UOT 004.8

DOI: 10.25045/ASUCAAI.2025.19

THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE CREATIVE PROSESS

Ulviyya Rahimova Namig g.
Teacher
Sumqayıt State Technical College under Sumqayıt State University
Sumqayıt, Azərbaycan
mehemmedli.ulviyye1994@gmail.com

Abstract

The release of ChatGPT has sparked quite a bit of interest about creativity in the context of artificial intelligence (AI), with theorizing and empirical research asking questions about the nature of creativity (both human and artificially-produced) and the valuing of work produced by humans and artificial means. In this article, we discuss one specific scenario identified in the creativity research community – co-creation, or use of AI as a tool that could augment human creativity. We present emerging research relevant to how AI can be used on a continuum of four levels of creativity, from mini-c/creativity in learning to little-c/everyday creativity to Pro-C/professional creativity and Big-C/eminent creativity. In this discussion, AI is defined broadly, not to include only large language models (e.g., ChatGPT) which might approach general AI, but also other computer programs that perform tasks typically understood as requiring human intelligence. We conclude by considering future directions for research on AI as a tool for creativity across the four c’s.

Ülviyyə Rəhimova

Süni intellektin yaradıcılıq prosesində tətbiqi

Xülasə

ChatGPT-in istifadəyə verilməsi süni intellektin (AI) kontekstində yaradıcılıq haqqında böyük maraq doğurmuşdur. Nəzəri və empirik tədqiqatlar insan və süni yollarla yaradılan yaradıcılığın mahiyyəti və insan tərəfindən yaradılmış işlərin dəyərinin qiymətləndirilməsi kimi suallar qoyur. Bu məqalədə yaradıcılıq tədqiqatları icması tərəfindən müəyyən edilmiş konkret bir ssenarini – həmmüəllifliyi və ya süni intellektin insan yaradıcılığını gücləndirə bilən bir alət kimi istifadəsini müzakirə edirik. AI-nin yaradıcılığın dörd səviyyəsi boyunca – mini-c/öyrənmədə yaradıcılıqdan little-c/gündəlik yaradıcılığa, Pro-C/peşəkar yaradıcılığa və Big-C/məşhur yaradıcılığa qədər necə istifadə oluna biləcəyinə dair yeni araşdırmaları təqdim edirik. Bu müzakirədə AI geniş mənada müəyyən edilir; təkcə ümumi süni intellektə yaxınlaşa bilən böyük dil modellərini (məsələn, ChatGPT) deyil, həmçinin adətən insan zəkası tələb edən vəzifələri yerinə yetirən digər kompüter proqramlarını da əhatə edir. Sonda biz süni intellektin dörd C çərçivəsində yaradıcılıq üçün bir alət kimi gələcək tədqiqat istiqamətlərini nəzərdən keçiririk.

Ульвийя Рагимова

Применение искусственного интеллекта в творческом процессе

Аннотация

Выпуск ChatGPT вызвал большой интерес к креативности в контексте искусственного интеллекта (ИИ). Теоретические и эмпирические исследования поднимают вопросы о природе креативности (как человеческой, так и созданной искусственным путем) и оценке ценности работы, произведенной людьми и искусственными средствами. В этой статье мы обсуждаем один конкретный сценарий, определенный в сообществе исследований креативности – со-творчество или использование ИИ как инструмента, который может усилить человеческую креативность. Мы представляем новые исследования, которые касаются того, как ИИ может использоваться на континууме четырех уровней креативности: от mini-c/креативности в обучении до little-c/повседневной креативности, Pro-C/профессиональной креативности и Big-C/выдающейся креативности. В этом обсуждении ИИ определяется в широком смысле, не только как большие языковые модели (например, ChatGPT), которые могут приближаться к общему ИИ, но и как другие компьютерные программы, выполняющие задачи, обычно требующие человеческого интеллекта. В заключение мы рассматриваем будущие направления исследований ИИ как инструмента для креативности на протяжении всех четырех уровней.

Açar sözlər: Süni intellekt, Yaradıcılıq üçün AI alət kimi, Yaradıcılığın 4C modeli.
Keywords: Artificial intelligence, Creativity AI as tool, 4c’s Model of Creativity.
Ключевые слова: Искусственный интеллект, Креативность, ИИ как инструмент, Модель 4C креативности.

