AI role in ideation for design creativity enhancement

Gong, Zhengya; Paananen, Siiri ; Nurmela, Petra; Gonçalves, Milene; Georgiev, Georgi V.; Häkkilä, Jonna

Publication date
2024

Document Version
Final published version

Published in
Proceedings Of Asia Design And Innovation Conference

PROCEEDINGS OF ASIA DESIGN AND INNOVATION CONFERENCE
5–6 DECEMBER, 2024, SHANGHAI, CHINA

AI ROLE IN IDEATION FOR DESIGN CREATIVITY ENHANCEMENT

Zhengya Gong[1], Siiri Paananen[1], Petra Nurmela[1], Milene Gonçalves[2], Georgi V. Georgiev[3] and Jonna Häkkilä[1]
[1]University of Lapland
[2]Faculty of Industrial Design, Delft University of Technology
[3]Center for Ubiquitous Computing, University of Oulu

ABSTRACT
Artificial Intelligence (AI) has gained significant attention as a tool to support creative design, especially during the ideation phase. Although AI's role in design has been explored, its effectiveness in enhancing design creativity during idea generation remains uncertain. This study investigates how generative AI can influence design creativity in both individual and group ideation. Seven students participated in the study, generating ideas either individually or in groups using AI tools. The research examines AI's impact on creativity from participants' perspectives and outputs, aiming to provide a clearer understanding of AI's evolving role in design. By analyzing both the benefits and limitations of AI in the creative process, this study contributes to the ongoing discussion about AI's potential to enhance creativity.

Keywords: Artificial intelligence, Design creativity, Ideation, Generative AI

1 INTRODUCTION

In recent years, there has been a noticeable increase in interest in using Artificial Intelligence (AI) in the creative design process [1–5]. Given its expanding powers in picture generation, data analysis, and ideation recommendations, there is a compelling reason to investigate how AI may enhance creativity in individual and group settings. Although AI might help and inspire individuals by automating repetitive processes and developing ideas [6–8], it is still being determined if AI can assist in enhancing design creativity in ideation. The motivation for this study was to learn more about the role AI may play in design creativity—especially in the ideation stage.

In this study, we compared the influence of AI in individual and group settings to explore how useful it is as a tool for creativity enhancement in the early design stage (ideation). Seven master's students participated in the study. Participants had to generate creative ideas for transportation on mountain terrain individually or in groups for free using AI technologies. Specifically, we aimed to explore whether AI can be used in ideation for creativity enhancement based on the output and feedback of participants. In the end, we contributed to the understanding of AI's increasing position in design by highlighting both the advantages and disadvantages of AI in the creative design process through this study.

2 BACKGROUNDS

2.1 Design creativity

Ideation, also known as conceptual design, encompasses a variety of activities that involve the creation and development of ideas [9,10], particularly within the realm of design [11]. In the ideation phase, designers participate in activities that involve generating ideas and making decisions [12]. Ideation research typically assesses the creativity of outcomes generated in ideation to validate the efficacy of diverse techniques or stimuli [13,14]. Design creativity occurs when individuals utilize their capacity to generate ideas, solutions, or products that are novel and valuable (e.g., utility or usefulness) [15,16]. Regarding creativity metrics, researchers have identified four distinct measures of effectiveness: novelty, variety, quality, and quantity [17,18]. In addition, it is advisable to assess the novelty, and quality of

outcomes when a study is exclusively centered on design creativity [13], which was used in creativity-related studies [19,20].

2.2 AI in ideation

AI is increasingly employed in creative industries, especially in ideation processes, which may generate, filter, and enhance ideas [21,22]. AI helps individuals think outside the box and explore various ideas throughout the idea generation by providing new stimuli or automating repetitive chores [3,23]. Text-based generative models—like ChatGPT—have been popular in idea generation because they offer a novel viewpoint and facilitate the quick development of ideas in various fields [24–26]. Because of their adaptability, these models enable users to develop various solutions, from intricate problem-solving exercises to product ideas [24–26].

