Key Challenges and their Impact on Human-AI Teaming: A Systematic Literature Review using PRISMA

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The purpose for conducting this Systematic Literature Review is to review the key challenges in Human-AI Teaming and its impact on tech-mediated human relationships. A total of 27,500 papers were retrieved using Google Scholar's database and 23 of those papers were relevant after undergoing a screening technique using PRISMA. Results indicate that ethical concerns and trust, two of the themes identified, are key challenges within Human-AI Teaming and tech mediated human relationships. In addition, having control mechanisms, for better human decision making and role accountability, are pivotal for overall team performance towards the shared goal.

CCS Concepts: • **Human-Centered Computing → Human Computer Interaction (HCI)**; *Human-AI Teaming*.

Additional Key Words and Phrases: human-AI, challenges in human-AI teaming, HATs, impact of AI on human-human relationships

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1 INTRODUCTION

Teaming with a Synthetic Teammate is vastly emerging as one the hottest trends related to Human-Autonomy Teaming (HAT). Prior analysis on the empirical literature of Human-Autonomy Teams (HATs) (O'Neill, 2022) has always been perceived as humans and intelligent, autonomous agents working together interdependently toward a common goal (Chen et al., 2016; Johnson et al., 2012; Wynne and Lyons, 2018) Human-AI Teaming involves at least one human working alongside at least one AI, which has a level of autonomy to be considered as a teammate rather than a servant (Schelble, Beau G., et al, 2022; Demir, M. et al., (2016). Prior research on HAT (McNeese, 2018), mentions the traditional concept of "team" as being used to complete work in a variety of tasks and contexts (Salas et al., 2008).

Autonomous agents working in sync, as teammates, with humans more will have to address the rising questions of what exactly does HAT look like and how do we ensure these teams are successful (O'Neill et al., 2020). Much evolution in the domain of Human-AI collaboration has led to increased growth and interest in Human-AI Teaming, where humans and intelligent agents coordinate with each other and perform high-complexity tasks as an integrated unit. Human-AI Teaming is a subset of human-AI collaboration mainly emphasizing very close coordination between humans and AI teammates with a shared goal (Rui Zhang et al., 2020). People's expectations of AI teammates, in Human-AI Teaming, is

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an ideal human where AI is expected to perform well in rapid changing, collaborative environments (Rui Zhang et al., 2020). Intelligent agents are not humans therefore key challenges do exist, pertaining to ethical concerns and trust issues, prohibiting Human-AI Teams from performing at their best. Having an ethical foundation is pivotal for the success of a team The need for trust in Human-AI Teams involves theories that are well designed to regulate and encourage compliance amongst humans in collaboration with technology (Schoorman et al., 2007). Many large corporations tend to use control mechanisms in order to alter decision-making processes by having reward systems and structures to help avoid broken trust (Schoorman, 2007). Working within a team setting usually requires interdependence, where humans greatly depend on each other, to accomplish personal or organizational tasks (Schoorman, 2007).

Trust is then a major component, for ethical artificial intelligence (AI), in order to have effective team interactions and performance towards achieving those goals (Textor et al., 2022). Many empirical studies have long supported trust within teams during human-automation interactions as well as Human-Robot Teams. Trust can be evaluated in several contexts, such as interpersonal relationships and Human-Automation Interaction where collaboration depends on reliable teammates. Thus, we aim to study the effects of trust within Human-AI Teaming and reliability of our human counterparts. This study aims to address an understudied, yet relevant, construct that contributes to the greater knowledge pertaining to Human-AI Teaming, human reliability and trust. We hope to find results widely applicable throughout the industry by focusing on organizational or specialized constructed teams. Through a systematic investigation of challenges within Human-AI Teaming, we will answer the following research questions:

1. What are the key challenges associated with Human-AI Teaming?
2. How do these key challenges impact tech-mediated human relationships?

1.1 Motivation

Our motivation for conducting this Systematic Literature Review evolves around the emergence of Human-AI teaming and the key challenges impacting tech-mediated human relationships. Human-AI Teaming is gaining significant traction in regards to humans and technology working collaboratively using autonomy.

