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What Remains When Novelty Wears Off? The Impact of Repeated Exposure to Metaverse Meetings on Creativity

Short Paper

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Abstract

Remote working via videoconferencing (VC) is frequently used for collaboration in product development. However, VC meetings often result in negative consequences like exhaustion and diminished creativity. To address these issues, companies are turning to metaverse meetings that can be accessed via Virtual Reality (VR) headsets or laptops. Extant research primarily focuses on the outcomes of pure VR meetings, while neglecting hybrid VR meetings (i.e., meetings accessed via VR headset and laptop), and primarily considers short-term effects by examining one-time meetings. However, the benefits of metaverse meeting formats relative to VC meetings may change as employees repeatedly engage in these novel meeting formats. Drawing on conservation of resources theory and flow theory, our study suggests that repeated exposure to metaverse meetings impacts creativity over time through two countervailing mechanisms: an increase in flow which enhances creativity over time and a decrease in psychological safety which impairs creativity in the long run.

Keywords: Metaverse Meetings, Virtual Reality Meetings, Hybrid Virtual Reality Meetings, Creativity, Habituation, Sensitization, Psychological Safety, Flow

Introduction

Creativity is crucial for generating ideas for new products or services and hence, the long-term success of companies (Im & Workman, 2004; Sarooghi et al., 2015). However, in the wake of digitization and the COVID-19 pandemic, remote working via technology-mediated conferencing has emerged as the new status quo for collaboration in new product development (Marion & Fixson, 2021). While many companies rely on VC platforms such as Zoom and Microsoft Teams, these tools often lead to unintended adverse consequences like Zoom fatigue (i.e., exhaustion due to nonverbal overload), low participation within meetings (Bailenson, 2021; Seitz et al., 2024), and low creativity (Brucks & Levav, 2022). This, in turn, poses a risk to firm performance, as high creativity is crucial for maintaining a competitive edge through innovativeness (Im & Workman, 2004).

To mitigate these negative consequences, companies are increasingly resorting to more immersive meeting formats. One approach that is currently gaining momentum is metaverse meetings. The metaverse is an “online collaborative shared space built of 3D environments that leverage high consumer immersion techniques to reduce the perception of technological mediation [...] while allowing user-generated digital personas to interact with each other” (Yoo et al., 2023, pp. 174–176). Metaverse meetings can be accessed via VR headsets or devices such as laptops (Yoo et al., 2023). Correspondingly, metaverse meetings can manifest in two different formats: (1) pure VR meetings where all participants access via a VR headset and (2) hybrid VR meetings, where users can join the virtual meeting room via a VR headset or a 2D video interface (Lennig et al., 2023). This paper focuses on such metaverse meetings as an overarching concept capturing pure VR meetings and hybrid VR meetings.

The novel immersive capabilities of VR technology are frequently highlighted. Unlike traditional VC tools, VR is a rich medium that provides not only visual and audio cues, but also haptic feedback (Richter & Richter, 2024) and the ability to use and convey gestures (Lennig et al., 2024). Consequently, VR technology creates a more natural experience that approximates interpersonal interactions more than VC technologies and offers new possibilities for collaboration (Abramczuk et al., 2023). While research on the effectiveness of metaverse meetings is still in its infancy, few initial studies suggest that metaverse meetings may outperform classic VC meetings, especially for employees’ affective experiences and creativity (Abramczuk et al., 2023; Hennig-Thurau et al., 2023; Khojasteh & Won, 2021).

Most studies so far almost exclusively consider short-term effects by relying on static experiments and only focus on the outcomes of pure VR meetings, while neglecting hybrid VR meetings (Khojasteh & Won, 2021; Lennig et al., 2023). However, this approach may not fully capture the dynamics of real-world business practices, where virtual teams typically meet on a regular and ongoing basis and use different meeting formats, especially in the context of new product ideation. That is, the benefits of pure VR meetings relative to VC meetings may be different after employees have engaged in these meeting formats multiple times and get used to the once-novel characteristics of this technology (Khojasteh & Won, 2021). With repeated exposure, habituation could set in, meaning that creativity decreases (Han et al., 2023; Hennig-Thurau et al., 2023). On the contrary, repeated exposure to a stimulus can also lead to sensitization in terms of an increased intensity of creativity responses. While people often experience habituation, sensitization is frequently observed for complex stimuli (Nelson & Meyvis, 2008), such as meetings with VR headsets. Therefore, it is important to examine whether pure VR meetings (still) outperform VC meetings in terms of creativity even after repeated exposure. Correspondingly, this study will shed light on whether repeated exposure to pure VR (vs. VC) meetings trigger habituation or sensitization processes. Due to the high complexity and novel immersive characteristics of the VR technology (Hennig-Thurau et al., 2023), repeated exposure to pure VR meetings could lead to more pronounced habituation or sensitization processes than VC meetings and hence a greater change in creativity compared to VC meetings.