The rising trend of AI-assisted ideation shows the relevance of human-AI collaboration [27,28]. AI technologies are increasingly seen as co-creators that augment and supplement human efforts rather than replace human innovation [29,30]. Numerous research studies have focused on this hybrid method, indicating that AI can assist individuals in exploring concepts outside of their routine cognitive processes [31,32]. By incorporating AI technologies into the creative process, individuals have access to a broader range of viewpoints, ultimately resulting in more creative ideas [3,32].

2.3 Research motivation and aim

While successful in assisting human creativity, some academics contend that AI cannot be considered "creative" due to its inability to comprehend context or meaning [33–35]. According to this viewpoint, human creativity is anchored on emotional, cultural, and contextual knowledge [36,37], whereas AI is restricted to pattern recognition and data-driven outputs. However, others who support using AI in creativity contend that these instruments are essential for expanding the creative realm [4,24,25]. They view AI's capacity to generate ideas at scale and provide surprising connections as a helpful advantage, especially in industries like design that significantly rely on ideation [4,24,25]; how individuals' approach to ideation has changed because of AI's growing incorporation into creative professions [33–35]. However, more needs to be done to understand how AI may actively integrate into creative processes in both individual and group settings.

Therefore, our study examines how AI might improve group and individual ideation processes for design creativity. In particular, it explored how AI might affect individual and group ideation and how AI tools might supplement or augment human creativity in ideation. By dissecting these facets, the study attempted to add to the current conversation around AI's influence on design creativity.

3 METHODS

3.1 Participants

Seven participants participated in the study, including master students in the Art and Design faculty at the University of Lapland. They participated in the experiment as volunteers, and the participation did not affect their grades. We did not collect demographic information such as age, gender, or other personal details. This decision ensured that the focus remained solely on participants' creative output and their interaction with AI tools rather than introducing potential biases related to demographic factors.

3.2 Procedure

We experimented with a structured process. First, participants provided informed consent and completed a prequestionnaire that gathered their understanding and previous experiences related to AI, design creativity, and ideation. Next, participants took part in an ideation session, where they were tasked with generating as many ideas as possible within 20 minutes to design a transportation for people and goods in a mountainous area. Participants' use of AI tools during ideation was based on their responses to the pre-questionnaire. Those with a positive view of AI were instructed to use AI tools to assist in the ideation process individually (individual ideation: two participants in our study). Those uncertain about AI were given the flexibility to collaborate with group members (one or two) and use AI tools as they wished (group ideation: five participants in our study). Then, participants had to select, develop or generate one idea, as the best idea in 10 minutes. Finally, participants engaged in a discussion reflecting on the role of AI in enhancing creativity during the ideation process.

