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Integrating Generative AI in the UX Design Process: An Empirical Perspective

Abstract: With just a few words, designers can invoke text-to-image AI tools to generate relevant images that jump-start the creative process. These images are computationally generated to approximate everyday-life physical or digital products, such as a coffee machine or a sports website, and thus can aid collaborative design. But how do generative AI tools influence the User Experience (UX) design process, and do they improve product UX after all? This paper investigates the integration of generative AI in the UX design process in the context of mobile application design. We organized two distinct design workshops where eight designers in total (1) used no AI, or (2) the Midjourney AI tool, to design two high-fidelity mobile app prototypes. We evaluated both prototypes with 32 participants in a user study. Our results indicate that AI influences the UX design process in a differential way but it does not necessarily lead to superior UX quality.

Keywords: Artificial Intelligence, user experience, generative AI, AI design, digital products, mobile applications.

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Introduction

The integration of Artificial Intelligence (AI) into the practice of User Experience (UX) design has sparked extensive discourse about the imminent transformation of the design process. Historically, UX design, rooted in the field of human-computer interaction (HCI), has emphasized human understanding to translate user experiences into functional designs through an iterative design process (Zimmerman et al. 2007). Consequently, HCI researchers are exploring "AI as a design material," investigating how designers interact with AI in contexts that could benefit from integrating AI into the design process (Knearem et al. (2023), Liao et al. (2023), Lu et al. (2022), Yildirim et al. (2022), Yildirim et al. (2023). Prior research has shown that design practitioners and professionals face substantial difficulties in grasping the full scope of AI's capabilities, leading to inflated expectations and overlooked opportunities (Yildirim et al. 2022). For example, a typical misconception is that the mere availability of an AI tool will naturally revolutionize the UX design process, often overestimating the capabilities of current AI tools (Dove et al. 2017). However, recent related work approaches the integration of AI into the UX design process predominantly from a conjectural angle (Jin et al. 2021), Liao et al. (2023), Lu et al. (2022), Yildirim et al. (2022), Yildirim et al. (2023). Hassenzahl and Tractinsky (2006) describe UX by emphasizing its intersection with aesthetics, emotion, and experiential aspects, ensuring products address human needs comprehensively. As AI tools pivot more towards aiding app developers at post-design stage (e.g., GitHub Copilot1), a pressing question arises: how do designers practically utilize AI tools in the UX design process?

Yet, the sought-after integration of AI into the UX design process is not just about introducing new AI tooling—it is about re-imagining the design process in its entirety (Yang et al. 2020) (Yildirim et al. 2022). Some AI tools, such as Uizard2, facilitate the design process by translating hand-drawn sketches to wireframes and subsequently to prototypes. Text-to-image generative AI tools, such as Midjourney3, DALL-E 24 and Stable Diffusion5, have amassed immense popularity due to their capability of generating seemingly unique images from textual prompts. While AI's prowess in content generation promises revolutionary changes in the UX design process, its actual application is limited to inspiration rather than effective integration (Yang et al. 2020). Even so, it remains a mystery whether utilizing current AI tools in the UX design process truly has a bearing on overall UX outcomes.

We believe that establishing a cause-and-effect relationship, between (a) utilizing AI in the UX design process and (b) overall UX outcomes, will help the HCI community to effectively integrate AI into (UX) design. Therefore, it is first essential to empirically investigate how designers practically utilize current AI tools in the UX design process to delineate the impact of AI on design decision-making. Then, we need to experimentally and systematically evaluate the UX outcomes as products of utilizing AI in the UX design process.

