Towards a Design (Research) Framework with Generative AI

Van Der Maden, Willem; Van Beek, Evert; Nicenboim, Iohanna; Van Der Burg, Vera; Kun, Peter; Lomas, James Derek; Kang, Eunsu

DOI
10.1145/3563703.3591453

Publication date
2023

Document Version
Final published version

Published in
DIS 2023 Companion

Citation (APA)
Van Der Maden, W., Van Beek, E., Nicenboim, I., Van Der Burg, V., Kun, P., Lomas, J. D., & Kang, E. (2023). Towards a Design (Research) Framework with Generative AI. In D. Byrne, N. Martelaro, A. Boucher, D. Chatting, S. Fdili Alaoui, S. Fox, I. Nicenboim, & C. MacArthur (Eds.), *DIS 2023 Companion: Companion Publication of the 2023 ACM Designing Interactive Systems Conference* (pp. 107-109). Association for Computing Machinery (ACM). https://doi.org/10.1145/3563703.3591453

Towards a Design (Research) Framework with Generative AI

Willem van der Maden
Department of Human-centered Design, Delft University of Technology
Delft, Netherlands
w.l.a.vandermaden@tudelft.nl

Evert van Beek
Department of Human-centered Design, Delft University of Technology
Delft, Netherlands
E.vanbeek@tudelft.nl

Iohanna Nicenboim
Department of Human-centered Design, Delft University of Technology
Delft, Netherlands
i.nicenboim@tudelft.nl

Vera van der Burg
Design Intelligence Lab, Delft University of Technology
Delft, Netherlands
v.vanderburg@tudelft.nl

Peter Kun
Digital Design Department, IT University of Copenhagen
Copenhagen, Denmark
peku@itu.dk

Derek Lomas
Department of Human-centered Design, Delft University of Technology
Delft, The Netherlands
j.d.lomas@tudelft.nl

Eunsu Kang
Machine Learning Department, Carnegie Mellon University
Pittsburgh, United States of America
kangeunsu@gmail.com

ABSTRACT

This one day workshop will explore the use of Generative Artificial Intelligence (GenAI) in design research and practice. Generative technologies are developing rapidly and many designers are using them. Yet, there remains little published work on the use of GenAI in design. Our goal is to not only showcase the potential of GenAI for design, but to engage in discussions of its shortcomings and opportunities as they have been already articulated by scholars. By synthesizing both published and unpublished works, we will develop best practices, ethical considerations, and future research directions for the use of GenAI in design. We will explore a range of topics and themes, including leveraging the characteristics of GenAI for design, mapping the diverse applications of GenAI in design, envisioning a framework for design, and guiding future work on GenAI in design research. Ultimately, we hope to provide a roadmap for the integration of GenAI into the design research process and to encourage designers and researchers to explore the potential of GenAI in a thoughtful and deliberate way.

CCS CONCEPTS

• **General and reference** → **Design**; • **Human-centered computing** → *Interaction design process and methods*; • **Computing methodologies** → *Artificial intelligence.*

DIS Companion '23, July 10–14, 2023, Pittsburgh, PA, USA

ACM ISBN 978-1-4503-9898-5/23/07.
https://doi.org/10.1145/3563703.3591453

KEYWORDS

generative artificial intelligence, design research, creative practices, computational creativity

ACM Reference Format:
Willem van der Maden, Evert van Beek, Iohanna Nicenboim, Vera van der Burg, Peter Kun, Derek Lomas, and Eunsu Kang. 2023. Towards a Design (Research) Framework with Generative AI. In *Designing Interactive Systems Conference (DIS Companion '23), July 10–14, 2023, Pittsburgh, PA, USA.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/3563703.3591453

1 BACKGROUND AND MOTIVATION

The growing accessibility of Generative Artificial Intelligence (GenAI), such as StableDiffusion[1] and ChatGPT[2], has led to a boom in "AI Art" and creative applications such as a text-to-UI creator [3], speculative architecture [7], text-to-image integration into Photoshop [2], and brainstorming apps [1, 5]. This radical accessibility has the potential to transform the creative field by helping designers generate, explore, and extend ideas faster by offering serendipity, surprise, and generate friction through its unpredictable outcomes. The emergence of new GenAI tools on a weekly basis show how GenAI opens up new creative modalities and opportunities for exploration, and therefore new opportunities for design research. In this workshop, we intend to assess the potential of GenAI in the context of design, with a focus on creating a comprehensive vision for the role of GenAI in design practice and avenues for design research. We aim to collaboratively develop this vision by synthesizing the work that is currently developing within the community, and that participants will share during the workshop. To emphasize, instead of introducing and exploring GenAI tools, we invite pioneering participants that have already used GenAI in some way. We intend to build on case studies that participants bring to the workshop to

