Planned and Crisis-driven Digital Transformation of Work

Dissertation
zur Erlangung des Grades eines

Doktor rerum politicarum
(Dr. rer. pol.)

der Fakultät III – Wirtschaftswissenschaften, Wirtschaftsinformatik
und Wirtschaftsrecht der Universität Siegen

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Datum der Disputation: 11.07.2023

Acknowledgements

I would like to express my gratitude to all the individuals who have supported and accompanied me throughout my PhD.

First and foremost, I would like to thank my doctoral advisor, Björn Niehaves. Björn, I am grateful for your guidance throughout the process of obtaining my PhD. Your expertise and mentorship have played a significant role in developing my ideas and realizing my full potential. I am thankful for the time and opportunity to learn from you.

A special thanks goes to my friends, colleagues and, co-authors: Michael Klesel, Kristina Lemmer, and Andreas Weigel. Together, we have spent many inspiring and memorable hours conducting research, writing, and engaging in discussions. Your dedication and valuable input throughout my entire doctoral journey have greatly contributed to the success of my work. I would also like to extend my heartfelt thanks to my dear friend Jacqueline Gräf. Without your organizational talent and unwavering helpfulness, this achievement would not have been possible. Furthermore, I would also like to express my gratitude to my other colleagues and co-authors for their support: Thorben Baumgart, Andreas Eckhardt, Henrik Freude, Katharina Jahn, Christian Klein, Bastian Kordyaka, Michael Knop, Marius Müller, Frederike Oschinsky, Caroline Reßing, Cindy Schäfer, Michael Schlechtinger, Aida Stelter, and Sebastian Weber. It has been a pleasure to collaborate with all of you.

Finally and most importantly, I would like to express my deep gratitude to my family. My dear parents Ariane and Ulrich, and my sister Lisa, you have given me the strength to successfully master this path through your tireless support, your encouraging words in difficult moments and your constant help. Without you, none of this would have been possible. I am also infinitely grateful to my fiancé Robin. You have been my confidant, my motivator, and my unwavering supporter. Your patience in listening to my academic challenges on thousands of evening walks, your willingness to give me advice, and your understanding when I needed time to focus were invaluable. Your unwavering belief in me gave me the strength to continue and succeed. I am truly fortunate to have you in my life, and I cannot wait to embark on our next chapter of life together.

To all those I have not mentioned by name but who have nevertheless made a contribution, I sincerely thank you. Your support has been crucial in making this dissertation possible.

Frankfurt, 11.07.2023 Anna-Katharina Zeuge

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List of Abbreviations and Acronyms

AIS	Association for Information Systems
AMCIS	American Conference on Information Systems
AR	Augmented Reality
AV	Augmented Virtuality
COVID-19	Coronavirus Disease of 2019
DSR	Design Science Research
ECIS	European Conference on Information Systems
ERP	Enterprise Resource Planning
HICSS	Hawaii International Conference on System Sciences
ICIS	International Conference on Information Systems
ICT	Information and Communication Technology
IS	Information Systems
MR	Mixed Reality
NeuroIS	Neuro-Information-Systems Retreat
P	Paper
PACIS	Pacific Asia Conference on Information Systems
PVT	Process Virtualization Theory (PVT)
RQ	Research Question
SME	Small and Medium-sized Enterprise
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
VR	Virtual Reality

Part A

Overview

1 Introduction

This section introduces the planned and crisis-driven digital transformation of work and presents the overall aim of this cumulative thesis. In addition, the main research questions (RQs) as well as the structure of this thesis are described.

1.1 Planned and Crisis-driven Digital Transformation of Work

The digital transformation of work is a broad transformation of work processes, workflows, and practices which is enabled by information and communication technologies (ICTs) (Parviainen et al., 2022; Vial, 2019; Wessel et al., 2021). It is crucial to organizations' success and growth (Carroll et al., 2021) as the digital transformation of work allows them to adapt to changing industries and open new business segments, such as hybrid value chains (Weigel et al., 2022). It also enables organizations to remain competitive, by such means as developing solutions for improving efficiency (Carroll et al., 2021). Successfully implementing the digital transformation of work requires individuals, teams, and organizations to rethink the business (Hess et al., 2016).

On the one hand, digital transformation of work can be driven by strategic planning to address internal demands (e.g., process improvement, workplace improvement, cost reduction) or external demands (e.g., customer demands, laws/government, market pressure) (Chanias et al., 2019; Liere-Netheler et al., 2018). Strategic planning is the process of formulating a digital transformation strategy to achieve the organization's goals, aligning it with the overall organizational strategy (and other strategic aspects), and deciding on the allocation of resources for pursuing that strategy (Bharadwaj et al., 2013; Matt et al., 2015). In addition to financial aspects, the digital transformation strategy must define ICTs to use and changes in value creation and structural changes to achieve (Matt et al., 2015).

On the other hand, digital transformation of work can be driven by crises and thus takes place unexpectedly and immediately (Ayoko et al., 2017; Di Gangi et al., 2021; Haslam et al., 2021). Here, a distinction between internal and external crises can be useful. Internal crises directly relate to the organization, occurring within an organization or an industry (e.g., labor shortages) (Ayoko et al., 2017). External crises usually have a national or international impact on multiple organizations and industries. Examples include the coronavirus disease of 2019 (COVID-19), the financial crisis of 2008, and the more recent energy and gas crisis. Whether triggered internally or externally, overcoming the crisis often requires a digital transformation of work (Ayoko et al., 2017; Di Gangi et al., 2021).

In the field of information systems (IS), the digital transformation of work has received substantial attention in recent years (Carroll et al., 2021; Vial, 2019; Wessel et al., 2021). However, despite valuable efforts, research in this field is sparse. Most studies focus on the initial roll-out and implementation of the digital transformation of work rather than its effects (Carroll et al., 2021). In addition, before the COVID-19 pandemic, organizations had dedicated the majority of their research on the subject to the planned digital transformation of work (e.g., Bharadwaj et al., 2013; Chanias et al., 2019; Matt et al., 2015). Not until the COVID-19 crisis did research attention turn to the crisis-driven digital transformation of work (Di Gangi et al., 2021). Thus, there is a lack of research that addresses the impact of the digital transformation of work and considers the distinctive circumstances when the digital transformation of work is crisis-driven. Against this background, this cumulative thesis aims to provide insights into planned and crisis-driven digital transformation of work.

1.2 Main Research Questions

To obtain comprehensive insights into the planned and crisis-driven digital transformation of work, this thesis considers the effects from different perspectives, i.e., individuals, teams, and organizations. Accordingly, our RQs appear in Figure 1.1.

Figure 1.1: Main Research Questions

The individual perspective provides insights into the digital transformation of work of individual employees by investigating the influence of planned and crisis-driven digital transformation of work and the opportunities to support this employee during such

transformations. Similarly, the team perspective explores the effects of planned and crisis-driven digital transformation on teamwork and team leadership. The organizational perspective investigates how planned and crisis-driven digital transformation of work affect organizations and their adaptation of value-creating processes.

1.3 Thesis Structure

This thesis includes two major parts (cf. Figure 1.2).

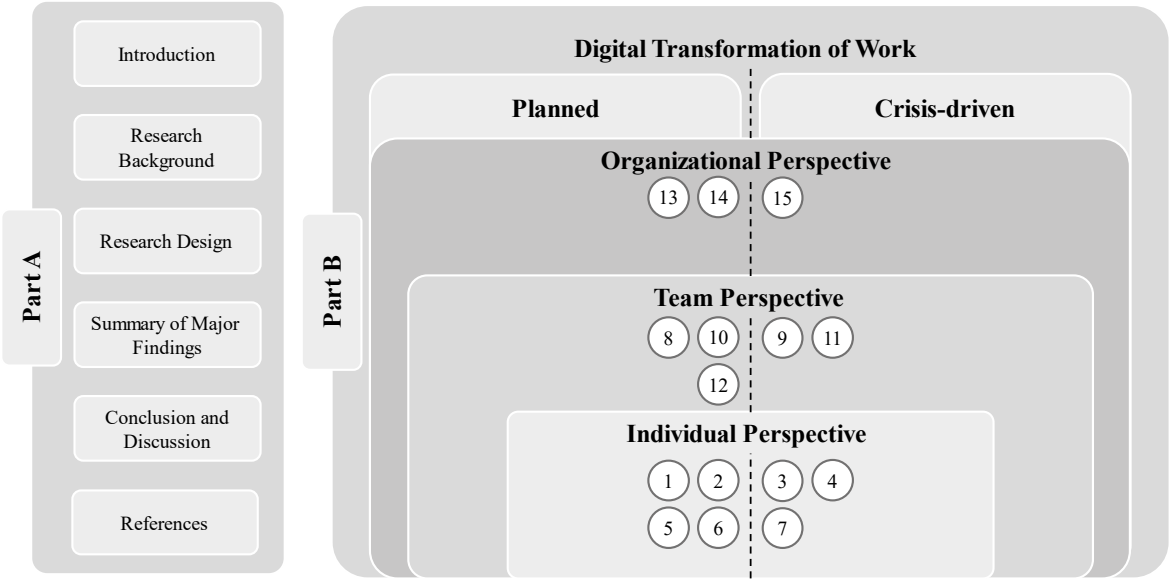

Figure 1.2: Proposed Research Model

Part A provides an overview of all research papers, introducing the overarching research aim of this thesis, the three main RQs, and the thesis structure (section 1). The sections that follow introduce the research background (section 2) and describe the research design (section 3). The next section summarizes the findings of the cumulative thesis (section 4), and the final section discusses the findings' relation to the RQs (section 5).

Part B presents the respective research papers. These include 12 publications from journals and conferences, as well as three research papers under revision. The journal publications appeared in *WORK: A Journal of Prevention, Assessment & Rehabilitation* and in the *HMD Praxis der Wirtschaftsinformatik*. Conference-related publications appeared in the conference proceedings of the International Conference on Information Systems (ICIS), the European Conference on Information Systems (ECIS), the Pacific Asia Conference on Information Systems (PACIS), the American Conference on Information Systems (AMCIS), the Neuro-Information-Systems Retreat (NeuroIS), the New Future of Work Virtual Conference, and the Proceedings on Digitalization at the Institute for Advanced Study of the University of Siegen.

Table 1.1 shows all research papers, and Figure 1.2 organizes the Part B papers by the RQs they address.

	#	Citation	VHB[a]	IF[b]
Individual Perspective	P1	**Zeuge, A.** (2020). The sweet escape - A research agenda for escapism in information system research. *Proceedings on Digitalization at the Institute for Advanced Study of the University of Siegen*. (published)	(-)	
	P2	Godefroid, M., **Zeuge, A.**, Oschinsky, F., Plattfaut, R., & Niehaves, B. (2021). Cognitive biases in IS research: A framework based on a systematic literature review. *Proceedings of the 25th Pacific Asia Conference on Information Systems*. (published)	C	
	P3	Reßing, C., **Zeuge, A.**, Arenz, R., Baumgart, T. L., Schneider, D. J., & Niehaves, B. (2022). Take it Easy - Eine qualitative Untersuchung digitaler Stressoren und Stressbewältigungsmaßnahmen im Homeoffice. *HMD Praxis Der Wirtschaftsinformatik, 59, 1011–103*. (published)	D	
	P4	Schaefer, C., Stelter, A., **Zeuge, A.**, Oschinsky, F. M., & Niehaves, B. (2022). AR- und Holografie-gestütztes Netzwerken als Alternative zum traditionellen Netzwerken vor Ort - ein multiperspektivischer Einblick. *HMD Praxis Der Wirtschaftsinformatik*, 59(1), 226–245. (published)	D	
	P5	**Zeuge, A.**, Oschinsky, F. M., Klesel, M., Reßing, C., & Niehaves, B. (2022). Age-related differences on mind wandering while using technology: A proposal for an experimental study. *Proceedings of the NeuroIS Retreat 2022*. (published)	(-)	
	P6	**Zeuge, A.**, Lemmer, K., Klesel, M., Kordyaka, B., Jahn, K., & Niehaves, B. (2022). To be or not to be stressed: Designing autonomy to reduce stress at work. *WORK: A Journal of Prevention, Assessment & Rehabilitation*. (accepted)	(-)	1.803
	P7	**Zeuge, A.**, Schaefer, C., Weigel, A., Eckhardt, A., & Niehaves, B. Crisis-driven digital transformation as a trigger for process virtualization: Fulfilling knowledge work process requirements for remote work. *International Journal of Information Management*. (under review / 2nd round)	C	18.958

	#	Citation	VHB[a]	IF[b]
Team Perspective	P8	**Zeuge, A.**, Oschinsky, F. M., Weigel, A., Schlechtinger, M., & Niehaves, B. (2020). Leading virtual teams - A literature review. *New Future of Work Symposium*. (published)	(-)	
	P9	**Zeuge, A.**, Schaefer, C., Weigel, A., & Niehaves, B. (2021). Happy together - How can virtual leaders foster team cohesion? *Proceedings of the 27th Americans Conference on Information Systems*. (published)	D	
	P10	Weigel, A., **Zeuge, A.**, Baumgart, T. L., & Niehaves, B. (2021). Bittersweet virtual reality collaboration: Necessary and sufficient conditions. *Proceedings of the 42nd International Conference on Information Systems*. (published)	A	
	P11	**Zeuge, A.**, Weigel, A., Schaefer, C., & Niehaves, B. (2022). The new normal of virtual team cohesion - A qualitative study to investigate the impact of COVID-19. *Proceedings of the 28th Americas Conference on Information Systems*. (published)	D	
	P12	Weigel A., **Zeuge**, A., Schaefer, C., & Niehaves, B. Leading like a rockstar - An investigation of virtual team leadership behavior. *Information & Management*. (under review – 1st round)	B	10.328
Organizational Perspective	P13	Weigel, A., **Zeuge, A.**, & Sauter, L. (2021). Influencers of digital transformation: A new concept of user participation in IS projects. *Proceedings of the 29th European Conference on Information Systems*. (published)	B	
	P14	Weigel, A., Baumgart, T. L., **Zeuge, A.**, Sauter, L. M., Niehaves, B., Huchler, N., Heinlein, M., Wittal, R., & Staiger, B. (2022). Competence transfer in virtual realities: Can virtual reality bring products and services together? *WORK: A Journal of Prevention, Assessment & Rehabilitation*, 72(4), 1727–1743. (published)	(-)	1.803
	P15	Mohos, J., **Zeuge, A.**, Reßing, C., Niehaves, B., & Moog, P. Stay committed - On the role of organizational commitment for virtual collaboration in SMEs. *Proceedings of the 13th International Conference on Advanced Collaborative Networks, Systems and Applications*. (under review – 1st round)	(-)	

[a] VHB-JOURQUAL3 (https://vhbonline.org/vhb4you/vhb-jourqual/vhb-jourqual-3)
[b] IF (Impact Factor) according to the Journal Citation Reports released in 2021 or in 2022

Table 1.1: Overview of Publications

The formatting of the research papers has been unified to ensure consistent presentations (Klesel, 2019). Possible linguistic and grammatical errors have been corrected. Therefore, the

research papers may differ from their original versions (Klesel, 2019; Oschinsky, 2022). Moreover, differences in terms, wording, and abbreviations resulting from the papers having been written at different points in time have been largely aligned in Part A (e.g., a digital or virtual team is consistently referred to as a “digital team”).

2 Research Background

This section presents the research background of this cumulative thesis. To this end, the overarching theoretical concepts of the research are described, and existing research gaps are identified. Accordingly, the described theoretical concepts ("Technology Acceptance and Use", "Ubiquitous Technology and the Role of Digital Stress and Attention", "Digital Teamwork and Digital Team Cohesion", "Digital Interaction and Collaboration through Mixed and Virtual Realities") can be found in multiple research papers in Part B and can belong to one or more research perspectives (individual, team, and organization).

2.1 Technology Acceptance and Use

Successful digital transformation in organizations requires employees to accept and use ICT (Kim & Kankanhalli, 2009; Lippert & Davis, 2006). Individual acceptance and usage decisions are primarily explored through the lens of models that assume rational human behavior, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology model (UTAUT, UTAUT2) (Coleman & Fararo, 1992; Davis, 1985; Venkatesh et al., 2003). Rational human behavior implies that individuals behaving completely rationally can evaluate their actions in terms of benefits and costs and will constantly strive to maximize their value (Coleman & Fararo, 1992). However, those models and their respective theories do not consider non-rational human behaviors (Boudon, 1998). Non-rational human behavior was first acknowledged in cognitive bias theory (Tversky & Kahneman, 1974). Cognitive biases include behaviors in which "individuals draw inferences or adopt beliefs where the evidence for doing so in a logically sound manner is either insufficient or absent" (Haselton et al., 2015, p. 2). Since the early 1990s, researchers have increasingly examined how cognitive biases influence technology adoption and use in organizations (Fleischmann et al., 2014). For example, the status quo bias was found to be an important driver of user resistance to Enterprise Resource Planning (ERP) systems (Kim & Kankanhalli, 2009). It was also revealed that employees' intentions to accept agile IS and to use future features are influenced by status quo, omission, and availability biases (Hong et al., 2011). Another study indicated that perceived value, sunk costs, conversion benefits, and citizen benefits best explain technology resistance among public-sector employees (Oschinsky et al., 2021). In addition, previous research has found a variety of cognitive-bias classifications (e.g., Arnott, 2006; Dimara et al., 2020; Fleischmann et al., 2014). However, these classifications build on an existing set of cognitive biases and require adaptation or extension with the identification of new, relevant biases

(Godefroid et al., 2021). Thus far, a flexible framework that allows for systematic exploration and meta-research is lacking (Godefroid et al., 2021).

Research demonstrates that user participation positively influences individual employees' acceptance and use of ICT (Bachore & Zhou, 2009; Kujala, 2003) by involving ICT users in all phases of the development process (Lin & Shao, 2000). User participation contributes to better aligning the developed systems with the requirements of future users and achieving higher system quality (Barki & Hartwick, 1989; Lin & Shao, 2000; Melchor & Chaparro, 2008). Since it can increase the likelihood that users will accept and use ICT, it also influences the ultimate success of ICT integration (Cushing, 1990; Hunton & Beeler, 1997). Existing participation concepts, such as the established key-user concept, aim toward the implementation and supervision of ICT (Mahdavian & Mostajeran, 2013). However, since the basis of the digital transformation of work is not the ICT implementation but a holistic change in work processes that the implementation supports, it remains questionable whether existing participation concepts (e.g., "key-users") are suitable or new participation concepts are required (Weigel, Zeuge, & Sauter, 2021).

2.2 Ubiquitous Technology and the Role of Digital Stress and Attention

The ubiquity of ICT adds value to work in many ways. For example, individuals can choose the software and devices that best suit their needs and preferences (Klesel et al., 2018), teams can collaborate digitally (Bjørn & Ngwenyama, 2009), and organizations can gather, analyze, and leverage information across the value chain (Ransbotham et al., 2016).

However, the ubiquity of technology in contemporary workplaces can pose many potential drawbacks, including digital stress (Fischer et al., 2021). Digital stress describes stress resulting from interaction with ICT (Fischer & Riedl, 2020). Three major research strings can summarize the research on digital stress. The first deals with digital stressors, an overview of which in contemporary workplaces appears in Table 2.1. The second research string examines the consequences of digital stress, such as impaired concentration, health problems, or reduced productivity (Ragu-Nathan et al., 2008; Tarafdar et al., 2010; Tu et al., 2005). In addition, digital stress can reduce employee motivation, impair job satisfaction, and negatively affect commitment to the organization (Ayyagari et al., 2011; Srivastava et al., 2015; Tu et al., 2005). The third research string examines managing digital stress. Stress management is understood as a regulative process that is triggered by a situation which is assessed as stressful (Lazarus & Folkman, 1984). A distinction exists between reactive and proactive stress management

measures (Kaluza, 2018; Wagner-Link, 2009). While reactive measures do not change, reduce, or eliminate the cause of stress (i.e., the stressor) (Kaluza, 2018; Litzcke & Schuh, 2010), proactive measures aim to do so (Scheier et al., 1986). Research on the ubiquity of technology and its impact on digital stress has already occurred from many perspectives. However, the pandemic forced home office work that significantly impacted perceptions of digital stressors (Reßing et al., 2022), prompting the emergence of many new research topics (Waizenegger et al., 2020). For example, no published research to date examines whether the same digital stressors are perceived in the home office or how reactive and proactive stress management measures can be implemented in the home office (Reßing et al., 2022).

Source	Digital Stressor	Description
Tarafdar et al. (2011)	Overload	ICT forces employees to work more and faster
	Invasion	ICT enables permanent availability
	Complexity	ICT is complex and requires extensive training
	Insecurity	Fear of replacement by users with greater ICT expertise
	Uncertainty	Constant changes and updates to ICT make it difficult to develop a profound knowledge of its use
Adam et al. (2017)	Unreliability	ICT malfunctions and other problems
Gimpel et al. (2019)	Performance monitoring	Fear of monitoring and benchmarking through the tracking of performance data
	Transparency	ICT impairment of privacy
	Interruption	ICT interruption of task and/or focus
	Non-availability	Lack of ICT availability
	Lack of role clarity	Conflict between troubleshooting technical problems and main business
	Lack of sense of achievement	Lack of feeling progress

Table 2.1: Overview of Research on Digital Stressors

Since workplace ICTs are ubiquitous, they very likely also affect individuals' attention during work. For example, ICT can help individuals to mentally escape their work (Cahir & Werner, 2013). Since escapism is often taking the form of excessive gaming with the potential for addiction and denial, it is widely considered as negative and unhealthy (Warmelink et al.,

2009). However, escapism can likewise function as a natural process that provides an opportunity for cognitive release (Kardefelt-Winther, 2014) that may reduce (digital) stress (Kuo et al., 2016) or improve mood (Hoffmann et al., 2017). Mind wandering is another common example of individuals' attention detaching from the external environment (Christoff et al., 2016; Giambra, 1995; Smallwood & Schooler, 2015). Mind wandering while using ICT is defined as "task-unrelated thought which occurs spontaneously, and related to the aspects of information systems" (Klesel et al., 2021, p. 1021). A detached mind often signals a lack of awareness, poor performance, or disengagement (Baldwin et al., 2017; Drescher et al., 2018; Zhang & Kumada, 2017) with undesirable consequences including unhappiness or stress (Epel et al., 2013; Killingsworth & Gilbert, 2010). Yet, mind wandering can also relate to creativity, problem-solving ability, and positive mood (Agnoli et al., 2018; Baird et al., 2012; Smallwood & Schooler, 2015).

The influence of ubiquitous ICT on escapism and mind wandering offers many possible starting points for future research. For example, the study of escapism has occurred mainly in the context of gaming (e.g., Hartl & Berger, 2017; Holsapple & Wu, 2007; H. Li et al., 2013). To better understand the impact on work of ICT escapism, a review of the research, the identification of existing shortcomings, and the derivation of a research agenda are valuable (Zeuge, 2020). Many studies of mind wandering's benefits and drawbacks for the individual already exists (e.g., Agnoli et al., 2018; Drescher et al., 2018; Smallwood & Schooler, 2015). In addition, research also indicates that using hedonic ICT leads to a higher level of mind wandering than using utilitarian ICT (Oschinsky et al., 2019). Missing so far is the investigation of individual differences (e.g., age) in terms of mind wandering and ICT use (Zeuge, Oschinsky, et al., 2022). Filling this gap is important because research has demonstrated individual differences in mind wandering (e.g., Maillet et al., 2018; Mowlem et al., 2019; Smallwood & Schooler, 2015). Introducing new ICT in the workplace requires understanding such individual differences, to acquire benefits and avoid drawbacks (Zeuge, Oschinsky, et al., 2022).

2.3 Digital Teamwork and Digital Team Cohesion

The common understanding of digital teamwork is teams of geographically and/or temporally distributed participants who work together toward a common goal, using ICT to accomplish a task (Bjørn & Ngwenyama, 2009). Therefore, distinguishing digital teamwork from face-to-face teamwork rests on the following characteristics: (a) geographic and/or temporal distance

that restricts face-to-face communication and (b) ICT-mediated interaction and communication (Bell & Kozlowski, 2002; Pierce & Hansen, 2008). As in team sports, three levels of (digital) teamwork can be distinguished (Briggs, 1994) (cf. Figure 2.1):

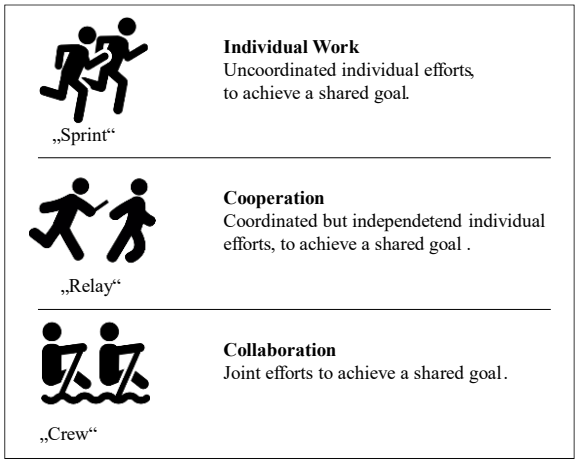

Figure 2.1: Levels of Teamwork
(Source: Briggs, 1994)

Similar to sprinting, teamwork on an individual level describes the uncoordinated contributions of individuals toward a shared goal (Briggs, 1994), each performing his or her own work process from the start to the end (Briggs, 1994; Nunamaker et al., 2009). A relay is analogous to teamwork on a cooperative level (Briggs, 1994), where team members' efforts align through managed interdependencies (Briggs, 1994; Großer & Baumöl, 2022). Team rowing describes collaborative teamwork in which two or more team members work together to achieve a common goal (Briggs, 1994; Fan et al., 2012; Patel et al., 2012). The individual and combined efforts of team members creating value that team members cannot create individually (Nunamaker et al., 2009).

Digital teams' success depends on effective leadership roles and behaviors that a leader adopts, depending on situations and circumstances (Murphy, 1941; Quinn, 1984, 1988; Wakefield et al., 2008). One crucial task for digital team leaders is to strengthen and maintain team cohesion digitally (Malhotra et al., 2007; Schanke et al., 2018; Van der Voet & Steijn, 2021). Successful teamwork requires the feeling of cohesion within a team (Hoegl & Gemuenden, 2001). Team cohesion thereby is commonly defined as "[…] the tendency for a group to stick together and remain united"(Carron et al., 1989, p. 3). Research has proved the manifold positive influences of team cohesion on teamwork, including motivating individual team members, collaboration among team members, overall team performance, and individuals' commitment to the organization (Bajaj & Russel, 2008; Beal et al., 2003; Greer, 2012; Mathieu et al., 2015; Paul

et al., 2016). Team cohesion comprises social and task team cohesion, with social team cohesion characterizing the relationships between team members (Mikalachki, 1969) and task team cohesion the advocacy by team members for the team task (Zaccaro, 1991; Zaccaro & Lowe, 1988). A feeling of cohesion in digital teams working across time and space is especially important, as the physical distance between the individual team members can create psychological distance (Garro-Abarca et al., 2021; Lilian, 2014; Purvanova & Bono, 2009). However, the lack of informal and spontaneous exchange opportunities that would be possible on-site impairs the feeling of digital team cohesion (Lepsinger & DeRosa, 2015; Yang et al., 2015).