To do so, we organized two distinct design workshops where eight designers in total (1) used no AI, or (2) the Midjourney AI tool, to design two high-fidelity mobile app prototypes. We evaluated both prototypes with 32 participants in a follow-up user study. Our findings can be summarized as follows:

(1) Text-to-image generative AI influences the stages of the UX design process differentially.
(2) Utilizing current text-to-image generative AI in the UX design process does not necessarily yield better overall UX outcomes.
(3) Text-to-image generative AI facilitates the core stages of the UX design process, enabling designers to think about additional stages such as validation and testing.
(4) Difficult to attribute every specific design decision to utilizing AI but aesthetics are easier to trace.
(5) Successfully utilizing an AI tool in the UX design process may discourage the exploration of alternative tools or design resources.
(6) Integration of generative AI tools into existing UX design toolsets is a sought-after feature.

Our contribution is twofold: (1) we make the first step towards establishing a cause-and-effect relationship between utilizing text-to-image generative AI in the UX design process and systematically measuring its effects on overall UX outcomes; and (2) we elicit empirical design guidelines for informing the integration of text-to-image generative AI tools into the UX design process.

2. Background

AI in UX Design

The effective integration of (generative) AI into the UX design process is expected to transform the design field by automating and enhancing various design tasks. AI tools, such as WireGen by Figma6, Visily7 and "Paper2Wire," can accelerate rapid prototyping by generating wireframes based on simple textual prompts (Buschek et al. 2020). Future AI tools will enable dynamic and adaptive user interfaces and personalize user experiences based on real-world data (Zimmerman et al. 2020). Generative AI can also aid in A/B testing by producing multiple design variants for experimentation, thus offering invaluable user insights (King et al. 2017). Currently, AI can serve as a "creative partner" to designers, generating novel concepts and even automating aspects of content creation (Knearem et al. 2023). This not only streamlines the design process, but also introduces a new level of user-centricity and accessibility, resulting in more efficient and inclusive designs.

However, integrating AI into the UX design process is not without hurdles. From the outset, Yang et al. (2020) point out that the difficulty in designing for Human-AI Interaction stems from the uncertainty surrounding AI's capabilities and its output complexity. Generative AI outputs can be notoriously "opaque," requiring prompt-engineering skills for a designer to properly utilize it, thus reducing trust and hindering adoption. In fact, Papenmeier et al. (2022) has identified trust as critical factor in AI adoption when investigating the intricate relationship between user trust and model accuracy in automated decision-making systems. Similarly, Liao et al. (2023) and Moore et al. (2023) argue that designers often struggle to grasp the limitations and transparency requirements for AI models, an essential criterion for responsible AI. Moreover, current AI systems are often too narrowly focused on graphical interface elements and overlook other vital areas in the UX design process, such as design inspiration and guideline checks (Lu et al. 2022). This further exacerbates the mismatch between UX practitioners' needs and AI tools capabilities. To bridge this gap, Jin et al. (2021) propose design heuristics based on AI patents, aiming to inspire UX designers in the early conceptual stage of the UX design process. These insights highlight the scarcity of empirical knowledge on how designers practically utilize AI tools in the UX design process. Empirical knowledge is necessary in informing those generative theories of interaction that will drive the effective integration of AI tools into the design process (Beaudouin-Lafon et al. 2021).

Even so, successful integration of AI into the UX design process is not just about broadening tool capabilities and formulating adequate theories; it will require organizational and workflow transformations as well. Subramonyam et al. (2021) delve into the co-creation process between designers and AI engineers, introducing a process model for rapid collaborative design. They found that user data can serve as design probes to enable divergent design thinking, content testing, and design validation in diverse group settings. This theme is also explored by Yildirim et al. (2022), who emphasize the system and service-level innovations that designers can bring to cross-functional AI teams in enterprise settings. Adaptive User Interfaces (AUIs) could be the gateway to effectively integrating AI into the UX design process, since they can learn to automate a frequent task by adapting to groups of users (Zimmerman et al. 2020). Finally, guidelines and frameworks to facilitate the AI integration are being shaped (Amershi et al. 2019). Recent research has shown that design professionals and practitioners use AI guidelines and frameworks not only for addressing AI's challenges in design, but also for education, cross-functional communication, and for developing internal resources (Yildirim et al. 2023).