[1] https://stability.ai
[2] http://chat.openai.com

build a vision for GenAI in design together. The workshop is related to the conference themes of design methods and processes, and technological innovation. We welcome and encourage explorations of GenAI in creative practices beyond text-to-image models, including but not limited to: text, synthetic data, music, video, speech or code.

2 RELATED WORK

To put the workshop in perspective, we here briefly discuss what Generative AI is, how it is presently related to design, and address similar ongoing or past workshops and how the goals of this workshop may differ.

2.1 Generative AI

GenAI, also referred to as Generative Models (GMs), is a class of algorithms that can generate data that is similar to, but not a copy of, its input data. Common examples of GenAI are Variational Autoencoders (VAE) [14], Generative Adversarial Neural Networks (GAN) [10], and Denoising Diffusion Probabilistic Models (DDPM) [11]. These techniques have been applied in all sorts of domains, including but not limited to video creation [21], 3D modeling [19], synthetic data [18], and treating disease [23]. The recent developments in the field open up a plethora of possibilities for design research as it may, for instance, be used to augment limited real-world data, be used to generate research material, and facilitate novel experiences. As many note that GenAI may also be a threat to the creative industry [8], it is important that we assess the potential application areas and practices *now*.

2.2 GenAI & Design

Cascini and colleagues discussed the possibilities of using AI in design [6]. They note that the main potential of AI will be during the conceptual phase. However, a preliminary review by Hwang [13], which studied the current product landscape of AI-empowered co-creative tools, states that only a few of the tools supported the early stages of the creative process, which the author named the wandering and Q&A stages. Further, the types of tools studied were: 1) editors enabling ease-of-use content editing, 2) transformers helping to alter and convert content to a different modality (e.g., hand-drawn sketches to digital images), 3) blenders combining two or more creative elements into new ideas, and 4) generators, producing ready-to-use creative outputs.

2.3 Generative AI Workshops

The number of workshops on Generative AI at Human-Computer Interaction and Design conferences indicate immense community interest around GenAI and its human implications. For example, GenAICHI 2023 [16] explores generative AI's interactions with humans, ethical considerations, and collaboration possibilities. Another workshop at CHI2023 concentrates on AI's role in collaborative ideation between humans [20]. HAI-GEN focuses on the challenges and opportunities of using deep generative models to enhance human-AI co-creation [24] and lastly, a Computational Creativity Workshop discussed co-creativity through work-in-progress and position papers [4].

Our workshop builds on this work, focusing on examples of GenAI use in design research contexts. We aim to gather researchers' and designers' experiences to reflect on this topic. Contrary to previous workshops, our focus is less about exploring future purposes, and more focused on already existing, "weak signal", design practices. In other words, we focus on GenAI in design processes and the community's early explorations to understand the best practices and move towards a design framework.

Within the cross-section of GenAI and design, we seek workshop participant contributions from any domain, and focused on any aspects of the design process. To illustrate the variety of our approach,the workshop organizers will share their published and ongoing work that can serve as a reference. Some of these examples are a study on using generative AI to overcome design fixation in the context of human-robot interaction [12], testing the emotional alignment of GPT-3, DALL-E, and Stable Diffusion [15], AI-generated 3D-printed sculptures [9], using LLM to create stories from the perspective of nonhumans with the aim to reflect on how to design for more-than-human futures [17], and a practical workshop aimed at subverting the biases in the dataset of Large Language Models for re-framing innovation discourse [22].

3 TOPICS AND THEMES

In this workshop, we aim to synthesize both published and unpublished works to develop best practices, ethical considerations, and future research directions for using Generative Artificial Intelligence (GenAI) in design. To achieve this goal, we will explore the following topics and themes:

(1) Leveraging the Characteristics of GenAI for Design
What are the key characteristics of GenAI that are relevant to design, such as serendipity, ease of use, and unpredictability, and how can they be leveraged to enhance design research and practice? What is the role of explainability in this regard?