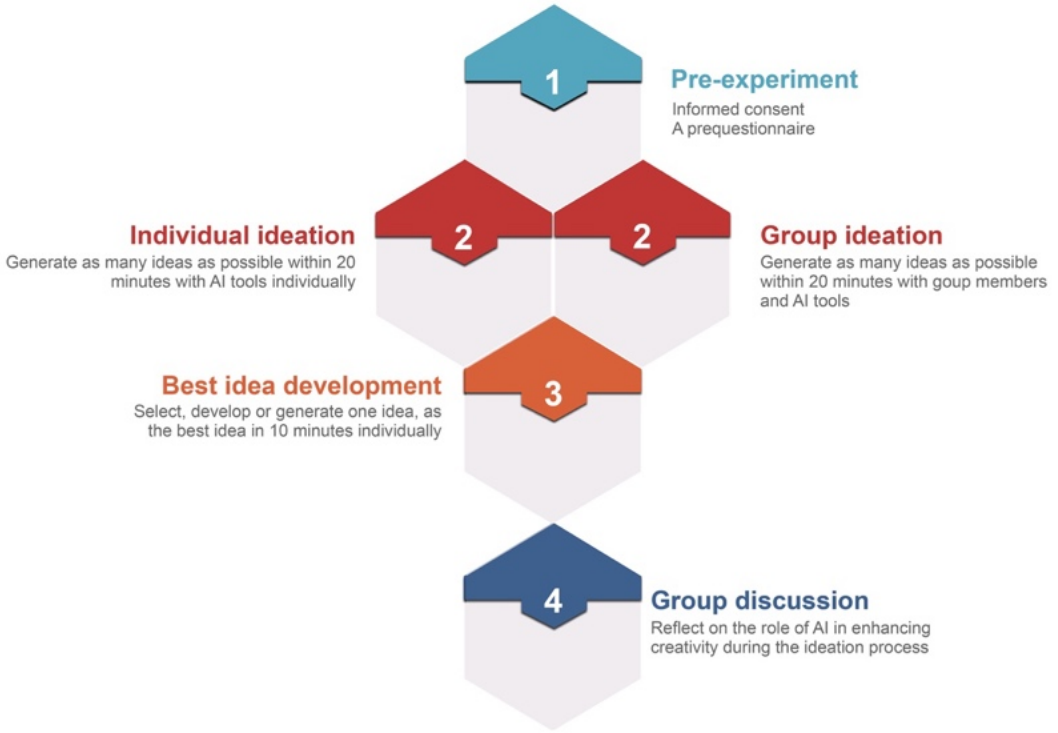


Figure 1. The procedure of the experiment

3.3 Data collection

We collected data in several stages. Initially, participants provided their opinions on AI, prior experiences with ideation, and general understanding of AI through a pre-questionnaire. After the ideation session, we gathered participants' final outputs, precisely the idea they considered to be their best. Although various metrics were used to measure design creativity [18], we adopted the study of Dean et al. [13], which was used to evaluate design creativity in ideation from four dimensions: novelty, workability/feasibility, relevance, and specificity [16,37]. In addition, we also collected participants' reflections during a post-ideation discussion, where they shared their thoughts on the role of AI in enhancing creativity. The audio recording from this discussion was transcribed for further analysis.

4 RESULTS

4.1 Description results

Before the experiment, we surveyed students on their familiarity with AI in the context of ideation for design creativity enhancement.

4.1.1: Participants previous experience of AI

Regarding AI, we asked about their understanding of AI. Participants provided varied descriptions of AI, reflecting a general understanding of its function and capabilities. One participant described AI as a program that processes information from the internet to answer questions or generate outputs based on available data. Another viewed AI as a data collection and reorganization tool, emphasizing its utility in multiple contexts. Some participants expressed the concept of AI as having "intelligence" that mimics human thinking, enabling it to perform tasks or create things. Participants demonstrated a shared understanding of AI as a computer-based system capable of gathering, processing, and responding to data, though their specific definitions varied in detail and focus.

Five participants were moderately familiar with AI, while two had limited familiarity. Four of the seven participants had previously integrated AI into their projects, while the remaining three had only briefly explored AI tools in everyday contexts. The most commonly used AI tools were chatbots and image generators, which all participants had tried, such as ChatGPT, Alexa, Midjourney, and Dell-2. In contrast, fewer participants had experience with machine learning models (two participants) and data analysis and visualization tools (two participants).

Participants expressed diverse perspectives on AI's role in the creative ideation process. One participant noted that AI might be useful for visualizing ideas that have already been formed but doubted its ability to generate innovative or "usable" designs for common objects. They suggested that AI might be more effective when generating unconventional designs, such as "a printer with the shape of a flower," to inspire further sketching and development. Some participants expressed uncertainty about integrating AI into their creative processes, with one mentioning that AI might offer new ideas but still needed to figure out its value. Conversely, others were more open to AI's potential, with one participant describing it as a co-creator, providing ideas and starting points to be developed further. Another participant recognized AI's utility in brainstorming and sharing ideas, considering it a valuable asset in the early stages of ideation. Overall, participants generally saw AI as a tool that enhances creativity by offering inspiration, visualizations, or alternative viewpoints, though opinions varied on its effectiveness and role in decision-making.

4.1.2: Participants previous experience of design creativity in ideation

Addressing creativity, participants described creativity primarily as the ability to generate new, unexpected solutions. Participant 1 highlighted the importance of originality, emphasizing that creativity involves thinking "outside the box." Another participant (participant 4) focused on the emotional aspect, defining creativity as a way to express feelings or present ideas through design. Several participants linked creativity with innovation, noting that it involves developing fresh ideas and designs that stand out from the past. One response specifically mentioned that creativity leads to innovative solutions that solve problems and enhance user experience. Overall, participants viewed creativity as both the generation of new ideas and the creation of designs that push beyond conventional boundaries, driven by the pursuit of novel solutions.

