Metaverse and Social Virtual Reality for Online Collaboration

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Abstract: "We're at the beginning of the next chapter for the internet", said Mark Zuckerberg in 2021 in his letter about the name change from Facebook to Meta. Social virtual reality (VR) platforms are part of the metaverse: Users immerse themselves in the metaverse using VR headsets and can interact with other users as avatars in a virtual world. During a digital conversation, non-verbal communication can suddenly be experienced in three dimensions. This raises the question of the extent to which the metaverse and social VR platforms can be used for online collaboration. Previous research has investigated how other media, such as the telephone or videoconferencing, can influence teamwork. Theories of media choice attempt to justify the extent to which communication media are chosen for particular interactions. However, there is still a research gap when it comes to including, comparing, and classifying the metaverse in these studies. In an experiment, 24 participants were divided into groups of four and given a creativity task and a decision task to solve together. The experiment tests the use of the metaverse as an alternative to videoconferencing. A standardised questionnaire was used to measure differences in use between the metaverse and videoconferencing, and variables from input-process-output models of teamwork were used as comparison characteristics. The results show that the metaverse can improve the process compared to videoconferencing. In particular, it is shown that social presence increases in the metaverse compared to videoconferencing. The quality of communication can also be improved in the metaverse compared to videoconferencing. With further development of the technology, the metaverse has the potential to replace videoconferencing in the mainstream in a few years.

Keywords: Virtual Reality, Metaverse, Online Collaboration, Spatial, Digital Innovation

1. Teamwork in the context of the metaverse

Online communication is about to enter a new era, if Meta CEO Mark Zuckerberg has his way. After the Corona pandemic, online meetings have become increasingly important. However, many companies recognise that video conferencing cannot fully replace face-to-face meetings. The lack of social presence and proximity to colleagues seems to be the key issue for many. In communication, this is primarily conveyed through spatial proximity or proxemics (Poggendorf, 2009). Since humans interpret all actions of a communication as a message (Watzlawick et al., 2016), the spatial constellation of the communication participants is also interpreted. While this dimension is missing in videoconferencing, the metaverse and social virtual reality can create an illusion of spatial proximity. Due to this feature, communication on this platform can convey different information compared to videoconferencing.

A universal definition of the metaverse does not yet exist, so the term is often generalised as a "catch-all" for various new developments on the Internet (Floridi, 2022). To narrow down the term, Floridi (2022) describes the metaverse as a three-dimensional, virtual space that can be entered through specific hardware. Meta founder Mark Zuckerberg (2021), on the other hand, emphasises the social component of the metaverse, where social presence can be felt. For the purposes of this paper, the metaverse is therefore defined as a three-dimensional virtual space in which multiple users can simultaneously feel part of the space and interact proxemically through immersive technologies.

The metaverse behaves similarly to the two-dimensional web (Floridi, 2022), which is why social virtual reality (VR) platforms can be seen as counterparts to websites or social media platforms. There can also be confusion about the similarity to the 3D web. For example, 360-degree websites, 3D massively multiplayer online games (MMOGs) or communication platforms with 3D features are not part of the metaverse if they don't have social features or VR compatibility. Figure 1 shows the different platforms and dimensions of the Internet.

