Participants self-described their prior experience in visual design (measured in years/months). We did not specify this experience should only be professional design experience. Participants had a mean age of 25.8 years (18--49, SD = 5.4). They included undergraduate, master's and PhD students from diverse domains such as arts, business, computer science & IT, design, engineering, and science. Each condition had an equal number of participants and was gender-balanced, with 10 women and 10 men per condition (gender was self-described by participants).

Analysis approaches: We used a mixed-method approach for our analysis. For quantitative analysis of design fixation and divergent thinking, we built Bayesian statistical models to quantify relationships between our dependent and independent variables and to have a broader understanding of participant interview data we used the Braun and Clarke's 6-phase reflexive thematic analysis approach [1].

Key-findings: Through our study we found that using an AI image generator during ideation leads to higher fixation on an initial example, but results in fewer ideas with less variety and lower originality compared to a baseline. **Both image stimuli led to more features in common with the example avatar, with GenAI causing more design fixation than Image Search.** However, **neither Image Search nor GenAI enhanced Fluency compared to the baseline, resulting in lower Fluency.** The effect of Image Search on Fluency is minimal when controlling for total output time, but GenAI does not exhibit a considerable direct negative effect on Fluency.

Neither Image Search nor GenAI provided meaningful support over the baseline in terms of enhancing the variety of the output, yielding lower variety than the baseline. The effect of Image Search was fully mediated by Fluency, but GenAI had an additional negative direct effect on Variety. On average, **neither Image Search nor GenAI provided considerable aid in terms of developing Originality** of the output, but these effects were negligible.

Our qualitative analysis suggests that participants frequently relied on prompts containing keywords copied directly from the design brief or used prompts inspired by the example design. These prompts resulted in AI-generated images that were conceptually like the example design in 44% of cases, and which frequently contained fixating features that were present in the example design. Further, while not all sketches exhibit high similarity to the example we provided, ideating

based on AI images can lead to *fixation displacement*, where participants simply fixate on the images generated by the AI and copy what they see. This can occur irrespective of whether the participant imitates the example design or whether they attempt to explore other areas of the conceptual space.

Reflections: We learned that by employing objective analysis may lead to lack of subjective essence that lies within the creative practice, therefore employing qualitative methods to better capture information might be beneficial.

4.2 Study 02: Interview study - How professional designers are adopting, considering, or rejecting AI-powered creativity support tools in their practice.

** This work is in progress. We will present preliminary results at the GenAICHI workshop.*

Objectives of the study: We aim to understand professional designers' perceived benefits, challenges, and concerns regarding using AI-powered creativity support tools (AI-CSTs) in visual design.

Method: semi-structured interviews, both in-person and via videoconferencing.

Participants: Professional designers, in graphics, UI/UX and digital product design fields.

Analysis approaches: We will analyse the interview transcripts using Braun and Clarke's 6-phase reflexive thematic analysis approach [1].

Expected outcomes: Our aim of this study is to comprehend different facets of generative AI, including its adoption and application, benefits, challenges, and impact on external parties. We are specifically interested in exploring designers' viewpoints on generative AI, their future expectations, and desired advancements. By considering these factors, we hope to make an informed decision on utilising GenAI in our design work and propose interventions that contribute to a safer and better human AI co-creation.

Reflections: With expect to develop an in-depth understanding of designers' experiences, expectations, and concerns.

5 CONCLUSION AND FUTURE DIRECTIONS:

At this early phase of adoption of GenAI, we may see a distinct contrast between the experiences and outcomes of innovators, adaptors, and laggards. We propose a greater emphasis on the designer's experience to better understand the impact of GenAI on design work. This will provide rich insights to make informed decisions on designing this technology. We believe it is vital to understand the designer's experience both qualitatively and quantitatively. We have used a combination of in-depth interviews and lab experiments. By utilizing mixed methodologies, we expect to develop a comprehensive understanding of contexts for the adoption of GenAI in design. In future work we plan to conduct research and design to improve human-AI co-creation. Our ultimate objective is to explore ways to design GenAI tools that contribute to a safer and more optimal work context for designers.

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