Participants shared various ideation methods they had previously used in their design projects, with brainstorming emerging as a common method. Benchmarking was another frequently mentioned method, with participants looking to existing designs for inspiration. This often involved sketching or writing down initial ideas that surfaced during the process. Collaboration also played a role, with some participants discussing their ideas with friends to further develop and test ideas. Overall, participants used a mix of ideation methods, relying on brainstorming, benchmarking, and creative exploration to solve design problems.

4.2 Design creativity

Two expert raters, each with approximately 10 years of professional experience in the design and creativity fields, independently evaluated the best idea randomly, which was developed and selected as their best idea by participants independently. The two raters have worked for the previous evaluation, and a high degree of agreement between them was evidenced by a statistically significant Kendall's W value of 0.755 ($p < 0.0005$) [16]. This result indicates strong consistency in their evaluation of the reliability of the evaluation process [38]. In the individual ideation condition, students scored the lowest in the novelty dimension of design creativity but achieved the highest scores in workability (feasibility) compared to group ideation, as shown in Figure 2. The average novelty score was 2.75 for individual ideation and 5.7 for group ideation. Conversely, the average workability score was 7.5 for individual ideation and 4.7 for group ideation. Additionally, there was minimal difference between the two conditions in the remaining dimensions of design creativity, including relevance and specificity, as shown in Figure 2. This implies that group cooperation improves the novelty of ideas, although AI may contribute more to producing feasible solutions throughout the ideation phase.

