



Analyzing engagement in virtual teams: A cross-cultural study on videoconference and virtual reality

Pedro Barreiras^{*}, Manuela Aparicio, Jorge Rodrigues, Yanrong Yang

NOVA Information Management School (NOVA IMS), Universidade NOVA de Lisboa, Campus de Campolide, 1070-312, Lisboa, Portugal

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ABSTRACT

This paper investigates the transition from videoconferencing (VC) to virtual reality (VR) collaborative meetings by comparing user perceptions in regions with low – United Kingdom (UK) and United States of America (USA) – and high – Portugal (PT) – uncertainty avoidance (UA) levels. Based on an experimental design approach, a questionnaire was distributed to respondents from one of two groups, depending on the type of platform (TP) – VC or VR. For the low UA region, Study 1.1 explores the impact of the type of platform on work engagement (WE) as well as the mediation of creative behavior (CB), impression of interaction possibilities (IIP), and perceived enjoyment (PE). Because no significant difference in WE levels between VR and VC was found, as a possible explanation for this result, we further examined and confirmed a significant moderation of resistance to change (RTC) in Study 1.2. From the findings of Study 1 emerged the possibility that these unfavorable feelings about the technological shift could be a more generalized phenomenon than previously expected (in low and high UA regions). Focusing on Portugal, Study 2 presented similar findings to the ones of Study 1: no significant WE difference between VR and VC was found and RTC's moderation was supported. Overall, despite the advantages of the technology, transitioning from VC to VR collaborative meetings may pose a higher challenge than previously expected. The findings of this paper initiate a critical discussion on the potential global barriers to the implementation of VR collaborative meetings.

1. Introduction

From its initial emergence in the 1920s, videoconferencing experienced its most significant surge after 2019, a century later, particularly because of its crucial role in supporting remote work. In 2019, merely around 5 % of employees had regular involvement with remote work, despite its concept being already known to organizations since the 1970s (Leonardi, 2021). Emerging at the end of 2019, the outbreak of COVID-19 impacted organizational processes and workers' routines, forcing organizations to implement new ways of work to cope with such changes (Klimburg-Witjes & Wentland, 2021; Narayanamurthy & Torella, 2021). To overcome the constraints of the pandemic (e.g., employees forced to work remotely), organizations relied on videoconferencing to support communication and conduct work meetings (Karl et al., 2021). This transition to digital remote work, where employees communicate distanced from each other, was supported by digital tools, such as Zoom and Microsoft Teams, through text, audio, video, and file sharing (Leonardi, 2021). Videoconferencing

applications verified an exponential increase in communities, schools, and businesses (Fauville et al., 2023), with Zoom achieving a growth of over 30 times in usage after 2019 and a mark of 300 million users per day in meetings (Georgiev & Defensor, 2024).

During the pandemic, regardless of managerial hesitance, companies were forced to incorporate digital technologies for the transition to remote work (Amankwah-Amoah et al., 2021). Those unable to keep up with this transition were heavily affected (A. Singh, Dijkstra-Soudarissanane, & Gunkel, 2022). Considering that such tools have already been emerging for a long time, one would expect firms to be ready for this shift. However, even though the technology to support remote work had already been available for decades prior to the pandemic, most businesses did not embrace it (Amankwah-Amoah et al., 2021; Rosalsky, 2020). While some companies face difficulties transitioning into digital, we are entering a fourth industrial revolution where digital, physical, and biological boundaries are technologically merged (Maynard, 2015; Schwab, 2016). For instance, virtual reality is already revolutionizing workplaces and supporting novel forms of

^{*} Corresponding author.

E-mail addresses: m20200368@novaims.unl.pt (P. Barreiras), manuela.aparicio@novaims.unl.pt (M. Aparicio), jcarrola@novaims.unl.pt (J. Rodrigues), 20220021@novaims.unl.pt (Y. Yang).

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collaboration that transcend physical constraints (Fusaro et al., 2025). Organizations have been enhancing distanced work meetings through augmented reality (AR) and virtual reality (VR) to explore immersive virtual workplaces where employees can collaborate without being limited to the restrictions of the physical world (Kugler, 2017).

Concerning remote meetings, not only is videoconferencing considered the most popular medium, but it is also viewed as a useful reference for a comparison with a rising alternative: virtual reality (Abdullah et al., 2021). While technological disruption has been one of the main drivers of the Future of Work, the shift to virtual environments is becoming more relevant for distanced communication (A. Singh, Dijkstra-Soudarissanane, & Gunkel, 2022). The possibility of virtual reality replacing traditional remote videoconferencing tools has been not only an important topic for scientific research but also for society in general, as people have been questioning or debating this transition over the last few years (Doherty, 2024; Jackson, 2023; Ramirez, 2022; Shahbaz, 2021). Meanwhile, Big tech companies have been describing virtual reality as the future of remote meetings and promoting its features for engaging employees: in 2022, besides presenting the metaverse to enhance engagement and creativity, Microsoft claimed that 52 % of employees were willing to participate in meetings or team activities within digital immersive environments in the metaverse over the following year (Microsoft, 2022); in accordance, Meta is also declaring that such immersive experiences improve collaborative interactions, creativity, and engagement (Meta, 2022). As VR is viewed as an alternative to VC, it is critical to comprehend its effects in the collaborative process (Abdullah et al., 2021) and analyze how it compares to its predecessor. That is, even though VR emerges as a promising technological advancement, it is crucial to validate whether this shift is perceived to result in improved outcomes, such as higher work engagement. This leads us to the following research question: How do videoconferencing and virtual reality for collaborative meetings compare in terms of perceived engagement, and what elements influence this comparison? Answering this research question contributes to a better understanding of the still largely unexplored aspects of engagement in videoconferencing (Karl et al., 2021), addresses the need to investigate the association between interactions in virtual meetings and work engagement (Wichmann et al., 2025) as well as the possible outcomes of introducing virtual reality in work contexts (Abramczuk et al., 2023).

In order to address the research question, we conducted two studies that considered an experimental design approach. We started by comparing the perceived work engagement levels of videoconferencing and virtual reality, followed by an examination of elements that potentially influence this comparison, focusing on aspects of the collaborative experience and cultural attributes. The analysis on elements of the collaborative experience regards the mediation analysis of creative behavior (CB), impression of interaction possibilities (IIP), and perceived enjoyment (PE). Meanwhile, the investigation on cultural elements concerns the influence of uncertainty avoidance (UA) and the moderating effect of resistance to change (RTC). Even with the widespread usage of videoconferencing and the potential of the technological shift, there is still a lack of understanding on the effect of cultural elements. Despite the importance of larger-scale factors (e.g., organizational and national factors) in the implementation success of work engagement-related interventions (Knight et al., 2019), to our knowledge, the influence of uncertainty avoidance (UA) on the WE when introducing VR (vs. VC) remains unexplored. According to Erumban and de Jong (2006), uncertainty avoidance is one of the most crucial Hofstede dimensions to influence perceptions toward information and communication technologies (ICT), to which countries with low UA (vs. high UA) levels are more likely to be receptive. With the logic that areas more open to new contexts will also have higher perceptions toward the introduction of VR, we examined work engagement considering the influence of culture, specifically uncertainty avoidance (UA) and resistance to change (RTC). This was conducted by comparing each

technology's perceived WE levels and analyzing the moderating effect of RTC in regions with low (United Kingdom and United States of America) and high (Portugal) uncertainty avoidance. The summary of studies is presented in Section 2.

2. Summary of studies

This paper is divided into Study 1 (Studies 1.1 and 1.2) and Study 2. This structure reflects the uncertainty avoidance levels of the regions under analysis. In Study 1.1, we start by conducting an experimental design that, for individuals from low UA regions (UK and USA), examines the relationship between the type of platform (videoconferencing or virtual reality) and work engagement, as well as the mediation effects of creative behavior, impression of interaction possibilities, and perceived enjoyment. Study 1.2 extends the analysis of Study 1.1 by investigating the moderating effect of resistance to change on the relationship between TP and WE. Moreover, Study 2 performs, for the high UA area (PT), the same direct effect experiment of Study 1.1 and moderating impact of Study 1.2. Fig. 1 illustrates the overall conceptual model of Study 1 and Study 2. Appendix A presents the sample characterization for Study 1 and Study 2.