Introduction

Artificial intelligence (AI) technology has become a major topic of interest to creativity scholars, especially since the release of ChapGPT in November 2022. New research questions emerged, from examining creativity of ideas produced by generative AI and comparing them to those produced by human participants [Cropley, D., 2023, pp. 2] to examining audience perceptions of AI-generated vs. human-made art to ethical and humanistic implications of AI for creativity suggested a term parallel to artificial intelligence – artificial creativity – to describe machine-based generative outputs. Cropley et al examined the attributes of artificial creativity and compared them to human creativity.

Taking a different approach, a collaborative of creativity scholars discussed four major scenarios how AI systems can influence creativity [Vinchon Florent, Lubart Todd, Bartolotta Sabrina, Gironnay Valentin, Botella Marion, Bourgeois-Bougrine Samira, Burkhardt Jean-Marie, Bonnardel Nathalie, Corazza Giovanni Emanuele, Glăveanu Vlad, Hanson Michael Hanchett, Ivcevic Zorana, Karwowski Maciej, Kaufman James C., Okada Takeshi, Reiter-Palmon Roni, Gaggioli Andrea, 2023, Pp. 467-837].

1) human-AI co-creation, where AI becomes a tool (or one of the tools) for human creativity and has a potential to augment it [Kaufman J.C., Beghetto R.A., 2009, pp. 1-12]];

2) human only creativity becoming a hallmark of ‘true’ creativity, similar to the handmade effect in consumer product evaluations or the authenticity effect in judgements of art

3) plagiarism concerns;

4) AI diminishing human creativity in some individuals by weakening motivation and self-concept of creativity.

Each of these scenarios is likely to spur their own lines of research. For instance, creativity researchers might conduct studies to examine who would be likely to get discouraged and who would be inspired by AI systems. Similar to the creative mortification effect [Beghetto R.A., 2014, pp. 266], we can hypothesize that those who end up being negatively affected by the presence of generative AI are individuals who do not have high creative self-efficacy, value of creativity, and the ability to regulate emotions, such as anxiety and frustration, during the creative process.

In this article, we focus on the scenario of co-creation or the use of AI as a tool for creativity. We consider a broad view of AI as including any computer programs that perform tasks that are typically understood as requiring human intelligence. AI technologies include narrow (or weak) intelligence that are specialized for specific kinds of tasks (e.g., self-driving cars) and broad or general intelligence (which is still theoretical, but tools like ChatGPT might be approaching it.

When we discuss AI as a tool for creativity, we draw an analogy with other technologies that have been used to augment human creativity. Invention of photographic technology created a new artform, although with some initial resistance. The advent of computers enabled development of innovative statistical methods and their widespread application in scientific research. For example, although factor analysis was first used by Spearman (1904) and formally defined by Thurstone (1935), increases of computational power made it possible to apply these techniques more broadly and spurred development of new methods (e.g., structural equation modelling, latent curve models; Cudeck & MacCallum, 2007). These methods were in turn applied broadly in scientific research, such as identification of five broad factors of personality. Although history is a good teacher, and can inform by analogy, it is important to examine how emerging AI technologies specifically can be used in the service of human creativity.

In the following sections, we examine potential uses of AI technologies across the four levels of creativity, from mini-c to little-c to Pro-c, and Big-C [3 followed by discussion of future research directions. We apply the Four C's framework as a convenient guide and acknowledge that it presents a simplified view of creativity. Most importantly, the four levels are not discrete and mutually exclusive categories. Rather, they are best understood as a continuum that provides a useful model for theory and research on different manifestations of creativity. For example, little-c creativity (or everyday creativity) can often become Pro-c/professional creativity when a casual activity inspires expertise acquisition and grows into a professional endeavor.

Mini-c creativity. Mini-c creativity is a form of creativity that happens in the learning process [Beghetto, R.A., Kaufman J.C., 2007, pp. 73-79]. Mini-c creativity can be described as original only to the individual, often without being shared with others, and its quality is best described in terms of personal meaningfulness. For instance, mini-c can manifest as insights that contribute to new understandings, or personally meaningful connections between one's experiences and new knowledge being acquired.