Since leadership behaviors cannot be readily transferred to the digital environment and presumed to be successful (Schmidt, 2014; Wakefield et al., 2008), complementary knowledge to understand how to adapt leadership behaviors can enable successful digital leadership (Weigel et al., Under Review; Zeuge et al., 2020). In addition, the pandemic and the associated social isolation that forced home office have created new challenges for teams and their leaders (Klonek et al., 2021; Waizenegger et al., 2020). One special challenge for (digital) teams is to maintain team cohesion digitally in times of social isolation (Zeuge et al., 2021; Zeuge, Weigel, et al., 2022). To enable teams and leadership to successfully master the crisis-driven digital transformation, new knowledge is needed about how to maintain team cohesion in times of forced home office and what measurements leaders can implement (Zeuge et al., 2021; Zeuge, Weigel, et al., 2022).

2.4 Digital Interaction and Collaboration through Mixed and Virtual Realities

The successful digital transformation of work (Smith & McKeen, 2011) requires ICT to enable communication and interaction that transcends spatial and temporal boundaries (Dubé & Robey, 2009). However, conventional ICT, such as video/audio conferencing or digital whiteboards, reaches its limits when people must interact digitally (Hassenzahl et al., 2012; Nor'a & Ismail, 2019). Such digital interactions as prototyping, brainstorming, or knowledge transfer, require transmitting facial expressions, gestures, and body language (Eckhardt et al., 2019). Mixed Reality (MR) and Virtual Reality (VR) create new opportunities for digital interaction independent of physical boundaries (Hatzipanayioti et al., 2019; Heldal, 2007; Mütterlein et al., 2018; Nor'a & Ismail, 2019). The Reality-Virtuality Continuum of Milgram and Kishino (1994) effectively characterizes MR and VR (cf. Figure 2.2).

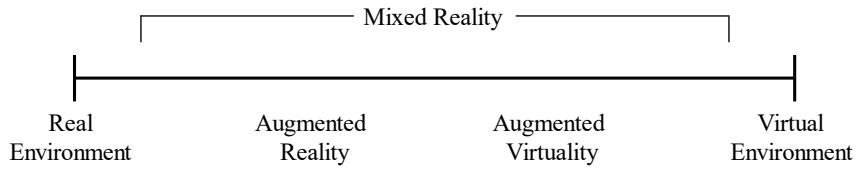

Figure 2.2: Reality-Virtuality Continuum
(Source: Milgram & Kishino, 1994)

The Reality-Virtuality Continuum describes the transition from one to the other, i.e., the entire spectrum from reality to virtuality including possible mixed forms of real and virtual objects (Milgram et al., 1995; Milgram & Kishino, 1994). As a form of MR, Augmented Reality (AR) makes it possible to enrich reality with further information, in the form of virtual objects or persons, and to interact with those in real-time (Lukosch et al., 2015), enabling such interactions as remote support through experts. Conversely, Augmented Virtuality (AV) makes the superimposing of real objects or people onto a virtual environment and interacting with them possible in real time (Milgram & Kishino, 1994) (e.g., integrating webcam videos into a virtual meeting room). In the context of crisis-driven digital transformation, MR could potentially bridge social isolation and bring people together, even at a distance (Schaefer et al., 2022). Identifying new use cases for MR and discussing their strengths and shortcomings requires research (Schaefer et al., 2022).

VR technology enables multiple individuals to meet and interact with each other and with virtual objects in a virtual environment (Alghamdi et al., 2016; Jalo et al., 2020; Mütterlein et al., 2018). Therefore, VR creates new opportunities for collaboration by supporting social presence, rich nonverbal communication, and immersive realistic interactions (Alghamdi et al., 2016). Although the benefits of VR for digital collaboration have already been demonstrated (Heldal, 2007; J. Li et al., 2020; Mütterlein et al., 2018), knowledge of which conditions influence the intention to collaborate in VR is sparse (Mütterlein et al., 2018; Weigel, Zeuge, Baumgart, et al., 2021). This is critical, as existing research has already shown that collaboration in VR differs from that in the physical environment (Hatzipanayioti et al., 2019; Mütterlein et al., 2018). In addition, research focuses on facilitating collaboration and knowledge transfer within an organization (Weigel et al., 2022). In the context of the planned digital transformation, however, knowledge transfer between organizations - for example, to enable hybrid value chains - is gaining importance (Dhillon, 2008; Henderson & Venkatraman, 1993; Weigel et al., 2020). To date, no knowledge exists of how to use the potential of VR technologies to ensure the transfer of competencies across organizational boundaries (Weigel et al., 2022)

3 Research Design

In this section, the methodological approaches of this thesis are presented. First, an overview of the methodological approaches is given. Subsequently, the different methodological approaches applied in the individual research papers are described in more detail.

3.1 Overview

This thesis includes 13 completed and two research-in-progress papers, with three major methodological approaches: literature and concept reviews, qualitative research, and quantitative research, which appear in Table 3.1.

	#	Methodology	Dataset	Reference
Individual Perspective	P1	Concept Review, Narrative	Narrative concept review	(Zeuge, 2020)
	P2	Literature Review, Systematic	10 journals and 5 conferences covering 166 research papers	(Godefroid et al., 2021)
	P3	Qualitative Research, Thematic Analysis	Qualitative, semi-structured interviews, 20 interviewees	(Reßing et al., 2022)
	P4	Qualitative Research, Methods of Grounded Theory	Qualitative, semi-structured interviews, 8 interviewees[a]	(Schaefer et al., 2022)
	P5	Quantitative Research, Research in Progress	(-)	(Zeuge, Oschinsky, et al., 2022)
	P6	Quantitative Research, Factorial Survey	Quantitative, survey data (factorial design), 51 participants	(Zeuge, Lemmer, et al., 2022)
	P7	Qualitative Research, Content Analysis	Qualitative, semi-structured interviews, 40 interviewees[a]	(Zeuge et al., Under review)
Team Perspective	P8	Literature Review, Narrative	Narrative literature review	(Zeuge et al., 2020)
	P9	Qualitative Research, Methods of Grounded Theory	Qualitative, semi-structured interviews, 40 interviewees[a]	(Zeuge et al., 2021)
	P10	Qualitative Research, Methods of Grounded Theory	Qualitative, semi-structured interviews, 20 interviewees[b]	(Weigel, Zeuge, Baumgart, et al., 2021)

	#	Methodology	Dataset	Reference
	P11	Qualitative Research, Methods of Grounded Theory	Qualitative, semi-structured interviews, 26 interviewees[a]	(Zeuge, Weigel, et al., 2022)
	P12	Qualitative Research, Content Analysis	Qualitative, semi-structured interviews, 40 interviewees[a]	(Weigel et al., Under Review)
Organizational Perspective	P13	Qualitative Research, Methods of Grounded Theory	Qualitative, semi-structured interviews, 11 interviewees (5 individual and 3 focus groups)	(Weigel, Zeuge, & Sauter, 2021)
	P14	Qualitative Research, Methods of Grounded Theory, Content Analysis	Qualitative, semi-structured interviews, 60 interviewees, DSR VR experiments[b]	(Weigel et al., 2022)
	P15	Qualitative Research, Methods of Grounded Theory	Qualitative, semi-structured interviews, 18 interviewees	(Mohos et al., Under Review)

[a/b] The underlying dataset has been used (in part) in other research papers within this thesis.

Table 3.1: Overview of Research Methodology and Data Sets

3.2 Concept and Literature Reviews

A basic objective of academic research is to concisely summarize and analyze the findings that have emerged from previous research (Rowe, 2014; vom Brocke et al., 2015; Webster & Watson, 2002). Reasons to conduct concept or literature reviews are many: establishing a solid foundation for developing new knowledge, facilitating theory development, gaining methodological insights, and identifying and delimiting research gaps (Webster & Watson, 2002). Following Klesel (2019), Table 3.2 summarizes this thesis's concept and literature reviews.

	P1 (Zeuge, 2020)	**P2** (Godefroid et al., 2021)	**P8** (Zeuge et al., 2020)
Objective	Research-in-progress; Developing a research agenda on escapism in IS research	Gaining a systematic overview of the current research state and research design on cognitive biases in IS research	Gathering prior knowledge
Type of review	Narrative concept review	Systematic literature review	Narrative literature review
Theoretical background	Escapism	Cognitive biases in IS literature	Digital leadership
Considered outlets	Databases such as Google Scholar, Web of Science, Scopus, and PUBMED	10 Journals (Senior Scholars' Basket of Journals, Decision Support Systems, International Journal of Electronic Commerce), Association for Information Systems (AIS) Conferences, and Hawaii International Conference on System Sciences)	Databases such as Google Scholar, Web of Science, Scopus, and PUBMED
Analysis	Review on escapism as a concept in technology-related context	Structured classification based on Fleischmann (2014)	Detailed review of digital leadership
Main Contribution	Research agenda on mental escapes in technology-related context	Framework for the cognitive biases relevant to IS research	Overview of the current state of research on digital leadership

Table 3.2: Overview of Concept and Literature Reviews

Narrative Concept Review. To provide a point of departure for future IS research on mental escapes, P1 developed a research agenda. Based on a narrative concept review of IS research on mental escape P1 highlights current shortcomings as well as the need to address them and formulates four main RQs.

Structured Literature Review. P2 builds on Fleischman et al. (2014), who provided the first comprehensive overview of cognitive bias in IS research and a categorization of the identified biases into eight categories. For that purpose, the study concentrated on the Senior Scholars' Basket of Journals (*European Journal of Information Systems*, *Information System Journal*,

Information System Research, *Journal of AIS*, *Journal of Information Technology*, *Journal of Management Information Systems*, *Journal of Strategic Information Systems*, *Management Information Systems Quarterly*) and four AIS conferences (AMCIS, ECIS, ICIS, PACIS). In addition, the Hawaii International Conference on System Sciences (HICSS) and two additional journals (*Decision Support Systems*, *International Journal of Electronic Commerce*) were included, due to the significant number of publications on cognitive biases and relevant contributions to IS research. To this end, the review included the respective databases for the identified outlets: AIS eLibrary, EbscoHost, Science Direct, SpringerLink, and Web of Science. The search terms build on the biases that Fleischman et al. (2014) identified. Publications that mentioned the selected search terms in the title or the abstract and had a publication date after 2012 - the end of the Fleischmann et al. (2014) research - were included. Based on 166 papers, the study provided insights into the growing body of IS research on cognitive biases and proposed a framework to sort cognitive bias in IS research.

Narrative Literature Review. To understand how leaders must adapt their leadership practices to the digital context and provide fruitful research directions for the future, P8 provides an overview of the current state of research on digital leadership. To this end, the study took a close narrative look at existing research on digital team leadership (Rowe, 2014; Schryen, 2015). To obtain a comprehensive search result, the search followed by using five researchers with no restriction regarding publication year or subject area. In addition, each researcher chose her/his own search terms to ensure sufficient heterogeneity. Common search engines, such as Google Scholar, Web of Science, Scopus, and PUBMED, were used. The study provides valuable directions for future research (e.g., structured exploration of digital team leadership) as well as important practical insights into how team leadership must change to meet the special requirements of digital environments.

3.3 Qualitative Studies

This thesis used qualitative studies to identify and provide thorough descriptions of emerging concepts and phenomena and to develop new theories (Sarker et al., 2013). To this end, it applied methods of Grounded Theory (J. M. Corbin & Strauss, 1990; J. Corbin & Strauss, 2014; Glaser & Strauss, 2017), thematic analysis (Braun & Clarke, 2012), and qualitative content analysis (Mayring, 1994; Mayring & Fenzl, 2014). An overview of qualitative studies appears in Tables 3.3 and 3.4.

	P3 (Reßing et al., 2022)	**P4** (Schaefer et al., 2022)	**P7** (Zeuge et al., Under review)	**P9** (Zeuge et al., 2021)	**P10** (Weigel, Zeuge, Baumgart, et al., 2021)
Primary objective	Investigating digital stressors in home office settings and identification of measures for individual stress management	Examining factors in favor of and against the use of AR and holography for networking	Investigating how knowledge work process requirements can be met by means of IT in a crisis-driven digital transformation	Identifying measures digital leaders can take to foster team cohesion in digital teams	Determining conditions influencing the intention to collaborate in VR
Technique for analysis	Thematic analysis	Methods of Grounded Theory	Qualitative content analysis	Methods of Grounded Theory	Methods of Grounded Theory
Data	20 interviews	8 interviews	40 interviews	40 interviews	20 interviews
Main contribution	Eleven of the twelve digital stressors that exist in the workplace were also identified in home office settings, along with one new digital stressor (lack of social connectedness)	Overview of factors in favor, against, or neutral for using AR and holography for networking	Expanded crisis-driven revisited perspective on Process Virtualization Theory (PVT)	Overview of “on the job” and “off the job” measures to strengthen digital team cohesion	Overview of necessary and sufficient conditions that influence the intention to collaborate in VR

Table 3.3: Overview of Qualitative Studies (1/2)

	P11 (Zeuge, Weigel, et al., 2022)	**P12** (Weigel et al., Under Review)	**P13** (Weigel, Zeuge, & Sauter, 2021)	**P14** (Weigel et al., 2022)	**P15** (Mohos et al., Under Review)
Primary objective	Investigating the impact of the COVID-19 pandemic on digital team cohesion in digital teams	Exploring how the competencies characterizing the different leadership roles of Quinn's Model, can be transferred to digital team leadership	Exploring how influencers differ from the conversational key-users concept and how they enhance digital transformation projects	Investigating the potentials of VR to enable competence transfer across organizational boundaries	Investigating the role of organizational commitment for digital collaboration in SMEs
Technique for analysis	Methods of Grounded Theory	Qualitative content analysis	Methods of Grounded Theory	Multi method approach: Methods of Grounded Theory and qualitative content analysis	Methods of Grounded Theory
Data	26 interviews	40 interviews	11 interviews (5 individual interviews and 3 focus group)	60 interviews	15 interviews
Main contribution	Demonstrate how COVID-19 has changed measures to strengthen digital team cohesion on the job, during breaktimes, and after work	Identifying nine new competencies necessary to fulfill the various leadership roles in the digital environment	Overview of differences between influencers and key-users in terms of focus, role, motivation, communication, function, direction, and objective	VR demonstrator leads to improved product/service quality. Further overview of the role of technology-supported perspective taking, tacit knowledge transfer, interruption, and collaboration in VR	Demonstrating that SMEs need to consider organizational commitment as an important factor for digital collaboration

Table 3.4: Overview of Qualitative Studies (2/2)

Thematic analysis. P3 used thematic analysis to identify digital stressors in home-office settings. Thematic analysis is a structured method for analyzing interview data for common and recurring themes, ideas, and patterns of meaning, consisting of six steps (Braun & Clarke, 2012): (1) familiarization, (2) coding, (3) generating themes, (4) reviewing themes, (5) defining and naming themes, and (6) writing up. 20 semi-structured interviews were conducted with German employees working almost exclusively from home during the pandemic.

Methods of Grounded Theory. This thesis applied Methods of Grounded Theory in several research studies (P4, P9, P10, P11, P13, P15) to generate or expand knowledge where sound and well-established knowledge was missing (J. M. Corbin & Strauss, 1990; J. Corbin & Strauss, 2014; Glaser & Corbin, 1967; Glaser & Strauss, 2017). P4 applied the methods of Corbin and Strauss (2014) and Glaser and Strauss (2017) to eight semi structured interviews, to explore factors in favor of, against, or neutral for using AR and holography for networking. The interviewees involved both customers (i.e., networkers) and AR/VR/holography experts. To explore measures that digital leaders can implement to foster digital team cohesion, P9 applied the methods of Corbin and Strauss (2014) and Glaser and Strauss (2017). To this end, 19 team members and 21 team leaders from 24 German organizations were interviewed using a semi-structured guideline. To identify technology, task, and user conditions necessary or sufficient for collaboration in VR, P10 used the methods of Corbin and Strauss (2014) and Glaser and Strauss (2017). In this study, a total of 20 semi-structured interviews were conducted with product engineers and service providers. P11 explored the influence of COVID-19 on digital team cohesion by analyzing 26 semi-structured interviews with the methods of Corbin and Strauss (2014) and Glaser and Strauss (2017). The interviewees were employees of German organizations who were already working in digital teams before the pandemic. To investigate how influencers enhance the key-user as a conversational user participation concept, P13 used the methods of Corbin and Strauss (1990), Gioia et al. (2013), and Glaser and Corbin (1967). To this end, 11 semi-structured interviews were conducted with key-users and influencers from small and medium-sized enterprises (SMEs). The interviews consisted of five individual interviews and three focus group interviews. P15 applied methods of Corbin and Strauss (1990) and Glaser and Corbin (1967) to 15 semi-structured interviews to investigate the role of organizational commitment for digital collaboration in SMEs.

Qualitative content analysis. Mayring's qualitative content analysis is a method to analyze text-based data, which a rule-based, structured, and fixed procedure characterizes (Mayring, 1994; Mayring & Fenzl, 2014). P7 applied Maying's qualitative content analysis to analyze 40 semi-

structured interviews and examined how a crisis-driven digital transformation can meet knowledge work process requirements by means of IT. P12 investigated how the eight leadership roles that Quinn's Model of Leadership Roles (Quinn's Model) proposed (Quinn, 1984, 1988; Quinn et al., 2007) need to be adopted for digital leadership. To this end, 40 semi-structured interviews in 24 organizations were conducted.

Qualitative multimethod approach. P14 combined multiple qualitative approaches (Chamberlain et al., 2011). The objective was to explore shortcomings in competence transfer processes between product engineers and service providers from two German organizations that formed one hybrid value chain. Thereby, the study follows the six phases of Design Science Research (DSR): (1) problem identification, (2) defining the objectives of a solution, (3) design and development, (4) demonstration, (5) evaluation, and (6) communication (Peffers et al., 2007). First, the existing processes were analyzed to understand employees' exact workflows, process knowledge, and proven work methods. The next step was to investigate the technical possibilities for implementing a VR environment, using a conceptual design developed to record how the VR demonstrator should incorporate the approaches studied and the data collected. Four iterations, conducted with a total of 60 interviewees, tested the VR demonstrator in an experimental setting. Methods of Grounded Theory (J. M. Corbin & Strauss, 1990; J. Corbin & Strauss, 2014; Glaser & Corbin, 1967; Glaser & Strauss, 2017) and qualitative content analysis (Mayring, 1994; Mayring & Fenzl, 2014) were applied to analyze the interviews. The final step was discussing development of the VR demonstrator and its further application.

3.4 Quantitative Studies

Quantitative data are used, respective will be used, to explore some aspects of this thesis. An overview of these studies appears in Table 3.5.

	P5 (Zeuge, Oschinsky, et al., 2022)	**P6** (Zeuge, Lemmer, et al., 2022)
Primary objective	Research-in-progress; Proposing a research model	Hypothesis Testing
Technique for analysis	(-)	Two-step approach: 1) Multiple linear regression, 2) One-way ANCOVA comparing the effects of the design options.
Data collection	(-)	Factorial survey
Data points	(-)	51
Main contribution	Provide a starting point for future research on how individual characteristics influence mind wandering during technology use	Demonstrating that autonomy can be influenced by technology design and is negatively related to perceived stress; furthermore, suggesting that the design options "autonomy" and "nudge" were associated with lower perceived stress than "enforcement"

Table 3.5: Overview of Quantitative Studies

Research in progress. P5 proposed a research model to investigate the relationship between the ICT (hedonic vs. utilitarian) used and the degree of mind wandering moderated by age. Data from young-young (20-30 years), young (31-64 years), young-old (65-74 years), and old-old adults (75-85 years) will be conducted. To assess the degree of mind wandering established measurement scales for mind wandering will be used (Oschinsky et al., 2019; Wati et al., 2014).

Survey data. P6 investigated the relationship between three autonomy-related design options (enforcement, nudge, autonomy) with the potential to reduce perceived stress, analyzing a survey data set from 51 participants (26 male and 25 female) with an average age of 38.29 years (SD = 11.40). The hypotheses were tested by conducting a multiple linear regression. Subsequently, a one-way ANCOVA was applied to compare the effects of the design options.

4 Summary of Major Findings

This section presents the major findings of this cumulative thesis. First, insights into the planned digital transformation are highlighted, followed by insights into the crisis-driven digital transformation. Both subsections consider findings from the perspectives of individuals, teams, and organizations.

4.1 Planned Digital Transformation of Work

4.1.1 Individual Perspective

For a successful planned digital transformation of work, it is crucial that individuals accept and use ICT (Kim & Kankanhalli, 2009; Lippert & Davis, 2006). Cognitive biases are important to consider when investigating acceptance and use (Fleischmann et al., 2014). To further investigate them in the future, P2 has developed a framework for cognitive biases in IS research, which classifies 45 cognitive biases into four quadrants. This framework can examine, e.g., the impact of cognitive biases on the decision to accept/use or not accept/use ICT, contextualize multiple cognitive biases, and explore possible countermeasures. The framework appears in Figure 4.1.

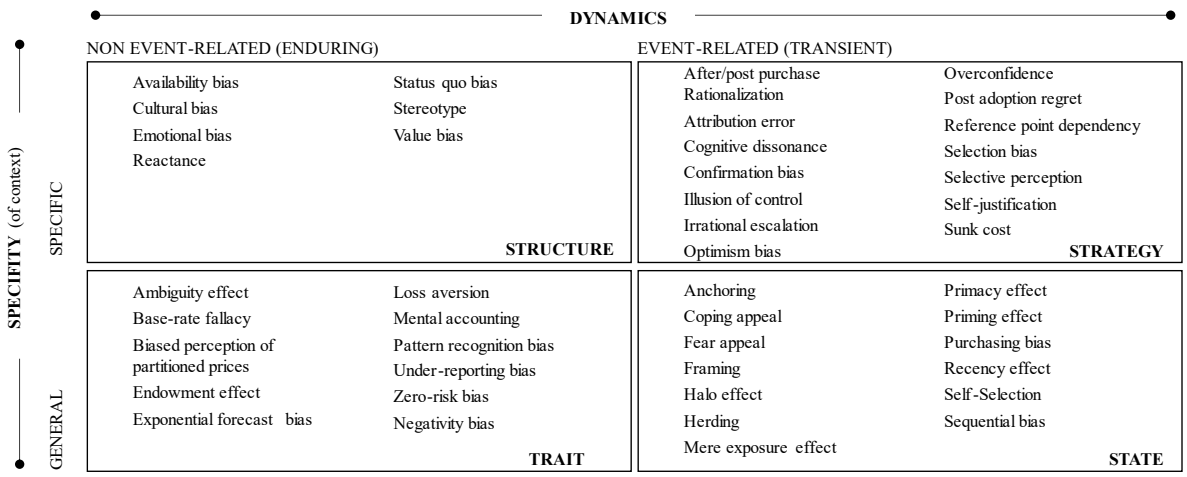

Figure 4.1: Cognitive Biases in IS Sorted into the Proposed Framework
(Source: Godefroid et al., 2021 (P2))

The first quadrant, "Structure," comprises cognitive biases that rely on internal concepts or experiences, for example, the status-quo bias, leading to a preference for the status quo over change, expressed in statements such as, "We have always used this software". The second quadrant, "Strategy," comprises biases that lead to biased information selection. This includes the confirmation bias: an employee who generally considers ICT useful for his/her work would tend to behave in a way that confirms this opinion when a new technology is introduced. The

third quadrant, “Trait,” comprises cognitive biases that have a lasting influence on an individual and, thus, presumably affect the acceptance or use of ICT at work. The fourth quadrant, “State,” contains more general influences that vary over time and are triggered by external stimuli. An example would be the framing of a software update, such that the message about the software update influences decisions about acceptance and use.

The ubiquity of ICT in modern workplaces has the potential to both increase and reduce the perceived stress of individual employees. P6 investigates how ICT design can reduce the perceived stress that overwork causes. To this end, the study considered the concept of autonomy as a design-relevant factor in deciding when to stop work. The study developed and tested three different design options intended to prevent employee stress: 1) enforcement (hard stop by design), 2) nudge (nudging by design), and 3) autonomy (no intervention by design). The research model appears in Figure 4.2.

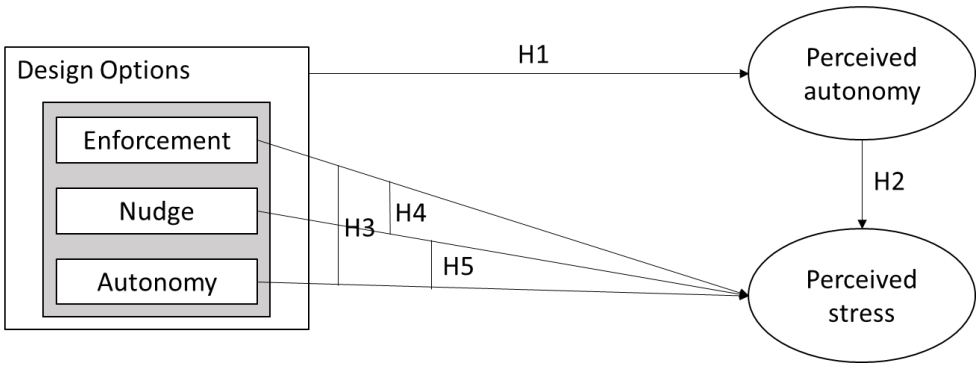

Figure 4.2: Research Model: Design Options to Reduce Perceived Stress
(Source: Zeuge et al., accepted (P6))

Table 4.1 shows that enforcement was found to increase stress. However, nudging, such as a reminder that the allowed working time has been exceeded or family pictures that pop up, can reduce perceived stress. Therefore, such approaches as time-limited computer or email access should be reconsidered, as they may even negatively impact the individual's work-life balance.

Hypothesis (H)		Result
H1:	Perceived autonomy can be manipulated through technology design.	supported
H2:	Overall, perceived autonomy is negatively correlated with perceived stress.	supported
H3:	Enforcement results in higher levels of perceived stress than does perceived autonomy.	supported
H4:	Enforcement results in higher levels of perceived stress than does nudging.	supported
H5:	Autonomy and nudging result in a similar level of perceived stress.	supported

Table 4.1: Hypothesis Testing
(Source: Zeuge et al., accepted (P6))

4.1.2 Team Perspective

Due to the planned digital transformation, teams are increasingly working together digitally, perhaps to collaborate internationally, recruit specialists regardless of location, or reduce travel costs (P8, P10, P12). However, digital teamwork is changing the demands imposed on leadership (P8, P12). The literature review in P8 summarizes overall leadership behaviors that are relevant to leading digital teams successfully. More than anything else, a digital leader should act as a digital transformer by being a role model for his/her team members and providing them with constant support. To this end, it is the digital leader's responsibility to create trustful relationships within the team, as well as a culture of togetherness and respectful communication patterns. In addition, he or she is responsible for developing awareness of diversity within the team. P12 demonstrates how the competencies of each of the eight leadership roles from Quinn's Model (Quinn, 1984, 1988; Quinn et al., 2007) must be adapted for digital leadership. For example, digital leaders must adapt their negotiation competencies (e.g., continuously summarizing interim results and explicitly designating responsibilities) since the digital environment poses special challenges (e.g., lack of transmitted eye contact, body language). In addition, P12 identifies nine new competencies that digital leaders need, to adequately fulfill the different roles in digital teams. Figure 4.3 shows Quinn's adapted model and highlights the new competencies required.