3. Study 1

3.1. Study 1 (1.1 and 1.2): overview and method

Study 1.1 and 1.2 follow an experimental design approach. Participants completed a 5-min questionnaire distributed through Prolific (Palan & Schitter, 2018) - <https://www.prolific.com> - where they were randomly assigned to a group, depending on the Type of Platform (VR or VC). At the beginning of the questionnaire, in order to manipulate the type of platform, the VC or VR group respondents started by watching a short 1-min video that explained the concept of VC/VR tools and their use for collaborative purposes. The video presented to the VC group respondents illustrated features of Microsoft Teams, including meeting rooms, presentation/screen sharing, document collaboration, and customizable background images (Ferreira, 2021; Hubbard et al., 2021; McFedries, 2022). Meanwhile, the video presented to the VR group respondents illustrated features of Meta Horizon Workrooms, such as the ability to conduct collaborative meetings in customizable immersive virtual environments where individuals can interact with each other through natural conversation and avatars that replicate hand gestures and body language, while also offering access to virtual tools and interactive whiteboards for enhanced teamwork (Meta, 2025). After the video, participants were told to place themselves in a scenario where their supervisor intended to implement a fixed model for remote meetings (VR or VC). This scenario was designed to collect individuals' initial perceptions when required to adapt to a more established (VC) or a less established (VR) technology for collaborative meetings. Then, they were asked to answer the questionnaire considering a nine-point Likert scale from 1 (strongly disagree) to 9 (strongly agree) (see Appendix B). The total number of participants was 407: 197 from the UK (VC, $n = 98$; VR, $n = 99$) and 210 from the USA (VC, $n = 105$; VR, $n = 105$). Fig. 2 illustrates the steps considered for the administration of the questionnaire.

Appendix B also presents additional details regarding the constructs, items, and reliability of the scales. Work engagement ($\alpha = 0.944$) was adapted from Mäkinen et al. (2020) and Schaufeli et al. (2017), considering the 3-item version of the Utrecht Work Engagement Scale and represents the extent to which the use of the tool (VC or VR) for collaborative work is a positive and fulfilling experience. Creative behavior ($\alpha = 0.958$) was based on Huang and Shiao (2017) and concerns the capabilities of the technology to support the production of new and useful ideas. Perceived enjoyment ($\alpha = 0.938$), adapted from J. Lee et al. (2019), considers the degree to which using the tool for collaborative meetings is regarded as enjoyable, excluding the performance

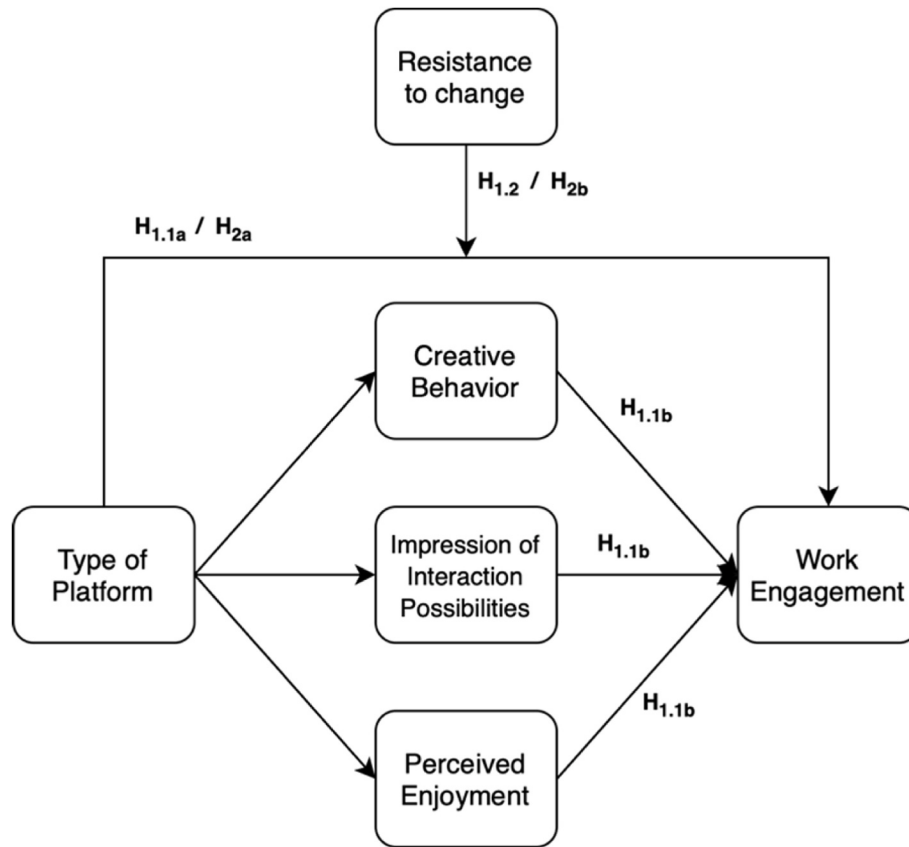


Fig. 1. Conceptual model.

consequences from its use (Venkatesh, 2000). Originally from Poeschl and Döring (2015), impression of interaction possibilities ($\alpha = 0.931$) concerns the individual being perceived by others in the meeting, potential interactions, and feelings of connectedness. Resistance to change ($\alpha = 0.953$) was adapted from Bhattacharjee and Hikmet (2007) and represents the degree to which users did not want the tool to change the way they work, intervene, interact, and perform in collaborative meetings.

3.2. Study 1.1

3.2.1. Study 1.1: theoretical framework

During a technological shift, it is essential to examine if the newer tool is recognized to be better than the previous one and understand what technological features are relevant to achieve the intended outcome. We investigated if VR is perceived as having higher work engagement levels than VC and explored the importance of technological capabilities, associated with VR and collaborative meetings (creative behavior, perceived enjoyment, impression of interaction possibilities), to enhance engagement. Whilst videoconferencing lacks capabilities to maintain users engaged in work meetings, research is demonstrating how extended reality (XR) technologies, including VR, are providing novel and superior experiences in such meetings (S. Singh, Dijkstra-Soudarissanane, & Gunkel, 2022). According to the Media Richness Theory, face-to-face is the richest medium (Ishii et al., 2019). By offering many benefits of face-to-face interactions, VR demonstrates a high engagement potential in collaborative settings (Dzardanova et al., 2022). Virtual Reality, which supports higher media richness than 2D, enables individuals to look around and utilize virtual versions of objects (Kandaurova et al., 2019) within customizable virtual environments (Held et al., 2024). Therefore, in VR, it is possible to present a shared custom environment adapted to the requirements of the collaborative

task, resulting in higher work engagement (Aufegger & Elliott-Deflo, 2022). We understand that the facilitation of collaboration and increase in engagement can be attributed to its higher capacity to: direct attention via virtual versions of physical objects (e.g., sticky notes), use visual cues for communication (e.g., whiteboards), incorporate innovative and interactive tools (e.g., virtual touch-responsive displays), leverage playful elements, and integrate the benefits of traditional methods such as video-based communication (Aufegger et al., 2022). In addition, whilst previous research points to remote meetings being linked to a decrease in engagement, individuals demonstrate appreciation for the increase in engagement provided by VR (Abramczuk et al., 2023).

H1.1a. VR technology (vs VC) has a higher positive influence on work engagement.

For remote meetings, besides being considered to have superior capacity in potentializing creativity, establishing relationships, and decreasing distance between participants, virtual reality is also capable of providing an enjoyable experience (Abramczuk et al., 2023). According to Kandaurova, Lee and Mark (2019), “VR provides a richer medium that combines 360-degree visual and audio dimensions, as well as the ability to interact within the environment (e.g., look around, or interact with objects in more advanced VR versions)” (p. 573). Virtual reality enhances interactions between users, as they can communicate not only by talking to each other but also by visualizing each other’s avatar faces and body movements (Mütterlein et al., 2018). Moreover, considering the media richness’s contribution to potentialize creativity (Chao et al., 2020), we argue that VR enhances the users’ ability to develop and share their creative thinking or ideas by supporting various communication forms without being restricted to the physical conditions of the real world or a 2D screen. Yang et al. (2018) demonstrated how VR offers the possibility to enhance creativity by using virtual tools,

