
Analogies-based Design using a Generative AI Application: A Play in Three Acts

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Abstract

Framing and Reframing are powerful co-creative strategies. We explore Reframing as a novel human-AI co-creative method using a conversational UI to a Large Language Model, presenting an actual session in the form of a theatrical script. We address themes of human-AI co-creativity, the role of the AI, and questions of AI anthropomorphism.

Author Keywords

Analogy-based design; Human-AI collaboration; Interactional creativity; Framing and reframing; Generative AI.

Introduction

Rapid growth in algorithms and work-practices in generative AI (GenAI) present new opportunities and challenges. Conversational GenAI paradigms allow people to explore complex ideas with relative ease [7, 11]. Generative algorithms tend to produce partially-deterministic, variable outcomes to similar or identical inputs [2, 31]. This attribute offers new opportunities for human-AI co-creative work [6, 16].

In discussions of creativity strategies [25, 32], Framing and Reframing have been advocated as powerful methods [15, 30]. We interpret these methods as providing a guiding analogy to create an integrated set of UI concepts. We describe recent explorations of using Large Language Models (LLMs) to aid in Framing and Reframing. In the form of a

Notes on the concepts in the script

¹ These interactions occurred in three conversational interactions of the form “User: Please review the definition of ____.” We omit this dialog to conserve space.

² The User requests the AI to propose a Framing - i.e., a metaphor that can guide design.

³ This was the metaphor proposed by the UI and explored as the basis for co-creativity in [20]. In this position paper, the human will reject this metaphor and ask for a new concept. This Reframing is the core of the novelty in this position paper.

⁴ Shortened to conserve space.

⁵ Through the principle of generative variability (different outcomes for similar inputs [31]), the User could request a different answer to the same question, thereby eliciting a Reframing of the design problem.

theatrical script, we present excerpts from an actual dialog with a highly-conversational UI to a LLM based on [23]. We explore themes of human-AI co-creativity (e.g., [20, 18]), relationships of human and AI [12, 13], and AI anthropomorphism [1, 27]. We develop these themes in the Discussion.

Experimental Setting

This paper presents a transcript of a real human-AI session using a highly-conversational UI to the GPT-3.5-turbo LLM based on [23]. The UI has been tuned for relatively brief conversational turns through prompt engineering, storing the series of conversational turns in a dynamic prompt buffer, similar to [24]. Thereby, we maintain the human’s control over both the strategy of the creative process and the tactical direction of the work (e.g., [21, 26, 27]).

The experimental task was to create a set of UI concepts - i.e., a Framing [15, 30] - for a computer interface, using UI concepts that would be familiar to a non-specialist. In earlier work [20], we explored analogies such as “a database is like a toolbox,” and we used the UI to an LLM to create mappings of database actions to analogous actions with physical tools [20] - similar to older “desktop” metaphors for computer files [28]. In this paper, we explore metaphors for “a human interacting with a computer,” and we build on prior Framing-based work by adding LLM-assisted Reframing.

A Play in Three Acts

Prelude

To prepare the prompt buffer by inserting relevant concepts, there was an initial dialog in which the human asked the UI to review definitions for “analogy,” “metaphor,” and “simile.”¹

Act I Scene 1: User requests the AI to propose a Framing for the UI design

[the curtain opens]

User: What is a good metaphor for a human using a computer?²

AI: I think a good metaphor for a human using a computer is that of a conductor leading an orchestra. The conductor uses a baton to direct the musicians, just as a human uses a mouse or keyboard to direct the computer. The conductor must have a clear understanding of the music and how it should be played, just as a human must have a clear understanding of the task they are trying to accomplish and how to use the computer to achieve it...

Act I Scene 2: Problems with the Framing

User: If the human is the conductor, and the computer is the orchestra, then what is the analogy for the audience?⁴

AI: I think a possible analogy for the audience in the context of a human using a computer to conduct an orchestra could be the users of the output produced by the computer...

User: I thought the human (the conductor) was the user?

AI: I apologize for the confusion. You are correct that the human is the user in the context of a computer program. The human uses the computer to conduct the orchestra, and the computer is the tool that the human uses to achieve their goal. In this case, the audience could be the people who benefit from the output produced by the computer program, such as the listeners who enjoy the music produced by the orchestra.

Act II Scene 1: User requests the AI to propose a Reframing for the UI design

User: I think there are too many different humans involved in this analogy. Please choose a different analogy for a human using a computer.⁵

AI: Thank you for the reminder. I will make sure to provide complete answers after thinking.