The study of AI in the context of education is examining applications of AI technologies in traditional academic subjects (e.g., supporting learning toward mastery of reading and

writing, Passonneau et al., 2017), as well as investigating how these technologies might be applied toward learning skills beyond traditional academic competencies [Simone Grassini]; [Beghetto R.A., 2014, pp. 266]. Implications of AI for mini-c creativity remain largely unexamined. We could hypothesize that because of the potential for personalization of learning using AI technology, the likelihood of personally meaningful insights and associations that is the highlight of this kind of creativity could be higher than with traditional instruction.

Beghetto and Karwowski have proposed micro-longitudinal design to study the dynamic nature of the creative process in learning. In contrast to traditional longitudinal designs which include multiple assessments across days (e.g., in the case of experience sampling methods), months, or years, micro-longitudinal designs involve measurements in a short time period – from seconds to minutes. These designs could be useful in the study of mini-c creativity in interactions with AIs, with data about the nature of the interaction recorded in the AI environment and supplemented by think aloud and survey methods. A similar approach has been employed by Kangasharju et al. (2022) to observe how secondary school students use the AI tool Poetry Machine to learn poetry writing and what kinds of poems they generate using this tool.

Little-c/everyday creativity. Little-c creativity refers to original and appropriate ideas or products in the context of everyday life and interactions (e.g., leisure activities, daily challenges in relationships or work). Typical measures of creative thinking, such as divergent thinking tests or problem solving tasks, are best understood as measuring little-c creativity. As these measures continue being widely used in creativity research, and they are easy and quick to administer, it is not surprising that this is where research on AI and creativity has started.

Cropley (2023) compared responses to a divergent association task produced by human participants and by ChatGPT (versions 3 and 4). The task asked respondents to generate 10 words that are as different from each other as possible, with responses scored based on semantic distance. ChatGPT generated more original responses than humans, although the differences were small. Koivisto and Grassini (2023) collected responses from human participants, ChatGPT (versions 3.5 and 4), and Copy.Ai on the alternate uses test and found higher mean originality for AI responses, measured both in terms of semantic distance and human ratings. AI did not generate commonplace responses, but it also did not consistently produce more original ideas than the best performing humans. These results suggest that AI as an idea generation tool might be especially helpful to those who tend to generate ideas low on originality.

A study of storytelling provided a direct test of the effects of humans using AI as a tool. Participants were asked to write an 8-sentence story about an adventure on open sea. Comparing those who had no AI access, participants who were introduced to ChatGPT-4 as a tool for idea generation wrote more novel and useful stories (defined as appropriate, feasible, publishable) (Doshi & Hauser, 2023). Moreover, being able to solicit multiple ideas from the AI further increased novelty and usefulness compared to getting a single idea, as well as resulted in stories rated as better-written, more enjoyable, having a surprising twist, and having changed people's expectations of future stories they read. The downside of access to AI was that stories were more similar to each other for those who worked with ChatGPT than for the human-only condition. Of note, story originality and usefulness were enhanced only for participants with low creative thinking ability (measured by the divergent

association task), suggesting that benefits of using AI might be restricted to those with low creative potential.

Dell'Acqua et al. (2023) conducted a study in a sample of management consultants in which the control (human-only) group was compared with the experimental groups having access to ChatGPT-4 (AI tool only and AI tool plus prompt engineering materials groups). The dependent tasks were designed to realistically reflect consultant work (e.g., developing a concept for a niche footwear product from generating ideas, to developing prototype description, to market analysis, and product launch). Human raters judged quality of each of 18 subtasks, including: (1) tasks directly relevant to the creative process, such as generating product ideas, evaluating and selecting the best idea, coming up with potential names for their product, describing a prototype, coming up with a marketing slogan; and (2) communication about the creative product (e.g., writing an inspirational memo to company employees, describing the product development process in a Harvard Business Review style article).

Results showed that participants in both AI conditions performed better than those in the control condition, even when controlling for performance on a similar baseline task, with the ChatGPT + training group doing better than the ChatGPT only group. Similar to other studies, those who had low scores on the baseline task benefited more than those who had high scores, and using AI reduced variability of ideas.

Furthermore, the study compared performance on a task within the capability of the AI tool and a task designed so that AI would produce incorrect output without extensive guidance. Although participants with access to ChatGPT were rated as producing higher quality output than those without AI help, they were also more likely to make mistakes. In other words, participants over-relied on the AI.