2 RELATED WORK

Humans has always sought out to enhance the performance of teams by supporting them through with the latest technology. This perception makes Human-AI Teams very relevant, so it heavily evolves around trust and its unique relationship to ethics. This understanding comes from Looking at models and guides on how to create ethical human-AI teams (Flathmann et al., 2023).

2.1 Human-AI Teams

Studies on the effects of AI teammate ethicality on trust outcomes and individual performance in Human-AI Teams (Schelble et al., 2023), indicate how Human-AI Teams or Human-Autonomy Teams are defined by unique characteristics that include a significant degree of agency for the artificial teammate to make decisions of its own volition with a unique role on the team amongst at least one other human team member (O'Neill, 2020). Guides on creating ethical Human-AI teams (Flathmann, 2023), empirically, addresses the current state of the domain by highlighting the importance between trust in AI teammates and team performance (McNeese et al., 2019).

2.2 Addressing Ethical Concerns and Trust Issues

Without a strong ethical foundation, human-AI teams may find it challenging to make decisions in complex situations (Flathmann et al., 2021). The modeling and guiding of creating ethical human-AI teams will help to mitigate societal concerns surrounding trust. A comprehensive model of ethical AI teamwork serves as a guide to building ethical HATs, which is a necessity for achieving effective human-AI teaming (Flathmann, 2023). Trust in AI systems can exist when a human perceives the intelligent agent as a reliable teammate. It is important for all team members to understand the distribution of the decision making roles can come from either member (human or AI) based on data that is given (Ibrahim et al., 2022). With the explosion of AI automation within recent years, HATs has been a field of exploration growing at a rapid rate. With this growth, many challenges have come about in regards to humans becoming too reliant on AI technology in order to make high-stake decisions resulting in speculation whether or not a decision can be trusted. This also holds true in regards to trust in human-human teams and how reliable one is towards one another (Ibrahim, 2022).

3 METHODS

We utilized the PRISMA method for our foundation of refining searches within the Google Scholar database. After gathering the initial data set we then were able to sift through all of the relevant articles until concluding with n=23 total articles. Screening techniques will be used for refining the data by length, date range and most frequently published in the research area.

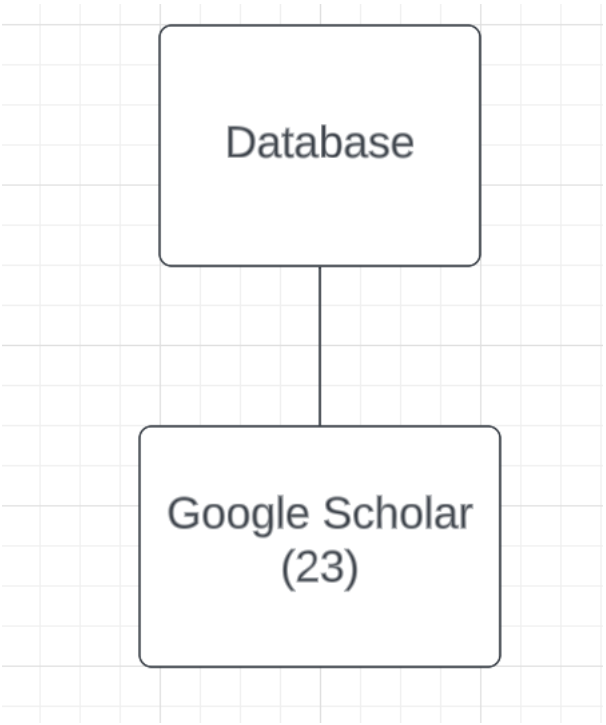

Fig. 1. Database and number of publications

3.1 PRISMA

PRISMA was founded in 1986 as a basis for healthcare researches to report their work and was used to jump start future research. PRISMA has since been updated through the years and the most recent version was published in 2021 [3]. PRISMA is the "preferred reporting tool for Systematic Review and Meta-Analyses" according to leading researchers and organizations. PRISMA focuses primarily on the reporting of reviews and evaluating documents based on objectives [3]. For our initial search we decided to use a google scholar search based on our key words: challenges in human AI teaming, impact of AI on human-human relationships, HAT, Human-AI Teaming. This initially resulted in 27,500 results.

