From Imagination to Simulation: How Conversational AI Reconfigures the Fantasy Dimension of Cognitive Empathy*

Provocation Paper

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Abstract

Empathy is a driver in the innovation process of wicked, societal problems in domains such as HCI, and social innovation, which rely on cognitive empathy, the prediction and imaginative representation of others' realities. However, as we move toward routinised human-AI collaboration in distributed cognitive systems, we are confronted with a contradiction: interaction with Conversational Agents (CAs) increases productivity in divergent thinking, while it diminishes the fantasy dimension of cognitive empathy. This provocation paper addresses implications of this shift by presenting results of an empirical mixed-methods study with 22 participants combining eye-tracking, self-report empathy scales, and think-aloud protocols. The findings reveal a significant decline in the fantasy dimension of cognitive empathy among participants interacting with CAs compared to the human-only group. Eye-tracking data demonstrated attentional anchoring toward the interface of the CA, which disrupts the mental incubation required for mentally effortful imaginative engagement. The results indicate a shift from internal, cognitively demanding imaginations to the passive semantic consumption of external AI-generated simulations, a process defined in this paper as "Artificial Fantasy". These insights suggest that CAs not only assist in cultivating empathetic engagement, but their materiality evokes the opposite effect: cognitive offloading of imaginative effort to artificial simulations.

Keywords

Human-AI Interaction, Cognitive Psychology, Empathy-centric Design, Creative Cognition

1. Introduction

Human-centered innovation requires an interplay of creative and empathetic cognition to transform insights into tangible solutions [1, 2]. Human agents do not operate in isolation; instead, their cognitive operations are reconfigured by the material interaction between human agents and technological artifacts integrated in the innovation process [3, 4]. As CAs become collaborative agents in the process [5], these technological artifacts not only assist but extend mental processes for inhabiting others' perspectives [6, 7]. This paper examines cognitive reconfigurations, specifically of attentional shifting, cognitive empathy and divergent thinking, beyond the quality of AI-assisted output. The materiality of the CA interface redirects cognitive energy away from internal mentalization, which disrupts the fantasy sub-dimension of empathy [9, 10]. Consequently, human agents may mistake the processing of synthetic data for their own imaginative engagement with others' realities and substitute internal mentalizations with passive semantic consumption of artificial fantasies. In this paper, "Artificial Fantasy" is defined as the cognitive substitution of internal, imaginative representations with AI-generated stimuli without engaging the fantasy dimension of cognitive empathy.

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1.1. Creative and empathetic cognition in HCI

Innovation processes in HCI involve cognitive operations, such as attentional shifting, cognitive empathy, and divergent and convergent thinking [11, 12], as well as the ability to shift between them [13]. The generation of novel creative ideas relies on the imagination of non-existent realities to transition from present states to desired future states [12, 14]. Imagination facilitates the development of tangible solutions by allowing human agents to internally visualize fictional scenarios [2]. According to the dual-route model of empathy, cognitive empathy is a slow, analytical, and cognitively demanding process that requires significant mental effort (see Figure 1) [15]. It encompasses two dimensions: the fantasy dimension, the ability to imagine others' realities, and perspective-taking, the capacity to rationally comprehend their viewpoints [4].

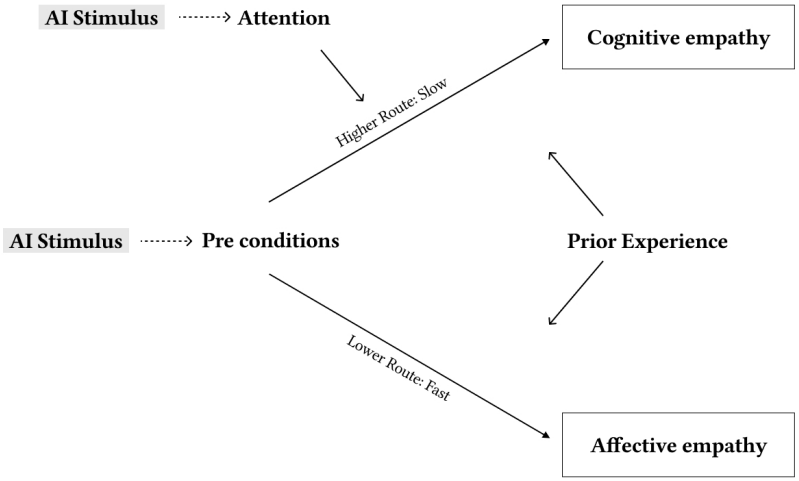

Figure 1: Figure 1: Conceptual model of the dual-route model of empathy, visualizing the distinction between the cognitively demanding higher route and the less cognitively demanding lower route of empathy, adapted [15].

