Exploring the Relation Between Generative AI Tools and Mental Imagery in Novice Design

Creativity in design depends on the generation and transformation of internal representations, particularly visual mental imagery. With the growing adoption of generative AI tools, a key question is how these systems interact with the cognitive mechanisms that support creative thinking.

Generative AI systems for visual production, particularly text-to-image (T2I) and image-to-image (I2I) models, enable rapid externalization of ideas and promise to accelerate ideation while lowering technical barriers. T2I models generate images from natural-language descriptions by mapping linguistic representations onto learned visual structures, most commonly using diffusion-based architectures. I2I models extend this process by conditioning generation on an existing image, allowing controlled transformations such as variation, refinement, or style transfer (Zineb Sordo et al., 2025). Tools such as Midjourney, Adobe Firefly, and Imagen operationalize these mechanisms for design practice, shifting early-stage visual exploration from manual depiction toward language-driven interaction.

Despite their growing adoption, it remains unclear how effectively designers with different creative and imagery abilities can leverage these systems. In particular, the relationship between individual differences in mental imagery – such as vividness, transformability, and originality – and effective use of generative AI tools remains largely unexplored. Understanding how traditionally studied forms of creativity translate into interaction with AI-mediated tools is increasingly important for design education and the creative market.

Drawing on the pictorial theory of mental imagery (Kosslyn et al., 2006; Kosslyn & Pomerantz, 1977), visual imagery is conceptualized as a spatial, picture-like representation in working memory that supports transformation and reinterpretation. Empirical research demonstrates that imagery vividness and transformability are associated with domain-specific visual creativity (Palmiero et al., 2015) and successful design outcomes, including those embedded in business contexts (Dahl et al., 1999). In design sketching functions as a primary means of externalizing mental imagery, enabling reinterpretation and iterative conceptual development (Fan et al., 2023; Kavakli & Gero, 2001). AI introduces a novel form of externalization – mediated by language rather than manual depiction – raising questions about how imagery processes modulates AI-based image generation.

The study employs a between-groups experimental design with graphic design students. Participants are assigned to either a control group completing a design task without AI support or an experimental group allowed unrestricted use of generative AI tools. Baseline imagery abilities are assessed using the Spontaneous Use of Imagery Scale (SUIS) alongside imagery vividness, originality, and transformation. The main task consists of either a business-embedded design brief (e.g., logo design) evaluated using consensual assessment techniques or a psychometrically grounded drawing task adapted from established imagery measures.

The primary hypothesis predicts that individual differences in imagery vividness modulate the frequency of AI-assisted image generation events. Additionally, it is hypothesized that generative AI reduces conceptual diversity unless explicitly guided by variation-oriented prompts and that AI-supported designers show a higher incidence of cognitive biases such as confirmation, framing,

and anchoring. This research aims to clarify how generative AI interacts with mental imagery and creative cognition in novice design.

Bibliography

Dahl, D. W., Chattopadhyay, A., & Gorn, G. J. (1999). The Use of Visual Mental Imagery in New Product Design. Journal of Marketing Research, 36(1), 18. https://doi.org/10.2307/3151912

Fan, J. E., Bainbridge, W. A., Chamberlain, R., & Wammes, J. D. (2023). Drawing as a versatile cognitive tool. Nature Reviews Psychology, 2(9), 556–568. https://doi.org/10.1038/s44159-023-00212-w

Kavakli, M., & Gero, J. S. (2001). Sketching as mental imagery processing. Design Studies, 22(4), 347–364. https://doi.org/10.1016/S0142-694X(01)00002-3

Kosslyn, S. M., & Pomerantz, J. R. (1977). Imagery, propositions, and the form of internal representations. Cognitive Psychology, 9(1), 52–76. https://doi.org/10.1016/0010-0285(77)90004-4

Kosslyn, S. M., Thompson, W. L., & Ganis, G. (2006). The Case for Mental Imagery. Oxford University Press.

Palmiero, M., Nori, R., Aloisi, V., Ferrara, M., & Piccardi, L. (2015). Domain-Specificity of Creativity: A Study on the Relationship Between Visual Creativity and Visual Mental Imagery. Frontiers in Psychology, 6. https://doi.org/10.3389/fpsyg.2015.01870

Zineb Sordo, Eric Chagnon, & Daniela Ushizima. (2025). A Review on Generative AI for Text-to-Image and Image-to-Image Generation and Implications to Scientific Images. https://arxiv.org/html/2502.21151v2?utm_source=chatgpt.com