3.2 Screening Technique

PRISMA's screening technique is a key component within its Flow Diagram of conducting a Systematic Literature Review. The screening process enables our search to include a number of refinements in generating data for analysis. The first refinement was to automatically exclude articles that were shorter in length than at least two pages. This immediately discounted the search to 27,300 articles. After additional thinking, we decided that since we were dealing with a new avenue of technology, we were only going to look at articles that were published within the last 4 years. This cut out original search almost in half resulting in n=13,700 excluded. We found that there were still articles that were not refined enough for the purposes of our research, so we decided to take refinement even further and search by authors that were most frequently published in this space. We decided that this was a strong sorting method because researchers who ware at the forefront of this area are most likely going to have strong findings for the purposes of our Systematic Literature Review. This took our results to n=23 and after review of title and abstract we were able to take these articles into our review.

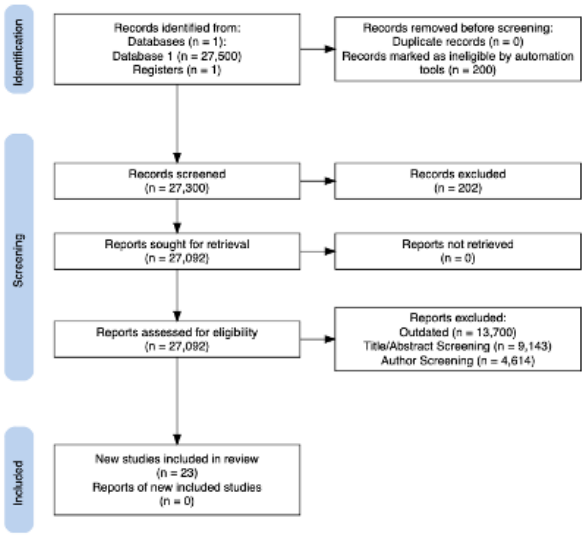

Fig. 2. PRISMA Flow Diagram for screening journal articles

4 KEY FINDINGS

Our key findings highlight ethical concerns and trust issues as key challenges, pertaining to respective roles and responsibilities, within Human-AI Teaming. Their impact on tech-mediated human relationships shows significant unwillingness for humans ability to adopt AI as a teammate. Communication and Situational Awareness (SA) are pivotal for overall team success and cognition towards achieving a common goal. Each member must be able to communicate each of the teammates actions, the process of how it is constructed and the purpose for existence. Overall, human-AI teaming encounter challenges in communication between human and AI agents (Schaefer, Kristin E., et al.), building trust (McNeese, Nathan, et al.,2019) and negative perceptions towards AI teammates. Moreover, there is very little research available regarding how to use extensive research on spatial awareness in CSCW by different human-only and human-AI teaming to develop team cognition.

4.1 Ethical Concerns

Ethical foundations are the principle that serves as a basis for ethical decision-making. This may include belief in right or wrong, fair or unfair, just or unjust. Studies indicate if the Human-AI Teams were unable to build these ethical foundations, then they may not only perform worse, but their actions could have extremely harmful consequences to others in society. The most apparent examples of these confrontations exist in the medical field, where teams are constantly tasked with scenarios that require ethical considerations as it is critical in healthcare to maintain and develop a solid framework to guide the decision-making and actions ((Flathmann et at., 2021). Furthermore, Human-Agent Teaming raises ethical considerations, such as the allocation of responsibility and accountability, as well as the potential for bias or discrimination in decision-making processes (Mallick et al., 2022).

4.2 Trust Issues Pertaining to Respective Roles and Responsibilities

With improvement and advancements in AI, Human-AI Teaming have become a reality nowadays. One of the key challenges in human-agent teaming is establishing and maintaining trust between human team members and the agents. In human-agent collaborations, trust issues can arise related to respective roles and responsibilities. Humans have concerns about allocating tasks to AI agents, fearing that they will not perform as expected that could harm people or the environment. Similarly, AI agents may have difficulty trusting human decision-making, especially in complex and uncertain situations.

A key challenge in determining how humans and AI agents can effectively collaborate while fulfilling their respective roles and responsibilities (Endsley et al., 2022). One of key factors pertains to the lack of shared understanding of each member's capabilities, limitations and decision-making process. Additionally, building trust requires demonstrating the reliability, competence, and ethical behavior of AI agents, which can be achieved through testing, monitoring, and accountability mechanisms. Overall, addressing trust issues related to respective roles and responsibilities is essential for building effective and sustainable human-agent collaborations (Endsley, 2022).