The fantasy dimension aligns closely with creative cognition, since the creation of fictional representations of others' mental states and nonexistent solutions is inherently creative [16, 14]. Furthermore, cognitive empathy elevates divergent thinking as it enables individuals to adopt multiple perspectives and simulate others' thoughts and feelings to generate novel solutions [6]. This interplay between divergent thinking and cognitive empathy relies on attentional shifting, the capacity to switch flexibly between internal representations and external stimuli [17]. Similarly, divergent thinking necessitates those rapid inward-outward shifts in attention [18], which enhance cognitive empathy and creative problem solving [19]. Gestures and eye movements, such as gazing into space, serve as indicators of these underlying mental processes and facilitate divergent thinking by directing attention toward internal information [9, 20].

1.2. The Effect of interaction with conversational agents on empathetic cognition

CA assistance extends distributed cognitive systems beyond human brains and opens new possibilities for human centered innovation by supporting idea generation, knowledge synthesis and providing information retrieval [3, 21, 22]. Moreover, human-AI interactions reconfigure cognitive operations, such as attentional shifting, divergent thinking, and cognitive empathy, and cause a change in the quality of empathetic engagement [18, 23].

2. Experimental Design

This paper builds on and expands empirical findings of a previous study on the effect of conversational generative AI on cognitive empathy in creative problem-solving, originally presented at the 25th International Conference on Artificial Intelligence in Education (AIED 2024) in Palermo. The study examines the influence of conversational AI systems on cognitive empathy in a divergent thinking task in a higher education context, integrating self-report cognitive-empathy scales (Interpersonal Reactivity Index (IRI)), cognitive interviews, outcome-based analysis, physiological assessment of attention (eye-tracking), and retrospective think-aloud protocols in a mixed-method design. By engaging twenty-two Master's students from creative domains with the wicked, societal problem of homelessness in Barcelona, the research revealed a shift in cognitive behavior and a significant impact on the fantasy dimension of cognitive empathy [4, 25].

3. Research Findings

The primary divergence between the two groups revealed a significant decline in fantasy (FS) scores among AI-assisted participants (post-FS: 2.39) compared to the human-only group (post-FS: 3.00, p=0.029). This aligns with recent evidence, which suggests that conversational AI assistance can reduce cognitive effort [26]. While both groups showed comparable baseline empathy levels, as confirmed by a between-group analysis of pre-task IRI scores, post-task within-group comparison showed a statistically significant difference (Figure 2). Both subdimensions demonstrated a reduction in the AI-assisted group, but only the decline in Fantasy (FS) reached statistical significance, whereas Perspective-Taking (PT) remained non-significant. This suggests that although rational comprehension of others' perspectives stays relatively unaffected, the imaginative labor required to internally simulate others' realities is sensitive to CA-initiated cognitive reconfigurations. The observed decrease in the fantasy dimension likely stems from avoiding the cognitively demanding higher route, required for mental incubation by cognitively offloading internal visualizations to the conversational AI system [27, 28, 33].