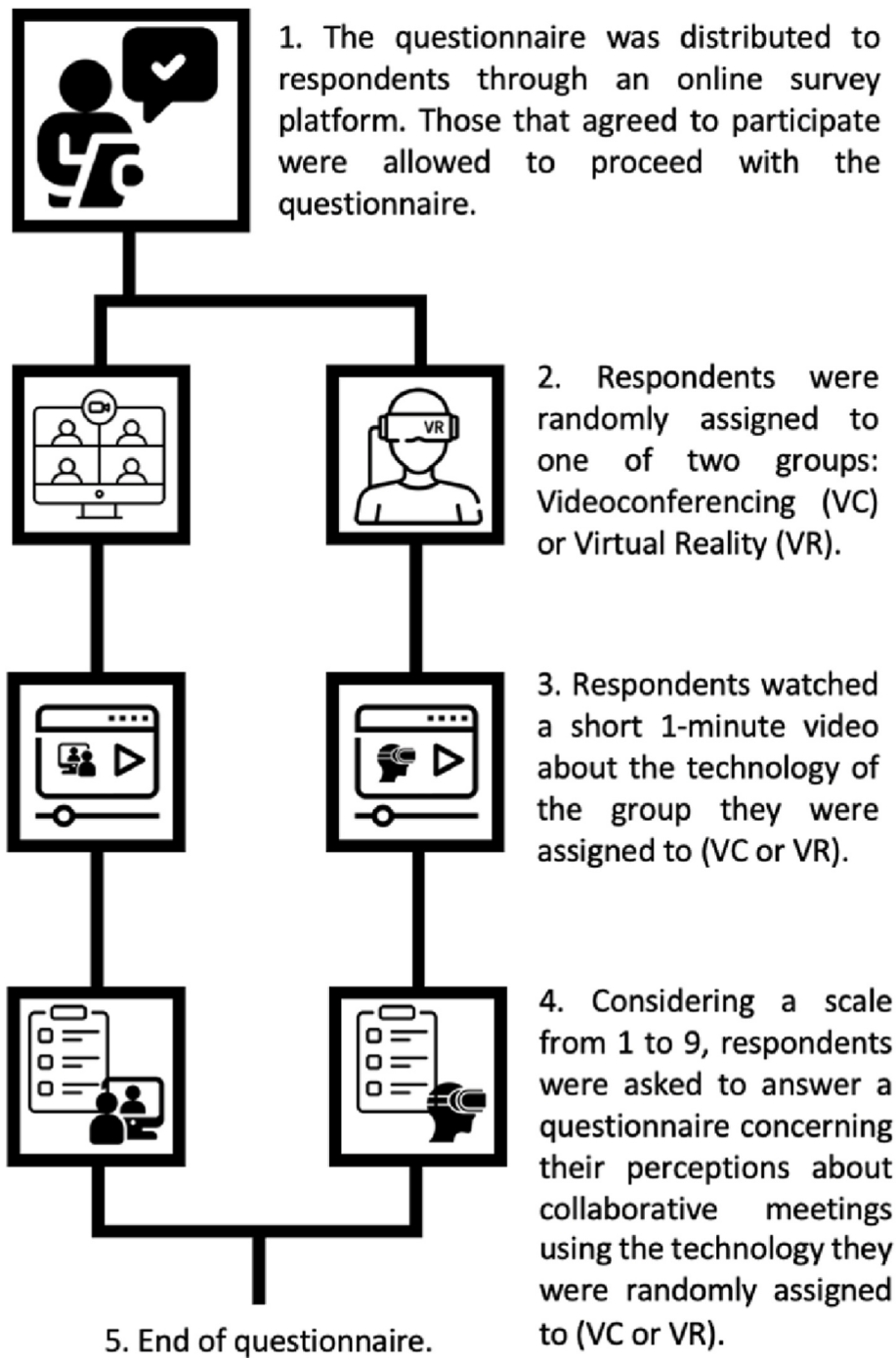


Fig. 2. Questionnaire administration steps.

moving freely in a virtual environment where users can explore different angles, becoming more immersed and focused, and performing full-body movements. Furthermore, as media richness also positively influences perceived enjoyment in the context of information systems (M. Lee et al., 2007), the sensory-rich capabilities of VR are important to provide pleasurable and enjoyable contexts (Jo & Park, 2023). In addition, another key point attributed to VR is its supported level of social presence (Oh et al., 2018), which is an important aspect for collaboration and its enjoyability (Weinel et al., 2011). For collaborative purposes, virtual reality has been regarded with realistic and enjoyable experiences (Abramczuk et al., 2023).

H1.1b. Creative behavior, impression of interaction possibilities, and

perceived enjoyment mediate the relationship between the type of platform and work engagement.

3.2.2. Study 1.1: results

In Study 1.1, we first conducted an independent-samples *t*-test analysis to compare the levels of work engagement between the two

Table 1
Independent-samples *t*-test analysis results.

Group	M	SD	<i>t</i> _(391.778)	p-value	<i>f</i> ²
VC	5.5764	1.93203	0.328	0.743	0.0326
VR	5.5065	2.33825			

groups of type of platform (VC vs VR). In Table 1, the results of this analysis demonstrate a non-significant mean difference between the VC and VR groups. Therefore, H_{1.1a} was not supported.

Furthermore, through PROCESS macro in SPSS and following Model 4 (Hayes, 2022), we examined how perceived enjoyment, creative behavior, and impression of interaction possibilities mediated the relationship between type of platform and work engagement. Tests were conducted to verify assumptions for regression analysis, such as the examination of the normality of residuals (Curran et al., 1996; Hair et al., 2019; Marôco, 2014). In addition, no multicollinearity issues were detected, as all variance inflation factors (VIF) values were below the recommended thresholds (Hair et al., 2019). In regard to the direct effects (Table 2), TP had a significant and negative effect on CB and IIP, and a marginally significant effect on PE. CB, IIP, and PE had a positive and significant effect on WE. Additionally, the direct effect of platform type on work engagement was not significant. The indirect effects (Table 3) by CB and IIP were significant. In contrast, the indirect effect by PE was not significant, indicating that there is an effect of platform type on work engagement, but this happens only through CB and IIP. Therefore, whilst H_{1.1b} was not supported for all the proposed mediations, creative behavior and impression of interaction possibilities were confirmed as indirect-only mediators. However, despite the non-significant indirect effect of PE, there was a marginally significant influence of TP on PE and a significant effect of PE on WE.

3.3. Study 1.2

3.3.1. Study 1.2: theoretical framework

In Study 1.1, despite the low levels of uncertainty avoidance, the results did not demonstrate a significant difference between the groups (VC vs VR). Subsequently, as a possible explanation for those findings, in Study 1.2, we explore if the relationship between introducing VR (vs VC) and work engagement is significantly weakened by resistance to change. That is, if the UK and USA respondents, despite being considered as having low UA, did not find the newer technology more engaging, then they could be demonstrating some resistance toward its introduction. In order to have a better comprehension about the introduction of new technologies in the workplace and its outcomes, it is important to understand the influence of resistance to change, which has been considerably regarded in the literature (Ali et al., 2016). Hirschheim and Newman (1988) provided the following definition for resistance to change:

Adverse reaction to a proposed change which may manifest itself in a visible, overt fashion (such as through sabotage or direct opposition) or may be less obvious and covert (such as relying on inertia to stall and ultimately kill a project) (p. 398).

Despite the fact that people are constantly being required to shift into using new technologies in the personal and business parts of their lives, a major problem for organizations is resistance to change from employees, one of the main reasons for the non-use of innovations (Laumer & Eckhardt, 2010). When introducing new information technologies in the workplace, companies may face resistance from employees, especially if they are imposed by upper management (Bhattacharjee et al., 2018). Due to the natural propensity of humans to avoid change, if a new system impacts the way business operations and tasks are conducted,

workers are more likely to demonstrate resistance toward it (Bhattacharjee & Hikmet, 2007). When users demonstrate interest in using new information technologies for their workplace tasks, it can lead to benefits, however, if they demonstrate resistance, those benefits may not be achieved (Nov & Ye, 2008). Furthermore, after finding in Study 1.1 that low UA regions did not demonstrate a significant WE advantage toward VR, we further explore if RTC can help explain those results.

H1.2. Resistance to change moderates the relationship between type of platform (VR or VC) and work engagement in low uncertainty avoidance regions.

3.3.2. Study 1.2: results

The moderation of resistance to change on the relationship between type of platform and work engagement was assessed through PROCESS macro in SPSS, following Model 1 (Hayes, 2022). Tests were conducted to verify assumptions for regression analysis, such as the analysis of the normality of residuals (Curran et al., 1996; Hair et al., 2019; Marôco, 2014). In addition, no multicollinearity issues were detected, as all variance inflation factors (VIF) values were below the recommended thresholds (Hair et al., 2019). The statistically significant influence of the interaction term, composed of TP and RTC, on WE ($b = -0.2802$, $se = 0.0827$, $p < 0.001$) evidences the presence of a moderation effect and provides support for H_{1.2}. Fig. 3 illustrates the impact of RTC on the dynamic between TP and WE: for low RTC values, VR presents higher WE levels than VC; for high RTC values, VC presents higher WE levels than VR. With this, under this study's conditions, the more resistant someone is to change, the greater the likelihood that they do not perceive VR as more engaging than VC.