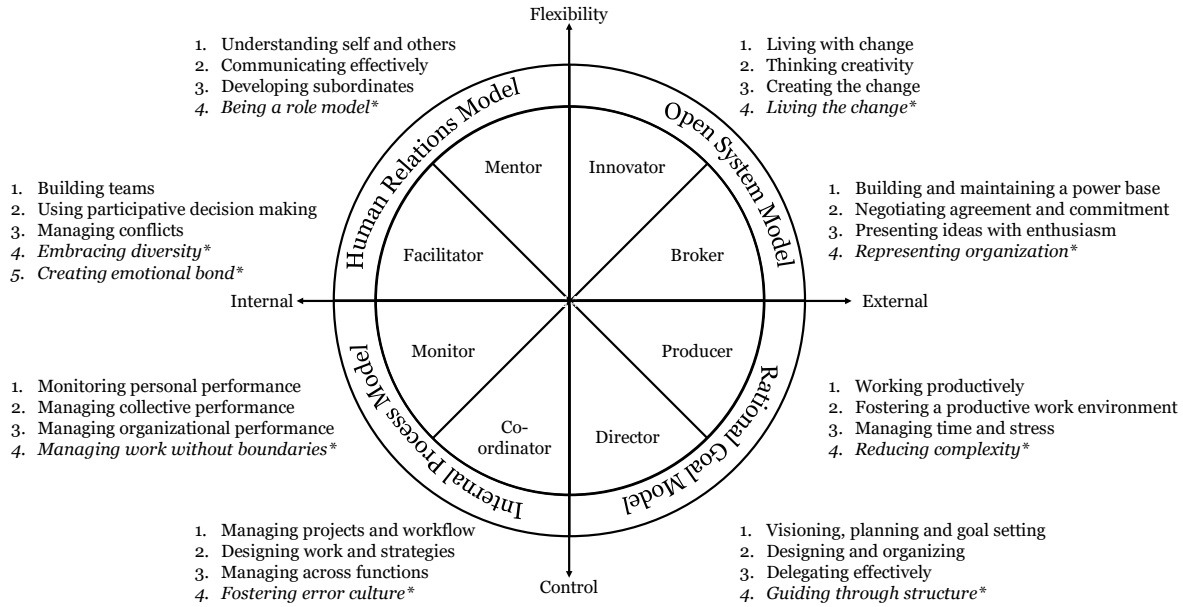

Figure 4.3: Adapted Quinn's Model for Digital Leadership
(Source: Zeuge et al., under review (P12))

Enabling location-independent teamwork increasingly looks to emerging technologies, such as VR (Hatzipanayioti et al., 2019; Mütterlein et al., 2018), which enables multiple users to collaborate in virtual spaces and can support digital and interactive collaboration between teams working at different locations (Alghamdi et al., 2016; Heldal, 2007). P10 explores conditions influencing the intention to collaborate with other users in VR. The identified conditions include technology, task, and user conditions. Those could be further divided into necessary and sufficient conditions. Necessary conditions are the basic requirements for collaboration in VR. However, meeting these conditions does not mean that collaboration will occur. Rather, sufficient conditions ensure collaboration. While all technological conditions represent necessary conditions for collaboration in VR, user-related conditions represent sufficient conditions. However, for task-related conditions, the distinction is twofold. On the one hand, formulation of tasks and transfer of information are necessary conditions, while on the other hand, realistic design of tasks, efficiency through collaboration, and task difficulty are sufficient conditions. Table 4.2 demonstrates conditions influencing the intention to collaborate with other users in VR.

Condition			Example in the VR experiment
Necessary	Technology	Handling	Intuitive use of VR hardware and VR environment
		Details of environment	Perception of crane assembly
		Design of avatars	Perceiving each other as human
		Immersion	Realistic representation of the assembly scenario
		Communication	Exchange-related tasks
Sufficient	Task	Formulation of tasks	Allow collaboration
		Transfer of information	Exchange about the assembly process
		Realistic design of tasks	Require collaboration
		Efficiency through collaboration	Division of tasks
		Difficulty of the task	Need for collaboration
	User	Personal acquaintance	The participants know each other before
		Perspective taking	Taking on the role of the service technician
		Transfer of knowledge	Exchange of experiences and knowledge

Table 4.2: Conditions Influencing the Intention to Collaborate in VR
(Source: Weigel et al., 2021 (P10))

4.1.3 Organizational Perspective

A successful planned digital transformation in organizations should involve users in all project stages (Pan & Mao, 2013). One common concept of user participation relates to key-users, assigned to support other end users and participate in all phases of project implementation (Maas et al., 2016). Thereby, key-users mainly have software know-how and act as trainers, advisors, and change agents (Wu & Wang, 2007). However, key-users have less expertise in the field of digital transformation (Wu & Wang, 2007). P13 demonstrates that the planned digital transformation in organizations requires new participation concepts to make the transformation successful and proposes “influencers” as another participation concept. The primary focus of the digital transformation influencer is on process transformation and sustainability. Since digital transformation projects are better accepted in organizations if the benefits are directly visible in the daily work, influencers can be crucial for the success of those projects. Table 4.3 shows the differences between key-users and influencers for digital transformation projects in organizations.

Concepts	Key-user	Influencer
		
Focus	Software implementation	Process transformation
Role	In the project and the daily business	Mainly in the daily business
Motivation	Extrinsic	Intrinsic
Communication	Request / Response	Publish
Function	Represents professional interests	Promotion of the transformation
Direction	Top-down	Bottom-up
Objective	Sustainability of the software	Sustainability of the process

Table 4.3: Comparison of Key-user Concept vs. Influencer Concept
(Source: Weigel et al., 2021 (P13))

In addition, the planned digital transformation requires new concepts for transferring knowledge across organizational boundaries, e.g., to enable such new business segments as hybrid value chains (Becker & Krcmar, 2008). Hybrid value chains combine machines and services (e.g., maintenance), often represented by multiple organizations (Santos et al., 2015). To enable hybrid value chains, alignment between products and services is particularly important, as different organizations often aim for different goals (Kolk et al., 2008). Therefore, competence transfer between product engineers and service providers can promote understanding of each other's work processes and workflows. However, due to the spatial separation of the organizations, opportunities to transfer knowledge are often lacking. To this end, P14 explores how to develop an interactive VR demonstrator to transfer competencies relating to hybrid value chains (i.e., design processes and maintenance workflows) across organizational boundaries. First, analyzing the existing processes identified workflows, process knowledge, and best practices within each organization. Next came examining the technical requirements for the VR demonstrator. Afterward, a concept to determine how to implement the researched requirements in the VR demonstrator was developed, and on that basis, the VR demonstrator was developed. This process included ongoing evaluations to determine whether the demonstrator met the requirements and aligned with the concept. Recording newly identified requirements in the concept resulted in a total of four iterations. Once no new

requirements emerged, the final step was to discuss the development of the prototype and its further application. Figure 4.4 summarizes the development procedure.

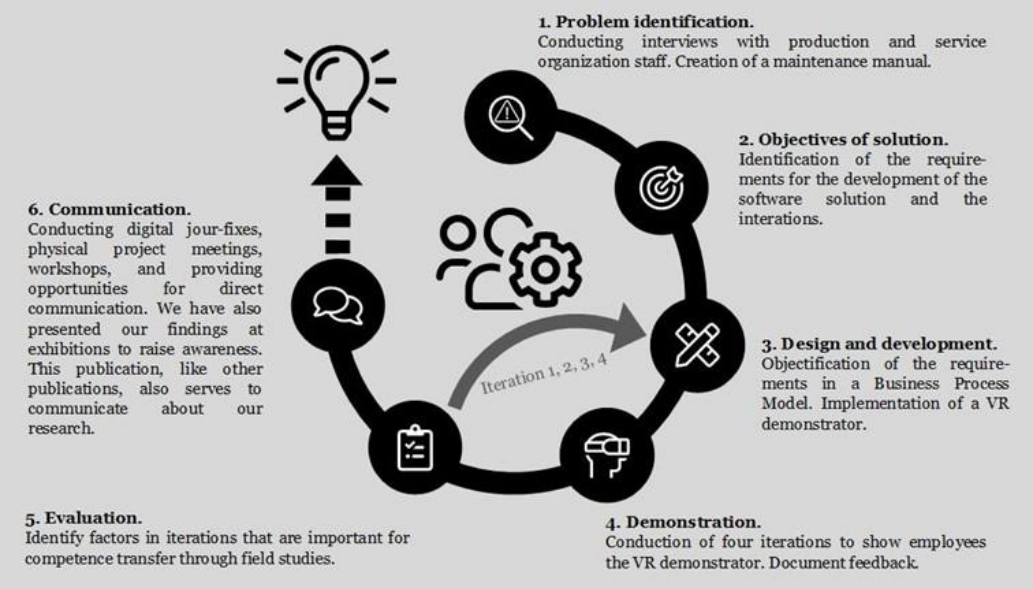

Figure 4.4: Overview and Application of the Design Science Phases
(Source: Weigel et al., 2022 (P14))

The findings of the four iterations appear in Figure 4.5. The study shows that VR can contribute to location-independent and cross-organizational knowledge transfer, by enabling the perspective of the other organization, the transfer of tacit knowledge, and collaboration between organizations. Furthermore, the research paper shows that although the use of VR disrupts work processes, the advantages of competence transfer outweigh this downside.

Iteration	Research object	Key finding
1	Perspective taking	VR can help designers add a service perspective to their general understanding of how their designs work. Environmental conditions or specific designs can be simulated and tested virtually. The lack of understanding of these specific conditions is reinforced by VR and perspective taking across organizational boundaries.
2	Tacit knowledge transfer	VR offers potentials to support the transfer of tacit knowledge in organizations. While in the past the transfer of tacit knowledge was often considered at the level of individual employees in an organization, these research results now enable the consideration of interrelated value creation processes across organizational boundaries.
3	Interruptions	To fully exploit the potential of VR use, one must also address the threatening side effects. Only if VR use is seen as beneficial, it will be used in reality. The research shows that work processes (in our case CAD processes) can be intentionally interrupted by VR use to gain an advantage, provided that the use of VR adds value.
4	Collaboration	Collaboration in VR is a promising method to share experiences between designers and service technicians. This could be defined in terms of technology, task, and user-related aspects.

Figure 4.5: Summary of the Most Significant Findings from the Four Iterations
(Source: Weigel et al., 2022 (P14))

4.2 Crisis-driven Digital Transformation of Work

4.2.1 Individual Perspective

The crisis-driven digital transformation of work due to COVID-19 has affected the work of individuals. P3 demonstrates that the fact that many employees must work from home conditions the digital stressors they face. Some of the digital stressors of on-site workplaces are similarly present in home-office environments. For example, the unavailability of ICT and the associated negative consequences (e.g., loss of productivity) are also perceived as stressful by employees working from home. However, most digital stressors, such as “invasion,” are perceived more intensely in the forced home office because the boundaries between personal and professional life blur, and remote workers feel the need to be available to their colleagues during breaks or after work. However, the digital stressor “insecurity” was not identified, presumable due to the generally high level of job insecurity in times of the pandemic and no specific insecurity about someone with greater ICT affinity replacing the individual. In

addition, a new digital stressor was identified, namely, lack of social connectedness. Due to the spatial distance, communication and teamwork take place exclusively by means of ICT, which only transmits gestures, facial expressions, and body language to a limited extent. Social distance arises between employees, their superiors, and their organization reinforced by the fact that opportunities for spontaneous and personal exchange disappear (Herath & Herath, 2020; Lepsinger & DeRosa, 2015). The identified reactive stress-management measures can be used to manage digital stress in the home office ad hoc (e.g., listening to music). In addition, numerous proactive stress-management measures were identified that both employees (e.g., leisure ritual to introduce the after work) and the organization (e.g., introduction of care calls) can take, to avoid digital stress in enforced home office.

Forced home office and contact restrictions also hamper networking opportunities, e.g., at conferences, lectures, and meetings. Many networking events did not continue during the pandemic because traditional ICTs, such as videoconferencing, do not successfully create a sense of presence (Srivastava & Chandra, 2018), build trusting relationships (Sarker et al., 2003), or enable spontaneous communication and interactions (Sarker et al., 2011). However, enabling and participating in networking events is important for employees and organizations. P4 assumes that AR combined with holography offers a way to enable virtual network events that overcome previous shortcomings. To this end, P4 investigated arguments in favor of, neutral toward, or against the use of AR and holography for location- and time-independent networking. Table 4.4 provides an overview of these arguments.

Arguments ...		
In favor	**Neutral**	**Against**
Digital alternative with great potential	Age	Unreal persons
Social media channels as basis	Competencies	Forced atmosphere
Mutual visibility	Gestures and facial expressions	Lack of technical feasibility of AR and holography
Greater humanity than 2D applications		Much technical equipment required
Part of own environment		
Networking in small groups creates intimacy		
Alternative for people with Cave Syndrome		
Benefits in terms of finances and time		

Table 4.4: Overview of the Identified Arguments in Favor, Neutral, or Against the Use of AR and Holography for Networking (translated into English)
(Source: Schaefer et al., 2022 (P4))

Before the COVID-19 pandemic, much knowledge work could not be digitalized because it was assumed that process requirements (i.e., sensory, relationship, synchronism as well as identification and control requirements) could not be met (e.g., Eisenberg & Krishnan, 2018; Nor'a & Ismail, 2019; Robert et al., 2009). However, the COVID-19 pandemic demonstrated that almost all knowledge work processes can be digitalized. Building on PVT, P7 outlines how ICT has fulfilled knowledge work process requirements during the pandemic. The paper develops an expanded crisis-driven revisited perspective on PVT. In the expanded crisis-driven revisited perspective on PVT the dependent factor "process virtualizability" turns into a prerequisite (established Process Virtualization; cf. Figure 4.6). Here, P7 demonstrates that the ICT characteristics of PVT (representation, reach, monitoring capability) help to fulfill knowledge work process requirements in a crisis-driven digital transformation. In addition, social presence and situation awareness were highlighted as additional ICT characteristics that positively support that fulfillment.

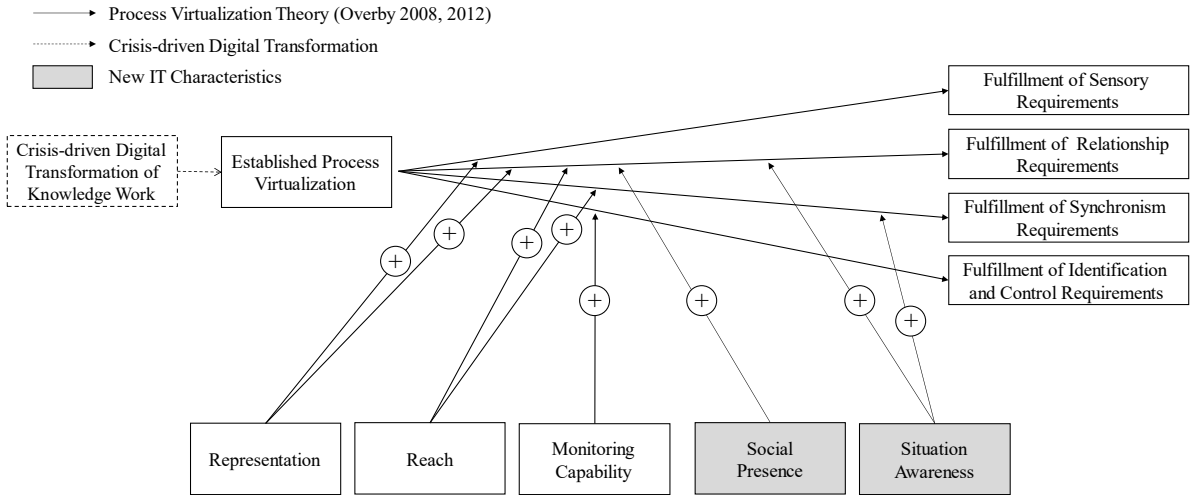

Figure 4.6: An Expanded Crisis-Driven Revisited Perspective on Process Virtualization Theory
(Source: Zeuge et al., under review (P7))

4.2.2 Team Perspective

It became apparent that maintaining and strengthening cohesion of teams is especially important in the context of crisis-driven digital transformation (P9, P11). In situations that require immediate and unexpected digitization, such as during the COVID-19 pandemic, it becomes even more important for leaders to foster team cohesion across spatial and temporal distances (AbuJarour et al., 2021; Whillans et al., 2021). To this end, P9 highlights measures that leaders can implement to foster team cohesion. Those measures were subdivided into those strengthening team cohesion on the job (i.e., during working hours) and off the job, (i.e., in break times or after work). An overview of these measures and examples of their implementation appears in Table 4.5.

	Measures		Examples
„On the Job"	Exchange	Substantive exchange	Regular virtual meetings Bilateral exchange
		Interpersonal exchange	Care calls Instant personal exchange
	Communication	Communication patterns	Unambiguous communication Transfer physical communication patterns to virtual
		Technical communication	Turn camera on Avoidance of digital wallpaper
	Team interaction	Team-Team	Availability in core hours Keeping agreements
		Leadership-Team	Celebrating achievements Merchandise by post
„Off the Job"	Break Times	Socializing	Virtual coffee roulette Permanent virtual break room
		Sport	Virtual yoga class Virtual office gymnastic
	After-work	Sport event	Virtual run Virtual challenges
		Virtual game night	Virtual escape rooms Virtual online games
		Virtual regulars table	Virtual drink tasting and cooking Virtual concerts

Table 4.5: Overview of Selected Best Practices
(Excerpts from Zeuge et al., 2021 (P9))

P11 demonstrates that digital teams that worked digitally before the pandemic also must adapt team cohesion measures in times of enforced home office. To this end, the study highlights key differences between team cohesion measures before and during COVID-19. Before the crisis, team-cohesion strengthening measures conducted "on the job" were mainly task-oriented, to strengthen commitment to the team task. However, in times of crisis, the focus is on social-cohesion measures to promote personal exchange (e.g., time for personal exchange in jour fixes) and a feeling of being together (e.g., turning on the camera). Before the crisis, breaks

were spent individually in digital teams. However, in times of the pandemic, measures to strengthen social team cohesion become more important. To this end, measures that promote both spontaneous (e.g., virtual lunch breaks) and planned exchanges (e.g., virtual sporting events) are implemented. Prior to the crisis, planned after-work events promoted social team cohesion (e.g., Christmas parties). In times of social isolation and distance, these are transferred to digital venues (e.g., digital Christmas parties) and supplemented by new digital events (e.g., digital game nights). In addition, opportunities for spontaneous exchange after work are introduced. Figure 4.7 summarizes how crisis impacts team cohesion of digital teams.

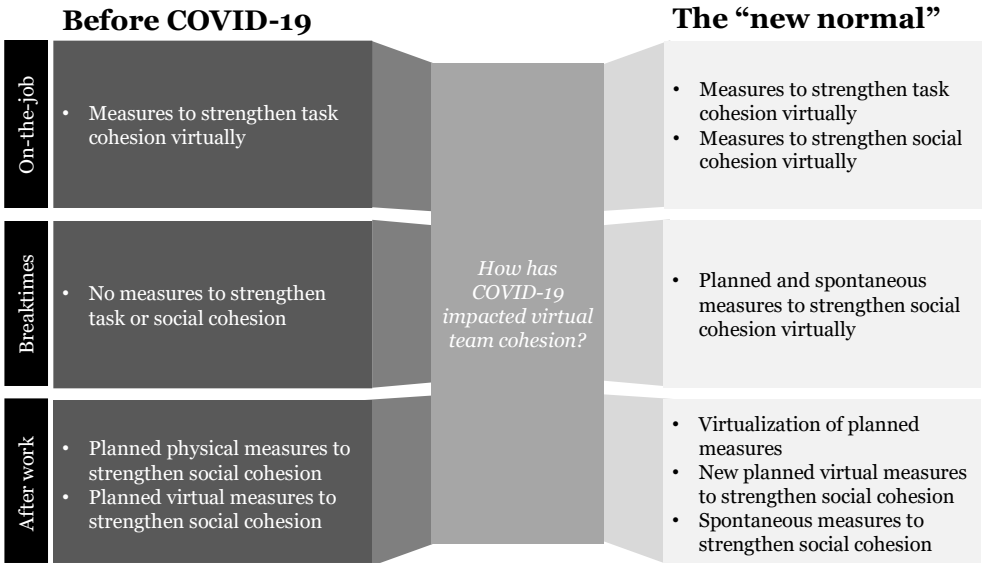

Figure 4.7: The Impact of COVID-19 on Digital Team Cohesion in Digital Teams
(Source: Zeuge et al., 2022 (P11))

4.2.3 Organizational Perspective

From the organizational perspective, P15 demonstrates that organizational commitment is a crucial factor to preserve the benefits of crisis-driven digital transformation and associated digital collaboration in SMEs (e.g., the recruitment of skilled workers regardless of their location). For successful digital collaboration, it is important that SME's take action to ensure digital participation of employees. Even digitally employees need to feel part of the organization, identifying themselves with the organization's values and goals and feel appreciated. When employees don't feel tied to the organization, digital work puts them at a higher risk of turning to other organizations. This occurs unnoticed for their company and managers. Study P15 further indicates that organizational commitment can be maintained during digital work, however fostering organizational commitment requires on-side collaboration.

5 Conclusion and Discussion

This section summarizes the major findings of this cumulative thesis, answers the RQs, and discusses contributions to theory and practice. In addition, the overall limitations of this thesis are highlighted and avenues for future research are identified.

5.1 Conclusion

The main aim of this cumulative thesis comprising several related studies is to provide insights into planned and crisis-driven digital transformations of work. Figure 5.1 summarizes the findings regarding the three proposed RQs (cf. Section 1.2), and more detailed answers follow.

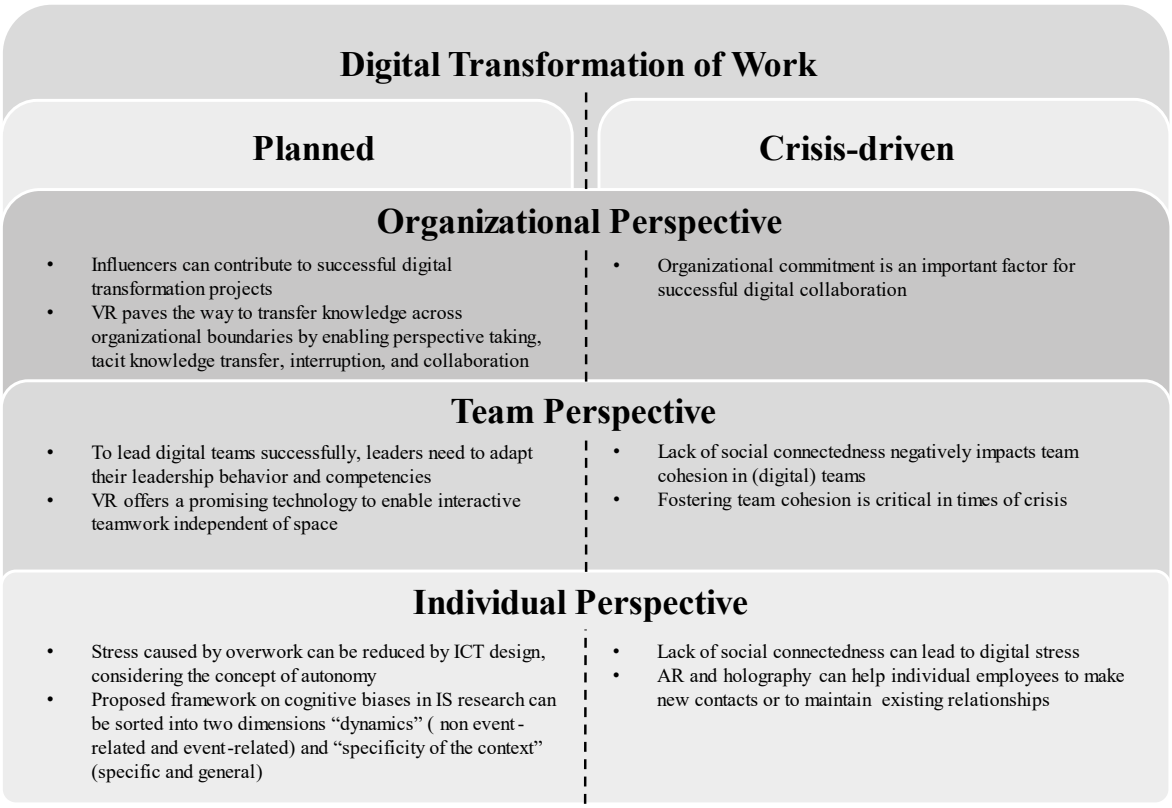

Figure 5.1: Overview of the Major Findings

Regarding RQ1 (*How does the digital transformation of work affect individuals, and how can they be supported?*), the planned digital transformation of work can both negatively and positively affect individuals' work (e.g., Fischer & Riedl, 2020; Klesel et al., 2018; Oschinsky et al., 2019). On the one hand, the ubiquity of ICT can increase digital stress, due to such causes as overload, invasion, or performance monitoring (Gimpel et al., 2019; Tarafdar et al., 2011). On the other hand, ICT can be purposefully designed to reduce individuals' stress caused by overwork (P6). Here, one design-relevant factor in reducing stress is the concept of autonomy (P6). Further, taking cognitive biases into account is important for improving our

understanding of the acceptance and use of ICT in the workplace (Fleischmann et al., 2014). To this end, the proposed framework enables further research on cognitive biases by sorting them in a meaningful way (P2). The crisis-driven digital transformation of work poses special challenges to individuals (Di Gangi et al., 2021). The lack of social connectedness in the crisis-enforced work in a home office can lead to digital stress among individuals (P3), and stress-reduction measures must be adapted to the respective crisis (P3). Emerging technologies, such as AR and holography, can help individual employees make new contacts or maintain existing relationships (P4). However, the crisis-induced digital transformation has also brought about positive changes by demonstrating that knowledge work processes that were considered non-digitizable before the crisis can indeed be digitized (P7). Here, the ICT characteristics of the expanded crisis-driven revisited perspective on PVT (representation, reach, monitoring capability, social presence, situational awareness) can help to meet the requirements for digitization of knowledge processes (P7).

