INVESTIGATING THE DEVELOPMENT OF DIGITALISED WORK ENVIRONMENTS: CHARTING A COURSE FOR THE FUTURE OF WORK

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Abstract

As the labour market evolved towards alternative working arrangements, digital technologies and technological solutions such as virtual reality (VR) gained importance. This conference paper examined the impact of VR technology on virtual workplaces, including how to overcome employee distractions from home, increase visibility, and strengthen relationships between coworkers. Utilizing a conceptual approach, coupled with the narrative literature review, we investigated the limitations of computer-mediated two-dimensional communication tools for flexible work arrangements and how the aforementioned technology-facilitated collaboration and participation in the work process. Thus, the paper laid out the theoretical foundations for future research into the digitalization of the workplace and the application of new technologies to office work.

Key words: virtual reality, remote work, virtual work, wellbeing.

JEL Code: M15, O33, J24

Introduction

The labor market is undergoing substantial shifts as alternative working arrangements become more widespread, a trend exemplified by the integration of virtual reality (VR) technology to tackle remote work challenges. This broad digital transformation, accelerated by the COVID-19 pandemic, has substantial implications for the future of work and the evolution of the global labor market (Brynjolfsson et al., 2020; Ball et al., 2021). The pandemic catalyzed a seismic shift to remote work, leading to businesses adopting policies allowing employees to work indefinitely from home. While enhancing productivity and job satisfaction for many, issues like blurred work-life boundaries and mental distractions persist. As remote work prevails, it is essential to explore how emerging technologies like VR can improve virtual workspaces, surmount obstacles, and foster collaboration. This conference paper thus explores VR's utility in creating separate in-home workspaces, facilitating work detachment and supporting

wellbeing, productivity, and collaboration among remote workers. However, barriers such as situational awareness, interruptions, technological obstacles, and usability issues hinder VR's widespread adoption for remote work. In the context of the COVID-19 pandemic and rapidly evolving labor market, this paper conceptually discusses key research and industry advancements, and analyzes the advantages and disadvantages of employing VR for remote work.

1 Foundations of Virtual Reality-Accessible Digital Workplaces

This opening section examines the literature on the advantages and difficulties of remote work and the use of VR technologies in virtual work environments. The following debate will serve as the basis for our investigation of VR's potential to overcome the limitations of computer-mediated communication tools.

The current era, characterized by the prevalence of remote work, has created an ideal environment for VR technology to revolutionize professional interactions. The capability of VR to generate immersive virtual environments simulating physical workplaces can significantly improve employee engagement, facilitate collaboration, and reduce distractions (Orel, 2022). Moreover, using VR in virtual work environments can improve communication by encouraging more natural, face-to-face exchanges than traditional videoconferencing techniques (Huttar & Brintzenhofe, 2020).

To thoroughly comprehend the historical foundation of VR applications in remote work contexts, examining several cases that have influenced the field is prudent. In a seminal article, Oyama et al. (1993) outlined the vast potential of VR in enhancing tele-existence systems to support remote work operations. Tele-existence systems permit human operators to control robots remotely and perform duties as if physically present in the robot's environment. The conception of an environment simulator as a virtual space resembling the real world provides operators with enhanced visibility and access to necessary information across dispersed teams. Integrating VR with tele-existence systems can enhance human capabilities, optimize task training, and fortify the remote work process as a whole. Education, training, teleoperation, and data visualization are just some of the many disciplines in which VR-enabled environments can be used. NASA's earliest experiments with VR as a communication medium demonstrated that it could provide more expedient, efficient, and cost-effective solutions for tasks requiring coordination and control, such as laparoscopic surgery and teleoperation assignments. Moreover, VR enables the incorporation of visual, aural, and haptic interaction modalities that are impossible in physical environments, thereby enhancing the remote work experience.