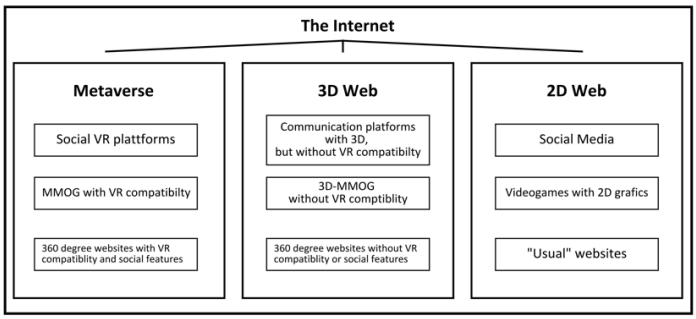

Figure 1: Dimensions of *Internet*

As a synchronous communication medium, the metaverse can be used for collaborations, which are understood as synchronised processes of constructive knowledge generation by two or more people (Bornemann, 2012). A particular aspect of online collaboration is that communication is limited by technology (Schmidt, 2019). In the input-process-output (IPO) model of telecooperation, it is evident that media act as an input factor on the process and outcome of teamwork (Hertel & Konradt, 2007). However, in addition to media, there are four other categories of factors that influence teamwork, namely *tasks, group structure, personal characteristics* and *resources* (ibid.). The processes and results of teamwork are subsequently divided into *a task-related* and a *social level* in the IPO model (ibid.). The psychology of interpersonal communication provides explanations as to why the information content differs in face-to-face meetings, videoconferences and meetings in the metaverse.

Several theories have been proposed to explain how teams choose a communication medium for their collaboration. These can be divided into rational choice approaches and social influence approaches (Johannsen, 2002). In the social presence theory according to Short et al. (1976), the degree of social presence is the decisive factor in the choice. If the social presence is indeed higher in the metaverse, the medium would thus be more attractive than videoconferencing. However, according to Daft and Lengel's (1984) theory of media appropriateness, it is necessary to consider how rich the information of the medium needs to be for the purpose.

While communication media such as the telephone or videoconferencing are already classified in Daft and Lengel's (1984) theory of media appropriateness, there is still no classification for the metaverse or social VR. This paper therefore investigates whether communication participants can really perceive a higher social presence in the metaverse and whether communication is improved at the same time. With richer communication via the metaverse, the medium could thus be an alternative to videoconferencing. This leads to the research question:

RQ: To what extent can the metaverse be used as an alternative to videoconferencing for teamwork?

To answer this question, the characteristics, and functions of the metaverse and social VR platforms are considered, and Hertel & Konradt's IPO model is used to illustrate which variables influence teamwork. Furthermore, interpersonal communication is considered to explain the influence of the communication medium. An experiment was conducted to observe the expression of the variables in the metaverse. Subjects were then asked to rate teamwork in the metaverse compared to videoconferencing using a standardised questionnaire.

2. Theoretical Background

2.1 The Metaverse and Social Virtual Reality

As with the different conferencing platforms in videoconferencing, social VR platforms in the metaverse have different functions. However, the basic features and functions are the same. Using the hardware VR controllers, users can move around in virtual space. They can move naturally by walking or by teleportation jumps. The latter prevents motion sickness because there is no or less discrepancy in the brain's perception of movement (Dobie, 2019). On some platforms it is also possible to fly through space.

The communication characteristics are strongly influenced by the hardware, such as the microphone, the audio output and tracking systems. For example, finger tracking is required for the detailed transmission of gestures. VR glasses with face tracking are required to map facial expressions in the metaverse (Bastian, 2022). As few models support face tracking, some social VR platforms use alternative methods to bring avatar faces to life. For

example, the *Rec Room* platform uses an algorithm to play out facial expressions such as laughter when the user laughs into the microphone (Hayden, 2016).

For professional teamwork, there are social VR platforms in the metaverse that are designed for this purpose. You can use a remote desktop, to integrate platforms from Microsoft or Google or take notes on a whiteboard. Unlike real meeting rooms, the virtual meeting room in the metaverse can be designed without great expense and without physical or geographical feasibility.

Avatars allow users to represent themselves in the metaverse and interact with their environment and other users (Beil & Rauscher, 2018). Avatars can vary widely in the metaverse and usually follow their own style depending on the platform. While avatars on the *Rec Room* platform are cartoonish and simplified, on the *Spatial* platform used for the experiment, an avatar can be created by scanning a photo of the user. However, due to the limitations of the graphical representation on *Spatial*, the avatars do not come close to the actual appearance of the user.

2.2 IPO model for telecooperation according to Hertel & Konradt

To take a closer look at teamwork via telecooperation, the IPO model of Hertel & Konradt (2007) is used here (see Figure 2). The two authors describe teamwork using variables at the input, process and output levels. The model can be seen as a further development of the IPO model of Tannenbaum et al. (1992).

