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Research Article

An Analysis of Human-AI Interaction

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ABSTRACT

The pervasive integration of AI technologies, such as ChatGPT, into various sectors of daily life has necessitated a shift in AI research. While initial studies primarily concentrated on technological advancements, the current focus has transitioned towards a human-centric approach in understanding AI. This special issue aims to expand the body of knowledge on human-AI interaction, addressing the challenges presented by AI's increasingly human-like capabilities and the diminishing distinction between individuals and technology.

The issue introduces a comprehensive framework for human-AI interaction, conceptualizing AI as an agent for human users. Two critical types of compatibility are identified: human-AI fit and task-AI fit. Additionally, the framework considers varying degrees of AI agency, resulting in a human-AI collaboration continuum. This conceptualization leads to a research framework that examines AI characteristics, behaviours, and outcomes, moderated by user and task characteristics.

Keywords: Human-AI interaction, Artificial intelligence (AI), ChatGPT, GPT4, Fairness-accountability-transparency (FAT) framework, Anthropomorphic design

1. Brief introduction

Since 2022, the widespread adoption of ChatGPT and GPT4, developed by OpenAI, has led to the extensive integration of artificial intelligence (AI) technologies into everyday life. AI is no longer a complex concept reserved for technicians; various AI applications, including robots, self-driving vehicles, virtual assistants, and facial and motion recognition systems, have become accessible tools for the general public, even those without extensive technical knowledge. These AI technologies are now widely employed in sectors such as education, healthcare management, and customer service. While early AI research, particularly in computer science, concentrated on technological development (a technology-centric approach) like machine learning and natural language processing, an increasing number of researchers now acknowledge the crucial role of humans in both AI design and application. The introduction of human-centered design and human-in-the-loop concepts has prompted a shift towards a human-centric perspective in AI theoretical understanding.

In response to this trend, this special issue aims to expand current research on human-AI interaction. The human-like capabilities of AI in the present technological landscape challenge existing assumptions about human interactions with IT artifacts. As AI develops its ability to perceive, comprehend, respond, and learn, it enters domains previously exclusive to humans, blurring the line between people and technology. Consequently, human-AI interaction remains a significant challenge in both industrial and academic spheres, raising new research questions that differ from those associated with traditional IT artifacts. Interdisciplinary studies have shown that people tend to anthropomorphize AI during interactions. Therefore, AI should be viewed as an autonomous, intelligent entity that interacts with humans, rather than merely an IT artifact. Rapid AI advancements have enabled unprecedented human-like interactions, shifting the focus of human-machine interaction research. However, research on human-AI interaction is still in its infancy. There is a lack of comprehensive understanding regarding the conceptualization, theorization, and evolution of human-AI interaction, as well as its positive and negative outcomes. This understanding is crucial for scholars seeking to deepen their knowledge of IT through human-AI interaction studies. Interdisciplinary research presents an opportunity to make further discoveries that will guide human-AI interaction. Based on these considerations, this special issue aims to advance discussions on the future of human-AI interaction and contribute to the development of current and future research in this field.

2. Interaction between humans and artificial intelligence: a general framework

Although AI possesses autonomous capabilities, it remains a tool for humans to accomplish specific tasks. The primary principle in understanding the human-AI relationship is AI's role as an agent (see Fig. 1). Humans, acting as principals, assign certain tasks to AI, which then executes them on behalf of humans. To ensure AI effectively and efficiently completes tasks according to human intentions, two types of compatibility must be achieved: human-AI fit and task-AI fit. Human-AI fit involves AI accurately interpreting and fulfilling human needs. This fit can be assessed through three key aspects: physical, cognitive, and emotional fit. Physical fit pertains to AI's ability to properly receive and digitize physical information provided by humans (e.g., voice, images, videos). Cognitive fit focuses on AI's capacity to accurately comprehend human intentions and identify their requirements. Emotional fit addresses AI's ability to recognize human emotions and offer empathetic emotional support. Task-AI fit, analogous to task-technology fit, refers to how well AI meets task requirements. Different tasks may require various AI affordances. For instance, ChatGPT encounters two main task types: routine and creative. Routine tasks involve information retrieval (e.g., "What is the world's highest peak?"), while creative tasks demand innovation beyond existing knowledge (e.g., "Compose a poem about spring"). For routine tasks, answer credibility may be more crucial, whereas for creative tasks, answer novelty may take precedence. Consequently, AI should be designed in diverse forms to accommodate different task requirements, rather than in a standardized manner.

When considering AI as a human agent for task completion, an important consideration is the degree to which humans are willing to delegate or empower AI to autonomously handle tasks. Varying levels of AI agency result in a human-AI collaboration continuum, as illustrated in Fig. 2. At one extreme, humans complete all tasks without AI assistance (fully manual), while at the other, AI handles everything (fully autonomous). The two intermediate modes are human-dominant, where AI serves as a decision support system and humans make final decisions based on AI results, and AI-dominant, where AI is the primary decision-maker with human support. As agency levels increase, human controllability and decision autonomy decrease, while decision efficiency improves.