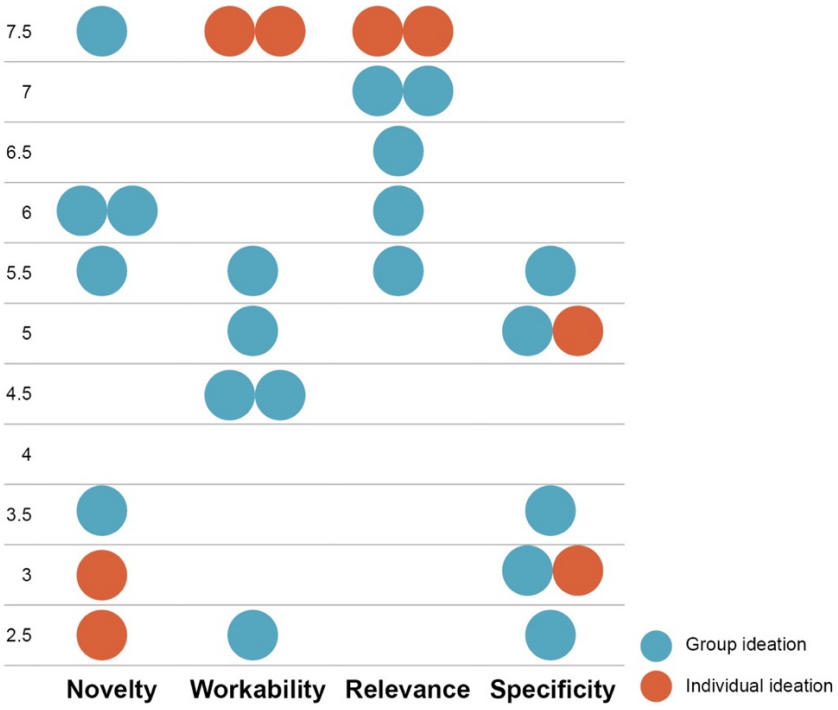


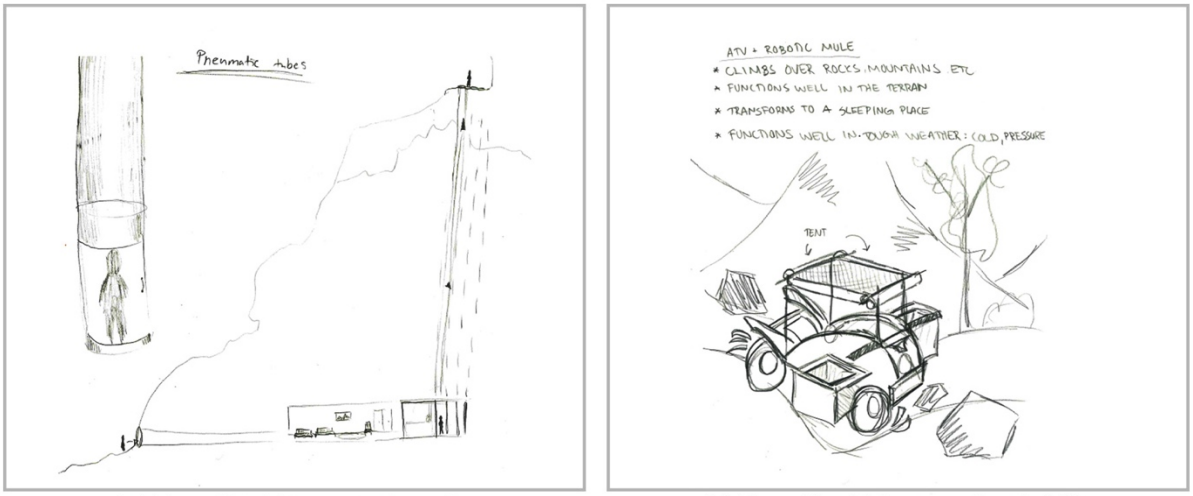
Figure 2. The scores of design creativity in two conditions

5 DISCUSSION

In this section, we discussed the difference in design creativity based on their output in two conditions (individual and group ideation). In addition, because no different opinion about AI's influence was found in the two conditions, we discussed the role of AI in ideation combined with two conditions.

5.1 Design creativity in individual and group ideation

We examined the contrasts between using AI in individual and group ideation based on their best ideas (two examples shown in Figure 3). The findings suggested that group ideation enhanced the novelty of ideas compared to individual ideation. In group settings, the collaborative exchange of ideas appeared to foster more innovative and unconventional solutions, as reflected in the higher average novelty score. Conversely, individual ideation prioritizes practicality, with participants generating ideas that scored higher in workability, likely because AI provided the workable ideas based on existing solutions.



(a) Idea with a high score of novelty

(b) Idea with a high score of workability

Figure 3. The two examples of ideas are in two conditions. (a) is the idea with a high score in novelty generated in the group condition, and (b) is the idea with a high score in workability generated in the individual condition.

The minimal differences in other dimensions, such as relevance and specificity, indicated that these aspects of design creativity were not heavily influenced by whether ideation occurs individually or, in groups or AI assistance. Interestingly, while group ideation boosts novelty, the presence of AI might have supported participants in generating more feasible solutions, highlighting AI's potential to enhance the workability of ideas during the creative process.

5.2 The role of AI in ideation

Following the ideation activity, participants engaged in a group conversation about the role of AI in ideation for creativity enhancement. There is no difference between individual and group ideation. Thus, we discussed participants' opinions together. One of the topics was that, while AI is helpful, *it cannot replace human creativity*. One participant stated that "to be creative, the machine still needs a human," implying that AI is primarily a support tool in the creative process. Another participant mentioned the difficulty of expressing highly unique ideas to AI (i.e., image-AI generator), such as having a fresh mind and describing it to the image-AI generator, which cannot provide any valuable visuals.

Several participants voiced dissatisfaction with *AI's limits in producing novel results*. One participant commented that AI struggles to create truly unique designs, making it more useful for simple and fundamental concepts than for developing fresh ones. Others demonstrated that while AI may provide fundamental ideas or beginning points, it requires human involvement to produce complicated or high-quality ideas. However, not all interviewees saw AI solely as a restriction. Two participants saw its utility in bringing fresh insights or simplifying ideas, especially in collaborative situations.

We also examined the contrasts between working with AI and colleagues. Many participants discovered *that cooperating with human peers was more advantageous than working alone with AI*. One participant mentioned that their partner contributed more to the creative process than the AI, which helped to keep ideas flowing and improved the ideas. On the other hand, those who worked only with AI expressed that it only provided fundamental ideas, necessitating more intervention to generate more novel ideas.