On the input side, factors are grouped into five categories: *Tasks, media, group structure, personal characteristics and resources* (Hertel & Konradt, 2007). Teamwork is therefore influenced by these factors, although no statement is made about the extent of the influence. The communication medium is therefore only one of many variables that influence teamwork.

The process level is divided into *task-related* and *social interaction processes* (Hertel & Konradt, 2007). *Task-related interaction processes* are understood as more factual processes such *as execution, coordination, control and optimisation* (ibid.). Aspects such as *social presence, trust, expectations, appropriation processes, values and norms* are referred to as social interaction processes (Hertel & Konradt, 2007). In the IPO model according to Tannenbaum et al. (1992), the important variables of *communication* and *decision-making* are still mentioned at the process level.

At the output level, the results are further differentiated into task-related and socio-emotional variables (Hertel & Konradt, 2007). *Effectivity*, *efficiency*, *and task conflicts* are the end results of the task (ibid.). In the team, cooperation leaves behind *satisfaction, cohesion* or even *social conflicts* (ibid.). In Tannenbaum et al. (1992) the results also include *changes in the team*, in the *inner attitude* and in the *abilities of the individuals*.

As a communication medium, the metaverse can only have a limited impact on teamwork, as other variables are also highly significant. However, through direct or indirect influences, the medium has an impact on both the process and the outcome.

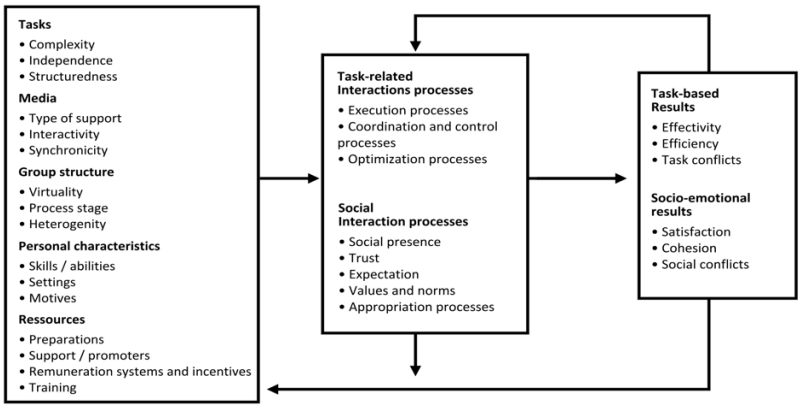

Figure 2: IPO model for telecooperation according to Hertel & Konradt (2007)

The variables of Hertel & Konradt's (2007) IPO model are the basis for the variables in the standardised questionnaire of our experiment. The IPO model of Tannenbaum et al. (1992) is also considered.

2.3 Interpersonal communication

The components of interpersonal communication show why the spatial dimension is important for communication. Verbal communication depends on features such as *volume, intonation, pitch, speed* and *rhythm*, which can be affected by the medium of communication (Argyle et al., 1981). The intelligibility of the message can become unclear due to interference (Lazarus et al, 2007). However, spatial hearing makes it possible to locate the interference from a particular direction.

Non-verbal communication is even more dependent on three-dimensionality. Haptic signals can at least be perceived visually through the VR glasses. Body language is also given more weight because gestures can be experienced in three dimensions. It is also possible to tell from the other person's body whether he or she is facing the conversation. For example, the alignment of the feet, body, head and eyes is important (Poggendorf, 2009). Eye contact can be partially or, with face tracking, completely represented in the metaverse. This takes on important functions in communication, such as signaling a change of speaker (Schönherr (1997)). Emotions such as trust or aggression can also be conveyed through eye contact (ibid). Facial expressions are limited when using VR glasses without face tracking. Facial expressions are primarily responsible for conveying emotions (Röhner & Schütz, 2016). Posture can also be interpreted in a spatial context, for example when people try to stand higher than others (ibid).

Proxemics describes the "spatial behaviour, i.e. the spatial constellation of the communication or interaction partners in a certain situation" (Poggendorf, 2009). Distance or posture in space is interpreted through this factor. The virtual space in the metaverse can, for example, create situational features via walls, doors or chairs with which the communication participants interact (Argyle et al., 1981).