Hybrid VR meetings are “in the middle” between pure VR and pure VC meetings as they can be accessed via novel 3D devices (i.e., VR headsets) and laptops and hence combine elements of pure VR meetings and classic VC meetings. Hybrid VR meetings are therefore characterized by a lower degree of novelty than pure VR meetings (albeit higher novelty than VC meetings) and thus repeated exposure to pure VR meetings could lead to greater habituation or sensitization of creativity also relative to hybrid VR meetings. Given these technological differences, firms must know whether repeated exposure to pure VR meetings leads to higher changes in meeting creativity compared to hybrid VR meetings and VC meetings. Thus, we pose the following research question:

How does repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings impact a change in creativity? (RQ1)

We suggest that two key mechanisms can explain why pure VR (vs. hybrid VR vs. VC) meetings increase creativity. First, qualitative research indicates that pure VR meetings induce a sense of psychological safety compared to VC meetings (Abramczuk et al., 2023). *Psychological safety* is defined as the collective belief among team members that it is safe to take interpersonal risks within the team (Edmondson, 1999). This finding is in line with literature describing that information systems can facilitate connectivity, social support, and feedback among the workforce (Tarafdar et al., 2024). Nevertheless, there is a lack of research concerning whether the beneficial effects of pure VR meetings for psychological safety (compared to VC meetings) still hold after repeated exposure to the respective meeting format.

Avatar embodiment in hybrid VR meetings creates a sense of anonymity, which also fosters psychological safety (Lennig et al., 2023). However, it remains unknown whether pure VR (vs. hybrid VR) meetings exhibit significant differences regarding psychological safety. In addition, extant research also shows that users increasingly identify with their avatars (Teng, 2019). Therefore, this research aims to explore whether repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings creates a habituation effect that impairs psychological safety.

Second, it is widely noted that individuals need to reach a flow state to be creative (Yan et al., 2013). *Flow* is defined as a “highly enjoyable psychological state that occurs when people are engrossed in an activity” (Drengner et al., 2018, p. 727). Flow manifests as high concentration, perceived control merging of action and awareness, loss of self-consciousness, autotelic experience, and transformation of time (Guo & Poole, 2009). Distinct meeting formats impact participants' flow differently (Lennig et al., 2023). Nevertheless, it is unclear how repeated exposure to pure VR (vs. VC) meetings changes the emergence of flow experiences over time. For autotelic experience, Han et al. (2023) find that enjoyment of meetings increases with increasing exposure to pure VR meetings. In contrast, Hennig-Thurau et al. (2023) find that positive emotions which are close to autotelic experiences decrease with repeated exposure to pure VR meetings. Further, there is lack of research on the impact of pure VR (vs. hybrid VR) meetings on flow. Hence, there is a need to investigate the impact of repeated exposure to pure VR (vs. hybrid VR) meetings on change in flow.

Given the lack of conclusive insights, we will examine how repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings changes psychological safety and flow and whether these changes affect the change in creativity. Correspondingly, our second research question is:

Can the effects of repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings on change in creativity be explained by changes in psychological safety and flow? (RQ2)

To answer the research questions, we capitalize on the conservation of resources theory (Hobfoll, 1989) and flow theory (Csikszentmihalyi, 1975). While the former theory posits that individuals want to acquire and maintain psychological resources, the latter complements this view and suggests flow to be a valuable resource that can be provided by the metaverse. The remainder of this paper is structured as follows. First, we present related work on metaverse meetings. Then, we introduce the theoretical background of our research model. Before we present the methodology, we derive our hypotheses and introduce our research framework. Lastly, we provide a discussion, expected contribution, and give an outlook.