Big-C/eminent Creativity. Contributions that change a domain and have an enduring influence on a field, or even culture at large, constitute Big-C or eminent creativity [Kaufman J.C., Beghetto R.A., 2009, pp. 13-16]. At this time, there are no studies of Big-C creativity enabled or facilitated by AI systems. However, developments in AI, such as the AlphaFold, which was designed to predict 3D structure of proteins based on their genetic sequence, have sparked interest of scientists in biomedical fields [Callaway E., 2022, pp. 234-238]. At a minimum, AlphaFold can be used to save time on a long process of understanding the structure of proteins that could be employed in developing new treatments for challenging diseases and potentially lead to revolutionary innovations. In a year after AlphaFold database was publicly released, more than 250 publications across biomedical sciences referred to it, suggesting quick adoption and application in research [Varadi Mihaly, Velankar Sameer]. It would not be far-fetched to imagine Nobel Prize winners in physiology or medicine employing this tool or a similar AI tool in the years to come.

Observational and think aloud studies will be valuable in examining mini-c creativity in interactions with AI technology. Mini-c creativity can emerge in the process of learning about AI tools themselves (e.g., exploring new ways of using the technology and gaining new insights about it), as well as when AI tools are used as part of the instructional process. If the instructional process is personalized with the use of AI, we can ask whether creative learning is more likely than in group-based instruction. Furthermore, interaction between human instruction and the AI will be relevant. Students, whether children or adults in professional settings, might be less likely to rely only on the

ideas provided by the AI if they learn about how these technologies generate ideas (i.e., based on co-occurrences of concepts in a body of training data) and the nature of the creative process before interacting with the AI (e.g., that first ideas tend not to be the most creative; Lucas & Nordgren, 2020).

Across the continuum of creativity, it will be important to investigate individual and situational factors that facilitate the use of AI technologies to augment human creativity. On the individual level, we can hypothesize that openness to experience can predispose individuals to be more receptive to adopting AI tools and that narrower traits, such as curiosity, can facilitate exploration aimed at developing strategies for how to optimally use the technology. Situational factors can involve both training in strategies of AI use and team processes that can facilitate problem finding and verification tasks.

References:

1. Cropley D. Is artificial intelligence more creative than humans? ChatGPT and the divergent association task, [2023, pp. 2].

2. Callaway E. What’s next for the AI protein-folding revolution. Nature, 604 [2022, pp. 234-238].

3. Kaufman J.C., Beghetto R.A. Beyond big and little: The Four C Model of Creativity, Review of General Psychology, 13 [2009 pp. 1-12].

4. Kaufman J.C., Beghetto R.A. Beyond big and little: The Four C Model of Creativity Review of General Psychology, 13 [2009 pp. 13-16].

5. Beghetto R.A. Creative mortification: An initial exploration. Psychology of Aesthetics, Creativity, and the Arts, 8 [2014, pp. 266].

6. Beghetto, R.A., Kaufman J.C. Toward a broader conception of creativity: A case for ‘mini-c’ creativity. Psychology of Aesthetics, Creativity, and the Arts [2007, pp. 73-79].

7. Tuomi Beyond Mastery: Toward a Broader Understanding of AI in Education, International Journal of Artificial Intelligence in Education [2023, pp. 1-12].

8. Vinchon Florent, Lubart Todd, Bartolotta Sabrina, Gironnay Valentin, Botella Marion, Bourgeois-Bougrine Samira, Burkhardt Jean-Marie, Bonnardel Nathalie, Corazza Giovanni Emanuele, Glăveanu Vlad, Hanson Michael Hanchett, Ivcevic Zorana, Karwowski Maciej, Kaufman James C., Okada Takeshi, Reiter-Palmon Roni, Gaggioli Andrea. Artificial Intelligence & Creativity: A Manifesto for Collaboration. *The Journal of Creative Behavior*. Volume 57, Issue 4. December 2023. Pages 467-837. https://onlinelibrary.wiley.com/doi/epdf/10.1002/jocb.597?getft_integrator=sciencedirect_contenthosting&src=getftr&utm_source=sciencedirect_contenthosting

9. Simone Grassini. Shaping the Future of Education: Exploring the Potential and Consequences of AI and ChatGPT in Educational Settings. https://www.mdpi.com/2227-7102/13/7/692

10. Varadi Mihaly, Velankar Sameer. The impact of AlphaFold Protein Structure Database on the fields of life sciences. https://analyticalsciencejournals.onlinelibrary.wiley.com/doi/10.1002/pmic.202200128