Although it is encouraging that design professionals are receptive to new AI design guidelines, most of the guidelines available are elicited through interviews and online surveys that ask designers to envision working with AI, and thus carry limited ecological validity. Most importantly, there is scarce empirical evidence on whether utilizing AI in the UX

design process leads to superior UX outcomes in the first place. Here, we attempt to address this research gap by first empirically investigating how designers practically utilize current AI tools in the UX design process on-the-job. Then, we experimentally evaluate the bearing of AI on the UX design process by systematically measuring overall UX outcomes.

The Midjourney AI Tool

Midjourney is an AI tool that generates images from natural language prompts, like OpenAI's DALL-E, and Stable Diffusion. For example, a command such as /imagine, followed by the prompt "a small dog," generates four images of small dogs (or puppies). The tool is accessible via Discord bot commands and is under active development as a web interface. Users are mainly artists, designers, architects and professionals from the advertising industry who employ Midjourney for rapid prototyping and digital art creation. At the time this study was conducted, everyone with a Discord account could use Midjoureny for free with a limited capacity for image creations. Currently, Midjourney no longer offers a free tier or a trial period to new users. Midjourney's functionality can be summarized in three steps:

(1) "Processes the Job:" The Midjourney Bot takes about a minute to generate four options. The users start the prompting by using the /imagine command.

(2) "Upscale or Create Variations:" After the initial image grid has finished generating, two rows of buttons appear: The U-row to upscale one specific option and the V-row for creating other three variations of one of the four previously created options

(3) "Create Variations or Favorite Your Image:" After upscaling an image, a new set of options will appear: Make Variations, Web and Favorite Midjourney has inspired both excitement and controversy, especially around copyright issues, with some artists claiming that it devalues original creative work. In response, the tool's terms of service include a "Digital Millennium Copyright Act" (DMCA) takedown policy8. Midjourney also attracted attention for generating viral AI-based photos, raising questions about content moderation and ethical considerations. While earlier versions used a "banned words" system for content moderation, recent updates have implemented an AI-powered moderation system for a more nuanced interpretation of user prompts. Here, we utilize Midjourney as our AI intervention in the UX design process.

The 5 Stages of UX Design Process by Adobe

Typically, UX design and its process has been a practice that design professionals and practitioners exercise in the enterprise realm predominantly (Norman, 2013). The UX Design process is a holistic, multi-step journey focused on creating a product, system or

service that aligns with both user expectations and business objectives (Gothelf & Seiden, 2016). There are many variations of the UX design process, involving from three up to seven stages. To pinpoint the effects of AI tools on the UX design process, we follow the Adobe UX design process (Babich, 2017) that encompasses five stages. Adobe has a long record in developing tools and guidelines that support (UX) design professionals and HCI researchers (Jin et al. 2021).

It all starts with the "Product Definition" stage, where a broad concept of the product is fleshed out through stakeholder interviews and value proposition mapping. At this early stage, UX designers work with business stakeholders to define what the product is, who its users are, and why they would want to use it. Sketches or low-fidelity mock-ups may be generated to visualize initial ideas. A project kick-off meeting concludes this phase, establishing team roles, communication channels, and key performance indicators for measuring success. After laying down the groundwork, the team advances to the "Research" stage, which is often tailored to the project's unique requirements and constraints. Research, conducted through methods such as individual interviews and observation, provides a deep understanding of the user needs, pain points, and opportunities for differentiation in the market. Subsequently, the "Analysis" stage involves synthesizing data into actionable insights. User personas and user stories are developed to act as guiding representations of the target audience throughout the design process. The process then progresses to the "Design" stage, a critical step where user "wants" and needs are translated into actual product features and interactions. In this stage, activities range from sketching initial ideas to developing wireframes that outline the basic structure of the product, system or service. Prototyping is simulation of the user experience. Prototypes can vary in fidelity from clickable wireframes to fully coded simulations, serving as the foundation for user testing and stakeholder reviews.