Notes on the concepts in the script

⁶ Four additional mappings are removed to conserve space.

⁷ Six additional mappings are removed to conserve space.

⁸ The User was concerned that take-off and landing are high-risk moments in piloting, but were not mentioned in the AI-generated concepts.

⁹ Three additional mappings are removed to conserve space.

As for a different analogy for a human using a computer, how about the analogy of a pilot flying a plane? The pilot uses the controls of the plane to navigate and control the flight, just as a human uses the keyboard, mouse, or other input devices to control the computer...

User: Thank you, the pilot-and-plane analogy is better, because it doesn't include unnecessary complexities.

Act II Scene 2: Exploring the new Reframing

User: From the human's perspective, please make a series of one-to-one mappings of the human actions with a computer, and their analogous actions by the pilot.

AI: I apologize for the previous response. Here are some possible mappings of human actions with a computer and their analogous actions by a pilot:

- Typing on a keyboard to input commands into the computer is analogous to using the controls in the cockpit to adjust the plane's course and altitude.
- Using a mouse or touchpad to navigate through menus and select options is analogous to using the plane's instruments to monitor the flight and make adjustments as needed...⁶

User: From the plane's perspective, please make a series of one-to-one mappings of computer actions, and their analogous plane actions.

AI: I apologize for the previous response. Here are some possible mappings of computer actions and their analogous plane actions:

- Saving a file or document on the computer is analogous to recording data or information about the flight in the plane's logbook or flight recorder.
- Troubleshooting errors or issues on the computer is analogous to diagnosing and resolving problems with the plane's systems or equipment...⁷

Act II Scene 3: Following-up on an under-developed aspect of the Reframing

User: Can you propose one-to-one mappings of the computer-user's activities that are analogous to the pilot's activities in taking off from the runway and in landing on the runway?⁸

AI: I will try to provide some mappings of computer-user activities that are analogous to the pilot's activities in taking off from the runway and in landing on the runway:

- Before taking off, the pilot goes through a pre-flight checklist to ensure that all systems are functioning properly and that the plane is ready for takeoff. Similarly, before starting a task on the computer, the user may go through a checklist of necessary steps or requirements to ensure that the computer is ready for use...
- During landing, the pilot must carefully control the plane's descent and speed to ensure a safe landing. Similarly, when finishing a task on the computer, the user may need to carefully review and check their work to ensure a successful outcome...⁹

Act III: Envoi

User: Can you think of any other aspects of the pilot or the plane, that could give us design ideas about a human using a computer?

AI: Thank you for the reminder. Here are some additional aspects of the pilot or the plane that could give us design ideas about a human using a computer:

- The plane's systems and equipment must be regularly maintained and updated to ensure they are functioning properly and up-to-date with the latest technology. Similarly, computers and software must be regularly maintained and updated to ensure they are secure and functioning properly...
- The plane's flight is monitored and tracked by air traffic control and other systems to ensure safety and efficiency. Similarly, computer use should be monitored and tracked to ensure security and compliance with regulations and policies.¹⁰

User: How interesting! Thank you very much!

[the curtain closes]

Discussion

Human-AI Co-Creativity: The UI is Where the Action Is
We believe that the highly-conversational UI to the LLM [23] was a crucial aspect of this work. As with many applications of GenAI, the human was able to exercise strategic *agency* [8] to choose the Framing for the co-creative activity (e.g., by selecting a metaphor). In addition, the conversational nature of the UI permitted fine-grained exchanges in a mixed-initiative paradigm [5, 9, 22], allowing the human to adjust and correct the tactical moves toward the chosen goal. This structure of interaction helps to maintain human control over AI functionality, consistent with Shneiderman's call to action [26].

Relationships of Human and AI

The conversational paradigm supports the structuring of interactions in accordance with different roles that an AI (UI+LLM) may plan in human work, play, and spiritual life. Diverse categories of roles have been proposed for AI agents, including tools, assistants, servants, mediators [12]; collaborators, problem solvers, advisors, coaches, reviewers, colleagues [23]; and even pen-pals and nannies [17]. Conversational paradigms may be used experimentally to structure both the vocabulary and the dynamics of different roles, and to investigate which roles may be beneficial to which users under which circumstances.