3. Methodology and Hypotheses Development

To answer the research question and thus to observe the expression of the variables in the metaverse, an experiment was conducted with 24 students. They were asked to solve a simple task within 30 minutes in groups of four using appropriate VR hardware in the metaverse via a social VR platform in the metaverse. The students formed their groups independently. Later, the groups of four were invited to a university facility where they were given a brief introduction to the use of the VR glasses and the social VR platforms. The group members were then separated into different rooms in the same building, where they could not hear or see each other. Three pairs of HTC Vive glasses, which require several cables, and one pair of Meta Quest 2 glasses, which are used without cables, were provided for the work. The teamwork took place on the free social VR platform *Spatial*. Participants created avatars by scanning an image of themselves. All groups were then given the task of finding a motto for a party in their class, being as creative as possible and agreeing on only one. After completing this task, the students were asked to complete a standardised online questionnaire. In the questionnaire they had to rate the variables of teamwork in the metaverse and compare them with the hypothetical execution of the task via videoconference. They were also asked about personal characteristics and opinions about virtual reality.

The comparison of the variables was measured using Likert scales. Students could rate teamwork in the metaverse as better (5), rather better (4), the same (3), rather worse (2) or worse (1) compared to videoconferencing. They were also asked to give a self-assessment of their VR skills, creativity and affinity with the technology, as well as how important social presence was to them in teamwork.

Prior to the experiment, it was suspected that the metaverse as a communication medium might improve teamwork compared to videoconferencing. Since the IPO model is used to describe teamwork, this would imply an improvement in the process and outcome variables. Therefore, the primary hypothesis H1 reads:

H: *The metaverse as a communication medium for online collaborations has a positive impact on the process and outcome of teamwork compared to videoconferencing.*

To test this hypothesis in more detail, the hypothesis was split into two parts and further hypotheses were formulated. In the sub-hypotheses, individual significant variables from the process and outcome levels are addressed separately. Table 1 lists all the hypotheses that are addressed in this paper.

Table 1: Research hypotheses

	Hypotheses
H1.1	The metaverse as a communication medium for online collaborations has a positive impact on the *process of teamwork* compared to videoconferencing.
H1.2	The metaverse as a communication medium for online collaborations has a positive impact on the *outcome of teamwork* compared to videoconferencing.
H2	Through the metaverse as a communication medium for online collaborations, the *social presence* is conveyed more strongly than in comparison to videoconferences.
H3	The metaverse as a communication medium for online collaborations has a positive impact on *team cohesion* compared to videoconferencing.
H4	The metaverse as a communication medium for online collaborations has a positive impact on the *quality of communication* compared to videoconferencing.
H5	The *personal characteristics* influence the effect of the metaverse as a communication medium for online collaborations.

4. Research results

To evaluate the hypotheses, the subjects were asked to compare the collaboration in the metaverse based on the process and outcome variables with the hypothetical completion of the task via a videoconference. The samples were then tested for normality using the Kolmogorov-Smirnov test. The t-test and the Wilcoxon test were then used as significance tests, where the t-test is only significant for normally distributed variables. The Wilcoxon effect size can be used to compare the influence of the metaverse on the variables. Only for hypothesis H5 the Spearman correlation coefficient was used to test for a dependence of the effect on the personal characteristics of the respondents.

Table 2 below shows the results of the survey for the process-level variables. The variable *communication* was evaluated by the students both holistically and differentiated according to several sub-variables.

In the questionnaire, 96% of the students indicated that they were between 18 and 30 years old, while one of the 24 subjects was between 41 and 50 years old. The gender ratio was 50:50. Three of the 24 participants experienced mild motion sickness, but none had to abandon the experiment. The female subject, aged between 41 and 50, was the only participant who coped badly or rather badly with the VR glasses and the social VR platform. On average, students tend to rate themselves as creative and tech-savvy. While they show a high level of interest in VR, they consider their skills in this area to be mediocre. The six groups represent different constellations of the gender ratio. While some teams have worked together before, the members of other groups hardly know each other or do not know each other at all.