In response to RQ2 (*How is digital transformation changing teamwork, and how should leaders respond?*), findings confirm that digital teamwork is of fundamental importance for the success of digital transformation of work. Accordingly, leaders must adapt to the digital environment (e.g., being present, managing work without boundaries) (P8). Further, digital leaders must adapt their competencies to the digital environment and acquire new ones (being a role model, embracing diversity, creating emotional bonds, managing work without boundaries, fostering error culture, living the change, representing the organization, reducing complexity, guiding through structure) (P12). To perform interactive teamwork digitally, which previously only took place on-site, VR offers a promising alternative (Hatzipanayioti et al., 2019; Mütterlein et al., 2018). In the event of the crisis-driven digital transformation of teamwork, maintaining and strengthening team cohesion merits special attention (P9, P11). Leaders should take measures to promote team cohesion in teams that have not previously worked digitally, as well as in teams that have already done so (P9, P11).

Responding to RQ3 (*How are organizational structures changing in the context of the digital transformation of work?),* many organizational structures aim to implement digital transformation projects successfully (P13, P14). These include reconsideration of existing participation concepts (P13). Here, for a successful implementation of transformation projects throughout the organization, influencers who are intrinsically motivated can help pursue sustainability of the process and promote transformation in the organization (P13). In addition, for the successful implementation of digital transformation projects, cross-organizational

knowledge exchange is increasingly gaining importance (Becker & Krcmar, 2008). Here, VR offers a promising approach by enabling perspective-taking, tacit knowledge transfer, interruption, and collaboration (P14). To ensure that the benefits of crisis-driven digital transformation and associated digital collaboration are long-lasting, sustaining organizational commitment in SMEs is critical (P15).

5.2 Contributions to Theory

Overall, the findings of this cumulative thesis make three main theoretical contributions to the research on planned and crisis-driven digital transformation of work.

First, this thesis provides new insights into the planned digital transformation of work. Among other aspects, it shows how ICT design can reduce individuals' stress due to overwork, considering the concept of autonomy (P6). Thus, this thesis reinforces that the design of work-related ICT can improve the well-being of individual employees (Laschke et al., 2020). From a team perspective, this thesis presents an overview of how leaders must adapt their behaviors and competencies to lead digital teams appropriately (P8, P12). Furthermore, in line with the literature, this thesis confirms that VR is a suitable technology to enable interactive collaboration within teams at a distance (Heldal, 2007; J. Li et al., 2020; Mütterlein et al., 2018). Here, this thesis generates new knowledge on how to increase the intention to collaborate in VR, by proposing necessary and sufficient conditions for doing so (P10). From the organizational perspective, this thesis demonstrates that VR is also a suitable technology for transferring competencies across organizations by enabling perspective taking, tacit knowledge transfer, interruption, and collaboration (P14). Furthermore, this thesis proposes the "influencer" as a new participation concept in successfully implementing digital transformation projects in organizations (P13).

Second, this work contributes to the body of knowledge on crisis-driven digital transformation and, with several research papers (P3, P4, P7, P9, P11, P15), expands the previously rather one-sided research on the planned digital transformation of work. Thus, this thesis makes an important contribution to the emerging research stream of crisis-driven digital transformation and, thus, addresses the call for research (Di Gangi et al., 2021). Not only the COVID-19 crisis but also other current crises, such as the energy crisis in Germany or the war in Ukraine, underline the relevance of examining the crisis-related digital transformation of work. This thesis takes a multi-perspective approach and demonstrates how crisis-driven digital transformation affects the work of individual employees, teams, and organizations.

Third, this thesis underscores the critical role in crisis-driven digital transformation that social connection plays at the individual (P3, P4, P7), team (P9, P11), and organizational levels (P15). With immediate and unexpected digital transformation, most employees no longer have the opportunity to interact socially with their colleagues, leaders, or externals, in spontaneous or informal exchanges (Deloitte, 2020), which can negatively impact employee well-being and health (Kniffin et al., 2021). This thesis provides new insights into which reactive and proactive measures can help them to deal with and reduce the resulting stress (P3). Further, this thesis also demonstrates that ICT can support the feeling of individuals' social presence (P7). For instance, AR and holography can be suitable technologies for creating new contacts or maintaining existing relationships (P4). From a team perspective, this thesis shows that the lack of social connection in times of crisis has a negative impact on team cohesion (P9, P11). Here, it provides new knowledge about maintaining team cohesion in (digital) teams during crises (P9, P11). From an organizational perspective, this thesis indicates that organizational commitment is an important factor for successful digital collaboration in SMEs (P15).

5.3 Contributions to Practice

This thesis provides several practical implications for the planned digital transformation of work.

First, it shares insights into factors that influence the acceptance of planned strategic digital transformation projects. Here, this thesis confirms that cognitive biases influence the acceptance of digital transformation projects (L. Li et al., 2018; Oschinsky et al., 2021). The developed framework can help organizations to analyze relevant employees' cognitive biases, to better understand them and develop countermeasures (P2). In addition, suitable team leadership behavior is crucial for the acceptance of digital transformation projects. This thesis shows which behaviors leaders should adopt and which competencies they must acquire to support digital teams (P8, P12). Organizations can use these findings to take steps to raise awareness of such behaviors and competencies and ensure their acquisition. Furthermore, this thesis demonstrates that digital transformation projects are better accepted when their benefits are directly visible to all employees in their day-to-day business (P13). By integrating influencers, the projects, their objectives, and their benefits for work processes are communicated with a wide reach that, in turn, can convince end-users of the change.

Second, this thesis highlights important aspects that VR developers and designers must consider when developing VR environments to support the planned digital transformation of

work. This thesis outlines necessary and sufficient conditions to support interactive digital collaboration between team members (P10). For example, it is a necessary condition that the formulation of the task allows for collaboration between users. However, the fact that the VR environment allows for a change in perspective can increase the chances that users will collaborate. In addition, this thesis outlines aspects to consider to enable cross-organizational knowledge transfer in the VR environment (P14). For example, the VR demonstrator should support the acquisition of tacit knowledge, enable perspective taking, and ensure collaboration across organizational boundaries.

Third, this thesis provides insights into improving the well-being of employees. It demonstrates that technology design can reduce the stress that overwork causes (P6). To this end, organizations should use nudging techniques (e.g., reminders in the form of superimposing family pictures on screen) rather than restricting email access. Furthermore, appropriate leadership also plays a decisive role (P8, P12). In digital teams, leaders must be attentive and sensitive to employees' well-being (P8, P12). This thesis outlines suitable behaviors and competencies that leaders should acquire, to perceive and influence well-being across space and time (P8, P12).

Furthermore, this thesis provides guidance to help employees, teams, and organizations to manage the crisis-driven digital transformation of work.

First, it offers approaches to supporting individual employees in the crisis-driven digital transformation. It can help to improve the awareness and management of digital stressors in the enforced home office (P3). To this end, the work provides both reactive (e.g., watching entertainment or relaxation videos, listening to music) and proactive (e.g., care calls, workshops, leisure rituals) measures that employees and organizations can take to prevent or reduce digital stress. In addition, this thesis provides an indication of the potential that AR and holography offer to help employees in crisis make new contacts and maintain existing relationships (P4). The results underscore the relevance for AR/holography developers and organizations of continuing to pursue location-independent networking. Further, this thesis provides insights into implementing ICT to fulfill knowledge work process requirements (i.e., sensory, relationship, synchronism as well as identification and control requirements) of individuals when the enforced home office must start immediately (P7).

Second, this thesis offers various insights into supporting teamwork in times of crisis. In particular, it emphasizes the special role of strengthening digital team cohesion (P9, P11). To

this end, the thesis proposes measures that leaders can implement to strengthen digital team cohesion both on the job (e.g., regular virtual meetings, avoidance of digital wallpaper, celebrating achievements) and off the job (e.g., virtual coffee roulette, virtual online games, virtual tastings) (P9). In addition, there are also implications for digital teams (P11). It shows that even in teams that have already been working together digitally, the needs of the team in terms of team cohesion change as a result of the crisis, requiring adaptation of the measures to strengthen team cohesion. This thesis informs digital leaders how to change team cohesion-strengthening measures on the job (e.g., strengthening social team cohesion digitally), in breaktimes (e.g., implementing spontaneous measures to strengthen social cohesion digitally), and after work (e.g., digitalization of planned measures).

Third, the thesis highlights the relevance of strengthening the organizational commitment in digital collaboration especially in times of crisis (P15). SMEs (as well as larger organizations) are informed by these findings that strengthening organizational commitment is critical to the success of digital collaboration and to sustain the benefits of digital collaboration. At the same time, it is important to acknowledge that organizational commitment can be maintained digitally to a certain extent, carefully appreciating that it cannot be achieved without regular meetings on-side.

5.4 Limitations and Future Research

This cumulative thesis has some limitations that provide promising avenues for future research. However, this section presents the overall limitations of this thesis (Klesel, 2019; Lemmer, 2021; Weigel, 2022); those of each component research paper appear in the respective section of that research paper (cf. Part B).

Since the main objective of this thesis was to provide insights into the planned and crisis-driven digital transformation of work, a diverse range of insights has been provided from a variety of perspectives (individuals, teams, and organizations). While the planned digital transformation underlies continuous change, for example through emerging technologies (e.g., VR, AR, holography), and research on crisis-driven digital transformation is still in its infancy, the findings are not comprehensive. Rather, they serve as another milestone for research on the digital transformation of work. From the organizational perspective, for example, there will be other changing structures due to the planned as well as the crisis-driven digital transformation, not identified in this thesis. This opens the door for future research. For instance, the change in

ICT governance structures to enable digital transformation projects could merit further investigation.

Most of the included research papers have implemented qualitative research that can provide thorough descriptions of emerging concepts and phenomena (Sarker et al., 2013). However, achieving higher levels of generalization and external validity requires quantitative research. Thus, future research can build on the findings and substantiate it with quantitative data. One example could be evaluating the effectiveness of measures for strengthening team cohesion digitally.

In addition, two research-in-progress papers are part of this work. These papers document the idea and objective of the intended research but do not yet offer findings (P1, P2). However, since the proposed research ideas offer promising concepts that affect the work of individuals, the future findings will offer further exciting insights into the digital transformation of work. P1 proposes a research agenda on escapism. As technology provides opportunities to escape unpleasant thoughts and situations at work (e.g., checking one's personal cell phone instead of listening to a meeting), a better understanding of the concept of escapism (e.g., its dimensions) and how we can leverage its upsides and downsides for individuals' work is important. P2 intends to investigate age-related differences in mind wandering while using different types of technology (i.e., hedonic, and utilitarian systems). Since thoughts wander when using technology at work, and mind wandering can have both positive and negative consequences (e.g., Agnoli et al., 2018; Baird et al., 2012; Killingsworth & Gilbert, 2010), it will be important to understand this cognitive concept in more detail. Research demonstrates that individual differences (e.g., Christian et al., 2013; Franklin et al., 2017; Mowlem et al., 2019) - particularly age (Maillet et al., 2018) - can influence the intensity of mind wandering. To take advantage of its positive and avoid its negative aspects at work calls for investigating the impact of age on mind wandering while using technology.

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Part B

Research Papers

I Individual Perspective

6 The Sweet Escape

Title	**The Sweet Escape – A Research Agenda on Escapism in Information Systems Research**
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Publication Type	Conference Paper
Publication Outlet	Proceedings on Digitalization at the Institute for Advanced Study of the University of Siegen
Status	Published
Full Citation	**Zeuge, A.** (2020). The sweet escape - A research agenda for escapism in information system research. *Proceedings on Digitalization at the Institute for Advanced Study of the University of Siegen*. (published).

Table 6.1: Fact Sheet Publication

The Sweet Escape – A Research Agenda on Escapism in Information Systems Research

Abstract. Escapism is often defined as temporally getting away from unpleasant situations or thoughts. Since technology creates new opportunities to escape from something unpleasant, the interest in studying escapism has recently increased in information system (IS) research. However, despite growing interest on escapism, research is still in its very beginning stages. To explore IS phenomena more comprehensively this paper proposes a research agenda that highlights current shortcomings and the need to address these shortcomings. Thus, this paper provides point of departure for future research on escapism and encourages IS-research to further investigate the effects of escapism in IS-related settings.

Keywords. Escapism · Escaping · Information System Research · Research Agenda · Technology Use.

6.1 Introduction

Popular forms of daily escaping-activities are watching TV, listening to music, reading books or online gaming (Warmelink et al., 2009). They all allow us to go from somewhere we don't want to be, to somewhere we do (Evans, 2002). Since Germans spend an average of 236 minutes per day watching TV, 36 minutes per day listening to music, 26 minutes reading books and 30 minutes per day with gaming (SevenOne Media 2019), they are escaping a lot of their waking time (Warmelink et al., 2009).

Literature defines escapism as a way to escape from unpleasant realities or distract attention from problems (Li et al. 2013; Young et al. 2017). Since escapism is often referred as unhealthy, it is considered as negative, both within academic and popular views (Calleja, 2010; Warmelink et al., 2009). More current literature shows that escapism also includes positive aspects. This literature suggests that escaping provides a way for transient mental retreat (Siricharoen, 2019; Vorderer et al., 2004) and therefore can be stress relieving (Kuo et al., 2016; Warmelink et al., 2009). Evans (2002, p. 75) notes that "as escapism appears to be a natural mechanism, the mind must have need for it".

Technology offers new opportunities to escape (Siricharoen, 2019) and therefore allows us to escape from situations one could not escape from without it (Cahir & Werner, 2013). For example, using the mobile phone to play online games allows to escape from unpleasant situations such as being preoccupied with unpleasant thoughts. Since escaping from specific situations is a natural and omnipresent behaviour, IS researcher started to acknowledge the

ubiquity and relevance of escapism and demonstrated that escapism can influence acceptance, adoption and use behaviour of technology (Hartl & Berger, 2017; Holsapple & Wu, 2007; Li et al., 2013; Yee, 2006).

Despite the first valuable efforts to show that the concept of escapism is relevant in various domains in the context of IS, research is still in very beginning stages. This paper aims to develop a research agenda that seeks to shed further light on current shortcomings and the need to address them. Therefore, this work provides a point of departure for further research and encourages IS-research to investigate the effects of escapism in IS-related settings including technology acceptance adoption and use behaviour in more detail.

In order to address the objective, the subsequent sections are structured as follows: In section two, existing research is briefly described. In section three, the research agenda is proposed.In section four, contributions of this research are highlighted.

6.2 Theoretical Background

There is no established definition of escapism so far (Evans, 2002; Kuo et al., 2016). Escapism is oftentimes defined as a behaviour to escape or distract oneself from something unpleasant (Hirschman, 1983; Young et al., 2017). Escapism is also understood as "get [temporally] away from it all", often involving an element of "pretend" (Huizinga 1949 as cited in Mathwick et al. 2001, p. 44). More current literature describes escapism as the need to avoid thinking about real life problems (Xu et al., 2012; Yee, 2006). Since there is no established definition, we refer to Yee (2006), Xu et al. (2012) and Young et al. (2017) and define escapism as a behaviour that occurs when individuals use information technology (IT) to temporarily escape from uninteresting or unpleasant aspects of reality and instead think about or do more pleasant things.

There are two motivation types to escape from reality: Cause-based and effect-based motivations (Warmelink et al., 2009). Caused-based motivations serve the purpose of negating an element in life (Warmelink et al., 2009). For example, people escape due to their desire to get out of their routine or demands of the day-to-day world (Li et al., 2013; Wu & Wang, 2011) or to release stress (Kuo et al., 2016). Another cause-based motivation is to distract attention from real-life problems or avoid hinking about real-life problems (Hartl & Berger, 2017; Korkeila & Hamari, 2018; Weiss, 2011; Yee, 2006). Effect-based escapism (e.g., pleasure

seeking or imagination conjuring) allows people to transcend reality by pursing an activity or fantasy (Warmelink et al., 2009).

Escapism is often used in a highly negative discourse (Warmelink et al., 2009) because it is considered to be a contributing factor for alcohol and substance abuse (Aldwin & Revenson, 1987; Chambers et al., 2005). Moreover, it has been associated with unhappiness, isolation, high anxiety levels, dissatisfaction, and addiction (Hirschman, 1983; Meier et al., 2018; Warmelink et al., 2009; Xu et al., 2012). More recent literature demonstrates that escapism also provides a way for mental relaxation and therefore can release stress (Kuo et al., 2016) and improve mood (Hoffmann et al., 2017). Evan (2002, p. 55) notes that escapism is often seen as a "voluntary way of getting to the part of their brain that is most happy, pleased and relaxed, whether through activity or by not doing nothing". In line with this positive understanding, escapism can lead to positive feelings and amusement (Jung & Kang, 2009).

Escapism can be operationalized as a state and trait because it is both a personality trait to tend to engage escape from something unpleasant, but also a pattern of escaping in respect to a given situation (Hartl & Berger, 2017; Warmelink et al., 2009).

Existing literature distinguishes four types of escaping-activities (Evans, 2002; Kuo et al.,2016; Siricharoen, 2019; Warmelink et al., 2009): Evasive escape-activities comprise all activities to avoid another activity e.g., walking out of an argument. Active escaping-activities e.g., playing computer games, describe a participative or collaborative form of escapism requiring an actual input from the escapist. In contrast, passive escaping-activities denote a non-participative form of escapism i.e., the escapist acts as passive observers from a third person perspective. The fourth form are extreme escape-activities: They denote a problematic form of escapism as they encompass dangerous and challenging activities e.g., excessive computer gaming.

Escaping-activities can significantly differ in their duration. The time horizon can range from the short-term postponement of an action to the medium-term postponement or avoidance of feelings to the lifelong suppression of certain questions (Kohler, 2014).

Emerging technologies allow us to withdraw problems from reality into the virtual world and therefore offer new opportunities to escape (Siricharoen 2019). For example, virtual reality (VR) glasses induce presence, a sense of being in another environment, and therefore offer escapists an enjoyable experience by immersing them in an arguably more favorable virtual environment (Hartl & Berger, 2017). Thus, IS research has recently acknowledged the relevance of escapism and first attempts have been made to demonstrate that escapism can

influence acceptance, adoption and use behaviour of technology. For example, Holsapple and Wu (2007) identified escapism as an emotional factor underlying an individual's intention to accept virtual worlds. Hartl and Berger (2017) showed that escapism as a distinctive personal trait determines the adoption of VR glasses. Parker and Plank (2000) found that escaping predicted internet usage. Li et al. (2013) demonstrated that escapism strengthens influence on an individual's continuous intention to use social network games. Figure 6.1 summarizes the different dimensions of escapism embedded in a technology related-context.

Despite the valuable first efforts to investigate escapism in IS context, research is still in it very beginning stages.

Therefore, in order to assist future research in this field, a research agenda is developed, highlighting current shortcomings and the need to address these shortcomings.

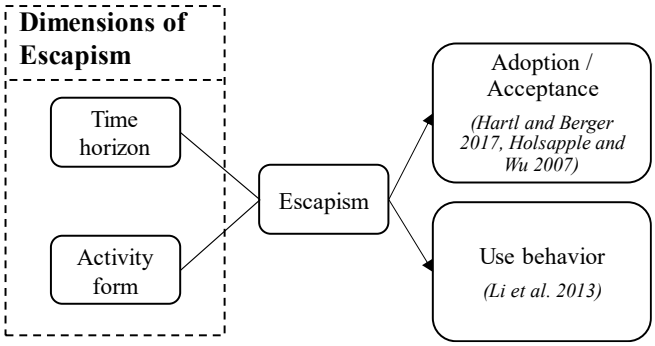

Figure 6.1: Escapism in Technology Related Context

6.3 Research Agenda

Although IS-research is increasingly considering escapism, there is a lack of conceptual clarity. For example, Young et al. (2017, p. 25) define escapism as "a behaviour employed to distract oneself from real life problems". In turn Thiruchselvam et al. (2011, p. 84) define distraction as a state of "deploying attention away from the emotionally salient aspects of an emotion-eliciting event". Since both definitions imply that attention is diverted away from something unpleasant, the definitions overlap, and it remains unclear how escapism and distraction can be separated. Furthermore, Evans (2002) defines procrastination as an unhealthy form of escapism. In contrast Meier et al. (2018) define escapism as "a dysfunctional avoidance coping response to negative life circumstances" while the authors define procrastination as "a self-regulatory failure rooted in low self-control". Therefore, it remains unclear if procrastination is an unhealthy form of escapism or if escapism and procrastination are two distinct concepts.

The lack of conceptual clarity impedes theory development. Therefore, it is important to separate escapism from related constructs including distraction and procrastination. Consequently, we raise the following research question:

Question 1: What are the idiosyncratic characteristics of escapism and how can escapism be separated from related constructs including distraction and procrastination?

With an increasing body of knowledge, two dimensions of escapism have been identified: the escaping-activity form (e.g., evasive, active, passive, extreme) and the time horizon (e.g., short-, middle-, long-term). Since research on escapism is still at its beginning stages, there could be more dimensions that are not considered yet. For example, there could be a differentiation between hedonic and utilitarian escaping-activities. Most escaping-activities listed in literature are hedonic, for example gaming or watching TV. However, Evans (2002) gave the example that escaping could also mean to do more pleasant tasks before pressing ones, which could be considered as a utilitarian escaping-activity. Moreover, there is a lack of literature investigating if individuals are always aware of their escaping behaviour. Investigating and understanding the diversity of escapism is an important step to study the effects of escapism on IS-related phenomena in more detail. In this context we raise the following research question:

Question 2: Are there any additional dimensions of escapism?

IS research has started to acknowledge the mentioned dimensions. For example, Kuo et al. (2016) developed a conceptual framework for active escapism, which comprises antecedents, processes, and consequences of active escapism in the context of video game consumption. Warmelink et al. (2009) developed a framework that assigns cause-based and effect-based escaping motivations to the different escaping activities. Despite these valuable first efforts to understand the different escaping dimensions, there is a lack of literature, investigating the influence of the different dimensions on IS related phenomena. To fill this gap is an important step to a better understanding of acceptance, adoption and use behaviour. Against this background, we raise the following research question:

Question 3: How do the different dimensions influence IS-related phenomena including acceptance, adoption and use behaviour?

First valuable attempts have been made to measure escapism. For example, Lee et al. (2004) developed a measurement instrument to study escapism in the domain of tourism. Chung et al. (2012) adopted and refined this measurement instrument by adding the item “Getting a change

from a busy job." Xu et al. (2012) developed a measurement instrument to investigate escapism as functional need that drives online game playing and addiction. Hoffmann et al. (2017) introduced the concept of escapist Facebook use and developed a measurement instrument to investigate escaping-behaviour while using Facebook.

However, an established measurement instrument that accounts for the richness of escapism is still missing so far. Existing scales are limited in terms of addressing the stability (i.e., state or trait) and the different dimensions (i.e., escaping-activity and time horizon). These shortcomings are critical, as valid, and reliable measurement instruments are a prerequisite for theorizing and theory development (Gregor, 2006, 2014; MacKenzie et al., 2011; Moore & Benbasat, 1991). A valid and reliable measurement instrument encourages IS research to further investigate the effects of escapism in IS-related settings. In this context we raise the following research question:

Question 4: How should existing instruments be modified to consider the different dimensions of escapism?

6.4 Contribution

This work aimed to advance research on escapism by developing a research agenda highlighting current shortcomings and the need to address these shortcomings. Since escapism is a natural and omnipresent behaviour, our research will contribute to theory and practice alike:

From a theoretical perspective, future research on escapism in technology-related settings can benefit from this research agenda as a point of departure. The investigation of escapism is an important step to a more holistic understanding of IS-related phenomena in various domains, such as use behaviour, acceptance, and adoption research. Moreover, research on important job outcomes (e.g., productivity) can benefit from investigating escapism in more detail.

Investigating escapism is also beneficial from a practical perspective. It provides important insights in the usefulness of escaping-activities. Therefore, it contributes to a better understanding, how organizations should take escapism into consideration when designing future workplaces. To be more precisely, research on escapism extends knowledge how to give more room for escapes, for example by including hedonic aspects in employees working environment.

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7 Cognitive Biases in IS Research

Title	**Cognitive Biases in IS Research: A Framework Based on a Systematic Literature Review**
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Publication Type	Conference Paper
Publication Outlet	Proceedings of the 25th Pacific Asia Conference on Information Systems
Status	Published
Full Citation	Godefroid, M., **Zeuge, A.**, Oschinsky, F., Plattfaut, R., & Niehaves, B. (2021). Cognitive biases in IS research: A framework based on a systematic literature review. *Proceedings of the 25th Pacific Asia Conference on Information Systems*. (published).

Table 7.1: Fact Sheet Publication

Cognitive Biases in IS Research: A Framework Based on a Systematic Literature Review

Abstract. Cognitive biases are worth considering in Information Systems (IS) research because they explain non-rational usage behavior and extend scientific understanding. Since the first publication in 1994, many papers in major IS outlets have appeared. However, although IS researchers increasingly acknowledge several specific biases (e.g., framing), other biases remain largely neglected (e.g., reference point dependency). In this article, we compile existing literature to create an overview of the growing body of IS research on cognitive biases. On this basis, we propose a framework that focuses on distinct biases regarding the IS topic they affect. Our framework will allow for more systematic research and analysis of the non-rational behavior of developers, managers, and users of information technology. Thereupon, future research will close existing theoretical gaps, e.g., the systematic combination with technology acceptance models. Besides, we also highlight tangible implications for practitioners.

Keywords. Cognitive Biases · IS Research · Framework · Literature Review · Introduction.

7.1 Introduction

Cognitive biases are important to Information Systems research as the bounded rationality concept is essential in understanding human behavior (Lee and Joshi 2017; Simon 1955). Cognitive biases describe behavior where "individuals draw inferences or adopt beliefs where the evidence for doing so in a logically sound manner is either insufficient or absent." (Haselton et al. 2015, p. 2). Researchers have traditionally explained human behavior with models based on the rational choice assumption. Rational choice models hold a unique appeal, being clear and simple. They were introduced to our domain with the Technology Acceptance Model (TAM) with its variables perceived usefulness and perceived ease of use that builds on the theory of reasoned action by Ajzen and Fishbein (Ajzen and Fishbein 1980; Davis et al. 1989). But rational choice models do not explain various human behaviors that are not rational (Boudon 1998). Exploring non-rational behavior is therefore relevant to IS research on two levels: Firstly, considering both rational and non-rational elements helps to increase the explanatory power of models and explanation approaches (Lee and Joshi 2017). Secondly, as for the example, the conceptualization of the status quo bias – a non-rational preference for the current situation – together with technology acceptance constructs by Kim and Kankanhalli (2009) shows that we need a IS specific research approach for cognitive biases. Such an IS specific approach is relevant to establish common ways to measure a bias in IS, ensure a correct combination with existing concepts and guide future research.