Finally, the "Validation & Testing" stage provides the team with essential feedback on the design's effectiveness. This stage employs various testing methods, including in-house usability tests, focus groups, beta testing, and A/B tests. Analytics tools and surveys may also be used to capture both quantitative and qualitative user data. Feedback from this stage is incorporated into the iterative design process, allowing for refinements and adjustments before the product is officially launched.

3. Methods and results

Two focus groups were conducted, one human-made and the other AI-influenced (utilizing Midjourney). Participants in both groups created prototypes in Figma, engaging in discussions and collaborative tasks guided by distinct coding categories: individual opinion, group decision, external tool support, and AI as an external support tool.

For the human-made prototype, participants emphasized personal opinions, with individuals taking initiative in aspects like typography selection and component use in Figma. Their decision-making processes included debates over navigation design and icon choice. They also experimented with various animation options in Figma, though some animations were later removed due to performance issues. In the exit questionnaire, participants expressed a generally positive view on AI as a conceptual tool, recognizing its potential for inspiration but noting its current limitations in producing design-ready elements.

In the AI-supported group, Midjourney served primarily as an inspirational resource, helping to establish a dark mode theme. However, participants found limitations when attempting to create functional icons, demonstrating the current constraints of Midjourney for practical design implementation. The group's use of AI tools led to discussions on AI's future potential in UX, with members predicting AI's supportive role rather than it replacing human creativity.

User Study Results

The user study aimed to compare the UX quality of the two prototypes with a between-subjects design, where participants interacted with only one of the prototypes. The study focused on task completion times, success rates, and feedback from System Usability Scale (SUS) and User Experience Questionnaire Plus (UEQ+) results.

Regarding task performance, completion times revealed minor differences. The human-made prototype was faster in task completion, particularly in Task 3. Direct success rates showed mixed results, with human-made prototypes excelling in Task 1 but the AI-supported design achieving higher success in Task 2. Task 3 had an even completion rate for both prototypes.

As for the SUS scores for both prototypes were high, indicating strong usability with no significant differences between them, placing both in Grade A for usability. UEQ+ scores also showed similar averages, though the human-made prototype scored higher in Clarity. These findings suggest that while Midjourney offers valuable inspiration, it does not significantly elevate the final UX quality compared to traditional design processes.

Conclusion

Although AI has set to revolutionize design, effectively integrating AI tools into the UX design process requires evidence through experimentation. In this paper, we empirically evaluated the impact of integrating a text-to image generative AI tool (Midjourney), into the UX design process. Our findings showcase that AI is most frequently utilized in the product

definition and design stages of UX design process, making an impact on the final design. However, utilizing an AI tool did not result in superior overall UX outcomes compared to traditional UX design methods.

Designing with AI reduces reliance on external content, leaning on the AI tool for ideation and design decisions. On one hand, this may accelerate the design process, enabling designers to dedicate more time to other stages. On the other hand, AI tools could potentially limit the designers' scope of exploration. We argue that AI tools should promote design pluralism by generating multiple design variations at a zero-shot prompting level, and ensure designers have access to a logical and traceable record of generated designs and outputs. Thus, AI's role should be one of enhancement rather than entrapment, supporting designers without confining them to computational "walled gardens." We hope our findings and guidelines will help the HCI community to effectively integrate AI into the UX design process.

Works Cited

Amershi, Saleema, et al. "Guidelines for Human-AI Interaction." *CHI '19: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, Apr. 2019, https://doi.org/10.1145/3290605.3300233.

Babich, Nick. *Moving from graphic design to UX design: The complete guide to career change*. 4 Sept. 2017, blog.adobe.com/en/publish/2017/09/04/ux-design-for-graphic- designers.

Beaudouin-Lafon, Michel, et al. "Generative theories of interaction." *ACM Transactions on Computer-Human Interaction*, vol. 28, no. 6, Nov. 2021, pp. 1–54. https://doi.org/10.1145/3468505.