Interestingly, some participants hypothesized about *AI's future potential in creativity*, particularly in more advanced applications such as machine vision or emotion tracking. One participant imagined a situation where AI could understand facial expressions or even eye movements and alter its outputs in real time, thus expanding its function as a creative collaborator. Although such developments are still in the works, one participant speculated that AI may ultimately become a more intuitive and responsive partner.

Overall, the conversation underlined that AI may help with the creative process but cannot replace humans. Participants confirmed AI's capacity to form simple ideas but also emphasized the need for human cooperation and judgment in refining and developing creative ideas. As AI advances, its function in ideation may grow more significant; nonetheless, for the time being, it remains a tool that provides basic, simple and existing ideas rather than creative ideas.

6 LIMITATIONS

While this study offers insights into the potential of AI to support creativity in ideation, several limitations should be acknowledged. First, the sample size was relatively small, with only seven participants, which limits the generalizability of the findings. A larger, more diverse sample might yield different perspectives on AI’s role in enhancing creativity. Additionally, the study focused on master's students in design, whose familiarity and comfort with creative ideation processes may differ significantly from professionals in other fields. This participant group may have unique perspectives, or skill sets that influence how they use AI in ideation, which could affect the transferability of these findings to other populations.

Moreover, our study's scope was limited to short-term ideation sessions. The results may differ if the ideation process were extended over a longer period, or if participants were using AI in a professional or commercial context where the stakes and outcomes are different. Longitudinal studies could provide a more comprehensive view of AI's role in sustained creative work and its evolving impact on design processes.

7 CONCLUSIONS

In this study, we investigated the influence of AI in enhancing design creativity in ideation. The findings demonstrated that while AI can help generate ideas and provide inspiration, the ideas and solutions provided are common and paradigm-preserving and might not assist in enhancing novelty but

workability of design creativity. Participants considered AI primarily a support tool that might provide beginning points or alternative viewpoints. However, its ability to generate original or rare ideas still needs to be expanded.

Collaboration was identified as a critical element in creative ideation. Participants who worked with teammates found the process more productive and innovative than those who worked solely with AI. Human collaboration sparked new ideas and sustained creative momentum, while AI often provided more basic suggestions that needed individual refinement.

AI might evolve into a more integrated part of the creative process, particularly with advancements in machine learning, emotion tracking, and adaptive technologies. However, AI currently functions as a complementary tool, offering primary and existing solutions rather than enhancing human creativity—particularly in generating novel ideas. It is far from replacing human creativity.

ACKNOWLEDGMENTS

This work is partially funded by grants from the Academy of Finland as part of the AWARE project [Grant Number: 355694], the Research Council of Norway ANeED project (project number:326907), AI.R Arctic AI and Robotics funded by ERDF.

REFERENCES

[1] Chandrasekera T, Hosseini Z, Perera U. Can artificial intelligence support creativity in early design processes? *International Journal of Architectural Computing,* 2024, pp.14780771241254637. https://doi.org/10.1177/14780771241254637.

[2] Figoli FA, Mattioli F, Rampino L. Artificial intelligence in the design process: The Impact on Creativity and Team Collaboration. FrancoAngeli; 2022.

[3] Gong Z, Soomro SA, Wang M, Latif UK, Georgiev GV. Text Stimuli Created by Generative AI in Ideation: An Exploratory Study. *DS 130: Proceedings of NordDesign 2024, Reykjavik, Iceland, 12th-14th August 2024*, pp.496-503.

[4] Joosten J, Bilgram V, Hahn A, Totzek D. Comparing the Ideation Quality of Humans With Generative Artificial Intelligence. *IEEE Engineering Management Review,* 2024, pp.1–10. https://doi.org/10.1109/EMR.2024.3353338.

[5] McCormack J, Hutchings P, Gifford T, Yee-King M, Llano MT, D'inverno M. Design Considerations for Real-Time Collaboration with Creative Artificial Intelligence. *Organised Sound*, 2020, *25*(1), pp.41-52. https://doi.org/10.1017/S1355771819000451.

[6] Kim J, Maher ML. The effect of AI-based inspiration on human design ideation. *International Journal of Design Creativity and Innovation*, 2023, *11*(2), pp.81-98. https://doi.org/10.1080/21650349.2023.2167124.