(2) Mapping the Landscape of GenAI Applications in Design
How can we map the diverse applications of GenAI in design along relevant dimensions to GenAIn insights into the potential of GenAI to transform and impact design?

(3) Envisioning a Framework for using GenAI in Design Research
How can we effectively leverage generative models for understanding and researching human experiences, while also developing a design framework to narrow and target their capabilities for practical utility beyond novelty?

(4) Guiding Future Work on GenAI in Design Research
How can we create shared scenarios and a vision for the potential of GenAI in design research with a focus on identifying specific use-cases and how they have affected the research process? And what are the best practices, ethical considerations, and future research directions needed to further explore the potential of GenAI in design, and how can we offer suggestions and recommendations to advance the field of GenAI in design?

We believe that this workshop will be a valuable opportunity to learn from one another and to push the boundaries of what is possible in design research, and we look forward to a productive and engaging discussion.

4 WORKSHOP CALL

The year 2022 saw a boom in the field of Generative Artificial Intelligence (GenAI). The radical accessibility of these technologies has the potential to transform the creative field including design practice and design research. For instance, by helping designers generate, explore, and extend ideas more quickly, or by offering serendipity, surprise and generative friction through its unpredictable outcomes. It is also likely that GenAI will open up new creative modalities and possibilities for creative exploration, as well as new opportunities for design research. Despite these potentials and advancements, there remains little published academic work on the topic. In this workshop, we intend to take stock of the (potential of) GenAI in the context of design, with a focus on creating a comprehensive vision for the role of GenAI in design practice and avenues for design research. We aim to collaboratively develop this vision by synthesizing the work that is currently developing within the community and that participants will share during the workshop. Rather than introducing and exploring tools, we ask participants to present their own cases, so we can build together upon our own experiences with GenAI in design.

Participants should submit a 2- to 4-page position paper (including references) in the ACM Extended Abstracts Format. The proposals should contain authors' (initial or preliminary) experiences and reflections using GenAI in creative practices. The proposals should be emailed to w.l.a.vandermaden@tudelft.nl. We will select papers based on their relevance, quality, and diversity. We will limit the size of the workshop to 25 participants. At least one author of each accepted submission must attend the workshop and all participants must register for both the workshop and for at least one day of the conference.

ACKNOWLEDGMENTS

REFERENCES

[1] [n.d.]. Ayoa - A revolutionary brainstorming app wth AI. https://www.ayoa.com/ai/

[2] [n.d.]. Christian Cantrell. https://christiancantrell.com/#ai-ml

[3] [n.d.]. Galileo AI · Copilot for interface design. https://usegalileo.ai

[4] [n.d.]. Second Workshop on the Future of Co-Creative Systems. http://computationalcreativity.net/iccc21

[5] [n.d.]. Vizologi - AI-Powered Innovation Management Software. https://vizologi.com/

[6] G. Cascini, Y. Nagai, G. V. Georgiev, J. Zelaya, N. Becattini, J. F. Boujut, H. Casakin, N. Crilly, E. Dekoninck, J. Gero, A. Goel, G. Goldschmidt, M. Gonçalves, K. Grace, L. Hay, P. Le Masson, M. L. Maher, D. Marjanović, D. Motte, P. Papalambros, R. Sosa, Srinivasan V, M. Štorga, B. Tversky, B. Yannou, and A. Wodehouse. 2022. Perspectives on design creativity and innovation research: 10 years later. *International Journal of Design Creativity and Innovation* 10, 1 (Jan. 2022), 1–30. https://doi.org/10.1080/21650349.2022.2021480

[7] S. Coorlas. 2022. AI generates speculative axonometric construction drawings of modern concrete houses. https://www.designboom.com/architecture/ai-generated-construction-documents-generative-design-architecture-stephen-coorlas-08-06-2022/

[8] Thomas Davenport and Nitin Mittal. 2022. How Generative AI Is Changing Creative Work. https://hbr.org/2022/11/how-generative-ai-is-changing-creative-work

[9] Songwei Ge, Austin Dill, Eunsu Kang, Chun-Liang Li, Lingyao Zhang, Manzil Zaheer, and Barnabas Poczos. 2019. Developing creative ai to generate sculptural objects. *arXiv preprint arXiv:1908.07587* (2019).