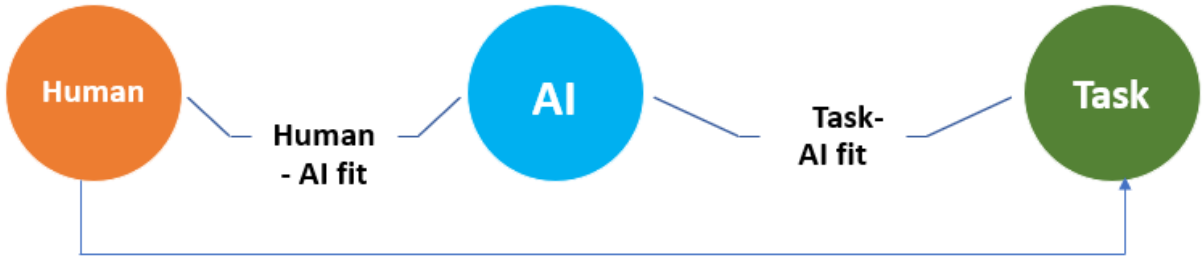

Fig. 1. Artificial intelligence and its role as an agency

Fig. 2. Collaboration between humans and artificial intelligence

The conceptualization of AI as an agent leads to a general research framework illustrated in Fig. 3. Initially, AI characteristics or affordances, such as credibility and creativity, influence various AI behaviors, including initial adoption, continued use, exploration, and exploitation. These behaviors ultimately result in a range of positive outcomes like effectiveness and efficiency, or negative consequences such as privacy concerns, security issues, ethical dilemmas, and bias. Furthermore, the human-AI fit suggests that user characteristics, including cognitive styles, regulatory focus, self-efficacy, and involvement, may moderate the effects of AI affordances on AI behaviors and the impact of these behaviors on AI outcomes. Similarly, the task-AI fit indicates that task characteristics, such as complexity and novelty, may also moderate the relationships between AI affordances, behaviors, and outcomes.

3. Papers in this special issue

This special issue features four papers that delve into the underlying mechanisms of human-AI interaction. Two of these papers employ quantitative methods (Calderon et al., 2023; Hu & Sun, 2023), one uses a qualitative approach (Zhu et al., 2023), and one is a review paper (Kaufmann et al., 2023). The studies examine both positive aspects (Hu & Sun, 2023) and negative implications of AI (Calderon et al., 2023), exploring its

applications in social media platforms (Calderon et al., 2023), conversational agents (Hu & Sun, 2023), and financial advisory systems (Zhu et al., 2023).
The first paper by Calderon et al. (2023) investigates the darker side of AI, examining how social media misinformation generated by Facebook's newsfeed algorithm affects parents' intentions to vaccinate their children. The study proposes a fairness-accountability-transparency (FAT) framework to assess perceptions of the algorithm. Findings indicate that FAT factors influence vaccination intentions through negative attitudes toward vaccination and Facebook's antivaccination norms. Hu and Sun (2023) explore the positive aspects of AI in the second paper, focusing on enhancing user satisfaction with chatbots through anthropomorphic design. The study distinguishes between internal and external anthropomorphic cues, with internal cues further categorized into cognitive and emotional elements. Using a 2*2*2 scenario survey, the research reveals the main effects, two-way interactions, and three-way interactions of various anthropomorphic cues on user satisfaction. Results show that emotional empathy has a stronger effect on satisfaction with real person appearances, while cognitive empathy has a greater impact on robot appearances.

The third paper by Zhu et al. (2023) uses a qualitative approach to examine factors influencing user adoption of AI-powered financial advisory systems (Robo-advisors). Through interviews with 24 participants using a retail bank's Robo-advisor, the study finds that users do not fully perceive the social aspects of these systems. Additionally, a lack of transparency and incomprehensible information leads to distrust and eventual abandonment of the system.Kaufmann et al. (2023) provide a literature review in the final paper, summarizing past research on task-specific algorithm advice acceptance and identifying potential future research directions. Analyzing 44 studies, 122 tasks, and 89,751 participants, the paper reveals that algorithm aversion is present in 75% of the examined tasks. The authors also highlight shortcomings in existing studies and offer valuable recommendations for future research on algorithm acceptance.

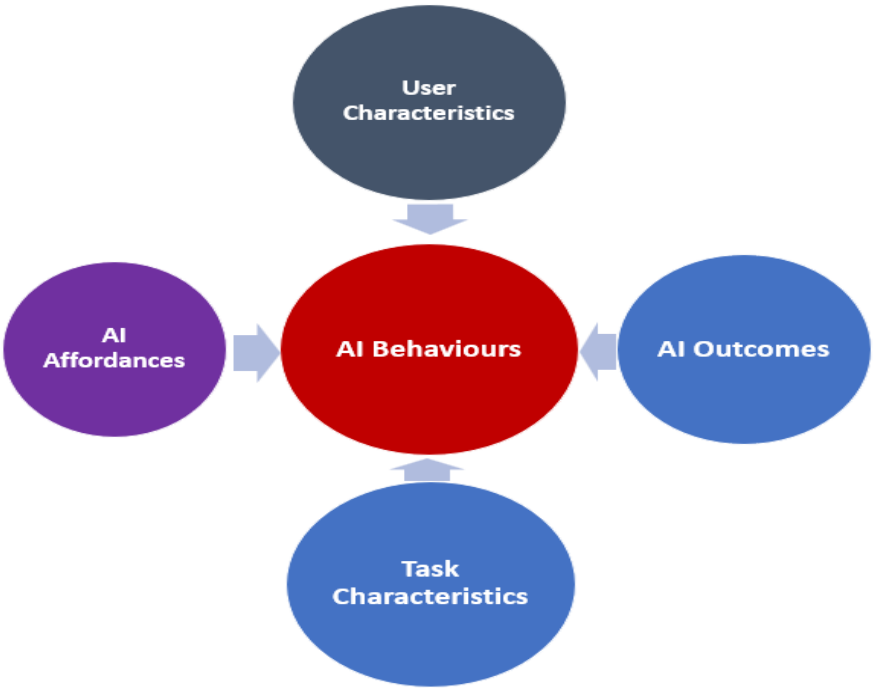

Fig. 3. Framework for general research

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