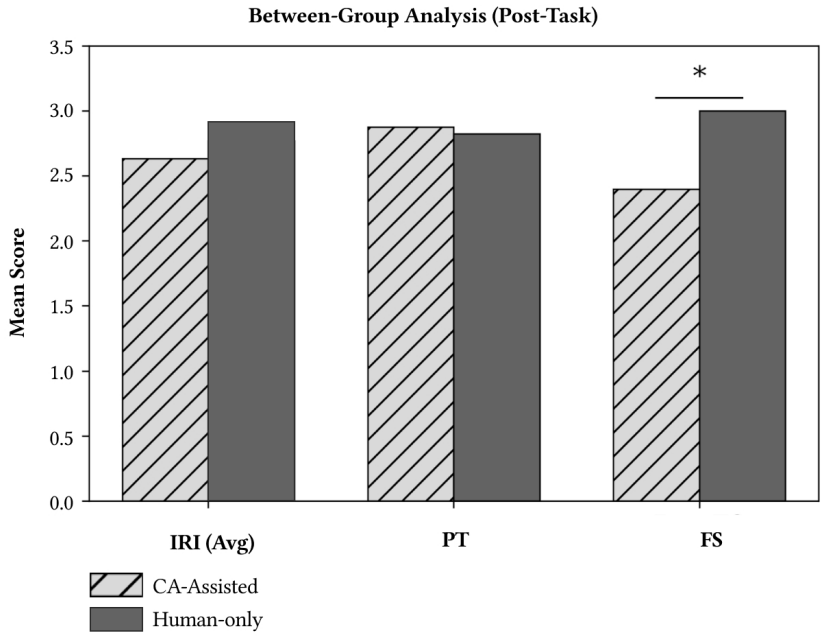

Figure 2: Figure 2: A bar chart showing the differences between the IRI (Avg), PT and FS of the between group analysis of the human-only and the CA-assisted group.

Eye-tracking data underlines high interface engagement and externalization of mental effort (mean Area of Interest (AOI) Gaze to CA: 20.5). The attentional shift toward the conversational AI interface

suggests that the materiality of the CA cognitively competes with mentally effortful cognitive processing [29, 30, 31]. These findings are supported by the Continuous Partial Attention theory, which states that attentional shifts prevent the mental incubation for cognitively effortful imaginative engagement [28]. This might be due to the CA system anchoring attention and demanding validation of AI-generated stimuli, rather than immersion in internal emotional representations, which leads to a state-level atrophy of the fantasy dimension [28]. Complementary, qualitative data from retrospective think-aloud protocols revealed a change in linguistic framing. CA-supported participants used less "imaginative vocabulary" than the control group (e.g., "I imagine," "I feel"). This might either indicate that participants "linguistically aligned" their expressions to the less emotional language of the AI system, or it corresponds with findings supporting that they cognitively offloaded the effortful mental simulation of others lived experiences to the model [32]. Outcome-based analysis highlights that while CA-assistance increased productivity, the quantity of practical solutions amplified at the expense of empathetic engagement.

4. Limitations

Even though the sample size (N = 22) reached thematic saturation, larger samples should enrich findings to ensure a more robust understanding of the observed effects and to enhance statistical power and generalizability. Moreover, this study's correlational design prevents causal inferences between attention and cognitive empathy. Future research could incorporate physiological metrics, such as numerical eye-tracking data, to validate attentional shifts and explore causal pathways. The IRI is a well-regarded scale, though it has a minor tendency to overestimated perceived capabilities due to inflated selfperception bias and positive response bias [8]. Furthermore, longitudinal research is required to determine whether the observed decline in the fantasy dimension represents a temporary state or a long-term cognitive empathetic atrophy of the fantasy dimension.

5. Discussion

These changes in cognitive operations demonstrate that the human mind is no longer the origin of ideas, but of a distributed cognitive system. Therefore, CAs should complement rather than diminish human cognitive capacities, such as imagination of others' realities [33, 34]. Instead of optimizing for seamless interactions, CAs could incorporate "Planned Friction" to create intentional pauses and to encourage engagement with cognitively effortful mentalizations of others' minds [10, 36]. Planned friction commonly refers to the deliberate integration of obstacles in educational technologies and educational settings, as applied in existing educational frameworks, such as impasse-driven learning, productive failure, and discovery-based learning [35, 36]. When implemented as a feature for mental engagement in creative domains, the same concept might enable a return to internal representations and stimulate the higher, cognitively demanding route of empathy [15]. While frictional interactions might seem counterintuitive in the context of HCI, CAs could enable human agents to engage with their innate capacity for empathetic imaginations through various design interventions, such as providing inspirational stimuli that challenge initial assumptions, delaying CA responses that force a short reflection, temporarily hiding the interface when users gaze into space or when camera-based eye-tracking detects loss of attention. Nevertheless, the prevalent materiality of CAs demands debate about whether we should integrate them as tools in HCI research, since they disrupt the cognitive processes required to mentally simulate others' realities. We must examine whether the current technological affordances of CAs inherit the capacity to mitigate empathy, and ultimately, how we design human-AI interactions that assist with the effortful cognitive engagement with internal mentalizations of others' realities, rather than merely affording passive semantic consumption of simulated artificial fantasies.

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Declaration on Generative AI

During the preparation of this work, the author used Gemini 3.5 Flash and Grammarly in order to: Grammar and spelling check. After using these tools, the author reviewed and edited the content as needed and takes full responsibility for the publication's content.

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