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Hybrid work – a reconceptualisation and research agenda

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Abstract: We begin this conceptual paper, by outlining three recent developments in the context of the changing the nature of work: (1) the increasing proportion of remote work, (2) the quickly expanding use of (generative) AI applications, and (3) the growing advancements in virtual world technologies and platforms. We argue that the synthesis of these developments will vastly impact traditional work models and practices. This transformation warrants a critical rethinking of the traditional understanding of hybrid work which, so far, has predominantly focused on the spectrum of in-person and remote work. We suggest adjusting this perspective and posit grand challenges and related research questions in order to do so.

Keywords: generative AI; human-AI collaboration; hybrid teams; hybrid work; Metaverse

1 The rise of hybrid work

The nature of work has been changing significantly in recent years. The amount of remote work has enormously increased, and our understanding of where, when, and how work can be done has constantly been evolving [1]. The COVID-19 pandemic has accelerated this shift, as many organizations were forced to quickly adopt remote work [2–5]. The transition to hybrid or fully remote work has been successful in the eyes of many company leaders and employees, and they are having difficulties imagining to return to traditional office environments [6, 7]. As hybrid work transitioned from a niche arrangement to a mainstream mode of operation, organizations have re-evaluated and redeveloped their traditional workplace policies and guidelines that account for the unique challenges and opportunities presented by remote work [8]. Likewise employees have learned to navigate the challenges associated with remote work, such as maintaining productivity, and managing the boundaries between work and private life [9, 10]. For instance, flexible work hours, results-oriented performance metrics, and virtual team-building activities have become increasingly popular in response to the evolving work environment [11, 12].

Whereas many organizations still make sense of the role of hybrid work in a post-pandemic world, two further technological innovations make fast inroads into organizational practices: the various implementations of AI-based systems and recent developments in the context of virtual worlds. With their addition, the concept of hybrid work is no longer limited to a continuum of in-person and virtual interactions but also encompasses human-AI collaboration in virtual environments. Based on the considerations above, it seems necessary to revisit the term "hybrid work" and extend its scope to include recent developments. Therefore, our paper aims to contribute to an extended, holistic conceptual understanding of hybrid work that includes human-AI collaboration and new forms of presence in a virtual environment. With this aim in mind, we draw a picture of the Metaverse – the convergence of virtual worlds for remote collaboration where human actors interact with AI-powered avatars, bots, and other entities. Based on this widened understanding, we outline promising research avenues to extend existing research of hybrid work.

2 Hybrid teams

In early 2023, millions of users worldwide began enthusiastically experimenting with ChatGPT, sharing their "eureka" moments with colleagues, friends, and family. Whereas there have also been justified concerns raised about the reliability and level of trust of the generated text [13], there have been numerous reports and an increasing amount of studies exploring the potential of generative AI models like ChatGPT as a member of hybrid innovation teams. From taking on the role of an innovator in the new product development process [14], to contributing novel ideas and concepts and software development roles among others [15]. While tools like ChatGPT may generate ideas that are less original and valuable than those of human team members, it can help them better understand the problem and solution space.

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Definition

"Generative AI" models like ChatGPT are neural network models developed to generate human-like text, utilizing a context window to understand and respond to input text sequences. In the case of ChatGPT the model's training involves unsupervised learning on a diverse range of internet text, enabling it to perform various natural language processing tasks through fine-tuned contextual understanding and generation [15].

Studies showed that Generative AI excels in various natural language processing tasks, enabling conversations, answering questions, and generating coherent and contextually relevant responses [16]. Whereas this makes them interesting new partners for knowledge workers in many domains, it is worth to note that the idea of human-AI collaboration dates back to AI's inception and that pioneers saw the potential for a symbiotic relationship where AI enhances human intelligence for problem-solving, decision-making, and increased efficiency [17]. Recent developments in AI have facilitated more nuanced and sophisticated forms of collaboration between humans and artificial entities and it is reasonable to expect a strongly increasing prevalence of hybrid teams composed of humans and AI. Generative AI, with its ability to create content, simulate human-like interactions, and adapt to diverse scenarios, has introduced a new dimension to collaborative work [18]. This form of human-AI collaboration goes beyond mere automation of tasks, enabling synergistic interactions where both human and artificial agents contribute uniquely to the collaborative process. In conclusion this leads us to conceptualise hybrid teams.