The psychologists Tversky and Kahnemann (1973) introduced cognitive biases with three initial heuristics as a starting point for later researchers, who have since discovered many biases. They introduced the first heuristic in an experiment where they showed that participants falsely guessed the probability of an event because they relied on the "availability" of related information (availability heuristic). The representativeness heuristic describes an effect where participants of experiments assess the likelihood of a student belonging to a specific group not based on the overall statistical probability, but rather on how much the student's description represents a certain class (Tversky and Kahneman 1974). Tversky and Kahneman (1974) also demonstrated how unrelated numerical anchors heavily influence participants guessing a city's population (anchoring and adjustment heuristic). To date, there are numerous publications on cognitive biases, and a large number of biases have been identified by different disciplines, from management studies (Das and Teng 1999) to design science (Arnott 2006). For example, Arnott (2006) mentioned 37 biases, Burow (2010) found 19 biases, Browne and Parsons (2012) discuss ten biases. Efforts concentrated on bias collection and classification have found even more biases, e.g., Benson (2019) identified 188 biases. This large number of biases in research indicates that cognitive biases are indeed relevant to current research.

Cognitive bias research has reached a significant level in IS research, with more than 50 biases studied to date. The first IS publication targeting cognitive biases by Keil et al. appeared in 1994. It looked at sunk cost, self-justification, and irrational escalation in the context of technology project management (Keil et al. 1994). Since then, a continuous stream of research has looked at more than 50 different biases (e.g., framing, anchoring, reactance). This reflection of biases in IS research amounts to approximately 1/4 of biases identified in research in general. It shows the relevance of cognitive biases to explain, for example, non-rational aspects of technology use behavior as well as to broadening technology acceptance theory. They also improve existing acceptance models and theorizing on technology use across different sectors and are thereby specified for IS research.

No current overview of the IS research field's present state exists, and to date, researchers could not establish an exhaustive framework. The first overview of this growing body of research was an initial scientometric analysis by Fleischmann et al. (2014), which offered an overview until 2012. They identified forty-six cognitive biases and clustered them into eight categories. On this basis, they identified research gaps and promising research questions for further research. This provided a valuable starting point for subsequent researchers in the IS domain to systematically assess additional phenomena and thereby extend the knowledge base. With

the growing number of publications, the necessity for an overarching framework arises to facilitate the identification of related biases in the IS research and meta-research. Although several categorizations of biases have been put forth (Arnott 2006; Burow 2010; Browne and Parsons 2012; Fleischmann et al. 2014), and these have inspired further research (Mohanani et al. 2020) researchers could not yet establish a framework that allows to sort biases in a way not constructed from the biases in question and derive further research insights for all biases in IS on an aggregated level. Closing this gap is important as it allows us to systematically increase our scientific understanding of various IS phenomena, e.g., technology acceptance and thereby advancing the current knowledge and facilitating future research. To achieve this, we conducted an extensive literature review with the following research questions (RQ) and research objective (RO):

RQ1: What is the current state of research on cognitive biases in IS research?

RQ2: Which research designs are researchers using to study cognitive biases in IS research?

Based on these insights, we address our research objective (RO), as we needed an understanding of which and how IS researchers study biases to create a framework to guide future research:

RO: Identify a framework for the cognitive biases relevant to IS research.

In the following, we discuss the theoretical background on cognitive biases and explain the research method in more detail. Moreover, we present the findings and discuss our results in a final section, opening the door for future research.

7.2 Cognitive Biases

Tversky and Kahneman (1974) challenged the established rational choice assumption in research with their cognitive bias theory. The concept of a homo oeconomicus assumes that humans behave completely rationally and can assess their actions regarding merits and costs and constantly aim for utility and wealth. Economics researchers introduced the approach in the late 19th century. It allowed them to illustrate human behavior in parsimonious models with simple assumptions (Persky 1995). Only in the late 20th century, Tversky and Kahnemann challenged those assumptions and introduced cognitive biases as a systematic approach to study human behavioral inconsistencies. In the beginning, Tversky and Kahnemann (1974) identified three types of biases: availability, representativeness, and anchoring and adjustment. In IS research, the first publication on cognitive biases appeared 20 years later, where Keil et

al. (1994) looked at sunk cost, self-justification, and irrational escalation in the context of IT projects. Since then, researchers have studied a significant number of biases.

In 2014, Fleischman et al. provided the first comprehensive overview of cognitive bias research in IS with their scientometric analysis and their categorization of biases. This categorization of biases into the following eight categories was a major contribution of their research: Perception biases, pattern recognition biases, memory biases, decision biases, action-orientated biases, stability biases, social biases, interest biases. One can refer to Fleischmann et al. (2014) for a detailed description.

To date, several taxonomies of biases have been established in various contexts and from different perspectives. The available set of taxonomies ranges from those in the psychology literature like an individual differences perspective (Oreg and Bayazit 2009), over the categorization based on bias type introduced above (Fleischmann et al., 2014), their relevance for certain tasks (Dimara et al. 2015), different domains such as supply chain management (Carter et al. 2007), to specific types of information systems like decision support systems (Arnott 2006). The different categorizations established so far have in common that their underlying logic and number of categories depending on the considered number of biases. Therefore, each time a new bias is discovered or applied to the IS field, these have to be reconsidered and possibly appended or changed. A framework could help to ensure a systematic exploration of the topic and encourage meta-research.

7.3 Method

7.3.1 Scope of Literature Search

To create a wide-ranging overview of cognitive biases in IS research, we conducted a comprehensive literature search in key IS journals and established IS conferences. We concentrated on the Senior Scholars' Basket of Journals as a representative sample of IS research (Gogan et al. 2014; Sørensen and Landau 2015). To complement this, we considered the proceedings of the four AIS conferences (see Table 7.2) as well as the HICSS due to the significant number of publications on the topic. We also added two journals cited in prior literature due to relevant contributions to the cognitive bias studies in IS (see Table 7.2). Such an approach yields the advantage that our findings are comparable with prior systematic literature reviews (Fleischmann et al. 2014).

Regarding the search terms used, we adapted prior literature results to develop the biases over time. In other words, we used the biases identified by Fleischmann et al. (2014) as search terms:

Framing, negativity bias, halo effect, selection bias, representativeness bias, sequential bias, priming effect, recency effect, biased perception of partitioned prices, emotional bias, primacy effect, selective perception, confirmation bias, availability bias, reasoning by analogy, disconfirmation bias, reference point dependency, irrational escalation, reactance, illusion of control, cognitive dissonance, mental accounting, mere exposure effect, exponential forecast bias, ambiguity effect, zero-risk bias, input bias, base-rate fallacy, omission bias, overconfidence, optimism bias, anchoring, sunk cost bias, status-quo bias, loss aversion, endowment effect, herding, stereotype, value bias, attribution error, cultural bias, after-purchase rationalization, self-justification. Our aim was to show the development over time; therefore, we did not search for additional biases already researched in other disciplines. Nonetheless, when new biases appeared in the same publication with already established biases we included these.

7.3.2 Search procedure

In a first step, we identified publications with the selected biases (search terms) mentioned in their title or abstract in the previous section's outlets and a publication date after 2012 (starting where Fleischmann et al. (2014) left of).

This search included the respective databases for the identified outlets: Science Direct, EbscoHost, SpringerLink, Web of Science, and AIS eLibrary. In a subsequent step, a forward and backward search ensured exhaustiveness of search, and a subsequent manual check identified relevant publications for the detailed analysis. Our initial search identified 210 publications. For the forward search, we used Google scholar. The backward and forward search combined identified 16 additional publications, among other things, due to insufficient classification of publications in the databases mentioned above.

Both steps combined resulted in 226 articles published after 2012. Three researchers scanned these identified papers manually for relevance and possible misclassification of outlet or publication type. For example, we excluded publications that only referred to a bias in their research method. On these grounds, 43 publications were excluded, which left 183 articles published after 2012 for further analysis. Combined with the 83 publications already identified by Fleischman et al. (2014), this allowed us to consider 266 publications altogether. We present the search results per outlet in Table 7.2. For some outlets, no results were available in the given period (marked with "NA").

Outlet	< 2012	<= 2020	Total
International Conference on Information Systems (ICIS)	19	28	47
Decision Support Systems (DSS)	16	8	24
MIS Quarterly (MISQ)	11	12	23
Americas Conference on Information Systems (AMCIS)	13	20	33
Pacific Asia Conference on Information Systems (PACIS)	7	17	24
Hawaii International Conference on System Sciences (HICSS)	NA	21	21
Information Systems Research (ISR)	11	10	21
European Conference on Information Systems (ECIS)	4	15	19
Journal of Management Information Systems (JMIS)	7	10	17
Information Systems Journal (ISJ)	3	6	9
International Journal of Electronic Commerce (IJEC)	6	2	8
Journal of the Association for Information Systems (JAIS)	2	5	7
Journal of Strategic Information Systems (JSIS)	NA	6	6
European Journal of Information Systems (EJIS)	1	4	5
Journal of Information Technology (JIT)	NA	2	2
∑	100	166	266

Table 7.2: Distribution of Publications on Cognitive Biases in Selected IS Outlets

7.3.3 Procedure of Analysis

We examined the 266 publications based on seven factors that answer three different questions:

- When and where are biases studied in the IS community? (1) year of publication, (2) outlet, and (3) industry contexts: We directly took the year of publication and outlet from the publications metadata. The industry context was coded following the NAICS 2012 1st level categories to ensure comparability with Fleischmann et al. (2014) and identify focus changes.

- What types of biases do IS researchers study? (4) biases studied, (5) bias categories as proposed by Fleischmann et al. (2014). We identified the bias based on the search terms derived from Fleischmann et al. (2014) and an explicit hint in the publication. This

identification allowed us to assign a bias category. We assigned new biases to a category based on descriptions by Fleischmann et al. (2014).

- How are biases studied in IS research? (6) examined research field and (7) applied research method. The examined research field was assigned based on the categories proposed by Fleischmann et al. (2014) to ensure continuity and comparability: research for business models of information and communication systems (ICT), software development, application systems, IS management, IS usage, the economic impact of IS, meta-research. We categorized the research method following Palvia et al. (2007).

7.3.4 Identification of the Framework

Based on the literature analysis results, we identified a framework for cognitive biases in line with Gregor's (2006) theory for analyzing. We defined acceptance criteria for a framework to sort cognitive biases. We then evaluated available frameworks from different literature streams in the context of cognition and biases for their possible fit with these criteria. Subsequently we adapted the framework we identified to the bias context and sorted the identified biases in IS research by its dimensions. We then assessed it against our initial acceptance criteria.

The study of cognitive biases in IS spans over 26 years (see Figure 7.1) and shows a positive trend. Nonetheless, it is no main topic in IS research yet. The analysis shows that the number of publications on the topic increases again in the last three years after a slump in 2013/2014. Interestingly, this happened directly after the initial scientometric analysis by Fleischmann et al. in 2012. Measured by the absolute number of publications in IS research, this is not yet one of this research field's main topics (Goyal et al. 2018).

More than 50 different biases have been studied in the IS context, even though names sometimes differ to date. From 2007 to 2012 appears most productive regarding introducing new biases to the IS research field (see Figure 7.2). Nonetheless, we have to take into account that biases are often not named consistently. For example, Yin et al. (2012) talk of loss avoidance while other authors talk of loss aversion (Davis and Ganeshan 2009; Gardiner and Kofi Andoh-Baidoo 2019; Zheng et al. 2017; Wang et al. 2019). Irrespective of this naming issue, all of them referred to the concept that most people tend to be risk-averse by placing more attention on avoiding losses than on a possible the opportunity of advantages (Yin et al. 2012).

7.4 Findings

7.4.1 Biases in IS Research

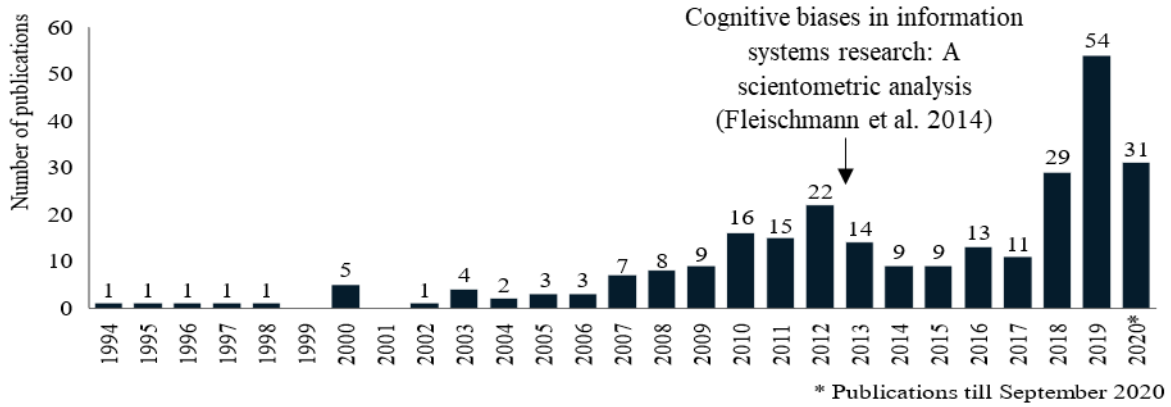

Figure 7.1: Number of Publications on Cognitive Biases in the IS Context per Year

Our study tried to identify similar concepts referred to by different names based on content analysis to facilitate their consistent identification for future researchers. In case of doubt, we referred to the concepts as two distinct biases. For example, we consider post-adoption regret and post-purchase rationalization as separate biases. Both refer to internal evaluation processes after taking a decision. But while post-adoption regret focuses on the effect of possible feelings of regret for having foregone a different option (Zou et al. 2015), post-purchase rationalization describes the phenomenon of trying to find positive arguments for the choice taken and thereby rationalizing it (Turel et al. 2011).

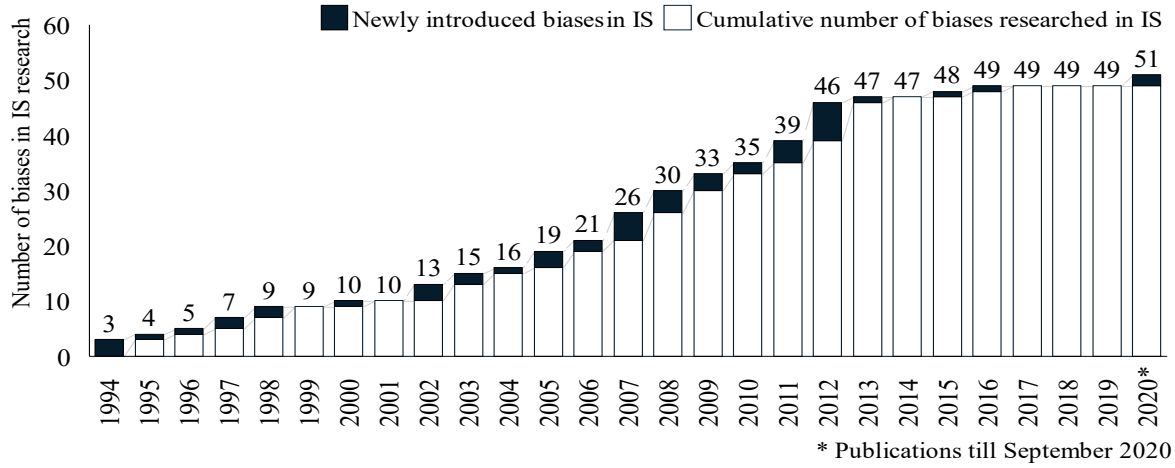

Figure 7.2: Number of Newly Introduced Cognitive Biases and the Cumulative Number of Total Cognitive Biases Studied in the IS Context

Regarding the research gaps identified by previous literature, e.g., IS usage and memory biases, most of them remain open (see Table 7.3). To allow the reader a comparison with prior

analyses, we structure biases based on bias category as identified by Fleischmann et al. (2014) and not on the single-bias level. The research focuses still on IS Usage and IS management. Especially in IS Usage, cognitive biases seem to explain different phenomena from user behavior on a crowdsourcing platform usage to employees' security behavior (Goel et al. 2017). This focus is unsurprising as the use of IS is one of the main focuses of the research field and, for example, prominently mentioned in editorial statements of key outlets (MIS Quarterly 2020).

As industry context is often relevant for practitioners and researchers alike, we also analyzed industry contexts' frequency. Of the 266 publications reviewed, 65% mentioned a specific industry, classified following the NAICS 2012 main categories. The focus of publications was heavily on Information (61), Retail Trade (48), Finance and Insurance (26), Health Care and Social Assistance (13), and Public Administration (8), but researchers also looked at Educational Services (7), Transportation and Warehousing (7), Rental and Leasing (2), Accommodation and Food Services (1), Arts, Entertainment, and Recreation (1).

Bias Category	Business Models of ICT-Firms	Soft-ware Development	Application Systems	IS Management	IS Usage	Economic impact of IS	Meta-research	∑(biases)
Perception biases	3	10	2	14	79	1	2	111
Pattern recognition biases	0	2	0	1	23	0	0	26
Memory biases	0	0	0	1	0	0	0	1
Decision biases	0	4	1	8	33	0	0	46
Action orientated biases	0	0	0	8	11	0	0	19
Stability Bias	0	8	2	5	43	0	1	59
Social biases	0	5	0	10	35	0	0	50
Interest biases	0	0	0	1	1	0	0	2
∑ (research field)	3	29	5	48	226	1	3	∑ =314

Table 7.3: Updated Coverage of Research Fields and Categories (Fleischmann et al. 2014)

As the bias categories by Fleischmann et al. (2014) are based on the biases identified future additions to the field might lead to additions or even revisions of these groups. We propose an analysis based on two dimensions of the bias relevance to an IS.

Bias dimension	Bias Category	Business Models of ICT-Firms	Soft-ware Development	Application Systems	IS Management	IS Usage	Economic impact of IS	Meta-research	∑(biases)
Specificity	General	3	16	5	15	114		2	155
	Specific		8		24	74	1	1	108
∑ (research field)		3	29	5	48	226	1	3	∑ =314
Dynamics	Event-related	3	17	4	28	140	1	2	195
	Not Event-rel.		7	1	11	48		1	68
∑ (research field)		3	29	5	48	226	1	3	∑ =314

Table 7.4: Coverage of Bias Dimensions Constructed Based on Posner and McLeod (1982)

Based on Posner and McLeod's (1982) dimensions of mental processing we propose two dimensions:

- The **Dynamics** dimension illustrates if a mental process is enduring like a learning style or transient like an emotion. For the IS context, we propose the terms non-event related and event-related. If one looks at the practical implications of biases for IS they either focus on a specific context, e.g., managers who make an unsuitable job decision (irrational escalation), or a general context, e.g., the misjudgment about someone's performance due to prior positive information (halo effect).
- The **Specificity** dimension describes how specific the context is. It makes the distinction between general mental processes like traits and specific processes like structures. Regarding the second dimension, biases are either not event-related, e.g., the general misinterpretation of information, when only text appears in decision support

systems (base-rate fallacy), e.g., not related to a certain process step, or event-related, e.g., the influence of message-framing – a concrete event – on app user privacy setting (framing).

It is important to note that these dimensions are not considered strict but rather serve as an orientation (Posner and McLeod 1982). Nonetheless, these dimensions allow us a different perspective: Apparently researchers have been much more interested in general context and event-related biases so far.

7.4.2 The Research Designs for Studying Cognitive Biases in IS

Regarding the research design (see Table 7.5), the most frequently used method is a laboratory experiment, which is in line with the psychological literature, from which most bias concepts stem. The second most frequent design is analyzing secondary data, especially online reviews and Peer to Peer (P2P) lending sites – and survey research.

In general, the research does not seem to follow systematic patterns where researchers assess one bias systematically, but biases appear across different contexts and researchers. For example, the availability bias was examined in 1997, 2002, and 2011, while 56 publications examined the framing bias between 2000 and 2020. At the same time, some biases only appear in one publication.

Interestingly, for those biased studies, often, the main research design seems to emerge (shaded in dark grey). In the following, we will briefly present three examples of biases with more than ten publications and their most frequent research design: Framing refers to the effect the framing of a message can have on an individuals' perception (Cheng and Wu 2010). IS research mostly studies framing in laboratory experiments. The same method is also most frequent for anchoring, as we introduced above (see Introduction). Herding refers to the decisions of others influencing an individual (Lee and Lee 2012). An abundance of available data allows the most frequent research via secondary data analysis.

Delving deeper into the most prevalent method of laboratory research it appears that student subjects are still prevalent – similar to IS research in general. To make the connectedness of the biases and their research design more tangible, we will take a closer look at the most frequently studied cognitive bias in IS research, framing with 56 publications. Of these, 23 experimented, but only three of these were field experiments. The majority (11) conducted laboratory experiments in the university context. Three of them performed additional experiments with practitioners and thereby showed the validity of their results (Compeau et al.

2012). Three publications used online subject pools like Amazon Mechanical Turk. Another two publications recruited participants through organizations – one being community centers and the other local practitioners. Four works were research in progress without detailed method descriptions. The research on cognitive biases shows a prevalence of student subjects, which fits with the overall research focus on the individual level. Compeau et al. (2012) showed that nearly 3/4 of the research in ISR and MIS Quarterly was with students.

Cognitive Biases *(We present biases with >10 publications due to page limitations.)*	Laboratory experiment	Secondary data	Survey	Conceptual models	Case study	Field experiment	Interviews	Mixed methods	Mathematical model	Multimethod	∑(bias)
Framing	20	10	5	6	7	3	1	4			56
Anchoring	8	3	1	5	1	3	3	1		1	26
Herding	1	16	3	1	1	1	1		1		25
Stereotype	7	2	4	3	1	1	2				20
Cognitive dissonance	5	4	5	2	1		2				19
Confirmation bias	7	4	1	1		2					15
Negativity bias	2	9	1					1			13
Overconfidence	5	1	5	1		1					13
Status quo bias	1		4	3	2			1			11
Other biases	26	10	12	6	6	5	1	2	0	0	68
∑ (research method)	82	59	41	28	19	16	10	9	1	1	∑ =266

Table 7.5: Methods Used to Explore Cognitive Biases Classified after Palvia et al. (2007)

The lack of a common measuring approach with established variables for exploring the same phenomenon hampers meta-research – in the following, we present the variables used to explore sunk cost as an example for the maximal variance. The five studies in IS research that primarily focuses on sunk cost all use different independent and dependent variables depending

on their exact research focus (see Table 7.6). Not considering the publications that considered sunk in the context of several other biases (Goh and Bockstedt 2013; Polites and Karahanna 2012).

Studies on Sunk Cost in IS Research	Independent Variable	Dependent Variable
Sunk cost and target achievement biases in subsequent IS-outsourcing decisions (Vetter et al. 2010)	Hard- and software, training (→ sunk cost), target-achievement	Adherence to the course of action, risk tolerance
Understanding runaway information technology projects: results from an international research (Keil et al. 1994)	Sunk cost and presence or absence of alternative	Willingness to pursue prior course of action
A cross-cultural study on escalation of commitment behavior in software projects (Keil et al. 2000)	Risk propensity, level of sunk cost (→ risk perception)	Willingness to continue a project
The effect of an initial budget and schedule goal on software project escalation (Lee et al. 2012)	Difficulty of a budget/schedule goal, specificity of a budget/schedule goal, project completion, commitment to a budget/schedule goal	Willingness to continue a troubled software project
Understanding the role of gender in bloggers' switching behavior (Zhang et al. 2009)	Satisfaction, attractive alternatives, sunk costs, gender	Intention to switch

Table 7.6: Example of Non-consistency of Variables Used to Explore Sunk Cost in IS

A more consistent approach to variable selection could hold potential for meta-research in the future. For example, this would allow subsequent tests across researchers and solidify findings on the use of specific variables. We hope that this research effort is a first step in that direction by creating the necessary awareness and transparency.

7.4.3 Towards a Framework for Studying Cognitive Biases in IS research

The first step to identify a framework for studying cognitive biases in IS research was to define the relevant selection criteria and select a framework accordingly: 1. the framework has to allow the sorting or ordering of biases in a meaningful way; 2. the classification must be simple and understandable; 3. the classification has to be MECE (i.e., mutually exclusive, collectively exhaustive); 4. the classification must result in an added value for further research, i.e., knowledge gain; 5. the framework needs to have proximity to cognitive biases, which means it should come from either research in psychology or IS. Following these criteria, we propose to adopt the taxonomy of mental operations developed by Posner and McLeod (1982). The

research identified their approach as ideal for sorting out current and future end-user computing research (Bostrom et al. 1990) and was cited to explain the mismatch between cognitive style research and MIS and DSS. In the wider context of cognitive biases, it only appears regarding general bias processes that affect decision making (Housel and Rodgers 1994).

We now propose a framework based on the two dimensions Specificity and Dynamics adapted from Posner and McLeod (1982) as introduced above to sort cognitive biases. Such a framework is relevant to IS research because it opens a new perspective for further research along its two dimensions both for identifying gaps and more systematically assessing possible similarities. In the following, we sorted the cognitive biases identified in the literature search into the framework (see Figure 7.3). Regarding the publications that look at more than one bias (40 of the 266 publications), most of them either consider one primary bias or multiple ones that fall in the same group. Nonetheless, researchers must conduct further studies for those 24 publications that looked at multiple biases from different quadrants in-depth.

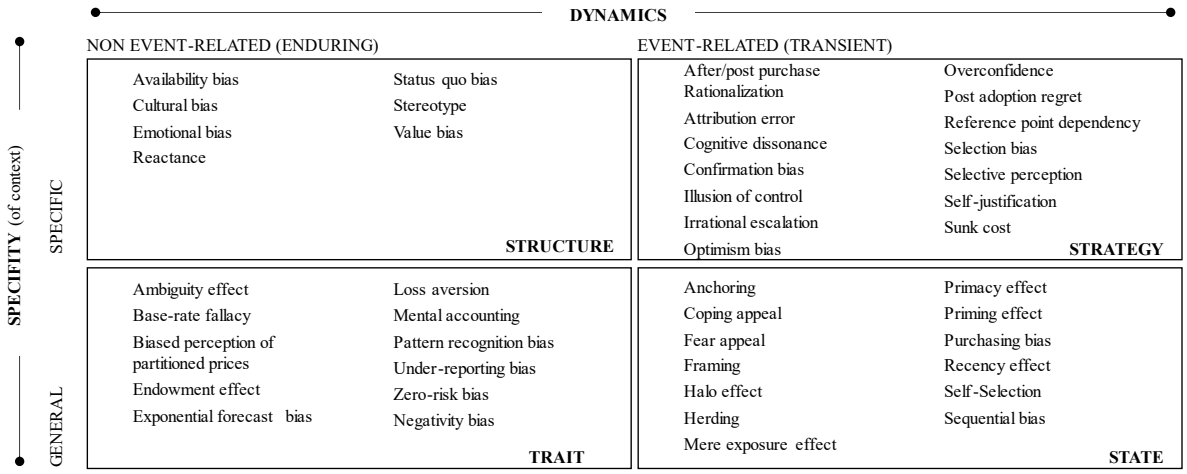

Figure 7.3: Cognitive Biases in IS Sorted into the Proposed Framework

Sorting the biases according to the two dimensions, Dynamics and Specificity, creates meaningful groups of biases that open up opportunities for further research:

- **Structure**: To differentiate between Structure and Strategy, Posner and McLeod (1982) build on a chess player's image whose strategy becomes an internalized structure with years of training. Following this notion, we placed biases under Structure that rely on an internal concept or experience, e.g., stereotypes that lead hosts not to accept Airbnb guests (Rhue and Daniel 2019).