4.3 Communication and Situational Awareness

Communication and SA plays a crucial role within a team setting. The awareness involves what team members are doing, how they do it and why they do it (Gross, T, 2013). Research has exhibited that spatial awareness is a crucial component in any team setting. The existing research work on awareness in teamwork has been majorly focuses on human-human teams. Hence, with increasing availability of Human-AI Teaming, researchers must address the spatial

awareness in human-AI teaming to ensure more effective communication. In a human-AI team, it is crucial for human team members to understand the agent's decision making and intentions to support mental models and trust (Schaefer, Kristin E., et al.). Recent research shows that human-agent teams face particular challenges in properly establishing awareness.

5 LIMITATIONS AND FUTURE RESEARCH

Our systematic literature review has certain limitations to the array of data used in the study, specifically lack of a broader array of data of keywords and authors. This paper only relied on limited set of keywords and authors. This review could have benefited greatly by using additional keywords pertaining to the history of the research, as well as extra filters for searching the authors like date range and citation counts. This research can be enhanced by including research in HAT from multiple authors. Furthermore, the limitation can be overcome by using additional keywords and phrases while refining the search on Google Scholars database. The improved process can involve reviewing the initial search results and identifying new relevant keywords related to challenges in human-AI teaming. Additionally, citation analysis can also be used to identify relevant keywords and phrases, which involves reviewing the references list of relevant articles and research papers. This can help gaining more relevant keywords and phrases related to Human-AI Teaming and the challenges associated with Human-AI Teaming, which can eventually result in refining the search and identifying relevant articles.

5.1 Broader Array of Data

This study could have included a broader array of data that includes additional keywords and authors. Overall, by combining various authors, keywords and phrases can significantly improve the limitations while providing a more transparent analysis of key challenges associated with Human-AI Teaming.

5.1.1 Additional Keywords. Additional Keywords are necessary to diversify a search in challenges in human-AI research because they help to filter and expand the search, making it more specific. By adding relevant keyword, it is possible to have a broader range of the articles that help to uncover different perspectives and insights that are not been initially apparent. This paper uses, the initial search query as "challenges in Human-AI teaming", additional keywords such as "Human-AI Teaming", "HAT", "Impact of AI on human-human relationship" can be added to the search to explore the different dimensions of the topic.

Including "Human-AI Teaming" as one of the additional keywords could have potentially led to the more specific research related to the collaboration between Human and AI within fields such as healthcare, aviation and education. Also, adding "Impact of AI on Human-Human relationships" could have possibly led to results discussing on effect of AI on social relationship and how AI can enhance or weakens the Human-Human relationship.

5.1.2 Additional Authors. This systematic literature review was mostly relied on using a specific author filter due to known knowledge about their work. Prior research on Human-AI Teaming defines automation as technology that requires human intervention or control and autonomy as technology capable of coexisting with humans ideally as a human teammate in HAT (McNeese, 2018). This review could greatly benefit from the use of additional authors to diversify perspectives on research expertise.

5.2 Human Centered Design

The demand for more Human-Centered designed technologies will help drive the impact of increased success among Human-AI Teaming. The perspective towards mutually beneficial decision making should be more user-central while considering the human-centered AI design principle, involving intelligent agents being developed based on human behavior, so that its behavior becomes recognizable to humans (Mallick, 2022).

6 CONCLUSION

The current paper discusses the challenges associated with Human-AI Teaming in the areas of ethical concerns, trust between human and AI, and the lack of communication and situational awareness. We have conducted a systematic literature review with PRISMA and identified key findings and future work in existing research topic. We found that ethical principles play a key role for decision-making and failure to establish ethics in Human-AI Teaming can lead to harmful outcomes for the human society. Additionally, trust is another consequential challenge in Human-AI Teaming, specifically in respective roles and responsibilities. Moreover, communication and situational awareness is also crucial for success of Human-AI Teaming. Our findings have also indicated that the development of intelligent agents based on human behavior can become more acceptable to humans in Human-AI Teaming.

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