4. Study 2

4.1. Study 2: overview and theoretical framework

In Study 2, we extend the analysis of Study 1 to a high uncertainty avoidance region, aiming to understand how the dynamics of work engagement could change depending on cultural characteristics. This is based on the foundations presented by Hofstede (1991, 2001) and Hofstede and Hofstede (2004) that societal and organizational behaviors are influenced by national and regional groups, in which these influenced behaviors persist over time (Snitker, 2010). Theoretical rationality and statistical examination supported the identification of five major dimensions that help differentiate country cultures, including Uncertainty Avoidance - the degree to which a culture influences its members to experience discomfort in novel, different, unknown, or surprising situations (Hofstede, 2001). One prominent premise of UA emphasizes its importance on the acceptance and receptivity of information and communication technologies by groups of people, based on the reasoning that, as the introduction of new technologies involves associated risks, those who are uncomfortable with uncertainty will be less willing to adopt and use them (Leidner & Kayworth, 2006).

According to the uncertainty avoidance rank presented by Hofstede (2001), considering a total of 50 regions, Great Britain and the United States of America were ranked among the top 10 with the least UA levels while, in contrast, Portugal was ranked as the second country with the highest levels of UA. Individuals from the UK are open to novel and uncertain situations, interested in new innovations, and are receptive to changes in the workplace environment, meanwhile, somewhat similarly, not only do people from the US have a fair degree of receptivity toward new innovations and ideas, but also demonstrate a willingness to embrace unknown contexts regarding technologies and business practices (Hofstede Insights, 2024). Conversely, uncertainty avoidance is the dimension that best describes Portugal due to its high-level tendency for avoiding uncertain contexts and favoring security, as well as resisting new ideas and innovations (Hofstede Insights, 2024). Considering that individuals from higher UA regions tend to exhibit lower receptivity to

Table 2
Direct effects results.

Antecedent	Consequent	b	Std. Error	p Value
TP	CB	-0.6977	0.1884	<0.001
TP	IIP	-0.7522	0.1906	<0.001
TP	PE	0.3926	0.2048	= 0.0559
TP	WE	0.1843	0.1045	= 0.0785
CB	WE	0.2203	0.0375	<0.001
IIP	WE	0.3845	0.0363	<0.001
PE	WE	0.4808	0.0349	<0.001

Table 3
Mediation analysis - Indirect effects.

Antecedent	Mediator	Consequent	b	Std. Error	LLCI	ULCI
TP	CB	WE	−0.1537	0.0511	−0.2619	−0.0633
TP	IIP	WE	−0.2892	0.0826	−0.4583	−0.1361
TP	PE	WE	0.1888	0.1016	−0.0054	0.3933

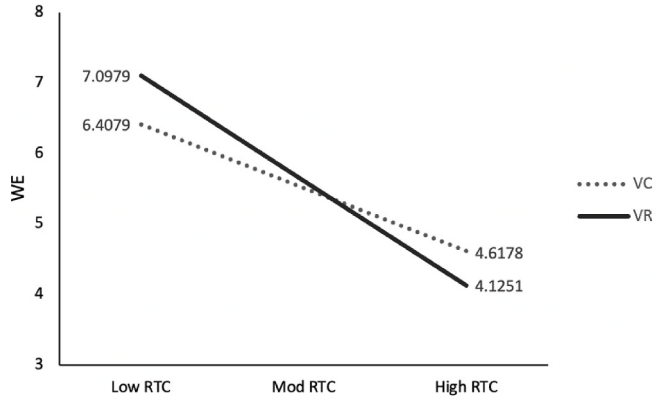


Fig. 3. Work engagement of VC and VR by the level of resistance to change.

the introduction of new workplace technologies, we do not expect them to demonstrate more favorable feelings toward VR than those from the lower UA regions in Study 1. Accordingly, under this study's conditions, we hypothesize that respondents from Portugal do not perceive significantly higher WE levels in VR collaborative meetings than in VC, with RTC moderating the relationship between type of platform and work engagement:

H2a. VR technology (vs VC) does not have a higher positive influence on work engagement in Portugal.

H2b. Resistance to change moderates the relationship between type of platform (VR or VC) and work engagement in Portugal.

4.2. Study 2: method

Study 2 replicated the experimental design and questionnaire administration procedures (Fig. 2) of Study 1, randomly assigning participants to either the VR or VC group, each viewing a short 1-min video that explained the concept of the tool and its use for collaborative purposes. The video presented to the VC group respondents illustrated features of Microsoft Teams, including meeting rooms, presentation/screen sharing, document collaboration, and customizable background images (Ferreira, 2021; Hubbard et al., 2021; McFedries, 2022). Meanwhile, the video presented to the VR group respondents illustrated features of Meta Horizon Workrooms, such as the ability to conduct collaborative meetings in customizable immersive virtual environments where individuals can interact with each other through natural conversation and avatars that replicate hand gestures and body language, while also offering access to virtual tools and interactive whiteboards for enhanced teamwork (Meta, 2025). After the video, participants were told to place themselves in a scenario where their supervisor intended to implement a fixed model for remote meetings (VR or VC). This scenario was designed to collect individuals' initial perceptions when required to adapt to a more established (VC) or a less established (VR) technology for collaborative meetings. Then, they were asked to answer the questionnaire's items considering a nine-point Likert scale from 1 (strongly disagree) to 9 (strongly agree) (see Appendix B). The total number of participants was 137 from PT (VC, $n = 68$; VR, $n = 69$). Appendix B presents additional details regarding the constructs, items, and

reliability of the used scales. Work engagement ($\alpha = 0.881$) was adapted from Mäkinen et al. (2020) and Schaufeli et al. (2017), considering the 3-item version of the Utrecht Work Engagement Scale and represents the extent to which the use of the tool (VC or VR) for collaborative work is a positive and fulfilling experience. Resistance to change ($\alpha = 0.949$) was adapted from Bhattacharjee and Hikmet (2007) and represents the degree to which users did not want the tool to change the way they work, intervene, interact, and perform in collaborative meetings.

4.3. Study 2: results

In Study 2, we first conducted an independent-samples t -test analysis in order to compare the levels of work engagement between the two groups of type of platform (VC vs VR). Tests were conducted to verify assumptions for regression analysis, such as the analysis of the normality of residuals (Curran et al., 1996; Hair et al., 2019; Marôco, 2014). In addition, no multicollinearity issues were detected, as all variance inflation factors (VIF) values were below the recommended thresholds (Hair et al., 2019). In Table 4, the results of the independent-samples t -test analysis demonstrate a non-significant mean difference between the VC and VR groups. Therefore, H_{2a} was supported.

Furthermore, the moderation of resistance to change on the relationship between type of platform and work engagement was assessed through PROCESS macro in SPSS, following Model 1 (Hayes, 2022). The statistically significant influence of the interaction term, composed of TP and RTC, on WE ($b = -0.3893$, $se = 0.1430$, $p < 0.01$) evidences the presence of a moderation effect and provides support for H_{2b}.

5. General discussion

When understanding the potential of technological changes, it is important to examine if the newer technology is perceived to be more beneficial than the previous one. Study 1.1 examined if people from low UA regions (UK and USA) perceived collaborative work as more engaging in virtual reality than videoconferencing. Study 1.1 did not find support to the significantly higher perceptions of work engagement toward VR when compared with VC. This was an unexpected result because low UA societies are regarded as being more receptive to change and new ideas, while high UA ones tend to resist novel contexts and are hesitant to change as a consequence of innovation (Efrat, 2014). Study 2 conducted the same analysis but for individuals from a high UA region (PT). Given that participants from the low UA regions in Study 1.1 did not report significantly increased engagement with VR (vs. VC), we further expected that participants from the high UA region in Study 2 would also not exhibit higher engagement perceptions toward VR. In the results of Study 1.1 and Study 2, no statistically significant differences were found in engagement levels between the technologies. Therefore, under the conditions of these studies, participants from both low and high UA regions did not report higher engagement with VR compared to VC.

One reason for this might be that videoconferencing is more

Table 4
Independent-samples t -test analysis results.