- **Trait**: Posner and McLeod (1982) classify enduring influences on an individual's performance as traits. Quite common human traits are biases that cause individuals to falsely process statistical information, e.g., customers of online retailers showing a biased reaction to shipping costs (Frischmann et al. 2012).

- **Strategy**: A sequence of mental operations for a particular task represents a Strategy following Posner and McLeod (1982). Therefore, we group biases in this quadrant that lead to distorted information selection about certain topics, a group or the subject itself, e.g., when selecting only information that confirms an initial statement or assumption and disregarding contradicting those presented by a search engine (Kayhan 2015).

- **State**: Posner and McLeod (1982) summarize more general influences that vary over time under State. External stimuli that affect the general population represent such influences. We, therefore, clustered biases in that quadrant that are triggered by some external stimulus, e.g., anchoring and adjustment when being provided a random number when guessing the size of a city (Tversky and Kahneman, 1974).

The framework, therefore, fulfills our initially identified acceptance criteria: It allows us to sort biases in a meaningful way. The classification is simple and understandable. The classification is MECE and results in an added value for further research due to the focus on bias characteristics in relation to IS. Finally, as it comes from psychology research, it has certain proximity to cognitive biases.

7.5 Discussion

Building on Fleischmann et al. (2014), we identified 51 cognitive biases in key IS research outlets. We analyzed the 266 publications that examined one or multiple cognitive biases regarding overall coverage of the research field and their research design. On this basis, we proposed a framework for sorting biases regarding their Dynamics and their Specificity in relation to the IS topic under question.

7.5.1 Practical and Theoretical Implications

Following the two initially introduced RQs and the RO, this paper contributes the following: First, we present the current research on cognitive biases in IS. Through the thorough literature search, we could provide an overview of the current research regarding biases and research contexts, i.e., industries. We were able to show that the cognitive bias perspective is gaining momentum in IS research and that cognitive bias theory has to be carefully combined with

existing concepts (Kim and Kankanhalli 2009; Lee and Joshi 2017). An overview makes the wealth of knowledge on how to study cognitive biases in IS already assembled easily available. At the same time, this overview makes it easier to identify gaps and facilitates future research to build on related studies. It has broad theoretical implications as it allows a comparison of models or a combined approach of one established IS model like TAM one or several selected biases, as has been shown for specific biases already, e.g., Kim and Kankanhalli (2009). Our overview could be, for example, the starting point to identify relevant biases regarding technology acceptance or similar concepts. Second, an overview of the research designs used for studying cognitive biases in IS was derived. We assess the prominent research designs in the field. We show that distinct approaches for certain biases have evolved in the literature. It could serve as a starting point for assessments in the field. Moreover, analyzing the research methods helps standardization and facilitates meta-research. Third, we identified a framework for the cognitive biases relevant to IS research. The proposed framework is not simply a clustering of biases but offers fruitful avenues for further research. Studying biases based on their implication on the decision-making process indicated by the quadrant could help put biases in relation with one another or to test for multi-bias mitigation strategies.

The overview of cognitive biases in IS, however, is also relevant to practitioners. Several of the identified biases have implications for the design of information systems and applications. This overview might be a starting point to explore relevant biases and adjust system design accordingly. The same applies to biases relevant in several other contexts, e.g., technology acceptance in the context of new system introduction. Here our overview of biases and methodological approaches to study them could help practitioners to test for relevant biases more rigorously and to develop countermeasures.

7.5.2 Limitations

Despite our utmost care in designing this research, there are some limitations regarding the scope and method of analysis as well as the proposed framework: Regarding the search scope there are two major limitations: The focus on major IS outlets neglects other IS-relevant publications in other outlets. We also focused on the development of biases identified by Fleischmann et al. (2014). Therefore, we did not search for all possible biases. Future research should add new search terms to reflect the newest findings from the psychology field. Regarding the analysis, we had to strike a balance between new developments and continuity. In the classification, the 2012 NAICS codes were therefore used – not the updated version from 2017. Regarding the proposed framework, one limitation is that Posner and McLeod (1982)

did not develop their framework for this purpose. But as it fits the identified criteria, it is suggested as an adaptation for the context. We hope that further research will be able to improve the framework fit even further. One example is the challenge that cognitive biases from different parts of the framework can be complimentary and studied in the same publications. Due to the small number (24), we do not consider this effect to be significant but see room for further advances.

7.5.3 Further Research

Following the structure of our analysis, we identify the following three calls for further research.

Broaden the scope of studied outlets and industries: This research effort focused on the core IS outlets. Future research should also look at key psychology outlets and related fields to identify new biases with possible explanatory power for phenomena researched in the IS context. Regarding the industry context, the research focus is clearly on Retail Trade and Information, Finance and Insurance, Healthcare and Social Assistance, and Public Administration. But even here, in some industries, only parts have been explored. For example, there is a lot on healthcare, but future research should look at Social Assistance, as there are few known examples so far. Future research could also focus on sectors only scarcely researched, like Educational Services, Real Estate, and Rental and Leasing, Accommodation and Food Services, Arts, Entertainment, and Recreation, and Transportation Warehousing. Another possibility is the exploration of industries not yet researched - especially when in testing bias effects across industries.

Increase the number and depth of biases studied in IS: Along the biases studied, we have identified several biases that only one publication mentions, e.g., after-purchase rationalization, attribution error, and base-rate fallacy. Here, more evidence on their effects and the implications for IS would be helpful. On the other end of the spectrum, meta-research on the biases most frequently researched would help consolidate existing knowledge. Regarding Fleischmann et al.'s (2014) bias categories, the memory bias and the interest bias category still lack research efforts (see Table 7.3).

Extend existing knowledge: Regarding the examined research fields, the field business models of ICT-firms and the field economic impact of IS are those with the fewest publications and could be interesting for further research (see Table 7.3). Based on the analysis of the applied research method of the existing publications, a more diverse selection of research subjects

would be helpful, e.g., favoring practitioners instead of students. Also, to reassess and expand existing knowledge, established IS models should be revisited and possibly appended by bias research. For example, models based on rational choice assumptions like TAM can be expanded and complemented in the light of cognitive bias research. This model expansion is already partly underway. Eleven publications in this analysis mention technology acceptance in the context of bias research, but so far, they assess specific biases and not the whole sum of biases possibly relevant. Researchers have also tested effective mitigation strategies for specific biases. Still, they need to build into standard approaches in research and practice, i.e., system design, to avoid the endowment effect's negative effects (Rafaeli and Raban 2003).

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8 Take it Easy – Eine qualitative Untersuchung digitaler Stressoren und Stressbewältigungsmaßnahmen im Homeoffice

Title	**Take it Easy – Eine qualitative Untersuchung digitaler Stressoren und Stressbewältigungsmaßnahmen im Homeoffice**
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Publication Type	Journal Paper
Publication Outlet	HMD Praxis der Wirtschaftsinformatik
Status	Published
Full Citation	Reßing, C., **Zeuge, A.**, Arenz, R., Baumgart, T. L., Schneider, D. J., & Niehaves, B. (2022). Take it Easy - Eine qualitative Untersuchung digitaler Stressoren und Stressbewältigungsmaßnahmen im Homeoffice. *HMD Praxis Der Wirtschaftsinformatik, 59, 1011–103*. (published)

Table 8.1: Fact Sheet Publication

Take it Easy – Eine qualitative Untersuchung digitaler Stressoren und Stressbewältigungsmaßnahmen im Homeoffice

Abstract. Understanding how to use communication and information technologies (ICT) in the home office workplace is critical to managing the ongoing transformation of hybrid working. In recent years, twelve digital stressors have been identified in the workplace, which is leading to increasing new solutions in work environments and stress management measures. However, previous research has not clarified the extent to which digital stressors have changed in the home office and what new ways of stress management measures employers and employees should adopt. To fill this gap, a qualitative approach has been chosen to revalidate, reject, or find new stressors for the previous twelve digital stressors in the home office context as well. For this purpose, twenty interviews would be conducted with individuals in the home office. The study was able to identify eleven of the twelve digital stressors also in the home office, which shows similar but also new modes of action. The study shows that the digital stressor "job insecurity" was not found or changed in the home office context; instead, a new stressor "lack of social connectedness" could be identified for work in the home office.

Keywords. Home Office · Digital Stressors · Information and Communication Technology · Reactive and Proactive Stress Management measures · Qualitative Study.

8.1 Einleitung

Die Corona-Pandemie ist der Auslöser eines tiefgreifenden und nachhaltigen Wandels in der Arbeitswelt (Weigel et al. 2020). Während vor der Pandemie nur 4% aller deutschen Arbeitnehmer:innen von zu Hause arbeiteten, waren es im Mai 2021 ca. 23% (infas 2021). Dabei stellte die plötzliche Verlagerung der Arbeitsstätte vom Büro in die eigenen vier Wände Arbeitgeber:innen und Arbeitnehmer:innen gleichermaßen vor neue Herausforderungen. Hierzu gehören unter anderem die ausschließliche digitale Kollaboration und Kommunikation, die Aufrechterhaltung von Datenschutzbestimmungen in privaten Wohnräumen und die Verschmelzung von Arbeits- und Privatleben in einem bisher unbekannten Ausmaß (Deloitte 2020).

Forschung und Praxis haben gezeigt, dass im Homeoffice eine bessere WorkLife-Balance, mehr Autonomie, allgemeine Lebenszufriedenheit und eine bessere Arbeitszeitgestaltung für Arbeitnehmer:innen ermöglicht (z.B. Bailey und Kurkland 1999; Sako 2021). Auch Motivation, Engagement, Jobzufriedenheit und Produktivität können gesteigert werden (Frolick et al. 1993; Bélanger 1999). Aktuell und anhaltend ist die Arbeit aus dem Homeoffice

in vielen Bereichen die einzige Möglichkeit der Beschäftigung nachzugehen (Deloitte 2020; van der Aalst et al. 2020). Während vor der Pandemie die Option auf Homeoffice sich oftmals als vorteilhaft erwiesen hat (z.B. Wegfall von Pendelzeiten), zeigen sich in der Pandemie auch die Nachteile. Insbesondere berichten Arbeitnehmer:innen von einem starken Anstieg zusätzlicher digitaler Stressbelastung (Gimpel et al. 2020).

Digitaler Stress bezeichnet die Form von Stress, die aus der Interaktion mit Informations- und Kommunikationstechnologien (IKT) resultiert (Fischer und Riedl 2020). Digitalem Stress (z.B. erhöhte Informationsflut) liegen verschiedene negative Konsequenzen zugrunde, die sich in Konzentrationsschwierigkeiten, gesundheitlichen Problemen (z.B. Kopfschmerzen) oder Erschöpfungszuständen äußern (Fischer und Riedl 2020; Hasenbein 2020). Bestehende Forschungen identifizierten 12 Auslöser für Stress (sog. Stressoren) als Resultat digitaler (d. h. IKT-gestützter) Arbeit am Arbeitsplatz (d. h. im Büro) und zeigten Möglichkeiten der Bewältigung auf (Tarafdar et al. 2010; Adam et al. 2017; Gimpel et al. 2019).

Zuerst wurde Homeoffice noch als pandemiebedingte Notlösung angesehen; heute ist eine Rückkehr zur verpflichtenden Büropräsenz für viele Arbeitgeber:innen und Arbeitnehmer:innen nur noch schwer vorstellbar: Erkenntnisse aus Studien in verschiedenen Unternehmen, verschiedener Branchen – von Barclays, PwC, Unilever, Facebook und Twitter, bis hin zu McKinsey & Company –, zeigen, dass viele Arbeitgeber:innen hybride Formen des Arbeitens auch in Zukunft anstreben (Boland et al. 2020). Eine Studie von Bitcom z.B. zeigt, dass hybride Arbeitsmodelle auch für Arbeitnehmer:innen mit zwei bis drei Tagen Homeoffice das „New Normal“ sein werden (Bitcom 2021). Da Homeoffice einen wichtigen Bestandteil von hybrider Arbeit bildet, ist es sowohl für Arbeitgeber:innen als auch Arbeitnehmer:innen wichtig zu verstehen, welche digitalen Stressoren bestehen, um präventiv und reaktiv geeignete Bewältigungsmaßnahmen ergreifen zu können (Waizenegger et al. 2020).

Der vorliegende Forschungsartikel baut auf den bestehenden zwölf digitalen Stressoren digitaler Arbeit am Büroarbeitsplatz auf und untersucht im Rahmen von 20 semi-strukturierten Interviews, ob und wie diese im Homeoffice wahrgenommen werden. Zudem wird untersucht, ob sich neue Stressoren für digitale Arbeit im Homeoffice ergeben. Hierauf aufbauend werden spezifische, präventive und reaktive Stressbewältigungsmaßnahmen herausgestellt, die geeignet sind, die identifizierten digitalen Stressoren im Homeoffice zu bewältigen. Der vorliegende Forschungsartikel adressiert somit folgende Forschungsfrage:

Welche digitalen Stressoren entstehen als Resultat digitaler Arbeit im Homeoffice und wie können diese durch adäquate Maßnahmen der Stressbewältigung adressiert werden?

Zur Beantwortung wird zunächst der theoretische Hintergrund von Stress, Stressbewältigung und digitalem Stress dargestellt. Im darauffolgenden Kapitel wird das methodische Vorgehen erläutert. Darauf aufbauend werden die identifizierten digitalen Stressoren im Homeoffice aufgezeigt und präventive sowie reaktive Stressbewältigungsmaßnahmen herausgestellt. Abschließend werden die Ergebnisse diskutiert und reflektiert, einige wichtige Einschränkungen der Forschung hervorgehoben und fruchtbare Wege für zukünftige Forschung aufgezeigt.

8.2 Theoretischer Hintergrund

8.2.1 Stress und Stressbewältigung

Lazarus und Folkman (1984) konzeptualisieren Stress als einen zweiseitigen Prozess, der die Reize von und die Reaktion auf Stressoren einschließt: Stress tritt auf, wenn ein Individuum wahrnimmt, dass die Anforderungen einer externen Situation seine wahrgenommene Fähigkeit, sie zu bewältigen, übersteigen (Lazarus und Folkman 1984; Hobfoll 1988). Insgesamt werden drei Ebenen von Stress unterschieden (Kaluza 2018): (1) Stressor, (2) Stressreaktion und (3) individuelle Stressverstärker. Reize, die potenziell Stress verursachen können, werden als Stressor (oder: Stressfaktor) bezeichnet (Mason 1975; Litzcke und Schuh 2010). Die physischen, psychischen oder verhaltensbezogenen Antworten des Individuums auf diese Stressoren werden als Stressreaktion bezeichnet (Dawans und Heinrichs 2018). Diese können auf einer körperlichen (Physiologische Veränderungen; z.B. erhöhter Herzschlag), verhaltensbezogenen (Veränderung der beobachtbaren Verhaltensweise; z.B. Gereiztheit), kognitiven (Veränderung der Art und Weise wie Informationen verarbeitet werden; z.B. kreisende Gedanken) oder emotionalen Ebene (Veränderung von Emotionen; z.B. Nervosität) ablaufen (Kaluza 2018). Die Stärke und Dauer von Stressoren wirken sich auf die Stressreaktionen aus (Litzcke und Schuh 2010). Individuelle Stressverstärker verstärken die Stressreaktionen des Individuums. Individuelle Stressverstärker sind u. a. individuelle Motive, Einstellungen oder Bewertungen (Plaumann et al. 2006; Dawans und Heinrichs 2018; Kaluza 2018).

Unter Stressbewältigung versteht man den regulativen Prozess, welcher durch eine als stressig eingeschätzte Situation ausgelöst wird (Lazarus und Folkman 1984; Gleis 2018). Je nach Situation erfolgt eine Anpassung an den Stressor oder eine Veränderung der

Umweltbedingungen. Zur Bewältigung von Stress können Maßnahmen eine reaktive oder präventive Wirkung haben. Zu den reaktiven Maßnahmen zählen beispielsweise das Abreagieren (z.B. bewusstes Ausatmen), die (kognitive) Ablenkung vom Stressor (z.B. Musik hören) aber auch das Schaffen von Zufriedenheitserlebnissen (z.B. Sport) (Wagner-Link 2009). Reaktive Maßnahmen werden bei akuter Stresssituation zur Beruhigung eingesetzt, um weitere, größere Belastungen zu vermeiden. Die Ursachen der Belastung (d. h. der Stressor) wird durch reaktive Maßnahmen jedoch nicht verändert, reduziert oder beseitigt (Litzcke und Schuh 2010; Kaluza 2018), durch präventive Maßnahmen hingegen schon (Scheier et al. 1986). Bei vorhersehbarer Belastung können somit vorbereitende Maßnahmen getroffen werden (Litzcke und Schuh 2010). Zu den proaktiven Maßnahmen gehören z.B. eine Veränderung der eigenen Einstellung oder des eigenen Verhaltens, die Unterstützung aus dem sozialen Umfeld oder systematische Entspannungen (Kaluza 2018).

8.2.2 Digitaler Stress

Digitaler Stress bezeichnet eine Form von Stress, die aus der Interaktion mit IKT resultiert (Fischer und Riedl 2020). Seit Anfang der 1980er-Jahre gilt digitaler Stress als spezifische Stressform (Brod 1982). Im Zuge dessen wurden die kurz- und langfristigen Konsequenzen von digitalem Stress intensiv untersucht: Zunächst konnte gezeigt werden, dass digitaler Stress kurzfristig unter anderem zu Konzentrationsschwierigkeiten, gesundheitlichen Problemen oder Erschöpfungszuständen führen kann (Gimpel et al. 2019; Hasenbein 2020). Im Arbeitskontext konnte gezeigt werde, dass digitaler Stress die Produktivität vermindern kann und einen negativen Einfluss auf die Arbeitszufriedenheit und Bindung an den/die Arbeitgeber:in und den Beruf haben kann (Tarafdar et al. 2010; Ayyagari et al. 2011; Srivastava et al. 2015). Zudem kann digitaler Stress langfristig einen negativen Einfluss auf die Work-LifeBalance haben und das Risiko eines Burnouts erhöhen (Hasenbein 2020).

Neben den Konsequenzen von digitalem Stress wurden auch digitale Stressoren bei der Arbeit mit IKT am Büroarbeitsplatz untersucht: Tarafdar et al. (2011) identifizierten fünf Faktoren von digitalem Stress: (1) Überflutung (d. h., IKT zwingt die Nutzer, schneller zu arbeiten und mehr Arbeit zu erledigen, als sie bewältigen können), (2) Omnipräsenz (d. h., IKT stellen eine ständige Erreichbarkeit her, die Grenzen zwischen Privatleben und Arbeit verwischen), (3) Komplexität (d. h., die Geräte zur Arbeitsverrichtung haben viele Funktionen und ihre Nutzung ist schwer zu erlernen), (4) Jobunsicherheit (d. h., Angst, von anderen Nutzer:innen mit besseren IKT-Kenntnissen ersetzt zu werden) und (5) Unsicherheit (d. h. ständige Software- und Hardwareänderungen). Adam et al. (2017) fügten den sechsten Faktor „Unzuverlässigkeit“

hinzu (d. h., Systemstörungen und andere IKT-Probleme). Ergänzt wurden diese um sechs weitere Faktoren von Gimpel et al. (2019): (7) Leistungsüberwachung (d. h., die Angst durch die Erfassung von Leistungsdaten kontrolliert und bewertet zu werden), (8) Gläserne Person (d. h., Beeinträchtigung der Privatsphäre durch IKT), (9) Unterbrechung (d. h., Unterbrechung der Tätigkeit und Konzentration durch IKT), (10) Nicht-Verfügbarkeit (d. h., wenn Prozesse mittels IKT effektiver und effizienter gestaltet werden könnten, IKT aber nicht verfügbar ist), (11) Unklarheit bei der Rolle (d. h., Behebung von technischen Problemen oder Störungen vs. Eigentliche Tätigkeit) und (12) Mangelndes Erfolgserlebnis (d. h., das fehlende Gefühl Fortschritte gemacht zu haben).

8.3 Methodik

8.3.1 Datenerhebung

Um einen möglichst tiefen und umfassenden Einblick über digitale Stressoren im Homeoffice zu erhalten, wurde ein qualitativer Ansatz gewählt (Flick et. al 2004). Dabei wurden semi-strukturierte Interviews mit offenen Fragen durchgeführt (Pumplun et al. 2019; Sarker et al. 2013). Um ein Höchstmaß an kontextueller Ähnlichkeit zu gewährleisten, wurden alle Interviews innerhalb von vier Monaten (August bis November 2021) durchgeführt. Die Interviews wurden in zwei Phasen realisiert: Die erste Phase umfasste die Entwicklung des Interviewleitfadens, der im Rahmen von drei Probeinterview getestet wurde. In der zweiten Phase wurde die erste Version des Interviewleitfadens überarbeitet und kleinere Änderungen vorgenommen. Nach weiteren sieben Interviews wurde der Interviewleitfaden erneut überprüft. Es wurden keine weiteren Änderungen vorgenommen. Die Interviewpartner:innen (IP) waren zum Zeitpunkt der Datenerhebung zwischen 20 und 57 Jahre alt, das Durchschnittsalter lag bei 36 Jahren. 55% der Befragten waren weiblich und 45% waren männlich. Eine Übersicht der IP kann Tabelle 8.2 entnommen werden. Alle IP haben vor der Pandemie ausschließlich im Büro gearbeitet und waren während der Durchführung der Interviews pandemiebedingt überwiegend (mindestens 4 von 5 Arbeitstagen) im Homeoffice tätig.

Nr.	IP	Alter	Geschlecht	Beruf	Beschäftigungsdauer (in Jahren)
1	IP-1	35	m	Mobilität & Logistik	5
2	IP-2	28	w	Versicherungswesen	1
3	IP-3	28	m	Finanzdienstleistung	1
4	IP-4	40	w	Energie- & Wasserwirtschaft	<1
5	IP-5	48	w	Bildungswesen	7
6	IP-6	48	w	Bildungswesen	5
7	IP-7	53	w	Mobilität & Logistik	9
8	IP-8	27	w	Finanzdienstleistung	2
9	IP-9	28	m	Finanzdienstleistung	5
10	IP-10	31	m	Versicherungswesen	5
11	IP-11	24	m	Energie- & Wasserwirtschaft	5
12	IP-12	49	m	Medien & Presse	22
13	IP-13	24	m	Automobilindustrie	4
14	IP-14	24	w	Veterinärwesen	9
15	IP-15	27	w	Metallindustrie	3
16	IP-16	20	m	IT-Branche	3
17	IP-17	40	w	Vertriebsdienstleistung	22
18	IP-18	57	w	Automobilindustrie	37
19	IP-19	41	w	Steuerberatung	24
20	IP-20	40	m	Steuerberatung	22

Table 8.2: Übersicht der Interviewpartner:innen

8.3.2 Datenanalyse

Die Interviews wurden in deutscher Sprache geführt, aufgezeichnet und nonverbatim transkribiert. Bei der Analyse wurde ein thematischer Ansatz verfolgt, bei dem die Daten auf gemeinsame und wiederkehrende Themen, Ideen und Bedeutungsmuster im Hinblick auf die zwölf digitalen Stressoren digitaler Arbeit analysiert worden sind (Boyatzis 1998; Braun und Clarke 2012). Es wurde ein induktiver Ansatz gewählt, um das Auftauchen verschiedener Themen und ihre iterative Reflexion im Hinblick auf die zugrunde liegenden empirischen

Daten zu ermöglichen. Das Datenanalyseverfahren bestand aus den sechs von Braun und Clarke (2012) vorgeschlagenen Schritten: (1) Zunächst haben sich die vier Forscher:innen mit den Daten vertraut gemacht, indem die Transkripte, Audioaufnahmen und schriftlichen Notizen gesichteten wurden. (2) Anschließend bildeten die Forscher:innen jeweils niederschwellige, offene Codes. (3) Im dritten Schritt wurden die identifizierten Codes zu den Themen der zwölf digitalen Stressoren (Tarafdar et al. 2010; Adam et al. 2017; Gimpel et al. 2019) zugeordnet. (4) Anschließend sind die Daten erneut auf zusätzliche Daten, welche die identifizierten Themen unterstützen oder erweitern geprüft worden. Dabei haben die Forscher:innen gemeinsam sichergestellt, dass diese Themen einen wesentlichen Beitrag zu der übergeordnete Forschungsfrage leisten. (5) Im fünften Schritt wurde der endgültige Satz von Themen zu den zwölf digitalen Stressoren gemeinsam festgelegt und nach weiteren thematischen Übereinstimmungen und digitalen Stressoren geprüft. Die Gesamtheit der Daten stellt eine kohärente Darstellung der Hauptergebnisse dar, die zum Papier und den übergeordneten Forschungsfrage passen. (6) Der letzte Schritt bestand darin, die Ergebnisse schriftlich festzuhalten und in Beziehung zueinander zu setzen. (Braun und Clarke 2012).

8.4 Ergebnisse

Im Folgenden werden zunächst die digitalen Stressoren digitaler Arbeit im Homeoffice aufgezeigt. Diese wurden entlang der in der Literatur bestehenden digitalen Stressoren strukturiert (siehe Kapitel „Digitaler Stress“). Elf der zwölf digitalen Stressoren für die Büroarbeit konnten auch für das Homeoffice identifiziert werden. Zusätzlich konnte ein neuer Stressor „Fehlende soziale Verbundenheit“ identifiziert werden. Anschließend werden proaktive und reaktive Stressbewältigungsmaßnahmen für das Homeoffice aufgeführt.

8.4.1 Digitale Stressoren im Homeoffice

8.4.1.1. Nicht-Verfügbarkeit

Die IP gaben an, dass sie es als stressig empfinden, wenn die technische Ausstattung im Homeoffice negativ von der Ausstattung im Büro abweicht. Die IP hoben hervor, dass sowohl eine unzureichende Hard- wie auch Softwareausstattung im Homeoffice Stress verursachen kann. Eine mangelnde Hardwareausstattung, wie z.B. fehlende/zu kleine Bildschirme oder fehlende Drucker, behindern den gewohnten Arbeitsablauf und können zu einem Mehraufwand führen.