In a similar manner to explore the prosperity of (back then) novel technological tool, the Caterpillar commissioned the National Center for Supercomputing Applications (NCSA) and Germany's National Research Center for Information Technology (GMD) to experiment with utilizing VR to optimize distributed work processes. The Virtual Prototyping System (VPS) facilitated collaboration between engineers from different countries on vehicle designs via distributed VR, which supported cooperative design evaluation and interactive redesign. Real-time video transmissions let participants visualize one another within the shared virtual environment. In contrast, virtual prototypes shorten the time between product design and market introduction, improving product quality. This innovative strategy expedited communication, energized collaboration and resulted in accelerated product development and superior quality.

Virtual workplaces supported by VR can overcome obstacles associated with physical distance by providing novel approaches to project management and nurturing effective team communication. VR can allow users to experience asymmetrical interaction environments and surmount the limitations of traditional collaboration tools, such as email and video conferencing (Lee & Yoo, 2021). As a result, businesses may undertake the enhanced productivity behind their employees, optimized cost savings, and improved service. VR can facilitate dynamic team membership, assist employees in achieving a work-life balance, and enable companies to recruit top talent regardless of their geographical location. Although virtual teams may struggle with trust-related issues and the lack of physical interaction (Cascio, 2000), VR technology can ameliorate these concerns and contribute to more effective remote work processes. The latter can be accomplished by transforming conventional knowledge-based work processes with VR, allowing team members to investigate various scenarios and situations in virtual learning environments (VLEs). VLEs can provide abundant resources, communication communities, active action tools, and facility toolkits, allowing employees to access information, participate in discussions, and contribute to problem-solving and decision-making processes. The VR virtual work environments allow remote workers to learn, develop, and foster better team connections and understanding, resulting in increased collaboration, innovation, wellbeing, and overall productivity (Pan et al., 2006).

With that being said, the VR has the identifiable potential to substantially transform remote work by addressing several obstacles encountered in the traditional WFH setup, such as the effectiveness of reducing distractions, the capacity to strengthen relationships with coworkers, and the technological readiness of VR-supported tools. These obstacles are addressed in the following segment.

2 Overcoming Obstacles in Virtual Work Environments

Businesses may promote better collaboration, communication, and productivity in distant work locations by utilising the immersive qualities of VR. Organisations should take into account these challenges and look into viable solutions to them. The following section of our conference paper covers typical challenges remote employees face and explores how VR technology might address these challenges. Dealing with interruptions, a loss of visibility, and worsening relationships with coworkers as a result of a lack of physical touch are some of these challenges. Distractions are a significant obstacle for remote employees, as the home environment lacks structure and boundaries. To address this issue, VR technology can create virtual workstations that isolate employees from their home environments, thereby minimizing external distractions. Employees can interact with coworkers in these virtual spaces and complete tasks in a controlled, immersive environment to enhance concentration and productivity. These virtual workspaces allow remote employees to "escape" their home environment and immerse themselves in a professional environment that closely resembles a physical office.

Visibility, or the extent to which remote employees feel seen and acknowledged by their colleagues and supervisors, is another essential aspect of remote work that VR technology can improve. In conventional office environments, spontaneous interactions and direct communication foster the exchange of ideas and the development of solid relationships. However, these serendipitous encounters are typically absent in remote work environments, resulting in employees' sentiments of isolation and disconnection. VR can bridge this gap by enabling more natural and direct interactions between remote employees, simulating physical presence and fostering a sense of connection (Orel, 2022).

Virtual meeting rooms, for instance, can replicate in-person meetings' spatial and social dynamics, allowing participants to engage in nuanced nonverbal communication and develop a shared understanding of the discussion. This perception of presence and connection can increase remote team members' trust, mutual accountability, and knowledge sharing. Moreover, by fostering a sense of presence, VR technology can enable remote workers to maintain their professional identity and create a more apparent distinction between their work and personal lives (Radhakrishnan et al., 2021).