Definition

The term "**hybrid team**" has so far been overly used for describing teams consisting of human teams working remotely (e.g. [19, 20]).

In the context of this paper, the term hybrid team refers to a group consisting of both human members and artificial intelligence systems working together towards common objectives. A hybrid team blends the unique capabilities of humans (such as creativity, emotional intelligence, and complex problem-solving), with the computational power and efficiency of AI, leveraging the complementary skills of humans and AI to achieve tasks or goals more effectively than either could alone (cf e.g. [21]).

We ultimately see a hybrid team as a dynamic combination aiming to leverage the best of both worlds, fostering innovation and adaptability.

3 Virtual work in the metaverse

Groundbreaking work by researchers such as [22], laid the foundation for our understanding of collaborative spaces. The exploration of "MASSIVE" and other seminal systems not only paved the way for contemporary developments but also offers valuable insights into the evolution of collaborative virtual environments [23]. The field of hybrid teams within these spaces represents a frontier yet to be fully explored, echoing the sentiment that while the Metaverse's technological infrastructure is rapidly advancing, the integration of hybrid work models remains in its nascent stages. More recently, the development of virtual reality (VR) and augmented reality (AR) technologies, alongside the emergence of Web3, has contributed to an increased interest in virtual worlds for living, learning, and working [22, 24].

Definition

The concept of the **"Metaverse"** enables users to engage within three-dimensional virtual worlds through virtual characters [25, 26]. Additionally, it creates more immersive and interactive workspaces, particularly useful for remote teams and organizations with a distributed workforce [27, 28]. This is especially pertinent as we delve deeper into the implications of hybrid work models in the Metaverse, underscoring the need for a comprehensive understanding of how we conceive of work and collaboration in virtual domains.

For instance, in hybrid work settings, AR's ability to overlay digital information onto the physical world offers unique opportunities for immersive learning experiences [29]. Furthermore, it facilitates collaboration between human and AI actors by using avatars. Avatars can represent both human actors and AI actors in the virtual world, allowing them to interact and collaborate as if they were in the same room, overcoming limitations of distance and time [30].

The integration of Blockchain technology, for instance, augments this dynamic by introducing a decentralized authentication mechanism, enhancing security and trust in virtual interactions, crucial for the effective operation of hybrid teams within these environments [31].

The concept of the Metaverse expands the boundaries of what constitutes a collaborative workspace [26]. It offers a realm where human actors can interact not only with each other (via avatars) but also with AI-powered avatars – in real-time, regardless of their physical location [27].

4 A new perspective on "hybrid work"

The prevailing discourse on hybrid work has largely been confined to discussions around the dichotomy of in-person and virtual work [32]. We acknowledge the traditional concept of hybrid work, primarily characterized by human-to-human collaboration in distributed settings, as a foundational aspect of our discussion. Our proposal aims to build upon and expand this established understanding, integrating emerging dimensions of human-AI collaboration without diminishing the significance of conventional human-centric models. The advent of advanced technologies, particularly the emergence of generative AI and the vision of the Metaverse (and related technological developments), signals a pivotal shift in the landscape of hybrid work. The following figure illustrates this vision where humans work together with other humans virtually (via the Metaverse) joined by AI-based Avatars (Figure 1).