Group	M	SD	$t_{(127.787)}$	p-value	f^2
VC	5.5441	1.8147	1.2494	0.214	0.213
VR	5.0966	2.3474			

established and used on a regular basis than virtual reality for work meetings. Therefore, people may not have the necessary foundations to attain consistent perceptions of VR technologies as they have of VC. This possible explanation has become more evident when examining the mediation of creative behavior and impression of interaction possibilities as, despite the statistical significance of the mediations, the direct effect from TP on those mediators was unexpectedly negative. In accordance, despite VR's superiority for creativity (Dzardanova et al., 2022) and interactions (McVeigh-Schultz & Isbister, 2022), its advantages may only be perceived when working in a virtual environment for an extended timeframe (Biener et al., 2022). Conversely, the effect on the mediator perceived enjoyment was marginally positive ($p = 0.0559$) instead of negative, possibly reflecting views of VR within gaming contexts. The great majority of VR applications are related to gaming, where its capabilities are perceived to provide a more enjoyable experience than other traditional alternatives (Reer et al., 2022).

In order to have a better understanding of the non-significant difference between the WE levels of VR and VC, we examined the possibility of a moderation from resistance to change. In Study 1.2 and Study 2, RTC exhibited a statistically significant moderating effect. Consequently, our results suggest that resisting and not perceiving the novel technology with higher WE levels could be a more widespread phenomenon than anticipated, for the low and high UA regions. Irshad et al. (2025) examined the influence of cultural factors in the context of AR and highlighted the worldwide need to mitigate uncertainty regarding novel technologies. The integration of VR tools, which support immersive virtual environments, in the work context will result in changes to workplace practices (Hofma et al., 2017). However, introducing virtual reality can be negatively perceived when considering its implicit changes to interfaces and interactions (Souchet et al., 2023). While engagement in XR may require more effort than non-XR tools (Xi et al., 2023), the uncertain aspect of organizational changes can cause employees to demonstrate resistance toward them, as they perceive their worth and coping abilities to become at risk (Cumplings & Worley, 2015). That is, considering that jobs are vital for the subsistence of individuals and their families, they may demonstrate resistance if they perceive that they cannot cope with the novel context. Furthermore, as the data collection was performed in the post-pandemic period, we further introduce the possibility that, due to the global scale (in low and high UA regions) of COVID-19's consequences in the labor market, there is now a more globalized fear of changes in the workplace. During that timeframe, almost the entirety of workers around the globe were forced to continue working in a novel context, while existing organizational routines and processes were compromised, and companies were pressured to change workforce procedures, causing behavior changes in employees (Narayanamurthy & Tortorella, 2021).

Even though current literature offers limited insights into the cross-cultural aspect of our analysis, we compared our results with prior studies that examined engagement levels in VC and VR. We found contradictory findings within existing research. In van Gent et al. (2024), where participants were randomly distributed between three meeting modalities (face-to-face, videoconferencing, and virtual reality), the authors reported "we found no significant effect between the three conditions for both subscales of task engagement" (p. 8). In Abramczuk et al. (2023), individuals were asked to compare VR and video meetings during three periods: before the study, after trying VR technology, and at the end of the study. The authors confirmed previous expectations of VR meetings being more engaging than video meetings and found that this higher level of engagement remained consistent throughout the different phases (Abramczuk et al., 2023). Consequently, in order to have a better understanding of those contradictory findings, we examine how the comparison was presented to participants. In our paper and van Gent et al. (2024), participants were randomly distributed into one of the conditions. The random assignment approach helps minimize the plausibility of other explanations for the results (Shadish et al., 2002) and avoid systematic bias (Creswell, 2009). Additionally, by

randomly assigning participants to only one technology group, we are reducing possible issues with carryover effects (Salkind, 2010). However, in Abramczuk et al. (2023), the same group directly compared VR and video meetings. We suggest that a possible explanation for this difference in results could be the influence of cognitive bias (e.g., anchoring bias/effect, asymmetric dominance) as, by including a direct comparison with VC, individuals may adjust their perceptions of VR based on their understanding of VC, instead of assessing both technologies independently. We consider this behavior similar to the rationale of the asymmetric dominance effect, in which the perceptions regarding an option increase when a perceived inferior alternative is included in the analysis (Sürücü et al., 2019).

Lastly, the results concerning the non-significant difference in WE levels between VC and VR, the negative direct effects on the mediators CB and IIP, and the moderating role of resistance to change also led us to extend the discussion on the value that individuals expect from the introduction of VR for collaborative meetings. Depending on their nature, meetings can benefit substantially from the use of keyboard and laptop, potentially diminishing the value of VR meetings (Aliman et al., 2025). Therefore, individuals may perceive that VC is sufficient for what needs to be accomplished in the meeting and that VR, despite being technologically superior, does not add enough value. In fact, the cognitive load and technical requirements associated with using VR can introduce additional barriers and challenges. For instance, the complexity of its features can cause cognitive overload, negatively impacting the overall user experience (Vakeel et al., 2025). Engagement with extended reality technologies may require a greater effort, as individuals are accustomed to interacting naturally and effortlessly in the real world, whereas interactions within virtual environments can be perceived as more demanding, frustrating, stressful, and unnatural (Xi et al., 2023). Moreover, implementing VR for remote work could also present technical challenges, including audio and video quality issues, and require that users have access to expensive high-performance computers (Zhu et al., 2023). Overall, in comparison to VC, VR's technological superiority does not necessarily guarantee a higher perceived value in remote collaborative meetings, and may instead introduce additional cognitive, physical, and technological demands that impact the user experience.

5.1. Limitations and future work

The data collection process in this paper involved two different groups of respondents, each offering feedback exclusively on one of the two technologies (VC or VR). This procedure does not consider the possible influence of cognitive bias from participants adjusting their perceptions of a technology when they are also confronted with an alternative one. Future research could explore the difference between engagement perceptions toward VR when presented alone and alongside VC. Consequently, if future research can demonstrate this cognitive bias effect, organizations could leverage and benefit from the approach of presenting VR's features alongside the ones of VC, resulting in a possible enhancement of virtual reality's perceived WE levels. In addition, based on the results of Study 1.1, we further emphasize the importance of having a better understanding on perceived enjoyment and hedonic elements to enhance engagement in collaborative meetings.

The work developed in this paper does not focus on a specific business sector or industry. As the introduction of VR for collaborative work may be more suitable for some business sectors than others, we acknowledge the importance of developing further work that narrows the scope of this paper's research to the industry level or type of organization. Besides the specificity of the business sector, as the labor market consists of individuals with varying levels of experience in VR, we suggest that further research examines how this variation in proficiency affects their perceptions. Our studies did not consider the duration of collaborative meetings, presenting an opportunity for future works to explore the impact of meeting length on WE across the different

technologies. In addition, while we limited our analysis to the comparison between VC and VR, we recognize that the potential applications of VR in the workplace extend beyond videoconferencing. This presents an opportunity for future studies to explore work engagement levels in relation to these other potential applications. Another suggestion is to extend this study to later stages of the implementation process because the context of this research is limited to the pre-implementation phase. Moreover, since this study only considers three Western countries, we suggest that future research extend the analysis to more regions. In addition, to complement the understanding of culture's influence (uncertainty avoidance), we recommend the inclusion of other variables based on Hofstede's cultural dimensions theory. Lastly, we emphasize that the results of this study should be interpreted considering the context and limitations of the scenario presented to respondents.

5.2. Theoretical and practical implications

To the best of our knowledge, no prior research has considered the cultural element of uncertainty avoidance in the comparative analysis of work engagement levels between videoconferencing and virtual reality collaborative meetings. Our findings suggest that the non-significant difference between WE levels in VR and VC can be verified in both low and high UA regions. Therefore, researchers should consider that even in societies more receptive to novel contexts, the introduction of virtual reality for collaborative meetings is not necessarily perceived with higher WE than the more traditional option of videoconferencing. Moreover, the results suggest that resistance to change is a factor that influences the relationship between the type of platform and work engagement. This implies that future research in collaborative meetings involving VR and VC should consider the effect of the resistance to change construct. Additionally, the moderating effect of RTC was verified in both low and high UA regions. Accordingly, researchers should critically account for the potential impact of resistance to change, even within societies that exhibit a greater openness to novel contexts.