> *Dieses Fokussieren auf diese kleinen Bildschirme, das fällt mir auch ein bisschen schwer, dass macht die Augen dann zusätzlich auch nochmal müde. Da ist es einfacher im Büro. (IP-20)*

> *Im Büro bin ich ein bisschen besser ausgestattet, hier im Homeoffice ist das alles so ein bisschen abgespeckt. Ich habe keinen Drucker oder so. [...] Alles, mache ich digital und drucke dann später alles auf der Arbeit aus. Dann muss man immer so ein bisschen improvisieren. Stressig. (IP-15)*

Auch eine unzureichende Softwareausstattung innerhalb der Organisation empfanden viele IP als stressig. Durch die Arbeit aus dem Homeoffice war neue Software notwendig, um bspw. digital zu kollaborieren (z.B. mittels Skype, Microsoft Teams oder Miro). Gleichzeitig konnte diese Software oftmals nicht angeschafft werden, da beispielsweise interne organisatorische Datenschutzbestimmungen dies nicht erlaubten. Die IP berichteten, dass sie oftmals in die Entscheidungen der Softwareanschaffung nicht einbezogen wurden, wodurch nicht alle benötigten Funktionen abgedeckt wurden.

> *Bei uns ist ein großes Problem, das viele [...] Kollaborationstools, die es gibt, bei uns [aus Datenschutzgründen] nicht benutzt werden dürfen. (IP-2)*

> *Zu Entscheiden welche Software reinkommt, das kam von Oben. Wir haben zwar mit mehreren Leuten erwähnt, dass wir bestimmte Werkzeuge brauchen, wenn wir im Homeoffice arbeiten sollen, dass das uns die Arbeit erleichtert. Aber welche es am Ende waren, das kam dann von einer anderen Stelle. Und manchmal passt es dann eben nicht. (IP-12)*

8.4.1.2. Unzuverlässigkeit

Unerwartete sowie unerwünschte Funktionalitäten bei der Technologiebenutzung zeigten sich laut den IP ebenfalls als digitale Stressoren im Homeoffice. In diesem Zusammenhang wurde insbesondere die Verbindung zum Internet und unternehmensinternen Virtual Private Network (VPN) genannt. Eine stabile Internetverbindung und ein zuverlässiger VPN-Zugang erwiesen sich als entscheidend für eine reibungslose Arbeit im Homeoffice. Dies ist besonders wichtig, wenn die Arbeit mit Anwendungssystemen eine verschlüsselte Internetverbindung voraussetzt. Die IP berichteten, dass eine stabile Internetverbindung bzw. VPN-Zugang nicht immer gewährleistet ist (z.B. in ländlichen Regionen). Abstürze oder Beeinträchtigungen dieser Verbindung lassen Stress durch die Nichterreichbarkeit oder Arbeitsunfähigkeit entstehen.

Wobei der Verlust von Arbeitsfortschritten aufgrund von Verbindungsabbrüchen ebenfalls als Stressauslöser angesehen wird.

> *Und im Homeoffice kommt es vor allem halt darauf [eine stabile Internetverbindung] an. Wenn das Internet nicht funktioniert oder der Laptop nicht hochfährt werden Situationen halt dadurch stressig. [...] Im Büro ist das einfach, wenn man ein Meeting hat, dann geht man da hin. Da kann nicht viel dazwischen kommen. Das ist von zuhause aus schwieriger. (IP-8)*

> *Gerade wenn man irgendetwas Großes aufgebaut hat und der Server stürzt ab. Dann könnte man den Laptop aus dem Fenster schmeißen, weil man dann weiß, ich habe das noch nicht gespeichert. [...] Das stresst mich jetzt zuhause am ehesten. (IP-6)*

8.4.1.3. Komplexität und Unsicherheit

Durch die Arbeit aus dem Homeoffice wurde es oftmals notwendig, dass Unternehmen neue Technologien (z.B. Diensthandy) oder Software einführen mussten, wodurch die Komplexität von Arbeitsprozessen zunahm. Insbesondere Software zur Kollaboration und Kommunikation wurde pandemiebedingt rapide und spontan eingeführt. Die Softwarefunktionen wurden somit „on-the-job" ausprobiert und getestet, wobei sich Funktionen oftmals als nicht ausreichend oder geeignet herausstellten. In diesem Fall musste die Software durch eine passendere ersetzt und erprobt werden. Hierdurch ergab sich eine hohe Unsicherheit. Zudem gestaltete sich die Unterstützung von Kolleg:innen bzw. der IT-Abteilung deutlich schwieriger und aufwendiger, da die Suche nach Lösungen und in der Kommunikation von Problemen Stress entstand. Es wurde berichtet, dass dies auch ein Gefühl des „Allein gelassen Werdens" und der Überforderung auslöste.

> *Ganz speziell im Bereich Videokonferenzen. [...] Hier haben wir uns langsam rangetastet. Und von daher musste ich vielerlei verschiedene Konferenzsysteme erlernen. [...] Das war sehr anstrengend für mich. (IP-9)*

> *Ich musste mich im Homeoffice sehr viel mehr mit Programmen beschäftigen, als ich das wahrscheinlich sonst tun müsste, d. h. ich hatte halt vorher die Möglichkeit den einfachen Weg zu gehen und jemanden zu fragen: „Das Programm. Kannst du mir da helfen?" Und im Homeoffice bin ich halt dazu übergegangen, erstmal selbst zu forschen, [...] und habe dadurch, glaube ich, so eine leichte Technikphobie [entwickelt]. (IP-20)*

8.4.1.4. Unklarheit der Rolle und mangelndes Erfolgserlebnis

Die IP gaben an, dass die Installation, die Einführung und das Erlernen der neuen IKT Zeitkapazitäten erforderten, die nicht nur nicht den eignen Aufgaben entsprechen, sondern auch zusätzlich zur regulären Arbeit erbracht werden mussten. Die IP berichteten, dass sie zwischen den primären Tätigkeiten und den Tätigkeiten, die erforderlich sind, um die primären überhaupt leisten zu können einen Konflikt wahrnahmen (Unklarheit der Rolle). Oftmals gerieten ihre primären Tätigkeiten in den Hintergrund bzw. wurden nicht geschafft, wodurch für viele IP das Gefühl entstand in ihren eigentlichen Aufgaben keinen Fortschritt erzielt zu haben (mangelndes Erfolgserlebnis).

> *Wenn ich etwas nicht selbst starten, bedienen, beherrschen konnte, musste ich mich erst mit unserer IT abstimmen. Das bedeutet also, dass ich einen Teil meines Arbeitstages ausschließlich mit IT-Themen verbringen musste, was nicht meine eigentliche Arbeit ist. (IP-18)*

> *Probleme im Homeoffice nehmen vielmehr Zeit ein, wie die Problemlösung im Office. [...] Man findet schneller jemanden der mal rüberkommen kann, man hat schneller eine Lösung. Jetzt im Homeoffice ist man immer sehr allein. „Wo liegt jetzt eigentlich das Problem?“ Ich muss das jetzt irgendwie formulieren in schriftlicher Form oder am Telefon. Ich muss den Richtigen finden. [...] Das ist alles viel schwieriger. (IP-7)*

8.4.1.5. Unterbrechung

Die IP benannten Unterbrechungen und Ablenkungen durch IKT als weiteren digitalen Stressor im Homeoffice. Ein Großteil der Kommunikation, die bisher physisch stattgefunden hat, findet im Homeoffice digital statt (z.B. per Mail, Chat, Audiooder Videoanruf). Hierbei werden nicht nur die akustischen oder visuellen Signale als stressig wahrgenommen, sondern auch die vermutete Bedeutung des Signals. Einige IP beschrieben beispielsweise, dass sie hinter jeder Chat-Benachrichtigung einen neuen Arbeitsauftrag befürchteten oder fühlten sich verpflichtet unmittelbar auf die Nachricht zu antworten. Neben der kurzzeitigen Unterbrechung der Arbeitstätigkeit wird nach Beantwortung der Nachricht erneut Zeit benötigt sich wieder einzuarbeiten, was als zusätzlich stressig beschrieben wurde.

> *Ja ein Programm was bei Notes integriert ist, ist SameTime, das ist ein Chatprogramm. Und wenn ich diese Nachrichten höre, ist das ein unschönes Gefühl, weil dann meistens zusätzliche Arbeit kommt. Leider kann man es bei der Software-Version nicht ausstellen. Deswegen muss ich das Geräusch einfach ertragen. (IP-3)*

> *Eigentlich müsste ich bei mir alles lautlos schalten, weil [durch] das Gebimmel [...] habe ich ganz schnell ein Stressgefühl. [...] Ich glaube, weil ich das mit Arbeit assoziiere. (IP-7)*

Zusätzlich wurde hervorgehoben, dass insbesondere private Smartphones und private Social-Media-Kanäle großes Ablenkungspotenzial für die Arbeit im Homeoffice bergen. Während im Büro entweder organisatorische Regelungen (z.B. No-Smartphone-Policy) oder innerliche Hemmungen (z.B. die anderen Kolleg:innen arbeiten auch) dazu geführt haben, Smartphones und Social Media nur eingeschränkt zu nutzen, fällt dies im Homeoffice weg, wodurch es als potenzieller Stressor beschrieben wurde: Zum einen gaben die IP an, dass die Arbeitstätigkeit unterbrochen und dadurch zusätzliche Zeit zur erneuten Einarbeitung benötigt wird. Zum anderen wurde die Ablenkung als „willkommen" und nicht stressig beschrieben. Allerdings resultiert zu viel Smartphone- bzw. Social Media-Nutzung im Homeoffice-Alltag oftmals darin, dass nicht alle Aufgaben wie geplant/fristgerecht erledigt werden können, was zu Stress führt (siehe auch mangelndes Erfolgserlebnis).

> *Mein Handy liegt im Homeoffice auf meinem Tisch und ich sehe, da kommt eine Instagram-Meldung und das löst schon innere Unruhen aus, wenn ich diese blöde Benachrichtigung nicht wegbekomme. Das hört sich ungesund an, ist auch wahrscheinlich ungesund. [...] Auf der Arbeit, da liegt mein Handy auch [auf dem Tisch], aber dadurch, dass die Leute um mich rum sind, geben wir uns alle relative viel Mühe, dass wir sowas in den Pausen regeln. (IP-13)*

> *Für den Moment ist Social Media wahrscheinlich nicht stressig, aber wenn ich dann nachher merke: „Oh, wir haben ja schon gleich Feierabend und ich habe nichts geschafft" [...] Ich bin im Nachhinein gestresst, anstatt in dem Moment selbst. (IP-15)*

8.4.1.6. Omnipräsenz

Als besonderer digitaler Stressor wurde die ständige Erreichbarkeit im Homeoffice hervorgehoben. Im Homeoffice verschmelzen die Grenzen zwischen Arbeit und Privatleben zunehmend. Ein Grund dafür, ist laut den IP, dass ein gewisser Zwang besteht, dauerhaft für Kolleg:innen, Kund:innnen oder Vorgesetzt:innen – auch in den Pausen oder nach Feierabend – erreichbar zu sein. Dies wird zusätzlich durch die Nutzung von arbeitsrelevanten Anwendungen auf dem privaten Smartphone verstärkt, sodass auch in der Freizeit u. a. Mails gelesen und beantwortet werden können.

Im Homeoffice ist diese ständige Erreichbarkeit ein großer Faktor, der Stress hervorruft. Weil man auch am Wochenende und Feierabend gar nicht richtig abschalten kann. Und Technologie macht das [die ständige Erreichbarkeit] halt erst möglich. (IP-4)

So ein Punkt, der dann irgendwie schon, ja, Unruhe in mir auslöst. Wenn dann nach Feierabend so eine Push-Mitteilung kommt und ich denke jetzt, ah, jetzt bin ich eigentlich gerade nicht auf der Arbeit. Aber ich könnte die theoretisch trotzdem angucken. (I13)

8.4.1.7. Leistungsüberwachung

Auch die Möglichkeit der Kontrolle und Überwachung durch IKT im Homeoffice wurde von den IP als stressig wahrgenommen. Bei der Nutzung von Kommunikationstools wie Skype oder Microsoft Teams kann die Ampel-Funktionen (z.B. Rot = nicht erreichbar, Grün = erreichbar, Weiß = offline) als Anzeichen dafür genutzt werden, ob man gerade arbeitet oder nicht. Einige IP berichteten, dass sie Kommunikationstools gerne zeitweise ausschalten würden, um konzentrierter arbeiten zu können. Hierdurch befürchteten sie jedoch, dass dies als nicht arbeitend interpretiert wird und fühlten sich dadurch gestresst. Andere hingegen berichteten, dass es mit der Einführung von Homeoffice vermehrt zu spontanen Kontrollanrufen durch Vorgesetzte kam. Aus Sicht der IP verstärkt dies zusätzlich das Gefühl dauerhaft erreichbar sein zu müssen und wird somit als zusätzlicher digitaler Stressor wahrgenommen.

Ok, jetzt muss ich mich wirklich eine Stunde mal richtig konzentrieren und auch nicht abgelenkt werden durch irgendwas. Da hast du halt auch schon mal, hier diesen Status geändert bei Teams, dass auch deine Kollegen dann sehen: Ok, vielleicht gerade nicht, sondern guckst du mal in einer Stunde nochmal. [...] Aber vielleicht wird das dann auch falsch interpretiert. (IP-16)

Ich weiß auch dass es Vorgesetzte gibt, die ihre Mitarbeiter im Homeoffice so relativ aus der Hüfte geschossen gesagt kontrollieren, indem sie sich zu verschiedenen Uhrzeiten mit einem Kontrollanruf irgendwie melden. Und das kann ich mir durchaus vorstellen, dass jemand, der in so einer Situation ist, dass das für den auch sehr stressig wirkt, da man ja letztlich immer erreichbar sein muss. (IP-4)

8.4.1.8. Gläserne Person

Eine neue Herausforderung, die sich für die IP im Homeoffice durch die Nutzung von IKT ergab, ist der Einblick in die eigene, private Umgebung. Es wurde als stressig wahrgenommen, dass Kolleg:innen, Vorgesetzt:innen und Kund:innen in Videokonferenzen Einblick in die private Umgebung bekommen konnten. Zwar können unaufgeräumte Hintergründe, wie eine Katze, die durchs Bild läuft oder Kinder, die im Hintergrund spielen, als Aufhänger für Gespräche dienen, dennoch kann dies auch ungewollten Einblick in das eigene Leben geben. Diese Einblicke in das private Leben und Umfeld wurden wiederum als Stressor der digitalisierten Arbeit im Homeoffice beschrieben.

> *Wie gesagt, in dem Raum steht halt noch ein Sofa drin, was man eben zum Schlafsofa ausklappen kann und es ist auch ein bisschen ein Abstellraum. Also es ist jetzt vielleicht im Teams-Meeting nicht so schön, wenn dann jemand meinen Hintergrund sieht. Sieht ein bisschen abstellkammermäßig aus. Dabei fühle ich mich nicht wohl. (IP-14)*

> *Wenn die Umgebung nicht aufgeräumt ist. Das würde dann zu Stress führen. (IP-11)*

8.4.1.9. Fehlende soziale Verbundenheit

Durch die Arbeit im Homeoffice besteht nicht nur eine physische, sondern auch soziale Distanz. IKT kann die physische Distanz zwar, wenn auch nur eingeschränkt, überbrücken, ein wirkliches Gefühl der Verbundenheit und sozialer Nähe ist jedoch schwer herzustellen (Sontag 2012). Von den IP wurden in diesem Zusammenhang die eingeschränkten Kommunikationsmöglichkeiten als digitaler Stressor hervorgehoben. Dadurch, dass Mimik und Gestik in Audiokonferenzen nicht und in Videokonferenzen nur eingeschränkt wahrgenommen werden können, können Missverständnisse und Konflikte leichter entstehen. Dies beschrieben die IP als stressig, da sie nicht nur befürchten falsch verstanden zu werden, sondern auch vor der Herausforderung stehen andere richtig zu verstehen. Die fehlende Vermittlung der Körpersprache führt auch dann zu Stress, wenn Körpersprache nicht mehr als Kommunikationsmittel in Diskussionen eingesetzt werden kann und beispielsweise Schweigepausen fehlinterpretiert werden.

> *Denn dieses persönliche Interagieren, dadurch dass mir die Mimik und Gestik des Gegenübers fehlt und ich auch nicht sagen kann, komm wir setzen uns jetzt mal, reden drüber, gehen mal in eine andere Räumlichkeit und schaffen ein anderes Umfeld. Das geht im Homeoffice nicht. Und da merkt man, dass da Stress entsteht. (IP-1)*

> *Mich setzt das schon mehr unter Stress. Ich bin rhetorisch nicht so aufgestellt. Ich brauche mal ein bisschen Zeit, um darüber nachzudenken, um das im Kopf zu formulieren. Und dann ist das Zeitfenster schon vorbei. [...] Die Kommunikation ist anders. Stressig. [...] Wenn ich in [Microsoft-]Teams eine Pause mache, dann ist das für die anderen abgehakt. (IP-7)*

Darüber hinaus heben die IP hervor, dass die Nutzung von digitalen Kommunikationstools es erschwert, das Teamgefühl und die Verbindung zur Organisation aufrecht zu erhalten. Digitale Kommunikations- und Kollaborationstools ermöglichen zwar die Zusammenarbeit, sind aber nicht dafür ausgelegt den Zusammenhalt von Mitarbeiter:innen zu stärken. Insbesondere bemängelten die IP, dass bestehende IKT wenig Möglichkeiten bieten, um spontan in Interaktion zu treten und Neuigkeiten auszutauschen („Flurfunk“). Stress besteht dann vor allem dadurch, dass befürchtet wird wesentliche Informationen zu verpassen. Darüber hinaus führen die fehlenden Möglichkeiten spontaner Begegnungen dazu, dass viele IP Pausen nicht nutzten und stattdessen weiterarbeiteten, wobei eine fehlende Erholung stresssteigernd wirken kann.

> *Einerseits gibt es Leute, die brauchen unbedingt die persönliche Interaktion mit Kollegen. Und wenn die wegfällt, kann ich mir vorstellen, dass das für die ein Zustand ist, der jetzt nicht sofort Stress ist, sondern der so ein bisschen wie Verlust und Isolation ist und [...] dann ist so ein bisschen Trübsal da. Und aus dem Trübsal kommt ein bisschen Frust [...] [der kann] durchaus wie Stress wirken. [...] Und diese digitalen Meetings können das [soziale Interaktionen] einfach nicht. (IP-1)*

> *Ja auf jeden Fall fehlt das bei solchen Technologien [spontan in Kontakt treten zu können]. Auch die Mittagspause, wenn man da allein ist, dann kommt es bei mir tatsächlich häufiger vor, dass ich die Mittagspause vor dem Rechner verbringe und weiterarbeite und eigentlich keine richtige Mittagspause habe. Das ist im Büro eine andere Situation. (IP-8)*

8.4.2 Maßnahmen der Stressbewältigung

Anhand der Interviews konnten für die identifizierten digitalen Stressoren proaktive Stressbewältigungsmaßnahmen identifiziert werden. Diese werden in Tabelle 8.3 entlang der digitalen Stressoren digitaler Arbeit im Homeoffice aufgezeigt und mittels Beispielzitaten aus den Interviews untermauert.

Stressor	Proaktive Stressbewältigungsmaßnahmen	Beispielzitate
Nicht-Verfügbarkeit	• Adäquate IKT-Landschaft (Organisatorisch) schaffen; Benötigte Hard- und Software regelmäßig bottom-up erfragen und bereitstellen • Einheitliche IKT Nutzung innerhalb der Organisation (keine Insellösungen) • Abstimmung interner Datenschutzbestimmungen für Tools, die außerhalb der Organisation verwendet werden	*„Unsere Firma macht klare Vorgaben welches Tool wir zur Kommunikation benutzen. So wird sichergestellt, dass es eine einheitliche Technologie gibt. […] So haben wir keine Insellösungen." (IP-16)* *„Mein Vorgesetzter fragt uns regelmäßig, ob wir noch was im Homeoffice brauchen. Software? Hardware? Und gibt, dass dann ggf. nach oben weiter. So wird sichergestellt, dass alle arbeitsfähig sind und es auch bleiben." (IP-9)*
Unzuverlässigkeit	• Cloud-Systeme bereitstellen • Expertenteams für verschiedene Software gründen und schulen • Festlegung klarer Ansprechpartner bei Störungen oder Probleme (z.B. Bereitstellung einer Telefonliste)	*„Ich habe Notfallnummern […] von der zuständigen IT-Firma, die halt zu kontaktieren ist. Ich weiß, im Notfall, wenn nichts geht, habe ich meinen IT-Menschen, der mir halt weiterhilft und dann bin ich schon beruhigt. Und dann stresst mich das auch nicht mehr. (IP-20)* *„Cloud, das gibt Sicherheit. Wenn wir immer alles in der Cloud abspeichern, kann auch nichts verloren gehen. Und es ist immer alles aktuell. Das ist extrem wichtig im Homeoffice." (IP-19)*
Komplexität und Unsicherheit	• Bereitstellung eines Helpdesk-Support • Bereitstellung von IKT-Schulungen für neue Hardware und Soft-wareanwendungen • Software-Mentor: Transparente Kommunikation von Vor- und Nachteilen bestimmter Software an zukünftige Nutzer:innen; Unterstützung bei der Nutzung	*„Wir haben Schulungen zu diesem System […]um immer wieder auf dem neusten Stand zu sein" (IP-7)* *„Wir haben immer jemanden der für sowas [Software] verantwortlich ist. Und der kommuniziert dann auch die Vorteile und Nachteile. Und das überzeugt dann auch so ein bisschen die Nutzer. Aber sie holen auch aktiv Feedback ein und helfen auch bei Problemen." (IP-9)*

Unklarheit der Rolle und mangelndes Erfolgserlebnis	• Begleitung technischer Veränderungen („Change-Management“) • IKT-Tandem: Erfahrene und unerfahrene Nutzer:innen einer Soft- ware bilden ein Tandem • Tagesziele durch digitale Notizen definieren und Aufgaben- und Zeitplanung hinterlegen • Respektieren der Grenzen und Möglichkeiten des Homeoffice	*„Ich wurde bei der Einführung vor allem von Gesprächen mit Kollegen unterstützt, die schon damit Erfahrung gesammelt haben.“ (IP-12)* *„Das Thema Homeoffice hat einen gesunde Portion Respekt verdient, weil es halt sehr viel mehr Disziplin erfordert. […] Durch Strukturierung im normalen Alltag kann man seine digitale Arbeit schaffen.“ (IP-20)*

Unterbrechung	• Kalenderpflege durch
	  ○ Kennzeichnung von Erreichbarkeitszeiträumen
	  ○ Freiräume für „Stillarbeit“ schaffen (z. B. Blocker in den Kalender eintragen)
	• Stillarbeitszeiten vorbereiten (z. B. Mailkonto ausschalten, Kommunikationstools schließen)
	• Kommunikationsregeln im Team besprechen und festlegen (z. B. für spontane Anrufe)
	• Schulungen für Zeitmanagement und Selbstorganisation
		„Und dann Zeit blockiere und bewusst Freiräume schaffe für Stillarbeit in meinem Kalender, damit steigert sich meine Produktivität.“ (IP-18)
		„Also wenn ich checken will, ob ich neue E-Mails habe, dann muss ich [das] im E-Mail-Programm aktiv einschalten.“ (IP-10)

Omnipräsenz	• Freizeit-Ritual, um Pausen oder Feierabend einzuläuten • Nutzung eines festen Arbeitsplatzes, um räumliche Trennung von Privat und Arbeit zu schaffen • (Nicht-) Erreichbarkeitszeiten im Team besprechen und festlegen • Schulungen: Selbstachtsamkeit und Work-Life-Balance	*„Ich mache den [PC] in der Pause aus, also ich fahre den jetzt nicht runter, aber ich sperre den halt und mache alles stumm. Ich will dann nichts hören und sehen. […] Wenn Feierabend ist, wird der Stecker gezogen. Und das ist so mein Ritual.“ (IP-14)* *„Ich verlasse dann auch den Raum, also selbst, wenn ich dann nachher nochmal Uni habe, mache ich das nicht im Büro, sondern quasi hier in meinem Esszimmer. Einfach um die Trennung ein bisschen räumlich zu haben.“ (IP-4)*

Leistungsüberwachung	• Regelmäßige Team-Meetings, damit jeder weiß wer woran arbeitet • Freigabe von Kalendern im Team, um Transparenz über Tätigkeiten zu vermitteln • Vertrauenskultur etablieren • Ergebnisorientierung statt Arbeitszeitorientierung	*„Was wir auch viel genutzt haben, ist die gemeinsame Kalenderfunktion, […] um eben uns ein bisschen abzustimmen und Transparenz zu schaffen." (IP-14)* *„Also ich finde da muss man als Arbeitsgeber schon auch in den Arbeitnehmer ein großes Stück Vertrauen haben […] und das auch kommunizieren." (IP-20)*
Gläserne Person	• Tür schließen: Klopfzeichen vereinbaren, Stillarbeitszeiten visualisieren (z. B. Schild) • Nutzung eines digitalen Hintergrunds, um Einblick in private Räumlichkeiten zu vermeiden (z. B. Unternehmenslogo) • Arbeitsplatz so einreichten, dass neutraler Hintergrund besteht • Headsets verwenden, um Umgebungsgeräusche zu reduzieren	*„Ich schließe als Vorsichtsmaßnahme die Tür. Und wir haben ein Zeichen vereinbart. Also ich habe, sozusagen, ein bisschen vorgesorgt, dass da nicht eine direkte Störung, nicht nur für mich, sondern auch für die anderen nicht entsteht." (IP-12)* *„Ich mache ein Schild an meine Tür: ‚Bitte von 07:00 Uhr bis 14:45 Uhr nicht stören'" (IP-13)*

Fehlende soziale Verbundenheit	• Bereitstellung einer Kamera für alle Mitarbeiter:innen und Etablierung einer „Kamera an"-Policy
	• Care Calls von den Vorgesetzten, um sich nach persönlichen Befinden der Mitarbeiter:innen zu erkundigen
	• Wöchentliche Update-Mail von Vorgesetzten, um über Entwicklungen im Team und in der Organisation zu berichten
	• Gelegenheit für privaten Austausch schaffen
	  ○ Geplant (Digitale Socials, Ersten Minuten für privaten Austausch in Meetings)
	  ○ Spontan (Digitaler Pausenraum)
		„Ich würde auf jeden Fall dafür sorgen, dass jeder Mitarbeiter eine Webcam erhält. Damit man sich auch bei Besprechungen sehen kann und […] wenn eine Besprechung über Teams notwendig ist, dass man die auch so persönlich wie möglich, gestalten kann." (IP-13)
		„Virtuelle Kaffeepausen und über irgendetwas Quatschen, was nicht mit der Arbeit zu tun hat. Das hilft mir dann doch besser, denke ich." (IP-2)

Table 8.3: Proaktive Maßnahmen der Stressbewältigung

Neben den proaktiven Maßnahmen wurden auch mehrere reaktive Maßnahmen genannt, welche den IP als geeignete Bewältigungsmaßnahme für die spontane Stresssituation erschienen. Die reaktiven Maßnahmen gelten für alle genannten digitalen Stressoren gleichermaßen und sind nicht den einzelnen Schritten zuzuordnen, da die Stressoren nicht

verändert, reduziert oder beseitigt werden können. Deshalb werden im Folgenden die reaktiven Maßnahmen betrachtet, welche die IP besonders geeignet für das Homeoffice empfanden.