Paradoxes of AI Anthropomorphism

AI anthropomorphism (e.g., the use of first-person pronouns by an AI agent) has been criticized as potentially deceitful and manipulative [1, 27]. Others have argued for more nuanced approaches [4, 29], in view of the thousands of years during which humans have treated objects and entities as if they were conscious beings [19, 27]. The risk may emerge in specifically *interactive* applications [14], if the AI does not present itself explicitly as a computational entity. In the script of this paper, the AI is named as "AI" and the UI uses the first-person pronoun as a conversational hedge [3, 10] ("I think...", "I apologize...", "I will try...") to *weaken* the authority of its computerized influence. In these dialogs, the first person pronoun is used as a form of *honesty about AI uncertainty*, rather than as deceitful manipulation of the User.

Conclusion

In this paper, we have used the variability of GenAI outcomes to explore Framing and Reframing of co-creative design exercises between human and AI. In future work, we hope to experiment with additional co-creativity strategies [25, 32].

Notes on the concepts in the script

¹⁰ Five additional mappings are removed to conserve space.

References

- [1] Gavin Abercrombie, Amanda Cercas Curry, Tanvi Dinkar, and Zeerak Talat. 2023. Mirages: On Anthropomorphism in Dialogue Systems. *arXiv preprint arXiv:2305.09800* (2023).
- [2] Aakash Ahmad, Muhammad Waseem, Peng Liang, Mahdi Fehmideh, Mst Shamima Aktar, and Tommi Mikkonen. 2023. Towards human-bot collaborative software architecting with chatgpt. *arXiv preprint arXiv:2302.14600* (2023).
- [3] Fareed H Al-Hindawi and Musaab A Raheem Alkhazaali. 2016. A critique of politeness theories. *Theory and Practice in Language Studies* 6, 8 (2016), 1537.
- [4] Amani Alabed, Ana Javornik, and Diana Gregory-Smith. 2022. AI anthropomorphism and its effect on users' self-congruence and self-AI integration: A theoretical framework and research agenda. *Technological Forecasting and Social Change* 182 (2022), 121786.
- [5] Caroline PC Chanel, Raphaëlle N Roy, Nicolas Drougard, and Frédéric Dehais. 2020. Mixed-initiative human-automated agents teaming: towards a flexible cooperation framework. In *Engineering Psychology and Cognitive Ergonomics. Cognition and Design: 17th International Conference, EPCE 2020, Held as Part of the 22nd HCI International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Part II* 22. Springer, 117–133.
- [6] Payel Das and Lav R Varshney. 2022. Explaining Artificial Intelligence Generation and Creativity: Human interpretability for novel ideas and artifacts. *IEEE Signal Processing Magazine* 39, 4 (2022), 85–95.
- [7] Stavros Demetriadis and Yannis Dimitriadis. 2023. Conversational Agents and Language Models that Learn from Human Dialogues to Support Design Thinking. In *International Conference on Intelligent Tutoring Systems*. Springer, 691–700.
- [8] Sebastian Deterding, Jonathan Hook, Rebecca Fiebrink, Marco Gillies, Jeremy Gow, Memo Akten, Gillian Smith, Antonios Liapis, and Kate Compton. 2017. Mixed-initiative creative interfaces. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. 628–635.
- [9] Imke Grabe, Miguel Gonzalez Duque, and Jichen Zhu. 2022. Towards a framework for human-ai interaction patterns in co-creative gan applications. In *Proceeding of the 3rd Workshop on Human-AI Co-Creation with Generative Models (HAI-GEN '22) at ACM IUI Workshops*.
- [10] Bernard Guerin. 2003. Language use as social strategy: A review and an analytic framework for the social sciences. *Review of General Psychology* 7, 3 (2003), 251–298.
- [11] Brandon A. Harwood. 2023. CHAI-DT: Prompting Conversational Generative AI Agents to Actively Participate in Co-creation. *GenAICHI workshop: Generative AI and CHI*, <https://generativeaiandhci.github.io/> (2023).
- [12] Taenyun Kim, Maria D Molina, Minjin Rheu, Emily S Zhan, and Wei Peng. 2023. One AI Does Not Fit All: A Cluster Analysis of the Laypeople's Perception of AI Roles. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. 1–20.