The third challenge remote employees face is the deterioration of their relationships with coworkers, which can negatively impact collaboration and overall team performance (Lee & Yoo, 2021). VR technology has the potential to combat this by enabling more engaging and

immersive interactions between coworkers, simulating face-to-face communication and nurturing a sense of team cohesion. With the leveraging VR's capabilities to create shared experiences and simulate physical co-location, organizations can nurture a sense of belonging and camaraderie among remote workers.

For instance, virtual team-building exercises and social events can leverage the immersive nature of VR to create memorable and engaging experiences for remote employees. These activities can strengthen interpersonal relationships and increase team members' understanding of their skills, strengths, and work approaches. Moreover, VR can facilitate more effective collaboration on complex tasks by allowing remote team members to interact with shared 3D models or virtual whiteboards, thereby streamlining communication and fostering a more comprehensive project comprehension (Radhakrishnan et al., 2021).

It is rather vital to recognize its limitations and potential drawbacks despite the potential benefits of VR technology in addressing the challenges encountered by remote workers . One example that we can set is the high cost of VR hardware and software and the requirement for sufficient internet bandwidth, which may be obstacles to widespread adoption. In addition, organizations must carefully consider and address data privacy and security concerns in virtual environments (Orel, 2022). Lastly, the potential for excessive reliance on VR technology may aggravate the digital divide among employees and contribute to feelings of isolation among those who lack access to or experience the technology.

Moreover, even though VR technology can effectively simulate many aspects of face-to-face interactions, it cannot replicate the complete spectrum of nonverbal cues and subtle nuances contributing to the richness of interpersonal communication (Lee & Yoo, 2021). Therefore, organizations must be aware of the limitations of VR-mediated interactions and investigate additional communication channels to ensure that remote employees remain well-integrated into their teams (Radhakrishnan et al., 2021; Orel, 2022).

That being said, extensive VR users' physiological and psychological effects over the long term are not yet completely understood. Long-term exposure to virtual environments may result in adverse health effects, such as cyber sickness, eyestrain, and fatigue, which could negatively influence the wellbeing and productivity of employees. To mitigate these risks, organizations must adopt a measured approach to implementing VR technology, considering their employees' unique requirements and preferences and incorporating regular breaks and opportunities for physical activity.

3 Future Research Directions

This closing section outlines prospective future research avenues in VR technology and remote work. The practical implementation of VR in various work contexts, the impact of VR on employee wellbeing, and the development of best practices for integrating VR into existing work processes are crucial research areas.

3.1 Implementation of VR in Diverse Work Environments

To maximize the utility of VR technology for remote work, it is essential to investigate the implementation of VR solutions in various industries and work environments. This line of inquiry must evaluate the efficacy of VR in addressing the unique challenges encountered by remote workers in various contexts and the potential adoption barriers and scalability of VR solutions.

The diversity of work environments necessitates a multifaceted strategy for comprehending the nuances of deploying VR technology. Diverse industries encounter distinct challenges in remote work; therefore, it is essential to consider how VR can be adapted to meet specific requirements (Orel, 2022). For example, the medical industry may benefit from VR simulations for surgical training, whereas the architecture industry may need immersive visualization tools for collaborative design. Consequently, research should concentrate on creating VR applications tailored to the specific needs of various industries.

Further, implementing VR technology in diverse work environments necessitates overcoming potential adoption barriers, such as infrastructure requirements, financial constraints, and employee resistance to change (Lee & Yoo, 2021). To address these issues, interdisciplinary research integrating computer science, economics, and organisational psychology is necessary. Thus, academicians can identify strategies for minimising obstacles and optimising the integration of VR technology in diverse work environments.

3.2 Effect of VR on Remote Workers' Wellbeing

Investigating the influence of VR technology on the wellbeing of remote employees is a crucial aspect of future research. This investigation should consider factors like work-life balance, mental health, and job satisfaction. Studies are required to determine whether the immersive nature of VR contributes positively or negatively to these factors, and to evaluate potential strategies for mitigating any adverse effects (Radhakrishnan et al., 2021).