This study provides organizations with valuable insights into how the introduction of virtual reality for collaborative meetings compares with a conventional technology - videoconferencing. The findings indicate that, even within societies generally more receptive to novel contexts, organizations should not assume that introducing VR for collaborative meetings will necessarily be perceived as more engaging than traditional videoconferencing. Furthermore, the results also suggest that organizations implementing VR should carefully consider strategies to mitigate employees' resistance to change. As the moderating effect of RTC was observed in both low and high uncertainty avoidance regions, its influence appears to be more globally widespread than previously expected. This implies that resistance to change should be taken into account not only by organizations in low UA regions but also by those operating in societies generally more open to novel contexts.

6. Conclusions

This paper analyzes the technological shift from videoconferencing to virtual reality collaborative meetings by comparing users' perceptions of both tools. First, in Study 1.1, we begin by exploring, for UK and USA, the impact of type of platform on work engagement as well as examining the mediation of creative behavior, perceived enjoyment, and impression of interaction possibilities. The results did not demonstrate a significant difference between the WE levels of VR and VC. In

addition, despite verifying an indirect significant mediation for CB and IIP alongside a marginally significant one for PE, only this last one was positive. As the results of Study 1.1 were not favorable toward VR, we considered investigating resistance to change in Study 1.2 as a possible explanation for the unexpected results. The logic that motivated the development of Study 1.2 was that if the UK and USA did not demonstrate better WE perceptions to the advantage of the newer technology, then it was possible that they could have been subjected to the moderation of resistance to change. The findings provide support for that logic, as RTC had a significant moderating effect on the relationship between TP and WE.

In general, Study 1 demonstrated that, although they are regarded as regions open to change, the UK and USA did not perceive VR with higher engagement levels, having RTC played a negative role in that result. Subsequently, based on the logic of Hofstede's cultural dimensions, if the UK and USA belong to the low UA group and did not judge WE levels in favor of VR, we did not expect a high UA region (PT) to demonstrate positive feelings for VR (vs VC). In accordance, the findings of Study 2, which focused on Portugal, concluded a non-significant difference between work engagement in VR and VC and presented a significant moderation of RTC. In conclusion, as the world moves from video to virtual, preparing and easing the transition to new technologies is essential. However, despite the claims of major key players in the VR market, we found a generalized tendency to resist this digital transformation process. Lastly, considering the findings of this study, we now view the aversion to this technological shift as a more widespread phenomenon than previously expected, present in regions with differing levels of openness to new contexts.

CRediT authorship contribution statement

Pedro Barreiras: Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Manuela Aparicio:** Writing – review & editing, Writing – original draft, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jorge Rodrigues:** Writing – review & editing, Writing – original draft, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Yanrong Yang:** Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Consent for publication

All authors agree and consent on the present submission and publication after revision.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chbr.2025.100803>.

APPENDIX

Appendix A – Study 1 and 2 Sample Characterization

		Frequency	Percentage (%)
Age	18–25	75	13,80 %
	26–35	142	26,10 %
	36–45	112	20,60 %
	46–55	111	20,40 %
	>55	104	19,10 %
Gender	Female	242	44,50 %
	Male	296	54,40 %
	Other	5	0,90 %
	Prefer not to say	1	0,20 %
Country	Portugal	137	25,20 %
	United Kingdom	197	36,20 %
	United States of America	210	38,60 %
Educational Level	Up to high school	149	27,40 %
	Bachelor	249	45,80 %
	Master	94	17,30 %
	PhD	10	1,80 %
	Others	42	7,70 %
Hours p/Week (remote work meetings)	0	126	23,20 %
	<5	196	36,00 %
	5–10	101	18,60 %
	11–20	54	9,90 %
	>20	67	12,30 %
Purpose of remote meetings	Academic	58	10,70 %
	Academic, Other	3	0,60 %
	Other	128	23,50 %
	Professional work	308	56,60 %
	Professional work, Academic	28	5,10 %
	Professional work, Academic,Other	7	1,30 %
	Professional work, Other	12	2,20 %

Appendix B – Study 1 and 2 Research Questionnaire

Construct	Item Code	Items (VR version)	Cronbach's alpha		
			Study 1.1	Study 1.2	Study 2
Work Engagement Mäkinen et al. (2020)	WE1	<i>When using VR tools in work meetings, I would feel more energetic and motivated.</i>	0.944	–	0.881
	WE2	<i>I am enthusiastic about using VR tools in my work meetings.</i>			
	WE3	<i>When using VR tools, I would feel immersed in my work meeting.</i>			
Resistance to Change Bhattacharjee and Hikmet (2007)	RTC1	<i>I don't want VR tools to change the way I conduct work meetings.</i>	–	0.953	0.949
	RTC2	<i>I don't want VR tools to change the way I intervene in work meetings.</i>			
	RTC3	<i>I don't want VR tools to change the way I interact with other people in work meetings.</i>			
	RTC4	<i>Overall, I don't want VR tools to change the way I currently perform meeting tasks.</i>			
Creative Behavior Huang and Shiau (2017)	CB1	<i>Using VR would help me find new ways to achieve work meetings' goals or objectives.</i>	0.958	–	–
	CB2	<i>Using VR would help me to present and develop plans of new ideas in work meetings.</i>			
	CB3	<i>Using VR would help me come up with creative solutions to problems in work meetings.</i>			
	CB4	<i>Using VR would help me find new ways of performing tasks in work meetings.</i>			
	CB5	<i>Using VR would help me come up with new and practical ideas to improve quality of work meetings.</i>			
Perceived Enjoyment J. Lee et al. (2019)	PE1	<i>It would be fun to use VR tools in work meetings.</i>	0.938	–	–
	PE2	<i>I would not be bored while using VR tools in work meetings.</i>			
	PE3	<i>VR tools would make my work meeting tasks more fun.</i>			
	PE4	<i>I find the use of VR tools in work meetings to be interesting.</i>			
Impression of Interaction Possibilities Poeschl and Döring (2015)	IIP1	<i>When using VR, I would feel to be interacting with real human beings.</i>	0.931	–	–
	IIP2	<i>When using VR, I would feel a close connection to the other people in the work meeting.</i>			
	IIP3	<i>When using VR, I would have a real sense of interaction with other people in the same work meeting.</i>			
	IIP4	<i>When using VR, I think that others would feel my presence in the work meeting.</i>			

Data availability

Data will be made available on request.