[10] Ian Goodfellow, Jean Pouget-Abadie, Mehdi Mirza, Bing Xu, David Warde-Farley, Sherjil Ozair, Aaron Courville, and Yoshua Bengio. 2020. Generative adversarial networks. *Commun. ACM* 63, 11 (2020), 139–144.

[11] Jonathan Ho, Ajay Jain, and Pieter Abbeel. 2020. Denoising diffusion probabilistic models. *Advances in Neural Information Processing Systems* 33 (2020), 6840–6851.

[12] Marius Hoggenmueller, Maria Luce Lupetti, Willem van der Maden, and Kazjon Grace. 2023. Creative AI for HRI Design Explorations. ACM, Stockholm, Sweden.

[13] Angel Hsing-Chi Hwang. 2022. Too Late to be Creative? AI-Empowered Tools in Creative Processes. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts*. ACM, New Orleans LA USA, 1–9. https://doi.org/10.1145/3491101.3503549

[14] Diederik P Kingma and Max Welling. 2013. Auto-encoding variational bayes. *arXiv preprint arXiv:1312.6114* (2013).

[15] James D Lomas, Willem van der Maden, Sohhom Bandyopadhyah, Giovanni Lion, Yanna Litowsky, Haian Xue, and Pieter Desmet. 2023. The Alignment of AI Emotions: human ratings of the emotions expressed by GPT-3, DALL-E and Stable Diffusion [manuscript]. (2023).

[16] Michael Muller, Lydia B Chilton, Anna Kantosalo, Charles Patrick Martin, and Greg Walsh. 2022. GenAICHI: Generative AI and HCI. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts*. 1–7.

[17] Iohanna Nicenboim, Shruthi Venkat, Neva Rustad, Diana Vardanyan, Elisa Giaccardi, and Johan Redström. 2023. Conversation Starters: How Can We Misunderstand AI Better? ACM, New York, NY, USA, Hamburg, Germany, 4. https://doi.org/10.1145/3544549.3583914

[18] Sergey I. Nikolenko. 2021. Deep Neural Networks for Computer Vision. In *Synthetic Data for Deep Learning*, Sergey I. Nikolenko (Ed.). Springer International Publishing, Cham, 59–95. https://doi.org/10.1007/978-3-030-75178-4_3

[19] Ben Poole, Ajay Jain, Jonathan T. Barron, and Ben Mildenhall. 2022. DreamFusion: Text-to-3D using 2D Diffusion. https://doi.org/10.48550/arXiv.2209.14988 arXiv:2209.14988 [cs, stat].

[20] Joongi Shin, Janin Koch, Andrés Lucero, Peter Dalsgaard, and Wendy E Mackay. 2023. Integrating AI in Human-Human Collaborative Ideation. (2023).

[21] Uriel Singer, Adam Polyak, Thomas Hayes, Xi Yin, Jie An, Songyang Zhang, Qiyuan Hu, Harry Yang, Oron Ashual, Oran Gafni, Devi Parikh, Sonal Gupta, and Yaniv Taigman. 2022. Make-A-Video: Text-to-Video Generation without Text-Video Data. https://doi.org/10.48550/ARXIV.2209.14792

[22] Evert van Beek. 2023. Thingscon Workshop Disrupting disruptive innovation. https://evertvanbeek.com/wp-content/uploads/2023/02/Recap_ThingsconWinterWorkshop22.pdf

[23] Fangping Wan, Daphne Kontogiorgos-Heintz, and Cesar de la Fuente-Nunez. 2022. Deep generative models for peptide design. *Digital Discovery* 1, 3 (2022), 195–208. https://doi.org/10.1039/D1DD00024A Publisher: Royal Society of Chemistry.

[24] Justin Weisz, Mary Lou Maher, Hendrik Strobelt, Lydia B. Chilton, David Bau, and Werner Geyer. 2022. HAI-GEN 2022: 3rd Workshop on Human-AI Co-Creation with Generative Models. https://research.ibm.com/publications/hai-gen-2022-3rd-workshop-on-human-ai-co-creation-with-generative-models