Related Work and Theoretical Foundation

Related Work

Many companies, including PwC and Fujitsu as prominent recent examples, regularly use metaverse meetings, which are expected to unfold a pronounced impact on the future of work (Purdy, 2022; Tsipursky, 2023). Despite this repeated usage over time, there is very limited work investigating the effects of repeated exposure to metaverse meetings on meeting experience and outcomes (Goel et al., 2011; Khojasteh & Won, 2021).

The few initial studies that have investigated the impact of multiple metaverse meetings on meeting outcomes reveal inconsistent results. In addition, all extant studies focus on pure VR meetings and neglect how hybrid VR meetings impact participants' responses over time although such meetings mixing different virtual meeting technologies are highly prevalent in the business world (Tsipursky, 2023). On the one hand, Hennig-Thurau et al. (2023) find that repeated exposure to pure VR meetings leads to lower social presence and consequently, lower meeting outcomes (performance and emotion). On the other hand, researchers find that repeated exposure to pure VR meetings leads to higher social presence, spatial presence, self-presence, enjoyment, entitativity, and realism (Han et al., 2023). A third study finds no significant impact of repeated exposure to pure VR meetings on social presence (Khojasteh & Won, 2021). In conclusion, repeated exposure to pure VR meetings over time may lead to habituation of experiences (e.g., reduced psychological safety) but could also lead to sensitization (e.g., increased flow) which in turn could result in either a decrease or increase in creativity.

In sum, there is a lack of research on how repeated exposure to metaverse meetings (i.e., pure VR and hybrid VR meetings) leads to changes in creativity over time and how changes in flow and psychological safety mediate this relationship.

Conservation of Resources Theory

The conservation of resources theory was introduced by Hobfoll (1989). The theory puts forward that employees want to gain resources or prevent resource loss. Psychological safety can be considered a valuable social resource which is critical for creativity (Gong et al., 2012) as it builds interpersonal trust (Edmondson, 1999; Frazier et al., 2017). Psychological safety implies that employees are likely to work creatively in teams when they feel safe enough to voice their (risky) thoughts openly (Edmondson, 1999). By enabling to safely exchange their honest opinions, thoughts, and ideas, psychological safety also represents an informational resource that employees gain from their colleagues, which facilitates diverse thinking through the exchange of ideas (Gong et al., 2012). Hence, psychological safety is a crucial antecedent of workplace outcomes like creativity (Frazier et al., 2017). Applying the conservation of resources theory to this research is suitable as it explains why repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings could impact changes in psychological resources that lead to changes in creativity.

Flow Theory

The concept of flow was introduced by Csikszentmihalyi (1975) and describes a state in which individuals are immersed in an activity (Drengner et al., 2018). In other words, flow refers to a deeply rewarding state of being completely absorbed in a task, where maintaining a high level of focus feels effortless (Norsworthy et al., 2023). More precisely, with high flow, individuals experience an increased sense of concentration, control, mergence of action and awareness, loss of self-consciousness, autotelic experience, and transformation of time (Guo & Poole, 2009) Flow is an essential mechanism that shapes performance like creativity outcomes (Csikszentmihalyi, 1975). Nevertheless, people rarely experience flow (Seligman & Csikszentmihalyi, 2000) and employees in particular often struggle to enter or maintain a flow state (Bartholomeyczik et al., 2023).

Information technologies like VR headsets can be game changers in this respect as they are known for inducing immersion (Richter & Richter, 2023), due to their interactivity and vividness (Barhorst et al., 2021). As immersion refers to the degree to which technology provides “an inclusive, extensive, surrounding and vivid illusion of reality to the senses of a human participant” (Slater and Wilbur, 1997, p. 3), VR technologies are an important source for triggering flow experiences. Applying flow theory to this research is beneficial since it is a central mechanism explaining the impact of repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings on changes in creativity.