[7] Liu F, Lv J, Cui S, Luan Z, Wu K, Zhou T. Smart "Error"! Exploring Imperfect AI to Support Creative Ideation. *Proceedings of the ACM on Human-Computer Interaction*, *8*(CSCW1), 2024, pp.1-28. https://doi.org/10.1145/3637398.

[8] Wadinambiarachchi S, Kelly RM, Pareek S, Zhou Q, Velloso E. The Effects of Generative AI on Design Fixation and Divergent Thinking. *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems*, New York, NY, USA: Association for Computing Machinery; 2024, pp. 1–18. https://doi.org/10.1145/3613904.3642919.

[9] Safin S, Dorta T, Pierini D, Kinayoglu G, Lesage A. Design Flow 2.0, assessing experience during ideation with increased granularity: A proposed method. *Design Studies,* 2016, *47*, pp.23-46. https://doi.org/10.1016/j.destud.2016.08.002.

[10] Zhang W. Ebb and flow: design fixation and creativity in professional groups. *Journal of Engineering Design,* 2024, *35*(3), pp.263-289. https://doi.org/10.1080/09544828.2024.2306783.

[11] Gonçalves M, Cash P. The life cycle of creative ideas: Towards a dual-process theory of ideation. *Design Studies,* 2021, *72*, p.100988. https://doi.org/10.1016/j.destud.2020.100988.

[12] Cross N. Designerly ways of knowing. Springer; 2006.

[13] Dean, D.L., Hender, J., Rodgers, T. and Santanen, E., Identifying good ideas: constructs and scales for idea evaluation. *Journal of Association for Information Systems*, 2006, *7*(10), pp.646-699.

[14] Lee JH, Ostwald MJ. The relationship between divergent thinking and ideation in the conceptual design process. *Design Studies,* 2022, *79*, p.101089.

[15] Sarkar P, Chakrabarti A. Assessing design creativity. *Design Studies,* 2011, *32*(4), pp.348-383.