References

- Abdullah, A., Kolkmeier, J., Lo, V., & Neff, M. (2021). Videoconference and embodied VR: Communication patterns across task and medium. *Proc ACM Hum-Comput Interact*, 5(CSCW2). <https://doi.org/10.1145/3479597>
- Abramczuk, K., Bohdanowicz, Z., Muczyński, B., Skorupska, K., & Cnotkowski, D. (2023). Meet me in VR! can VR space help remote teams connect: A seven-week study with horizon workrooms. *International Journal of Human-Computer Studies*, 179, Article 103104. <https://doi.org/10.1016/j.ijhcs.2023.103104>
- Ali, M., Zhou, L., Miller, L., & Ieromonachou, P. (2016). User resistance in IT: A literature review. *International Journal of Information Management*, 36(1), 35–43. <https://doi.org/10.1016/j.ijinfomgt.2015.09.007>
- Aliman, D. N., Hennig-Thurau, T., & Henke, A. (2025). Navigating the enterprise metaverse: How virtual reality affects business agility and meeting outcomes. *Business Horizons*, 68(5), 575–588. <https://doi.org/10.1016/j.bushor.2024.05.007>
- Amankwah-Amoah, J., Khan, Z., Wood, G., & Knight, G. (2021). COVID-19 and digitalization: The great acceleration. *Journal of Business Research*, 136, 602–611. <https://doi.org/10.1016/j.jbusres.2021.08.011>
- Aufegger, L., & Elliott-Deflo, N. (2022). Virtual reality and productivity in knowledge workers. *Front Virt Real*, 3. <https://doi.org/10.3389/frvir.2022.890700>
- Aufegger, L., Elliott-Deflo, N., & Nichols, T. (2022). Workspace and productivity: Guidelines for virtual reality workplace design and optimization. *Applied Sciences*, 12(15). <https://doi.org/10.3390/app12157393>
- Bhattacharjee, A., Davis, C., Connolly, A., & Hikmet, N. (2018). User response to mandatory IT use: A coping theory perspective. *European Journal of Information Systems*, 27(4), 395–414. <https://doi.org/10.1057/s41303-017-0047-0>
- Bhattacharjee, A., & Hikmet, N. (2007). Physicians' resistance toward healthcare information technology: A theoretical model and empirical test. *European Journal of Information Systems*, 16(6), 725–737. <https://doi.org/10.1057/palgrave.ejis.3000717>
- Biener, V., Kalamkar, S., Nouri, N., Ofek, E., Pahud, M., Dudley, J. J., Hu, J., Kristensen, P. O., Weerasinghe, M., Pucihar, K.C., Kljun, M., Streuber, S., & Grubert, J. (2022). Quantifying the effects of working in VR for one week. *IEEE Transactions on Visualization and Computer Graphics*, 28(11), 3810–3820. <https://doi.org/10.1109/TVCG.2022.3203103>
- Chao, S.-H., Jiang, J., Hsu, C.-H., Chiang, Y.-T., Ng, E., & Fang, W.-T. (2020). Technology-enhanced learning for graduate students: Exploring the correlation of media richness and creativity of computer-mediated communication and face-to-face communication. *Applied Sciences*, 10(5). <https://doi.org/10.3390/app10051602>
- Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. In *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). 3rd ed. Sage Publications, Inc.
- Cummings, T., & Worley, C. (2015). *Organization development & change* (10th ed.). Cengage Learning.
- Curran, P. J., West, S. G., & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods*, 1(1), 16–29. <https://doi.org/10.1037/1082-989X.1.1.16>
- Doherty, B. (2024). Can AR and VR finally disrupt the exhausting culture of video meetings? BBC. <https://www.bbc.com/worklife/article/20240125-can-ar-and-vr-finally-disrupt-the-exhausting-culture-of-video-meetings>
- Dzardanova, E., Kasapakis, V., Gavali, D., & Sylaiou, S. (2022). Virtual reality as a communication medium: A comparative study of forced compliance in virtual reality versus physical world. *Virtual Reality*, 26(2), 737–757. <https://doi.org/10.1007/s10055-021-00564-9>
- Efrat, K. (2014). The direct and indirect impact of culture on innovation. *Technovation*, 34(1), 12–20. <https://doi.org/10.1016/j.technovation.2013.08.003>
- Erumban, A. A., & de Jong, S. B. (2006). Cross-country differences in ICT adoption: A consequence of culture? *Journal of World Business*, 41(4), 302–314. <https://doi.org/10.1016/j.jwb.2006.08.005>
- Fauville, G., Luo, M., Queiroz, A., Lee, A., Bailenson, J., & Hancock, J. (2023). Videoconferencing usage dynamics and nonverbal mechanisms exacerbate zoom fatigue, particularly for women. *Computers in Human Behavior Reports*, 10, Article 100271. <https://doi.org/10.1016/j.chbr.2023.100271>
- Ferreira, J. (2021). *Hands-On Microsoft Teams* (2nd ed.). Packt Publishing.
- Fusaro, M., Lisi, M. P., Era, V., Porciello, G., Candidi, M., Aglioti, S. M., & Boukarras, S. (2025). The transformative power of virtual reality: Redefining interactions in virtual platforms, education, healthcare, and workplaces. *Topoi*. <https://doi.org/10.1007/s11245-025-10216-1>
- Georgiev, D., & Defensor, G. (2024). *17 Eye-Opening Zoom Statistics to Show How Big It Is in 2024*. Techjury. Available on <https://techjury.net/industry-analysis/how-many-zoom-users-are-there/> Accessed on 6th of April 2024.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage.
- Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. The Guilford Press. the Guilford Press (3rd ed., Issue 3).
- Held, N., Soeter, M., van Gent, S., Wiezer, N., Loots, G., & Niamut, O. (2024). Immersive gathering: Insights into virtual workplace meetings. *Front. Virt. Real.*, 5, 2024. <https://www.frontiersin.org/journals/virtual-reality/articles/10.3389/frvir.2024.1391662>
- Hirschheim, R., & Newman, M. (1988). Information systems and user resistance: Theory and practice. *The Computer Journal*, 31(5), 398–408. <https://doi.org/10.1093/comjnl/31.5.398>
- Hofma, C., Avital, M., & Blegind Jensen, T. (2017). *Liquid workplaces: The potential implications of virtual reality on the workplace*.
- Hofstede, G. (1991). *Cultures and organizations: Software of the mind*. McGraw-Hill.
- Hofstede, G. (2001). Culture's consequences: Comparing values, behaviors, institutions and organizations across nations. In *Behaviour research and therapy - behav res ther.* [https://doi.org/10.1016/S0005-7967\(02\)00184-5](https://doi.org/10.1016/S0005-7967(02)00184-5), 41.
- Hofstede, G., & Hofstede, J. (2004). *Cultures and organizations: Software of the mind*, 2. Hofstede Insights. (2024). Country comparison tool. <https://www.hofstede-insights.com/country-comparison-tool>
- Huang, L.-C., & Shiao, W.-L. (2017). Factors affecting creativity in information system development. *Industrial Management & Data Systems*, 117(3), 496–520. <https://doi.org/10.1108/IMDS-08-2015-0335>
- Hubbard, M., Bailey, M., Hess, D., & Hellebro, M. (2021). *Mastering Microsoft Teams: End user guide to practical usage, collaboration, and governance* (2nd ed.). Apress. <https://doi.org/10.1007/978-1-4842-6898-8>
- Irshad, W., Zhou, E., Rasheed, H. M. W., & Mumtaz, M. U. (2025). Augmented reality in the retail outlet: Shaping the retail shopping experience—A cross-cultural study. *Journal of Consumer Behaviour*. <https://doi.org/10.1002/cb.2483>
- Ishii, K., Lyons, M. M., & Carr, S. (2019). Revisiting media richness theory for today and future. *Human Behavior and Emerging Technologies*, 1(2), 124–131. <https://doi.org/10.1002/hbe2.138>
- Jackson, S. (2023). Apple's vision pro and Meta's quest headsets are poised to make the virtual workspace a reality — If they can past the buyer hurdles on price and quality. Business Insider. <https://www.businessinsider.com/how-virtual-reality-vr-could-change-workplace-quest-vision-pro-2023-8>
- Jo, H., & Park, D.-H. (2023). Affordance, usefulness, enjoyment, and aesthetics in sustaining virtual reality engagement. *Scientific Reports*, 13(1), Article 15097. <https://doi.org/10.1038/s41598-023-42113-1>
- Kandaurova, M., Lee, S. H., & Mark. (2019). The effects of virtual reality (VR) on charitable giving: The role of empathy, guilt, responsibility, and social exclusion. *Journal of Business Research*, 100, 571–580. <https://doi.org/10.1016/j.jbusres.2018.10.027>
- Karl, K., Peluchette, J., & Aghakhani, N. (2021). Virtual work meetings during the COVID-19 pandemic: The good, bad, and ugly. *Small Group Research*, 53(3), 343–365. <https://doi.org/10.1177/10464964211015286>
- Klimburg-Witjes, N., & Wentland, A. (2021). Hacking humans? Social engineering and the construction of the “Deficient User” in cybersecurity discourses. *Science, Technology & Human Values*, 46(6), 1316–1339. <https://doi.org/10.1177/0162243921992844>
- Knight, C., Patterson, M., & Dawson, J. (2019). Work engagement interventions can be effective: A systematic review. *European Journal of Work & Organizational Psychology*, 28(3), 348–372. <https://doi.org/10.1080/1359432X.2019.1588887>
- Kugler, L. (2017). Why virtual reality will transform a workplace near you. *Communications of the ACM*, 60(8), 15–17. <https://doi.org/10.1145/3105444>
- Laumer, S., & Eckhardt, A. (2010). Why do people reject technologies? - Towards a unified model of resistance to IT-induced organizational change. In *ICIS 2010 proceedings - Thirty first international conference on information systems*.
- Lee, M., Cheung, C., & Chen, Z. (2007). Understanding user acceptance of multimedia messaging services: An empirical study. *Journal of the American Society for Information Science and Technology*, 58(13), 2066–2077. <https://doi.org/10.1002/asi.20670>
- Lee, J., Kim, J., & Choi, J. Y. (2019). The adoption of virtual reality devices: The technology acceptance model integrating enjoyment, social interaction, and strength of the social ties. *Telematics and Informatics*, 39, 37–48. <https://doi.org/10.1016/j.tele.2018.12.006>
- Leidner, D., & Kayworth, T. (2006). Review: A review of culture in information systems research: Toward a theory of information technology culture conflict. *MIS Quarterly*, 30(2), 357–399. <https://doi.org/10.2307/25148735>
- Leonardi, P. (2021). COVID-19 and the new technologies of organizing: Digital exhaust, digital footprints, and artificial intelligence in the wake of remote work. *Journal of Management Studies*, 58(1), 249–253. <https://doi.org/10.1111/joms.12648>
- Mäkinen, J.-P., Ahola, S., & Joensuu, J. (2020). A novel construct to measure employees' technology-related experiences of well-being: Empirical validation of the techno-work engagement scale (TechnoWES). *Scandinavian Journal of Work and Organizational Psychology*. <https://doi.org/10.16993/sjwop.79>
- Marôco, J. (2014). *Análise de Equações Estruturais: Fundamentos teóricos, software e aplicações* (2nd ed.). ReportNumber.
- Maynard, A. (2015). Navigating the fourth industrial revolution. *Nature Nanotechnology*, 10(12), 1005–1006. <https://doi.org/10.1038/nnano.2015.286>
- McFedries, P. (2022). *Microsoft Teams step by step*. Pearson Education.
- McVeigh-Schultz, J., & Isbister, K. (2022). A “beyond being there” for VR meetings: Envisioning the future of remote work. *Human-Computer Interaction*, 37(5), 433–453. <https://doi.org/10.1080/07370024.2021.1994860>
- Meta. (2022). Future of work: 4 predictions that will define the next generation of work. <https://forwork.meta.com/resources/future-of-work-predictions/>
- Meta. (2025). Meta horizon workrooms. <https://forwork.meta.com/horizon-workroom/s/>
- Microsoft. (2022). *2022 work trend index: Annual report - Great expectations: Making hybrid work work*. In Microsoft.
- Mütterlein, J., Jelsch, S., & Hess, T. (2018). *Specifics of collaboration in virtual reality: How immersion drives the intention to collaborate*.
- Narayanamurthy, G., & Tortorella, G. (2021). Impact of COVID-19 outbreak on employee performance - Moderating role of industry 4.0 base technologies. *International*