Hypotheses and Research Model

The Impact of Repeated Exposure to Meeting Format on Changes in Creativity Mediated by Changes in Psychological Safety

Research shows that information technologies like VR headsets can increase connectivity, social support, or feedback between colleagues (Tarafdar et al., 2024), which is closely linked to psychological safety. Thus far, qualitative research suggests that pure VR (vs. VC) meetings increase psychological safety within the team (Abramczuk et al., 2023). Besides the fact that VR technology can increase empathy for others (Shin, 2018), avatar embodiment in pure VR meetings can foster a sense of anonymity, which is a crucial component of psychological safety (Abramczuk et al., 2023). Nevertheless, gaming literature has also shown that users increasingly identify with their avatars after longer usage (Teng, 2019). With repeated exposure to pure VR meetings and hence to avatar embodiment, the positive effect of an avatar-induced sense of anonymity could fade since employees are identifying with their avatar and getting used to it. Thus, a repetition of pure VR meetings could lead to habituation regarding psychological safety resulting in a stronger decrease in psychological safety after repeated exposure to pure VR meetings compared to repeated exposure to VC meetings. Prior studies support this notion by showing that repeated participation in pure VR meetings leads to a lower amount of interaction and a reduction in group atmosphere (Hennig-Thurau et al., 2023), factors that are closely linked to psychological safety. Consequently, we expect that

repeated exposure to pure VR (vs. VC) meetings leads to a stronger decrease in psychological safety over time.

For hybrid VR meetings, qualitative research also suggests an increased sense of psychological safety compared to VC meetings (Lennig et al., 2023). However, compared to pure VR meetings, some employees might experience a sense of disconnection in hybrid VR meetings because of a perceived barrier between participants connected via VR headsets and those connected via laptops (Lennig et al., 2023). This suggests that psychological safety in pure VR meetings could be higher compared to hybrid VR meetings. Similar to repeated exposure to pure VR meetings, repeated exposure to hybrid VR meetings may lead to habituation because employees increasingly identify with their avatars (i.e., feel less anonymous over time). Nevertheless, as hybrid VR meetings are less novel and complicated, it is easier for employees to become accustomed to the hybrid format of metaverse meetings and learn how to master this format. This will counteract the adverse effects of reduced anonymity and connectivity. As a result, we expect that repeated exposure to pure VR meetings will lead to a greater decline in psychological safety than repeated exposure to hybrid VR meetings.

In line with conservation of resources theory and given the findings on the beneficial role of psychological safety for fostering creativity in studies with one-time meetings (Newman et al., 2017), we expect that for settings where employees participate in meetings multiple times, the proposed decrease in psychological safety over time will lead to a decrease in creativity. Combining the above arguments, we expect a mediating role of a change in psychological safety for the relationship between repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings and change in creativity. Correspondingly, we derive the following hypothesis:

H₁: Repeated exposure to pure VR meetings (vs. hybrid VR vs. VC meetings) decreases creativity through a decrease in psychological safety.

The Impact of Repeated Exposure to Meeting Format on Changes in Creativity Mediated by Changes in Flow

The novelty of a technology like VR headsets (i.e., new and unusual experiences) has been shown to enhance flow (Barhorst et al., 2021). However, as users get used to the novel stimulus with repeated exposure, habituation of flow could occur so that flow decreases (Rzepka et al., 2022). Initial research on the evolution of positive affect in terms of autotelic experience due to repeated exposure to pure VR meetings supports this notion, revealing a decrease in positive affect over time (Hennig-Thurau et al., 2023); this could imply reduced flow responses over time. For hybrid VR meetings, qualitative research in a static setting (i.e., one-time meetings) indicates that this format induces a loss of self-consciousness in participants, which enhances flow (Lennig et al., 2023). However, for hybrid VR meetings, no insight exists on whether multiple repetitions also reduce flow.

On the other hand, employees need to accustom themselves to the technology used before a positive flow experience can unfold (Abramczuk et al., 2023). As VR is a very complex technology (Hennig-Thurau et al., 2023) and meetings are utilitarian, we expect that for flow, repeated exposure to pure VR meetings will lead to sensitization rather than habituation and lead to a higher increase in flow compared to VC meetings. This expectation rests on the reasoning that for initial pure VR meetings the attention is centered on learning how to fully use the benefits of the complex technology, mitigating flow experiences in the first meetings. However, multiple repetitions of pure VR meetings could lead to lower conscious awareness and make the meeting feel more natural (Khojasteh & Won, 2021), which enhances flow over time. In addition, research suggests that concentration decreases if the location, task, or social cues are too challenging to understand (Goel et al., 2011). While the location and social cues induced by a meeting technology like VR are potentially distracting when new, repeated exposure to these cues could enable users to increase concentration (Goel et al., 2011). Lastly, in challenging the findings of Hennig-Thurau et al. (2023), Han et al. (2023) find that enjoyment of pure VR meetings increases over time. We anticipate that repeated exposure to pure VR meetings increases flow, and in turn, creativity stronger than a similar repeated exposure to VC meetings due to mechanisms employed by the workforce that allow to better unlock the superior benefits of pure VR meetings over time. Therefore, pure VR meetings will outperform VC meetings in terms of creativity explained by flow after the novelty of the VR technology has worn off as this enables to better understand and handle the technology. Because pure VR meetings should be superior to hybrid