We argue that the synthesis of these changes will lead to a range of new opportunities and challenges – impacting traditional work models and practices. Given these developments, the term "hybrid work" necessitates a critical re-evaluation and reconceptualisation. It seems no longer adequate to view hybrid work solely as a blend of in-person and virtual human-human interactions. Instead, it seems beneficial to broaden the concept of hybrid work to encompass the dualities of human and artificial elements, integrating the collaborative efforts of both human workers and AI entities within both physical and virtual environments. This expanded view reflects the multifaceted nature of modern collaborative work, where the lines between the physical and digital, as well as the human and artificial, are becoming increasingly blurred.

In light of this, Figure 2 illustrates the evolved conceptualization of hybrid work, depicting the intersection of human and AI collaboration across various work modalities. This representation underscores the need for a comprehensive understanding of the diverse forms of collaboration that characterize the changing nature of work. It also highlights the imperative for individuals, organizations, and society to adapt their strategies, frameworks, and methodologies to effectively navigate and leverage the opportunities presented by this new paradigm of hybrid work.

The integration of AI into collaborative teams can lead to more efficient and effective problem-solving, decision-making, and creative ideation [33, 34]. As a continuum of in-person and virtual work, hybrid work has become the norm in many industries [35]. However, as generative AI technologies become more prevalent, it is crucial to establish guidelines and best practices for human-AI collaboration, ensuring that both humans and AI systems can work together sustainably and based on agreed policies [15, 36]. This expanded concept of hybrid work requires organizations to adapt their practices and policies to accommodate the growing presence of AI in the workplace.

Effective communication and collaboration are crucial for this new model of working [8]. Depending on the tasks and individual needs and preferences, employees and managers must find ways to balance the advantages of in-person interactions and the flexibility of working remotely [37, 38]. In addition, this work arrangement allows organizations to tap into high-quality talent from a wider geographical area and respond more effectively to customer needs [39]. Moreover, the emergence of the Metaverse as a potential platform for hybrid work introduces new dimensions to the workplace, blurring the lines between the physical, virtual, and digital realms. This development further complicates the dynamics of hybrid work, requiring organizations to navigate the complexities of multi-modal communication, cross-disciplinary collaboration, and digital ethics.

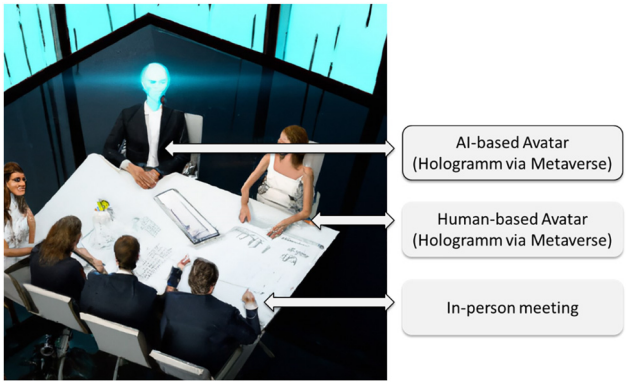

Figure 1: An extended perspective on hybrid work.

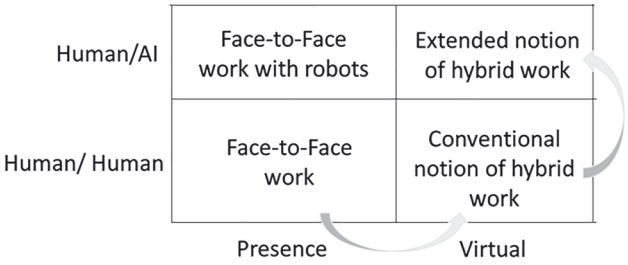

Figure 2: An extended perspective on hybrid work.