- Journal of Production Economics*, 234, Article 108075. <https://doi.org/10.1016/j.jpe.2021.108075>
- Nov, O., & Ye, C. (2008). Personality and technology acceptance: Personal innovativeness in IT, openness and resistance to change. *Proceedings of the 41st annual Hawaii international conference on system sciences (HICSS 2008)* (p. 448). <https://doi.org/10.1109/HICSS.2008.348>
- Oh, C. S., Bailenson, J. N., & Welch, G. F. (2018). A systematic review of social presence: Definition, antecedents, and implications. *Frontiers in Robotics and AI*, 5. <https://www.frontiersin.org/articles/10.3389/frobt.2018.00114>
- Palan, S., & Schitter, C. (2018). Prolific.ac—A subject pool for online experiments. *Journal of Behavioral and Experimental Finance*, 17, 22–27. <https://doi.org/10.1016/j.jbef.2017.12.004>
- Poeschl, S. G., & Döring, N. (2015). Measuring Co-Presence and social presence in virtual environments - Psychometric construction of a German scale for a fear of public speaking scenario. *Annual Review of CyberTherapy and Telemedicine*, 13, 58–63. <https://doi.org/10.3233/978-1-61499-595-1-58>
- Ramirez, A. (2022). *Are Virtual Reality And The Metaverse Ready To Support Collaborative Work?*. Forbes. Available on <https://www.forbes.com/sites/forbestechcouncil/2022/02/15/are-virtual-reality-and-the-metaverse-ready-to-support-collaborative-work/> Accessed on 2nd of May 2024.
- Reer, F., Wehden, L.-O., Janzik, R., Tang, W. Y., & Quandt, T. (2022). Virtual reality technology and game enjoyment: The contributions of natural mapping and need satisfaction. *Computers in Human Behavior*, 132, Article 107242. <https://doi.org/10.1016/j.chb.2022.107242>
- Rosalsky, G. (2020). *Is remote work here to stay?* NPR. <https://www.npr.org/sections/money/2020/06/30/882834590/is-remote-work-here-to-stay>
- Salkind, N. (2010). *Encyclopedia of research design*. SAGE Publications, Inc. <https://doi.org/10.4135/9781412961288>
- Schaufeli, W. B., Shimazu, A., Hakanen, J., Salanova, M., & De Witte, H. (2017). An ultra-short measure for work engagement. *European Journal of Psychological Assessment*, 35 (4), 577–591. <https://doi.org/10.1027/1015-5759/a000430>
- Schwab, K. (2016). *The fourth industrial revolution: What it means, how to respond*. World Economic Forum. <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). Experimental and quasi-experimental designs for generalized causal inference. In *Experimental and quasi-experimental designs for generalized causal inference*. Houghton, Mifflin and Company.
- Shahbaz, A. (2021). *Can Your Company Use Virtual Reality Instead of Zoom? Yes, Here's How*. Forbes. Available on <https://www.forbes.com/sites/alishahbaz/2021/02/21/can-your-company-use-virtual-reality-instead-of-zoom-yes-heres-how/?sh=2ed5d8166b98> Accessed on 2nd of May 2024.
- Singh, S., Dijkstra-Soudarissanane, S., & Gunkel, S. (2022). Engagement and quality of experience in remote business meetings: A social VR study. *Proceedings of the 1st workshop on interactive EXtended reality* (pp. 77–82). <https://doi.org/10.1145/3552483.3556457>
- Singh, A., Jha, S., Srivastava, D., & Somarajan, A. (2022). Future of work: A systematic literature review and evolution of themes. *Foresight*, 24(1), 99–125. <https://doi.org/10.1108/FS-09-2020-0093>
- Snitker, T. V. (2010). The impact of culture on user research. In R. M. Schumacher (Ed.), *Handbook of global user research* (pp. 257–277). Morgan Kaufmann. <https://doi.org/10.1016/B978-0-12-374852-2.00009-4>
- Souchet, A. D., Lourdeaux, D., Pagani, A., & Rebenitsch, L. (2023). A narrative review of immersive virtual reality's ergonomics and risks at the workplace: Cybersickness, visual fatigue, muscular fatigue, acute stress, and mental overload. *Virtual Reality*, 27 (1), 19–50. <https://doi.org/10.1007/s10055-022-00672-0>
- Sürücü, O., Djawadi, B. M., & Recker, S. (2019). The asymmetric dominance effect: Reexamination and extension in risky choice – An experimental study. *Journal of Economic Psychology*, 73, 102–122. <https://doi.org/10.1016/j.joep.2019.05.007>
- Vakeel, K. A., Chakraborty, S., & Black, L. (2025). Remote work in the metaverse: The impact of gamification and online social connectedness on job satisfaction. *Decision Support Systems*, 193, Article 114447. <https://doi.org/10.1016/j.dss.2025.114447>
- van Gent, S., Langefeld, A., Held, N., Cremers, A., Loots, G., & Gunkel, S. N. B. (2024). An experimental comparison of participants' experience in face-to-face, video, and virtual reality meetings. *Front. Virt. Real.*, 5, 2024. <https://www.frontiersin.org/journals/virtual-reality/articles/10.3389/frvir.2024.1463189>
- Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research*, 11(4), 342–365. <http://www.jstor.org/stable/23011042>
- Weinel, M., Bannert, M., Zumbach, J., Hoppe, H. U., & Malzahn, N. (2011). A closer look on social presence as a causing factor in computer-mediated collaboration. *Computers in Human Behavior*, 27(1), 513–521. <https://doi.org/10.1016/j.chb.2010.09.020>
- Wichmann, J., Gesk, T. S., & Leyer, M. (2025). The effect of social interaction in virtual meeting settings on work engagement: A socio-technical systems study. *Information Technology and Management*. <https://doi.org/10.1007/s10799-025-00453-6>
- Xi, N., Chen, J., Gama, F., Riar, M., & Hamari, J. (2023). The challenges of entering the metaverse: An experiment on the effect of extended reality on workload. *Information Systems Frontiers*, 25(2), 659–680. <https://doi.org/10.1007/s10796-022-10244-x>
- Yang, X., Lin, L., Cheng, P.-Y., Yang, X., Ren, Y., & Huang, Y.-M. (2018). Examining creativity through a virtual reality support system. *Educational Technology Research & Development*, 66(5), 1231–1254. <https://doi.org/10.1007/s11423-018-9604-z>
- Zhu, S., Vennemeyer, S., Xu, C., & Wu, D. T. Y. (2023). Adopting a metaverse-based workspace to support research team collaboration: A pilot study from an academic health informatics laboratory. *JAMIA Open*, 6(1), ooad010. <https://doi.org/10.1093/jamiaopen/ooad010>