On average, the students rated all process variables as significantly better than with videoconferencing. In particular, the students felt that *communication* had improved the most (Wilcoxon effect size r=0.788, mean x=4.13). There was also a strong effect for the other process-level factors such as *coordination* (r=0.755), *execution* (r=0.686), *opinion* (r=0.731) and *decision-making* (r=0.670). For the sub-variables of *communication*, there was also a significant improvement of the variables in the metaverse. Accordingly, *social presence* was perceived to be the most significantly improved (Wilcoxon effect size r=0.798, mean x=4.17). Aspects of *communication* such as the perception of *emotions* (r=0.802), *trust* (r=0.745), *opinions* (r=0.731) and *personality* (r=0.725) of the other test persons also benefited strongly from the performance in the metaverse. Charisma was also perceived better than in the videoconference, although the effect was not as strong as for the other variables (r=0.639).

Table 2: Results of the process variables

Process variables		p-value (K-S-test)	p-value (t-test)	p-value (Wilcoxon -test)	z-value (Wilcoxon -test)	r-test (effect size)	Mean value
Coordination of task		0,023	0,000*	0,000	-3,70	0,755	3,92
Discussion		0,085	0,000	0,000	-3,58	0,731	3,92
Execution of task		0,002	0,000*	0,001	-3,36	0,686	3,92
Decision process		0,111	0,000	0,001	-3,28	0,670	3,82
	Communication	0,011	0,000*	0,000	-3,86	0,788	4,13
	Social Presence	0,076	0,000	0,000	-3,91	0,798	4,17
	Trust	0,006	0,000*	0,000	-3,93	0,802	4,00
	Emotions	0,041	0,000*	0,000	-3,65	0,745	4,04
	Opinions	0,085	0,000	0,000	-3,58	0,731	3,92
	Personality	0,081	0,002	0,002	-3,55	0,725	4,00
	Charisma	0,028	0,000*	0,000	-3,13	0,639	3,88

*= Not meaningful, as not normally distributed

Based on the results, hypothesis H1.1 is supported. According to this hypothesis, the process of teamwork can be improved via the metaverse compared to videoconferencing.

The effect can be found for all sub-variables of the process level, which also confirms hypotheses H2 and H4. The results allow us to conclude that *social presence* is indeed higher in the metaverse, which enriches communication in teamwork in many aspects. The better rating of the other elements of the process level could be due to the improved communication. The relatively small effect on charisma could be related to the lack of facial expressions and the appearance of the avatars.

The effect of the metaverse on several variables was shown to correlate with the personal characteristics of the respondents by Spearman's correlation coefficient. Table 3 shows only those variables with a particularly strong correlation. According to this, the VR skills of the participants had the strongest correlation with the evaluation of *communication* (ρ=0.77), *exchange of opinions* (ρ=0.74) and *decision-making process* (ρ=0.54). Thus, participants who were already good at using technology were more likely to perceive the positive effect of the metaverse. An important personal characteristic was also the perceived *importance of social presence* for teamwork. This variable was particularly related to the effect on *confidence* (ρ=0.63), *opinion* (ρ=0.61), *social presence* (ρ=0.53) and perception of *personality* (ρ=0.53). The positive effect of the metaverse on *task performance* (ρ=0.56) and perception of others' *emotions* (ρ=0.51) also depended on *creativity*.

Table 3: Results on the correlation of personal characteristics

	Spearman-Correlations-coeffizient (ρ)	T according to Spearman correlation	p-value according to Spearman correlation
VR-skills x Communication	0,77	5,65	0,000
VR-skills x Discussion	0,74	5,12	0,000
Importance of social presence x Trust	0,63	3,83	0,001
Importance of social presence x Opinions	0,61	3,63	0,001
Creativity x Execution of task	0,56	3,18	0,004
VR-skills x Decision process	0,54	3,01	0,006
Interest in VR x Social Presence	0,54	3,02	0,006
Importance of social presence x Social Presence	0,53	2,91	0,008
Importance of social presence x Personality	0,53	2,91	0,008
Interest in VR x Execution of task	0,52	2,82	0,01
Creativity x Emotions	0,51	2,78	0,011