5 Implications of the new perspective on hybrid work

5.1 How to research something that has not yet materialised?

To keep pace with the speed of innovation of the technologies underlying the scenario that we have discussed in this paper (i.e. human-AI collaboration in the Metaverse), we posit that academia needs to embrace new methods to engage with the future. Computer-Supported Cooperative Work (CSCW) and related disciplines seem uniquely positioned to address the extensive changes that accompany the pervasive digitalization of cooperative and organizational life [40]. For instance, CSCW researchers have traditionally explored a diverse range of issues, including design theory, knowledge sharing, social computing, and the impact of platforms on collaborative work [41]. This diversity has enabled a comprehensive exploration of emerging technologies and their potential implications for society at large, underscoring the pressing need to continue incorporating new methods into our research and teaching practices. By doing so, we can expand the scope of our research and better prepare future professionals for the complex and rapidly evolving technological landscapes of the digital age [42].

The field of Future Studies explores possible, probable, and desirable futures, amalgamating insights from diverse fields like sociology, psychology, economics, philosophy, history, and science and technology studies [43–45]. Its objective is to holistically grasp the future, recognizing a multitude of potential outcomes and the necessity to extend beyond mere empirical analysis to encompass wider perspectives [46]. Closely associated with Future Studies, Foresight focuses on the participatory examination of future prospects to guide decision-making processes. It employs methodologies such as horizon scanning and scenario planning to cultivate strategic insights for addressing imminent challenges and seizing opportunities. Both fields do not aim to predict the future but to leverage futuristic thought to refine our comprehension of ongoing research and to prepare for upcoming developments [47, 48]. Both Future Studies and Foresight, along with related approaches, are pivotal for formulating proactive theories and designs that inform timely actions and interventions in an increasingly dynamic global context [49–51].

Yet, they carry a caveat that, despite the inclination to envision and imagine the future with creative ingenuity, suggested designs may still be susceptible to potential pitfalls stemming from entrenched past assumptions and unquestioned knowledge. A few research questions related to this endeavour are:

- How to speculate about the future of work in better ways?
- How can we better ignite imagination on the future of work?
- How can we engage users in discussion about the future of work?
- How can we develop scenarios of the future of work?
- How can we differentiate between the near and the far future?

5.2 Research avenues

Based on an adjusted, extended perspective on hybrid work, there is a range of topics, challenges and related research questions to engage in. Our analysis identifies four grand challenges, each distinct in its unit of analysis: individual level, technological level, organizational level, and societal level.

5.2.1 Grand challenge 1 (individual level): establishing trust in (human-AI) hybrid teams

Trust is an essential factor in human teams [52, 53]. Recent studies indicate that the evolution of trust dynamics between human and AI team members is significantly influenced by team interaction dynamics and the autonomous teammate's ability to recover from failures [54, 55]. Additionally, the concept of psychological safety has been identified as a crucial factor in mitigating the adverse effects of varying trust levels within hybrid teams [56]. Hence, we formulate the following related research questions:

How do trust dynamics evolve between human and AI team members in a virtual world?

What factors contribute to building and maintaining trust in these hybrid teams?

5.2.2 Grand challenge 2 (technological level): building AI in hybrid teams fair, inclusive, explainable

The second grand challenge intricately ties into the broader issue of trust in AI systems, highlighting the need for innovative methods in the realm of digital identity. One promising avenue that deserves attention is the exploration of Self-Sovereign Identity (SSI) within the context of emerging blockchain technologies [31]. As we navigate the evolving landscape of AI ethics, these considerations become

instrumental in shaping a trustworthy and inclusive future for AI-human collaboration. Hence, ensuring responsible and sustainable AI-human collaboration necessitates the establishment of ethical guidelines addressing data privacy, bias, accountability, and transparency. Innovative approaches to integrating law and ethics in AI systems' decision-making processes are just beginning to be explored [57].

Effective management of biases and limitations inherent in AI systems requires the development of ethical guidelines, promotion of transparency, and inclusivity in AI development and implementation. Innovative methods for applying law and ethics in AI systems are a way to ensure equitable and inclusive hybrid teamwork [58, 59]. Related research questions are:

What ethical considerations and guidelines should be established to ensure responsible and transparent AI-human collaboration?