Buschek, Daniel, et al. "Paper2Wire." In *Proceedings of Mensch Und Computer 2020*, Sept. 2020, https://doi.org/10.1145/3404983.3405506.

Dove, Graham, et al. "UX design Innovation." *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, May 2017, https://doi.org/10.1145/3025453.3025739.

Gothelf, Jeff, and Josh Seiden. *Lean UX: Designing Great Products with Agile Teams*. O'Reilly Media, 2016.

Hassenzahl, Marc, and Noam Tractinsky. "User experience – a research agenda." *Behaviour and Information Technology*, vol. 25, no. 2, Jan. 2006, pp. 91–97. https://doi.org/10.1080/01449290500330331.

Jin, Xiaoneng, et al. "Design Heuristics for Artificial Intelligence: Inspirational Design Stimuli for Supporting UX Designers in Generating AI-Powered Ideas." *CHI EA '21: Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*, vol. 15, May 2021, pp. 1–8. https://doi.org/10.1145/3411763.3451727.

King, Rochelle, et al. *Designing with Data: Improving the User Experience with A/B Testing*. O'Reilly Media, 2017.

Knearem, Tiffany, et al. “Exploring the Future of Design Tooling: The role of Artificial intelligence in Tools for User Experience professionals.” In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems*, Apr. 2023, https://doi.org/10.1145/3544549.3573874.

Liao, Q. Vera, et al. “Designerly Understanding: Information needs for model transparency to support design ideation for AI-Powered user experience.” In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, Apr. 2023, pp. 1–21. https://doi.org/10.1145/3544548.3580652.

Lu, Yuwen, et al. “Bridging the gap between UX practitioners’ work practices and AI- Enabled design support tools.” *CHI Conference on Human Factors in Computing Systems Extended Abstracts*, Apr. 2022, https://doi.org/10.1145/3491101.3519809.

Moore, Steven, et al. “FAILUreNotes: Supporting designers in understanding the limits of AI models for computer vision tasks.” In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, Apr. 2023, pp. 1–19. https://doi.org/10.1145/3544548.3581242.

Norman, Don. *The design of everyday things: Revised and Expanded Edition*. Hachette UK, 2013.

Papenmeier, Andrea, et al. “It’s Complicated: The Relationship between User Trust, Model Accuracy and Explanations in AI.” *ACM Transactions on Computer-Human Interaction*, vol. 29, no. 4, Mar. 2022, pp. 1–33. https://doi.org/10.1145/3495013.

Subramonyam, Hariharan, et al. “Towards a process model for Co-Creating AI experiences.” In *Designing Interactive Systems Conference*, June 2021, https://doi.org/10.1145/3461778.3462012.

Yang, Qian, et al. “Re-examining whether, why, and how Human-AI interaction is uniquely difficult to design.” *CHI ’20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, Apr. 2020, https://doi.org/10.1145/3313831.3376301.

Yildirim, Nur, Alex Kass, et al. “How experienced designers of enterprise applications engage AI as a design material.” *CHI Conference on Human Factors in Computing Systems*, Apr. 2022, https://doi.org/10.1145/3491102.3517491.

Yildirim, Nur, Mahima Pushkarna, et al. “Investigating how Practitioners use Human-AI guidelines: A case study on the People + AI Guidebook.” In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, Apr. 2023, pp. 1–13. https://doi.org/10.1145/3544548.3580900.

Zimmerman, John, Jodi Forlizzi, et al. “Research through Design as a method for Interaction Design Research in HCI.” *CHI ’07: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, Apr. 2007, https://doi.org/10.1145/1240624.1240704.

Zimmerman, John, Changhoon Oh, et al. “UX designers pushing AI in the enterprise.” *Interactions*, vol. 28, no. 1, Dec. 2020, pp. 72–77. https://doi.org/10.1145/3436954.