The results of the experiment confirm hypothesis H5 for numerous personal characteristics and correlations. According to this, the personal characteristics of the team members are important for the successful use of the metaverse as a communication medium. At the same time, the strong influence of personal characteristics on teamwork, as described by Hertel & Konradt (2007) and Tannenbaum et al. (1992) in their IPO models, is confirmed. Consequently, to use the metaverse, it is necessary to be able to use the communication medium well. People for whom social presence is particularly important in teamwork rate the effect of the metaverse higher. This can be attributed to the already proven higher *social presence* in the metaverse. The importance of creativity for a successful application could be explained by the more abstract, virtual representation of the task and emotions, which creative people may be better able to process.

No significant improvement or significant deterioration of the outcome variables was found for the study compared to videoconferencing. As shown in Table 4, all p-values for the outcome variables quality, time spent, own satisfaction, team satisfaction, team cohesion and avoidance of misunderstandings are significantly above p=0.05. Hypotheses H1.2 and H3 can therefore be rejected. The additional comparison of the teamwork in the metaverse with a hypothetical processing of the task in a face-to-face meeting also showed no improvement or deterioration.

Table 4: Results of the outcome variables

	p-value (K-S test)	p-value (Wilcoxon test)	Mean value
Quality	0,306	0,518	2,88
Time required	0,325	0,479	2,83
Own satisfaction	0,104	0,152	3,33
Team satisfaction	0,245	0,268	3,25
Team cohesion	0,451	0,253	3,25
Avoidance of misunderstandings	0,087	0,308	3,21

5. Limitations and Future Work

The result of the experiment can be interpreted or explained in different ways. Since the difficulty of the task was not high, working via videoconference would also be manageable without complications. The final product of the teamwork would therefore probably be similar for videoconferencing, metaverse and face-to-face meetings and therefore actually neither significantly better nor worse. Another explanation is the lack of long-term studies. An improvement in outcomes due to the improved processes may only become apparent after regular, long-term use. *Team cohesion* in particular is a product of long-term collaboration and is unlikely to be noticeably improved or worsened in a single day.

However, the same aspects apply to the classification of the results for the process variables. Long-term use of the communication medium and more complex tasks could lead to a different assessment of the variables. This points to the need for further research.

It should be noted that the sample was small (24 people) and therefore not representative. As the subjects were students of approximately the same age and with a high level of interest and openness to the topic of VR, different results can be expected for a more heterogeneous group. The sample's affinity with technology allowed them to complete the task with little difficulty, which cannot be assumed for less technologically savvy people. At the same time, further training and familiarity with the technology could increase the positive effects of use.

The VR glasses used in the experiment are not state of the art. In particular, the three HTC Vive models were uncomfortable to use because of the extensive wiring. Face tracking was not available with any of the VR glasses, so facial expressions could not be transmitted. However, these are an important part of non-verbal communication. The free version of *Spatial* was used as the social VR platform. There might be better paid-for platforms on the market.

Future research should investigate the long-term implementation of metaverse meetings with several groups in real everyday work. For this purpose, companies could be supported in the introduction of this communication medium in their teamwork. Alternatively, a semester project by groups of students using the metaverse would be conceivable. It should be noted that all participants will be trained in the use of the VR glasses and the social VR platforms. Ideally, participants will use modern VR hardware with face and finger tracking.

6. Practical Implications and Conclusion

The experiment provides the first insights into the use of the metaverse as a communication medium. By confirming the higher *social presence* and the general improvement of *communication*, the metaverse has a higher media richness than videoconferencing in the media appropriateness theory of Daft and Lengel (1984). The metaverse could therefore certainly be used as an alternative to videoconferencing. However, the study also showed that the use of VR glasses and the social VR platform needs to be learned or trained to take full advantage of the metaverse. Companies that want to test metaverse meetings should staff the working group with creative and tech-savvy people. It is also recommended to use wireless VR glasses with face and finger tracking. These allow for more comfortable use and the transmission of facial expressions. Task types such as creative tasks, task planning and decision-making tasks are particularly suitable for implementation in the metaverse.