How can the potential biases and limitations inherent in AI systems be effectively addressed, ensuring that human-AI teamwork remains equitable and inclusive?

5.2.3 Grand challenge 3 (organisational level): establishing a (hybrid team) culture of continuous learning and adaptation

To support the successful integration of AI into hybrid teams, organizations need to cultivate a culture of continuous learning and adaptation. The importance of implementing organizational support mechanisms such as training opportunities and a facilitating environment has been emphasized [60].

Preparing employees for collaboration with AI in hybrid work environments necessitates strategies focused on enhancing digital literacy, adaptability, understanding AI functionalities, addressing ethical considerations, and providing hands-on experience. The importance of organizational support mechanisms, including a conducive environment and training opportunities, has been emphasized in recent research [61]. Related research questions are:

How can organizations foster a culture of continuous learning and adaptation to support the successful integration of human-AI teams in the Metaverse?

What training and skill development strategies are required to prepare employees for collaboration with AI in the Metaverse?

In addition to potential job displacement, what new job roles and responsibilities might emerge as a result of AI integration?

How can individuals prepare for these changes?

5.2.4 Grand challenge (societal level): establishing country-wide and organisation-wide policies and regulations regarding new and evolving forms of human-AI collaboration

The potential consequences of AI-driven automation include alterations in job roles and the risk of job loss. Proactive strategies such as managing worker expectations, offering retraining, and developing performance evaluation frameworks for hybrid teams have been discussed as essential for addressing these concerns [62].

The imperative for establishing regulatory frameworks and policies for human-AI collaboration in the Metaverse is both timely and crucial. Recent works discuss the limitations of current AI ethics frameworks [63, 64], coupled a discussion on the need for regulatory measures to ensure AI's ethical and fair application [65, 66], underscores a complex landscape. These frameworks are necessary to address transparency, bias mitigation, data privacy, ethical guidelines, and international collaboration. Together, they highlight the multifaceted approach required to govern human-AI interactions responsibly in the Metaverse, balancing innovation with ethical standards and accountability in this rapidly advancing digital frontier. Related research questions are:

What are the potential consequences of AI-driven automation on job roles and employment opportunities?

How can organizations proactively address these concerns?

What regulatory frameworks and policies are needed to govern human-AI collaboration and ensure ethical and responsible use in the Metaverse?

6 Conclusions

In the context of a post-pandemic world, many organizations are still deciphering the role of hybrid work, while simultaneously witnessing the rapid incorporation of AI-based systems and the emergence of the Metaverse concept. Our article posits that discussion on hybrid work should transcend the spectrum of in-person and virtual interactions to also include human-AI collaboration in virtual

realms. We draw a picture of the Metaverse as the convergence of virtual worlds for remote collaboration where human actors interact with AI-powered avatars, bots, and other entities. Given these converging trends and the accelerating pace of change, it is imperative for CSCW and related disciplines to reassess its methods, tools, and approaches. The integration of AI-based systems within the Metaverse necessitates a comprehensive understanding of human-computer interaction, digital ethics, and the socio-technical dynamics that underpin virtual collaboration. Research and practice have an interest in exploring those new paradigms of cooperative work, examining how human-AI synergies can be leveraged to enhance productivity, creativity, and inclusivity.

Furthermore, we should address the challenges and ethical considerations that arise from human-AI collaborations in the Metaverse. Issues such as data privacy, digital identity, and algorithmic bias require careful consideration and thoughtful solutions to ensure that the Metaverse remains a safe, equitable, and inclusive space for all users. By doing so, the discipline can adeptly navigate the complexities of this rapidly evolving landscape and play a pivotal role in shaping the future of hybrid work. The insights and innovations developed within our academic community have the potential to guide organizational practices, inform policy development, and contribute to the realization of a more connected, collaborative, and equitable digital future, where human-AI collaborations in the Metaverse become a normative aspect of organizational practices.

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