https://doi.org/10.1016/j.destud.2011.01.002.
[16] Gong Z, Gonçalves M, Nanjappan V, Georgiev GV. Priming uncertainty avoidance values: Influence of virtual reality stimuli on design creativity in ideation. *Computers in Human Behavior*, 2024, *158*, p.108257. https://doi.org/10.1016/j.chb.2024.108257.
[17] Shah JJ, Smith SM, Vargas-Hernandez N. Metrics for measuring ideation effectiveness. *Design Studies*, 2003, *24*(2), pp.111-134. https://doi.org/10.1016/S0142-694X(02)00034-0.
[18] Fiorineschi L, Rotini F. Novelty metrics in engineering design. *Journal of Engineering Design*, 2021, *32*(11), pp.590-620. https://doi.org/10.1080/09544828.2021.1928024.
[19] Castanho A, Guerra M, Brites C, Oliveira JC, Cunha LM. Design thinking for food: Remote association as a creative tool in the context of the ideation of new rice-based meals. *International Journal of Gastronomy and Food Science,* 2023, pp.100664. https://doi.org/10.1016/j.ijgfs.2023.100664.
[20] Gong Z, Gonçalves M, Georgiev GV. Cultural influence on the creation of innovative products: An empirical study in the early stage of design. *Technovation (under review)* 2024.
[21] Tholander J, Jonsson M. Design Ideation with AI - Sketching, Thinking and Talking with Generative Machine Learning Models. *Proceedings of the 2023 ACM Designing Interactive Systems Conference,* New York, NY, USA: Association for Computing Machinery; 2023, p. 1930–40. https://doi.org/10.1145/3563657.3596014.
[22] Yildirim N, Oh C, Sayar D, Brand K, Challa S, Turri V, et al. Creating Design Resources to Scaffold the Ideation of AI Concepts. Proceedings of the 2023 *ACM Designing Interactive Systems Conference*, New York, NY, USA: Association for Computing Machinery; 2023, p. 2326–46. https://doi.org/10.1145/3563657.3596058.
[23] Chang H-Y, Kuo J-Y. Exploring metacognitive processes in design ideation with text-to-image AI tools. *Proceedings of the Design Society,* 2024, pp. 915–24.
[24] Taveekitworachai P, Thawonmas R. Enhancing Novelty in ChatGPT Responses: Incorporating Random Word Brainstorming. *Proceedings of the 13th International Conference on Advances in Information Technology*, New York, NY, USA: Association for Computing Machinery; 2023, p. 1–7. https://doi.org/10.1145/3628454.3628456.
[25] Filippi S. Measuring the Impact of ChatGPT on Fostering Concept Generation in Innovative Product Design. *Electronics*, 2023, *12*(16), pp.3535. https://doi.org/10.3390/electronics12163535.
[26] Lavrič F, Škraba A. Brainstorming Will Never Be the Same Again—A Human Group Supported by Artificial Intelligence. *Machine Learning and Knowledge Extraction*, 2023, *5*(4), pp.1282-1301. https://doi.org/10.3390/make5040065.
[27] Nguyen A, Hong Y, Dang B, Huang X. Human-AI collaboration patterns in AI-assisted academic writing. *Studies in Higher Education*, 2024, pp. 1–18. https://doi.org/10.1080/03075079.2024.2323593.
[28] Wang X, Lu Z, Yin M. Will You Accept the AI Recommendation? Predicting Human Behavior in AI-Assisted Decision Making. *Proceedings of the ACM Web Conference 2022*, New York, NY, USA: Association for Computing Machinery; 2022, p. 1697–708. https://doi.org/10.1145/3485447.3512240.
[29] Xia M. Co-working with AI is a Double-sword in Technostress? An Integrative Review of Human-AI Collaboration from a Holistic Process of Technostress. In *SHS Web of Conferences,* 2023*,* pp. 03022. EDP Sciences. https://doi.org/10.1051/shsconf/202315503022.
[30] Wang S, Ning Z, Truong A, Dontcheva M, Li D, Chilton LB. PodReels: Human-AI Co-Creation of Video Podcast Teasers. *Proceedings of the 2024 ACM Designing Interactive Systems Conference*, New York, NY, USA: Association for Computing Machinery; 2024, p. 958–74. https://doi.org/10.1145/3643834.3661591.
[31] Guo X, Xiao Y, Wang J, Ji T. Rethinking designer agency: A case study of co-creation between designers and AI. *IASDR Conference Series 2023*.
[32] Gmeiner F, Yang H, Yao L, Holstein K, Martelaro N. Exploring Challenges and Opportunities to Support Designers in Learning to Co-create with AI-based Manufacturing Design Tools. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems,* New York, NY, USA: Association for Computing Machinery; 2023, p. 1–20. https://doi.org/10.1145/3544548.3580999.
[33] Berni A, Borgianni Y, Rotini F, Gonçalves M, Thoring K. Stimulating design ideation with

artificial intelligence: present and (short-term) future. *Proceedings of the Design Society* 2024;4:1939–48. https://doi.org/10.1017/pds.2024.196.
[34] Marrone R, Cropley D, Medeiros K. How Does Narrow AI Impact Human Creativity? *Creativity Research Journal,* 2024, pp.1–11. https://doi.org/10.1080/10400419.2024.2378264.
[35] Oppenlaender J. The Creativity of Text-to-Image Generation. *Proceedings of the 25th International Academic Mindtrek Conference,* New York, NY, USA: Association for Computing Machinery; 2022, p. 192–202. https://doi.org/10.1145/3569219.3569352.
[36] Gong Z, Lee L-H, Soomro SA, Nanjappan V, Georgiev GV. A Systematic Review of Virtual Brainstorming from the Perspective of Creativity: Affordances, Framework, and Outlook. Digital Creativity, 2022, *33*(2), pp.96-127. https://doi.org/10.1080/14626268.2022.2064879.
[37] Gong Z, Nanjappan V, Lee L-H, Soomro SA, Georgiev GV. The Relationship Between Culture and Design Creativity at the Individual Level: A Case Study Based on Design Tasks. *International Journal of Design Creativity and Innovation,* 2023, *11*(3), pp.185-208.https://doi.org/10.1080/21650349.2022.2157889.
[38] Schmidt RC. Managing Delphi Surveys Using Nonparametric Statistical Techniques. *Decision Sciences,* 1997, *28*(3), pp.763-774. https://doi.org/10.1111/j.1540-5915.1997.tb01330.x.