- [13] Markus Langer, Tim Hunsicker, Tina Feldkamp, Cornelius J König, and Nina Grgić-Hlača. 2022. “Look! it’s a computer program! it’s an algorithm! it’s ai!”: does terminology affect human perceptions and evaluations of algorithmic decision-making systems?. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 1–28.
- [14] Jong-Eun Roselyn Lee and Clifford I Nass. 2010. Trust in computers: The computers-are-social-actors (CASA) paradigm and trustworthiness perception in human-computer communication. In *Trust and technology in a ubiquitous modern environment: Theoretical and methodological perspectives*. IGI Global, 1–15.
- [15] Antonios Liapis, Georgios N Yannakakis, Constantine Alexopoulos, and Phil Lopes. 2016. Can computers foster human users’ creativity? Theory and praxis of mixed-initiative co-creativity. (2016).
- [16] Vivian Liu and Lydia B Chilton. 2022. Design guidelines for prompt engineering text-to-image generative models. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 1–23.
- [17] Todd Lubart. 2005. How can computers be partners in the creative process: classification and commentary on the special issue. *International Journal of Human-Computer Studies* 63, 4-5 (2005), 365–369.
- [18] Mary Lou Maher. 2012. Computational and collective creativity: Who’s being creative?. In *ICCC*. 67–71.
- [19] Michael Muller. 2004. Multiple paradigms in affective computing. *Interacting with Computers* 16, 4 (2004), 759–768.
- [20] Michael Muller, Heloisa Caroline de Souza Pereira Candello, and Justin Weisz. 2023. Interactional Co-Creativity of Human and AI in Analogy-Based Design. In *International Conference on Computational Creativity*.
- [21] Michael Muller and Justin Weisz. 2022. Frameworks for Collaborating Humans and AIs: Sequence and Sociality in Organizational Applications. In *CHIWORK*.
- [22] Michael Muller, Justin D Weisz, and Werner Geyer. 2020. Mixed initiative generative AI interfaces: An analytic framework for generative AI applications. In *Proceedings of the Workshop The Future of Co-Creative Systems-A Workshop on Human-Computer Co-Creativity of the 11th International Conference on Computational Creativity (ICCC 2020)*.
- [23] Steven I Ross, Fernando Martinez, Stephanie Houde, Michael Muller, and Justin D Weisz. 2023a. The programmer’s assistant: Conversational interaction with a large language model for software development. In *Proceedings of the 28th International Conference on Intelligent User Interfaces*. 491–514.
- [24] Steven I Ross, Michael Muller, Fernando Martinez, Stephanie Houde, and Justin D Weisz. 2023b. A Case Study in Engineering a Conversational Programming Assistant’s Persona. *Proceedings of HAI-GEN 2023: IUI workshop on Human-AI Co-Creation with Generative Models*, <https://ceur-ws.org/Vol-3359/paper13.pdf> (2023).
- [25] Johannes Schleith, Milda Norkute, Mary Mikhail, and Daniella Tsar. 2022. Cognitive Strategy Prompts: Creativity Triggers for Human Centered AI Opportunity Detection. In *Creativity and Cognition*. 29–37.

- [26] Ben Shneiderman. 2022. *Human-centered AI*. Oxford University Press.
- [27] Ben Shneiderman and Michael Muller. 2023. On AI Anthropomorphism. Medium. (10 April 2023). <https://medium.com/human-centered-ai/on-ai-anthropomorphism-abff4cecc5ae>.
- [28] David C Smith, Frank E Ludolph, and Charles H Irby. 1985. The desktop metaphor as an approach to user interface design (panel discussion). In *Proceedings of the 1985 ACM annual conference on The range of computing: mid-80's perspective: mid-80's perspective*. 548–549.
- [29] Ertugrul Uysal, Sascha Alavi, and Valéry Bezençon. 2023. Anthropomorphism in artificial Intelligence: A review of empirical work across domains and insights for future research. *Artificial Intelligence in Marketing* (2023), 273–308.
- [30] Chris Walsh, Kerry Chappell, and Anna Craft. 2017. A co-creativity theoretical framework to foster and evaluate the presence of wise humanising creativity in virtual learning environments (VLEs). *Thinking skills and creativity* 24 (2017), 228–241.
- [31] Justin D Weisz, Michael Muller, Jessica He, and Stephanie Houde. 2023. Toward General Design Principles for Generative AI Applications. *arXiv preprint arXiv:2301.05578* (2023).
- [32] Zhuohao Wu, Danwen Ji, Kaiwen Yu, Xianxu Zeng, Dingming Wu, and Mohammad Shidujaman. 2021. AI creativity and the human-AI co-creation model. In *Human-Computer Interaction. Theory, Methods and Tools: Thematic Area, HCI 2021, Held as Part of the 23rd HCI International Conference, HCII 2021, Virtual Event, July 24–29, 2021, Proceedings, Part I 23*. Springer, 171–190.