VR meetings in terms of flow experiences in a static setting, we expect that repeated participation in pure VR (vs. hybrid VR) meetings leads to a higher increase in flow and correspondingly, increase in creativity.

H₂: Repeated exposure to pure VR meetings (vs. hybrid VR vs. VC meetings) increases creativity through an increase in flow.

As depicted in Figure 1, we are going to examine the effect of repeated exposure to (1) pure VR meetings, (2) hybrid VR meetings, and (3) VC meetings on changes in creativity. Thereby, we will take into account the mediating role of changes in psychological safety and changes in flow. While a decrease in these mechanisms over time would point to a habituation process, an increase reflects sensitization.

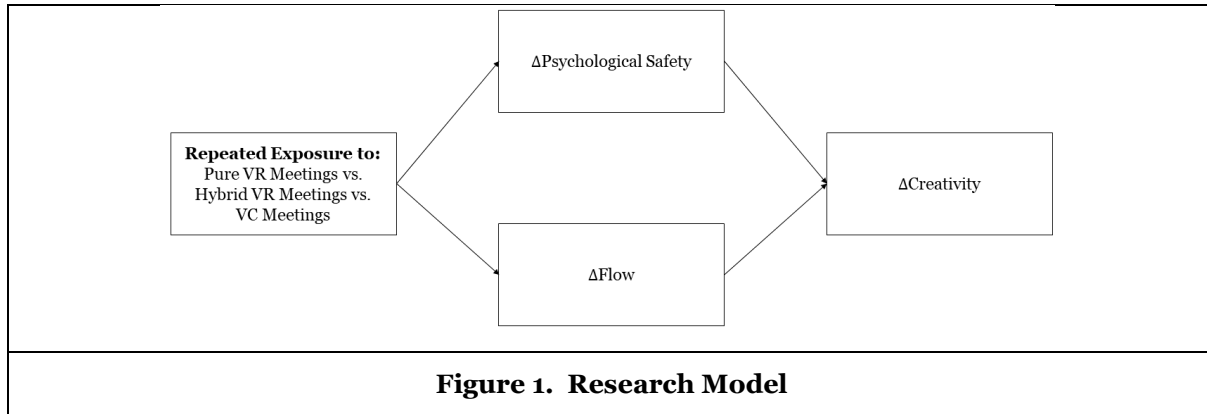


Figure 1. Research Model

Methodology

In our study, we conduct a longitudinal between-subjects laboratory experiment in which we simulate work meetings deploying pure VR, hybrid VR, and VC technologies. The participants are randomly assigned to a group of four people as well as one of the metaverse meeting formats (i.e., pure VR or hybrid VR) or the VC meeting format. The groups participate in a sequence of four meetings of the same format over four consecutive weeks to induce habituation or sensitization. Therefore, the sample has a nested data structure, where the four measurement time points that occur after repeated usage of a meeting format (level one) are nested with a single participant (level two) (see Weinert et al., 2022). This means, that for each format, a focal participant (level two) takes part in four weekly meetings (level one). This design allows us to identify the incremental effects of repeated exposure to the novel metaverse meeting formats compared to the repeated exposure to the reference technology (VC) dominating in most firms so far. Based on previous studies on habituation in other contexts, four repetitions (stimuli) should be sufficient to examine habituation and sensitization effects (Weinert et al., 2022). In each weekly meeting, participants work on a design thinking task to develop a new product in the food sector. While each task involves another food product (meat substitute, milk substitute, frozen product, and healthy food option), all tasks have a similar structure, length, and level of sophistication. The tasks require participants to envision themselves as colleagues in the marketing department of a major food company collaborating to develop a new product idea. The participants are given guiding questions to help them solve the task. The order in which the four tasks are resolved is randomized across groups. For example, the task referring to the meat substitute product reads as follows: [Food brand] is by far the market leader for meat substitute products in Germany. However, its market share of over 40 per cent has recently been shrinking. 'Many other manufacturers are now more innovative and have recently increased their market share. You work at [food brand] as a Marketing Manager and are responsible for product development. Develop an innovative product idea for [food brand] together with your colleagues. The guiding questions are as follows: (1) State the customer problem you want to solve. (2) Formulate it as a design question. (3) State the intended impact. (4) Describe possible solutions. (5) State the assumptions on which your solution is based and possible limitations.