The results show that the three-dimensional representation in the metaverse increases the perceived *social presence*, which improves *communication* in other aspects as well. The richer communication can also enrich processes such as *coordination, exchange of opinions, execution* and *decision-making*. An improvement in outcomes could not be demonstrated, which may require long-term research. Further studies should accompany long-term projects to observe changes in teamwork.

References

Beisch, N., & Koch, W. (2021). Aktuelle Aspekte der Internetnutzung in Deutschland. 25 Jahre ARD/ZDF-Onlinestudie: Unterwegsnutzung steigt wieder und Streaming/Mediatheken sind weiterhin Treiber des medialen Internets. *Media Perspektiven*, 10, 486-972.

Argyle, M., Furnham, A., & Graham, J. (1981). *Social Situations*. Cambridge University Press.

Argyle, M. (2013). *Körpersprache & Kommunikation: Nonverbaler Ausdruck und soziale Interaktion*. Junfermann Verlag.

Bastian, M. (2022). HTC rüstet Vive Focus 3 mit Augen- und Gesichtstracking auf, [online], mixed.de, https://mixed.de/htc-ruestet-vive-focus-3-mit-augen-und-gesichtstracking-auf/.

Beil, B. & Rauscher, A. (2018). Avatar. In: Beil, B., Hensel, T. & Rauscher, A. (Hrsg.): *Game Studies*, Springer VS.

Bornemann, S. (2012). *Kooperation Kollaboration: Das Kreative Feld als Weg zu innovativer Teamarbeit*, Springer VS.

Daft, R. L. & Lengel, R. H. (1984). Information Richness. A new approach to managerial bahavior and organization design. *Research in Organizational Behavior*, 6, 191-233.

Dobie, T. G. (2019). *Motion Sickness: A Motion Adaptation Syndrome*. Springer International Publishing.

Floridi, L. (2022). Metaverse: A Matter of Experience. *Philos. Technol.*, 35 (3), 73-79.

Hayden, S. (2016). Why New Social VR App 'Rec Room' Makes You Smile, [online], roadtovr.com, https://www.roadtovr.com/rec-room-makes-smile/.

Hertel, G. & Konradt, U. (2007). *Telekooperation und virtuelle Teamarbeit*. Oldenbourg Wissenschaftsverlag GmbH.

Johannsen, A. (2002). *Telepräsenz im eLearning: Ein Konzept für das virtualisierte Seminar*. Springer Fachmedien Wiesbaden GmbH.

Lazarus, H., Sust, C. A., Steckel, R., Kulka, M. & Kurtz, P. (2007). *Akustische Grundlagen sprachlicher Kommunikation*. Springer.

Poggendorf, A. (2009). Proxemik in der Teamdynamik – Raumsprache diktieren und interpretieren. In: Siems, F. (2009). *Anspruchsgruppenorientierte Kommunikation: Neue Ansätze zu Kunden-, Mitarbeiter- und Unternehmenskommunikation*. 233-246, VS Verlag für Sozialwissenschaften.

Röhner, J. & Schütz, A. (2016). *Psychologie der Kommunikation*. Springer.

Schmidt, C. (2019). Online collaboration – How modern teams succeed together. [online], Canto, https://www.canto.com/blog/online-collaboration/.

Short, J., Williams, E., Christie, B. (1976): *The Social Psychology of Telecommunications*. John Wiley & Sons.

Tannenbaum, S. I., Beard, R. L., & Salas, E. (1992). Team building and its influence on team effectiveness: An examination of conceptual and empirical developments. In: *Advances in psychology*, 82, 117-153). North-Holland.

Watzlawick, P., Beavin, J.H. & Jackson, D.D. (2016). *Menschliche Kommunikation: Formen, Störungen, Paradoxien*. Hogrefe Verlag.

Zuckerberg, M. (2021). Founder's Letter, 2021. [online], Meta, https://about.fb.com/news/2021/10/founders-letter/.