Existing research on the psychological effects of VR has demonstrated that it can enhance a sense of presence and engagement. However, disadvantages may accompany these advantages, such as increased tension, cognitive overload, and feelings of isolation from the physical world. Consequently, it is essential to conduct rigorous longitudinal studies examining the long-term effects of VR use among remote employees (Orel, 2022). This research should examine individual differences in variables such as susceptibility to cyber sickness and investigate the possibility of adaptive strategies to mitigate adverse effects.

The effect of VR on employee health also affects team relationships and organisational culture, going beyond just the individual. VR may change how a team communicates, makes decisions, and interacts with one another. Therefore, research should look at how changes brought on by VR in these areas influence the general wellness of remote workers and look into ways to promote a healthy virtual workplace.

3.3 Development of Best Practices for Integrating VR into Work Processes

Future research should also concentrate on developing best practices for integrating VR technology into existing work processes. The latter includes identifying the most effective methods for training employees to use VR tools, developing guidelines for maintaining a balance between virtual and real-world interactions, and establishing protocols for preserving privacy and security in virtual environments.

Training and development of employees are essential components of effectively implementing VR technology in remote work environments. As a result, research should investigate the most efficient and effective methods for teaching employees how to use VR tools and strategies for facilitating ongoing learning and skill development. This may involve the incorporation of existing training methodologies, such as integrated learning or experiential learning, as well as developing novel instructional approaches specifically tailored to the unique requirements of VR technology.

With that in mind, preserving a balance between virtual and real-world interactions is essential for individual health and organizational performance. The optimal proportion between VR-mediated and conventional communication, collaboration, and problem-solving methods should be investigated. This line of inquiry may involve examining the effects of various VR utilization patterns on cognitive load, social connection, and task performance. Researchers can provide organisations with evidence-based guidelines for navigating the integration of VR and traditional work processes by understanding these relationships.

In the end, in virtual environments, privacy and security are of paramount importance. As remote work continues to gain popularity and VR technology becomes more pervasive, it is crucial to establish protocols that protect sensitive data and ensure the privacy of individuals participating in virtual workplaces. This area of study should investigate the unique vulnerabilities of VR technology and develop innovative solutions to protect against potential threats. The latter may require interdisciplinary collaboration between computer scientists, cybersecurity experts, and organizational researchers to develop robust security protocols and effective and readily adaptable measures across industries.

The increasing prevalence of VR technology in remote work necessitates rigorous and exhaustive research in several essential fields. By investigating the practical implementation of VR in diverse work settings, assessing the impact of VR on employee wellbeing, and developing best practices for integrating VR into work processes, researchers can optimize VR technology for remote work and facilitate its successful integration across industries. In the end, this research will improve our comprehension of the potential benefits and challenges of VR technology and enable organizations to leverage its capabilities for enhanced productivity, collaboration, and employee satisfaction.

Conclusion

The paper delved into the capacity of Virtual Reality (VR) technology to revolutionize virtual workspaces. With the conceptual aim of addressing and tackling the multitude of difficulties encountered by remote workers, the work demonstrated the potential for VR to foster improved collaboration, visibility, and relationships among team members. The latter technology, as outlined, serves as a promising solution to overcome the isolation and communication barriers often associated with remote work. As the remote working trend continues expanding and gaining more acceptance, the paper underscored the importance of corporations considering pioneering solutions like VR. These innovative approaches are critical to sustaining employee wellbeing, promoting productivity, and ensuring superior team collaboration.

Looking forward, the paper also suggested avenues for further research to continue exploring and understanding VR technology within remote work environments. Such research should focus on the tangible application of VR across diverse work landscapes, highlighting the practical benefits and potential challenges of its integration. In concluding remark, future studies should assess the enduring consequences of employing VR technology in remote work

settings, including its potential impact on employee wellbeing. The paper also highlighted the need for research into developing optimal practices for incorporating VR into work procedures. In this way, future work can provide valuable insights and recommendations for companies seeking to leverage VR technology in their shift towards more flexible, remote working arrangements.

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