First, we will conduct an ANCOVA to test whether pure VR meetings outperform hybrid VR meetings and VC meetings regarding the absolute levels of psychological safety and flow in time 4. Secondly, we will conduct a regression analysis with creativity as the dependent variable and psychological safety and flow as the independent variables. Thirdly, we use bootstrapping to test for mediation using the product-of-

coefficient method (Zhao et al., 2010). In all three analyses, we use age and motivation of the participants as control variables.

Then, we are going to compare the changes in variables between time 1 and 4 for the three formats using mixed-effects-growth curve modeling. Mixed-effects-growth curve modeling is a method that enables to account for variable change for the individual subject over time and to identify changes due to inter-individual differences (Bliese & Ployhart, 2002; Rabe-Hesketh & Skrondal, 2012). More precisely, we calculate changes in our variables as slopes by subtracting the time 1 score from the time 4 score (Kraemer et al., 2020). Then we examine the differences between the changes across the three meeting formats to reveal the differential impacts of repeated exposure to pure VR (vs. hybrid VR vs. VC) meetings on the change in psychological safety and change in flow using ANCOVA. Additionally, we will conduct a regression analysis with change in creativity as the dependent variable and change in flow and change in psychological safety as the independent variables. Lastly, we will use bootstrapping employing the product-of-coefficient method to test for mediation (Zhao et al., 2010). In these three analyses, we will control for participants' age and change in motivation. This allows us to reveal whether the three meeting formats trigger different habituation and sensitization processes over time. One major advantage of growth curve modeling is the fact that it integrates information from the sample and each individual. Correspondingly, the results will be more precise, meaning the approach has less variance compared to calculating individual-specific slopes with separate ordinary least squares regressions for each person (Cohen et al., 2014; Rabe-Hesketh & Skrondal, 2012).

Measures and Validity

After each weekly meeting, participants will take part in an online survey, which will measure psychological safety (Edmondson, 1999), flow (Guo & Poole, 2009), perceived creativity (Im & Workman, 2004), and motivation of participants (Ryan, 1982). Moreover, participants will provide their demographics (i.e., age and gender) after the first meeting. Further, three experts will rate the creativity of the developed product ideas to obtain a more objective measure of team creativity. In our model, we are going to examine temporal changes in the variables across the four meetings. We are currently recruiting a panel of at least 120 participants on level two, which is why the sample size on level one will encompass 480 data points.

Discussion, Expected Contribution, and Outlook

This study aims to advance the knowledge about the impact of VR-technology-mediated meeting formats on creativity in new product development once the novelty of the new technology wears off. For doing so, we examine how repeated exposure to pure VR meetings impacts a change in meeting experiences compared to hybrid VR meetings as well as classic VC meetings as the status quo. Moreover, we contribute to research on the conservation of resources theory and flow theory by showing how repeated access to novel workplace resources provided by VR technologies changes psychological safety and flow over time. By doing so, we also help to understand the mechanisms that drive the changing effectiveness of pure VR (vs. hybrid VR vs. VC) meetings for fostering creativity. Thereby, our paper lays the foundation for future explorations into metaverse collaboration on both an organizational and individual level of analysis. With the results of our study, we will be able to demonstrate whether pure VR meetings provide a lasting benefit for organizations in terms of enhanced creativity because the majority of research has focused on one-time pure VR meetings. This research takes into account that the advantages of pure VR meetings could be subject to change once these meetings are used on a more regular basis, which is a goal many companies have at the top of their agenda. We conduct an online laboratory experiment with high internal validity (e.g., random assignment, precise treatment, and control). Nevertheless, as the participants are students, the findings need to be replicated in a field experiment within a more diverse workforce.

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