Vorteile der Stressbewältigung im Homeoffice sahen die IP insbesondere in der flexiblen Zeiteinteilung und dem spontanen Verlassen von Stresssituation vom Arbeitsplatz in die private Umgebung. Besonders zur Stressbewältigung ist das richtige Zeitmanagement unerlässlich (Wagner-Link 2009). Darüber hinaus gaben die IP an, dass Sie eher kurze kognitive Pausen einlegen, um das Stresslevel zu senken (z.B. durch Sport), oder ihren Emotionen eher freien Lauf lassen können (z.B. lautes Seufzen). was sich besonders im Homeoffice dank der gewohnten, geschützten und anonymen Umgebung umsetzen lässt und besonders körperliche Aktivität kann auf der Ebene der Stressreaktionen ansetzen und dort eine reaktionsmindernde Wirkung entfalten (Fuchs und Klaperski 2018).

> *Die Leute sind einfach viel flexibler, wenn Sie von Zuhause aus arbeiten und können spontaner auf Stress reagieren. (IP-17)*

> *Je nachdem wie groß der Stress ist, unterbreche ich meine Arbeit eher im Homeoffice [als im Büro]. Und um Abstand zu gewinnen, zu dem Stressthema, verlasse ich auch den Raum [...] ich hole mir was zu trinken oder mache Sport. (IP-18)*

Um IKT als reaktive Stressbewältigung nutzen zu können, bietet die Arbeit im Homeoffice eine geringere Hürde, um sich bspw. mit privaten Medien abzulenken. Die IP gaben an, das Ablenkungen durch das Anschauen eines Unterhaltungs- oder Entspannungsvideo oder das Hören von Musik spontan eingesetzt werden können, um den Kopf aktiv von der Arbeit abzulenken und den Körper zu entspannen. Dies zeigte auch eine Studie von Liu et al. (2021), welche durch das Anschauen von Kurzvideos die Stimmung und die Bereitschaft der Teilnehmer für die Arbeit signifikant verbesserte und gleichzeitig den physiologischen Stress verringerte. Aus unseren Interviews geht hervor, dass es dabei wichtig ist, dass die Ablenkung keinen Bezug zur Arbeit hat, um kurzfristig Abstand zu gewinnen.

> *Wenn ich also wieder sehr verkrampft bin [...], gehe ich schnell mal auf YouTube und mache zehn Minuten Gymnastik für den Nacken [...] oder schaue mir Entspannungsvideos an. (IP-6)*

> *Also ein probates Mittel ist auf jeden Fall YouTube oder ähnliche Plattformen. Sich witzige Videos anschauen, die nichts mit der Materie zu tun haben, um einfach ein bisschen Abstand zum Thema zu bekommen. (IP-3)*

8.5 Diskussion

Der vorliegende Forschungsartikel untersucht mittels 20 semi-strukturierter Interviews, welche digitalen Stressoren im Homeoffice auftreten und wie diese durch proaktive und reaktive Stressbewältigungsmaßnahmen adressiert werden können. Hierdurch leistet der Forschungsartikel einen sowohl wichtigen Beitrag für die aktuelle Forschung wie für die Praxis, die im Folgenden dargestellt werden:

Auf Basis der Interviews konnten elf der zwölf, aus bestehender Forschung identifizierten digitalen Stressoren am Arbeitsplatz (Tarafdar et al. 2010; Adam et al. 2017; Gimpel et al. 2019), auch für das Homeoffice identifiziert werden. Hierdurch konnte gezeigt werden, dass viele der digitalen Stressoren im Homeoffice ähnlich denen am Arbeitsplatz wahrgenommen werden und ähnliche Auswirkung auf Arbeitnehmer:innen haben. Beispielsweise zeigt sich, dass die Nicht-Verfügbarkeit von adäquater IKT und die Unzuverlässigkeit dieser auch im Homeoffice zu Stress der Arbeitnehmer:innen führen kann. Auch wenn die Arbeitnehmer:innen im Homeoffice arbeiten, sei es vollständig oder teilweise (d. h. hybride Arbeit), sollten Arbeitgeber:innen hierfür sensibel sein und Unterstützung anbieten, um proaktiv Stress auf Seiten der Arbeitnehmer:innen entgegenzuwirken. Die Ergebnisse haben gezeigt, dass ein Großteil der digitalen Stressoren auch für die Arbeit im Homeoffice nachgewiesen werden konnten, deren Wirkungsweisen sich im untersuchten Kontext jedoch verändert haben. Insbesondere die Omnipräsenz hat im Homeoffice zugenommen und wird auch in Zukunft für hybride und flexible Arbeit und ihre Umsetzung (z.B. Bring Your Own Device) an erheblicher Relevanz gewinnen (Klesel et al. 2018). Unternehmen stehen deshalb vor der Herausforderung hybride Arbeitskonzepte für Arbeitnehmer:innen zu ermöglichen und gleichzeitig eine ausgewogene Work-Life-Balance sicherzustellen (McKinsey 2020; Waizenegger et al. 2020). Aber auch die Leistungsüberwachung durch IKT sollte bereits heute und auch zukünftig besondere Beachtung von Unternehmen und Führungskräften finden. Bestehende Forschung zeigt, dass vollständige wie auch hybride Arbeitskonzepte vor allem eine Vertrauenskultur und eine Ergebnisorientierung voraussetzen (Bruch und Kowalevski 2013; Zeuge et al. 2020).

Der digitale Stressor „Jobunsicherheit“ konnte im Kontext des Homeoffice nicht festgestellt werden. In der Pandemie waren viele Unternehmen gezwungen Stellen abzubauen (Rüdiger Bachmann et al. 2020), wodurch insgesamt eine hohe Jobunsicherheit entstanden ist. Obwohl die IP mit neuen Herausforderungen durch die Nutzung von neuen IKT im Homeoffice

konfrontiert worden sind (siehe Komplexität und Unsicherheit), schien der Fokus auf der pandemiebedingten Jobunsicherheit zu liegen und nicht auf der Angst, zukünftig durch Arbeitnehmer:innen mit besseren IKT-Kenntnissen ersetzt zu werden (Tarafdar et al. 2011). Daher kann vermutet werden, dass diese Form der Jobunsicherheit dominiert und die Unsicherheit von anderen Arbeitnehmer:innen mit besseren IKT-Kompetenzen in den Hintergrund gerückt ist. Zukünftige Forschung kann hier ansetzen und dies differenzierter für Homeoffice wie auch hybride Arbeitskonzepte untersuchen. Durch diese Erkenntnisse können Unternehmen proaktiv Bewältigungsmaßnahmen ergreifen, um die Jobunsicherheit ihrer Arbeitnehmer:innen zu reduzieren und negative Konsequenzen (z.B. Produktivitätsverlust, gesundheitliche Folgen) zu vermeiden.

„Fehlende soziale Verbundenheit“ konnte als neuer digitaler Stressor für den Homeoffice-Kontext identifiziert werden. Dadurch, dass Kommunikation und Kollaboration im Homeoffice über IKT (z.B. E-Mail, Audio- oder Videokonferenzen) erfolgt, entsteht eine soziale Distanz zwischen den Arbeitnehmer:innen, sowie zu Vorgesetzt:innen (Herath und Herath 2020). Insbesondere können non-verbale Kommunikationssignale nicht geeignet vermittelt werden, wodurch Missverständnisse oder Konflikte entstehen können (Lepsinger und DeRosa 2015). Auch die fehlenden Möglichkeiten des spontanen Austauschs zeigen, dass das Gefühl der Verbundenheit zum Team und zur Organisation sinkt, und sich stresssteigernd auswirken können (Zeuge et al. 2021). Wir ermutigen zukünftige Forschung hieran anzuknüpfen und zu untersuchen, wie IKT oder dessen Nutzung verändert werden muss, um soziale Verbundenheit zu erzeugen.

Neben der Identifizierung von digitalen Stressoren konnten auch proaktive Maßnahmen der Stressbewältigung identifiziert werden. Hierbei konnten sowohl Maßnahmen aufgezeigt werden, die von der Organisation ergriffen werden können, wie beispielsweise die Bereitstellung klarer Ansprechpartner für Störungen oder Probleme (Unzuverlässigkeit) als auch Maßnahmen, die von einzelnen Arbeitnehmer:innen ergriffen werden können, wie beispielswiese die Einführung von Freizeit-Ritualen, um Pausen oder Feierabende einzuläuten (Omnipräsenz). Einige Maßnahmen decken sich mit Stressbewältigungsmaßnahmen, die auch am Arbeitsplatz (d. h. im Büro) ergriffen werden können, wie beispielsweise IKT-Schulungen für neue Hardware als auch Softwareanwendungen (Komplexität und Unsicherheit) (Gimpel et al. 2019). Andere Maßnahmen hingegen, sind explizit für das Homeoffice geeignet, wie beispielsweise einen festen Arbeitsplatz zu installieren, um das Privatleben von der Arbeit räumlich zu trennen (Omnipräsenz). Darüber hinaus wurden reaktive

Stressbewältigungsmaßnahmen identifiziert, welche die Arbeitnehmer:innen bei Stress ergreifen können (z.B. Sport oder Musik). Eine Kombination aus proaktiven und reaktiven Stressbewältigungsmaßnahmen können in der Praxis sowohl Arbeitgeber:innen als auch Arbeitnehmer:innen für vollständiges oder teilweises Homeoffice (d. h. hybride Arbeit) als eine Art Baukastensystem nutzen, um Stress proaktiv vorzubeugen bzw. reaktiv zu reduzieren.

Wie alle Forschungsarbeiten weist auch diese Studie mehrere Limitationen auf, die vielversprechende Möglichkeiten für künftige Forschungen bieten. Da diese Forschungsarbeit auf einer qualitativen Untersuchung beruht, weist sie die für qualitative Studien typischen Einschränkungen auf (z.B. schwache interne Validierung). Darüber hinaus ist anzumerken, dass alle IP aus Deutschland stammen. Folglich spiegeln die identifizierten digitalen Stressoren für die Arbeit im Homeoffice von in Deutschland lebenden Arbeitnehmer:innen wider. Wir regen an, in zukünftigen Studien zu untersuchen, ob und welche digitalen Stressoren in anderen Ländern und Kulturen wahrgenommen werden und wie diese proaktiv als auch reaktiv bewältigt werden können. Dies würde es den Arbeitgeber:innen und Führungskräften von internationalen Organisationen und Teams ermöglichen, auf die länder- und kulturübergreifende Natur dieser Teams bzw. Organisationen einzugehen. Als weitere Limitation ist hervorzuheben, dass die Datenerhebung zu Zeiten der Corona-Pandemie durchgeführt wurde und somit der Artikel zu den Zeiten von einer pandemiebedingten ausgedehnten Extremform entstanden ist. Dabei ist nicht auszuschließen, dass die pandemiebedingte private Isolation ebenfalls einen Einfluss auf die gefundenen digitalen Stressoren hat. Zukünftig muss deshalb untersucht werden, ob die gefundenen Effekte auch bei hybridem Arbeiten vorzufinden sind.

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9 AR- und Holografie-gestütztes Netzwerken

Title	**AR- und Holografie-gestütztes Netzwerken als Alternative zum traditionellen Netzwerken vor Ort – ein multiperspektivischer Einblick**
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Publication Type	Journal Paper
Publication Outlet	HMD Praxis der Wirtschaftsinformatik
Status	Published
Full Citation	Schaefer, C., Stelter, A., **Zeuge, A.**, Oschinsky, F. M., & Niehaves, B. (2022). AR- und Holografie-gestütztes Netzwerken als Alternative zum traditionellen Netzwerken vor Ort - ein multiperspektivischer Einblick. *HMD Praxis Der Wirtschaftsinformatik*, 59(1), 226–245. (published)

Table 9.1: Fact Sheet Publication

AR- und Holografie-gestütztes Netzwerken als Alternative zum traditionellen Netzwerken vor Ort – ein multiperspektivischer Einblick

Abstract. Virtual networking has become a key means of networking since the onset of the Corona pandemic. With this incisive event, numerous alternatives to traditional networking events such as trade fair shows, dinners, etc. have emerged. However, many barriers also arose in this process, such as the lack of humanity or the two-dimensional appearance in the digital space. One approach to overcome these barriers is the combination of augmented reality (AR) and holography. To assess the technical feasibility of this approach, we spoke with AR experts and customers and discussed the factors for and against using AR and holography for networking. Our results show that the experts and customers see high potential in the combination. However, there is currently still a lack of technological solutions to enable this to be used on a broad scale. In summary, the experts and customers agree that, based on the current technical developments in the field of AR and holography, there will be solutions for this soon and that the combination of AR and holography can then represent a good alternative to networking. From this, we conclude that location independent networking with AR and holography creates a world of well-being for users and represents a clear added value.

Keywords. Augmented Reality · AR · Networking · Holography · Virtual Reality · VR.

9.1 Einleitung und Motivation

Der digitale Wandel bestimmt unseren Alltag, denn „die technologischen Entwicklungen sind rasant und verändern die Art, wie wir uns informieren, wie wir kommunizieren, wie wir konsumieren – kurz: wie wir leben“ (Bundesministerium für Wirtschaft und Energie 2020). In Zeiten von Digitalisierung und der Corona-Pandemie und den damit verbundenen Kontaktbeschränkungen und Homeoffice-Reglungen rückt die digitale Zusammenarbeit zunehmend in den Vordergrund (AbuJarour et al. 2021). Zahlreiche Untersuchungen belegen die Vorteile, die mit der zunehmenden Digitalisierung einhergehen: Dadurch, dass orts- und zeitunabhängig gearbeitet werden kann, kann beispielsweise eine gesteigerte Produktivität und Effektivität erreicht, Kosten gespart (z.B. Reisekosten) und der Zugriff auf personelle Ressourcen erweitert werden (Holtbrügge und Schillo 2007). Gleichzeitig bringt die digitale Zusammenarbeit auch einige Nachteile mit sich. Ein Nachteil besteht darin, dass das Gefühl von Präsenz im Digitalen verloren oder nur schwer zu erzeugen ist (Srivastava und Chandra 2018). Ebenso ist es im digitalen Kontext deutlich herausfordernder vertrauensvolle Beziehungen aufzubauen als in Präsenz (Sarker et al. 2003). Ein weiterer Nachteil ist, dass die

spontane Kommunikation entfällt oder diese nicht mehr so natürlich ist wie zuvor (Sarker et al. 2011). Konferenzen, Vorträge, Besprechungen, Diskussionen und Vernetzungstreffen bringen bislang viele Hürden der Kommunikation und Verständigung mit sich. Insbesondere das Netzwerken in Projektpartnerschaften oder mit neuen Kunden stellt sich als Herausforderung dar. Die vorhandenen Plattformen wie Skype, Zoom, MS Teams oder Webex bieten zwar initiale Möglichkeiten zum Netzwerken an, dennoch ist das Gefühl des menschlichen, ungezwungenen Miteinanders nicht dasselbe wie in Präsenz. Ein Beispiel ist das gemeinsame Mittagessen vor Ort, welches Raum für unterschiedliche Gespräche bietet und sich bislang nicht durch Videotelefonie ersetzen lässt (Deutsche Bahn 2020). Neuartige Technologien können hier zwar helfen, etablierte Strukturen neu zu denken, doch wie können wir die Möglichkeiten der Digitalisierung nutzen, sodass sich Personen von unterschiedlichen Orten und in Echtzeit in dieser Form begegnen? Virtuelle und erweiterte Realitäten (engl. virtual reality (VR) and augmented reality (AR)) in Kombination mit Holografie können hier eine Möglichkeit darstellen.

Unser Ziel ist es, mit AR und Holografie einen „Raum“ für virtuelle Treffen zu erschaffen, der die bisherigen Herausforderungen überwindet. Die Teilnehmenden sehen sich dabei als fotorealistischen Avatar oder in realer Gestalt in Originalgröße (erzeugt durch Holografie) und können mit anderen Teilnehmenden aktiv in Kontakt treten. Ein erlebbares Gemeinschaftsgefühl und eine offene, vertrauensbildende Kommunikation können wie in Präsenz entstehen. Hier fangen wir mit unserer Lösung an und zeigen, wie Netzwerken in der digitalen Welt menschlich und so real wie möglich gestaltet werden kann, damit sich Teilnehmende wohl fühlen und natürlich vernetzen können. Im Zentrum unserer Arbeit möchten wir überprüfen inwieweit die Kombination von AR und Holografie von den Teilnehmenden genutzt und akzeptiert werden, um sich zu vernetzen. Gestützt auf Werke aus dem Bereich Human Computer Interaction und Design Science Research möchten wir herausfinden, wie die „Welt“ aufgebaut werden sollte, um sich in dieser wohlzufühlen. Wir möchten Faktoren, welche für oder gegen die neue Technologiekombination sind, identifizieren, um entsprechende Maßnahmen zur Förderung ihrer Technologieakzeptanz umzusetzen. Vor diesem Hintergrund möchten wir folgende Forschungsfrage untersuchen:

Inwieweit wird die Kombination von AR und Holografie genutzt und akzeptiert, um sich unabhängig von Ort und Zeit mit anderen Menschen in Echtzeit zu vernetzen?

Das vorliegende Papier ist wie folgt gegliedert: Einsteigen möchten wir in die Thematik, indem wir die Ergebnisse der ausführlichen Literatursuche zu den Themen AR, VR und Holografie, sowie die ersten Versuche von anderen Forschenden oder Unternehmen präsentieren. Anschließend erläutern wir unser methodisches Vorgehen. Im nächsten Kapitel stellen wir die Ergebnisse unserer Interviews vor. Zuletzt wird die Arbeit mit Limitationen, sowie den Implikationen für Wirtschaft und Wissenschaft abgeschlossen.

9.2 Theoretischer Hintergrund

9.2.1 Realitäts-Virtualitäts-Kontinuum

Das Papier beschäftigt sich mit einer digitalen Technologie, welche eine Kombination von AR und Holografie darstellt. Um beide Begriffe zu definieren und voneinander zu unterscheiden, wird zur Einordnung des Termini das Realitäts-Virtualitäts-Kontinuum von Milgram und Kishino (1994) herangezogen (siehe Abb. 9.1). Das Realitäts-Virtualitätskontinuum bildet das gesamte Spektrum zwischen den beiden Endpunkten „Realität“ und „Virtualität“ sowie die dazwischenliegenden Übergänge ab und beschreibt die gemischte Realität (engl. mixed reality oder kurz MR) als Oberbegriff (Milgram und Kishino 1994). MR umfasst dabei alle möglichen Variationen und Kombinationen von realen und virtuellen Objekten (d. h. der echten Realität und der virtuellen Realität) unter Ausschluss der beiden Extrempunkte (Hochberg et al. 2017). Kennzeichnend dabei ist der Grad der Virtualität, das heißt, ab welchem Grad der Virtualität noch von AR bzw. schon von erweiterter Virtualität (engl. augmented virtuality (AV)) gesprochen werden kann (Milgram und Kishino 1994). In der AR steht die reale Welt im Vordergrund und wird um virtuelle Elemente erweitert, zum Beispiel indem Grafiken in die reale Umgebung projiziert werden. In der AV werden in eine virtuelle Welt reale Elemente eingeblendet, zum Beispiel indem reale Objekte in Echtzeit eingeblendet werden (Mehler-Bicher et al. 2011).

9.2.2 Virtuelle Realität

VR bezeichnet eine Hardware-Software-Kombination, die es dem Menschen erlaubt in computergenerierte, interaktive und dreidimensionale Räume einzutauchen sowie sich frei zu bewegen (Wexelblat 1993; Mills und Noyes 1999). Der Kern moderner VR-Hardware ist die VR-Brille mit zwei hochauflösenden Displays zur Darstellung künstlich erzeugter Bilder (Burdea und Coiffet 2003; Dörner et al. 2019). Die VR-Brille ist an eine Sensorik gekoppelt, die die Lage und Position des Kopfes erfasst. Bewegt die nutzende Person den Kopf, registriert die Sensorik die Veränderung von Lage und Position und passt die erzeugten Bilder an (Wexelblat 1993; Tißler 2018). Vergehen zwischen dem Sensorik-Signal und der

Bilderzeugung weniger als elf Millisekunden (Motion-to-Photon-Latency), so entsteht der Eindruck der virtuellen Realität (Wexelblat 1993; Dörner et al. 2019; Wohlgenannt et al. 2020). Mithilfe von Controllern kann die benutzende Person zudem mit Objekten interagieren und sie manipulieren (Martín-Gutiérrez et al. 2017).

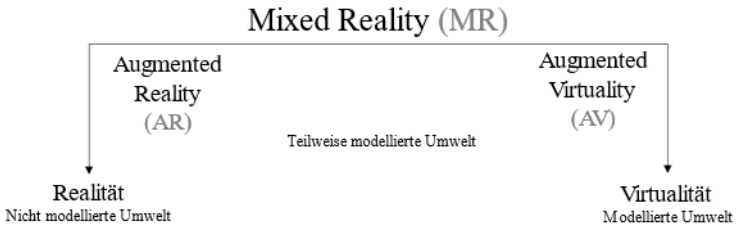

Figure 9.1: Realitäts-Virtualitäts-Kontinuum in Anlehnung an Milgram und Kishino (1994)

VR-Technologie charakterisiert sich durch Immersion, Präsenz und Interaktivität (Walsh und Pawlowski 2002; Wohlgenannt et al. 2020). *Immersion* charakterisiert sich durch die subjektive Erfahrung sich vollständig im virtuellen Raum involviert zu fühlen und ermöglicht es der nutzenden Person, sich innerhalb des virtuellen Raums zu bewegen und mit anderen Personen und Objekten zu interagieren (Wexelblat 1993; Suh und Lee 2005; Dede et al. 2017). *Präsenz* beschreibt das subjektive Gefühl, ob die nutzende Person die virtuelle Umgebung als reale Welt nachempfinden kann (Sanchez-Vives und Slater 2005). Das Gefühl der Präsenz lässt sich nach Lee (2004) in drei Komponenten untergliedern: räumliche Präsenz (Werden die Objekte in der virtuellen Welt als real wahrgenommen?), soziale Präsenz (Werden die anderen Personen als real wahrgenommen?) und Selbstpräsenz (Wird die eigene Präsenz im virtuellen Raum als real wahrgenommen?). *Interaktivität* beschreibt das Ausmaß, in dem die nutzende Person Einfluss auf die Form oder den virtuellen Raum nehmen kann (Steuer 1992).

9.2.3 Erweiterte Realität

AR ermöglicht den Nutzenden in der eigenen Umgebung zu bleiben und diese, um 3D registrierte Gegenstände oder Charakteristika, zu *ergänzen* (Azuma 1997; Amin und Govilkar 2015). Damit wird die reale und die virtuelle Welt *kombiniert*. Wichtig ist, dass die Ergänzungen in Echtzeit erfolgen, um die *Interaktivität* mit der realen Umgebung zu gewährleisten. Diese drei Eigenschaften bilden auch gleichzeitig die drei Bedingungen an AR-Systeme (kurz ARS) ab, die Azuma im Jahre 1997 postulierte (Azuma 1997). Die Nutzung von AR hat im Gegensatz zur Nutzung von VR den Vorteil, dass die Nutzenden nicht vollkommen von ihrer Umwelt abgeschottet sind und die Umgebung nicht rein virtuell dargestellt, sondern mit zusätzlichen Informationen erweitert wird (Deutsche Telekom 2020).

Für die Anwendung von ARS werden verschiedene Komponenten benötigt. Zum einen die Hardware, die die 3D registrierten Elemente überträgt. Hier gibt es für unseren Fall drei relevante Formen. Erstens, feste Displays, die ein 3D registriertes Objekt in den Raum erzeugen. Zweitens, sogenannte handheld Displays, also Smartphone- oder Tablet-Displays, mit denen die Objekte an den gewünschten Orten sichtbar werden. Und drittens eine AR-Brille oder ein so genannter Head-MountedDisplay (kurz HMD), welche mit Sensoren und Kameras ausgestattet ist. Die beiden letzten Arten nennt man auch mobile System, da hier eine uneingeschränkte Bewegungsfreiheit gewährleistet ist. Für die Positionierung der Gegenstände ist wichtig, dass die Position und die Richtung zu jeder Zeit definiert sind, um Schwimmeffekte zu vermeiden. Als Schwimmeffekte werden die Zeiträume bezeichnet, wenn das virtuelle Bild der realen Umgebung hinterherhängt und somit eine Differenz sichtbar wird. Zum anderen werden die 3D-Objekte benötigt, um sie darzustellen. Dafür müssen die 3D-Objekte in den zugehörigen Cloud Systemen programmiert und abgespeichert worden sein. Für die Echtzeit Anwendung werden abschließend eine ausreichende Übertragungskapazität und Download-Bandbreite benötigt (Azuma 1997; Tönnis 2010; Wursthorn 2019).

9.2.4 Holografie

Holografie ist eine Zusammensetzung der beiden griechischen Worte „holos“ („vollständig“) und „graphein“ („Aufzeichnung“). Es handelt sich um ein Verfahren, welches die Lichtwellen eines Objektes in mehreren Dimensionen aufnimmt (Fränzl et al. 2013). Der Unterschied zur Fotografie liegt darin, dass bei der Fotografie ein zweidimensionales Bild eines Objektes dargestellt wird, während die Holografie das gestreute Wellenfeld eines Objektes untersucht und ein dreidimensionales Bild darstellt (Ostrowski und Osten 2013; Voss-de Haan 2020). Dabei wird eine Aufnahme eines körperlichen Objektes als ein dreidimensionales Bild in einem realen Raum wiedergegeben, welches realitätsnah dargestellt wird (Bendel 2021).

Das Hologramm bzw. das dreidimensionale Abbild eines Objektes ist eine „kohärente, monochromatische Welle“ (Voss-de Haan 2021), die in zwei Wellen (Objektund Referenzwelle) aufgeteilt wird und durch eine Strahlungsquelle, in der Regel mit einem Laser, erzeugt wird. Die Objektwelle wird von einem Objekt gestreut und mit einer ungestreuten Referenzwelle zur Interferenz gebracht, welche Informationen beinhaltet und dementsprechend ein Interferenzmuster abbildet. Durch die Beleuchtung dieser mit einer entsprechenden identischen Welle, wird das Inferenzmuster zu dem ursprünglichen Wellenfeld abgebildet und das Hologramm erscheint als ein virtuelles 3D-Abbild eines Objektes. Durch die Wiederherstellung des aufgenommenen Wellenfeldes, kann im Unterschied zu einer

Fotografie das Objekt anschließend aus unterschiedlichen Richtungen betrachtet werden (Voss-de Haan 2021).

9.2.5 Umsetzung

9.2.5.1. Technische Umsetzung

AR ist die Grundlage für eine funktionierende Holografie-Anwendung. Hierfür sind zwei unterschiedliche Komponenten nötig: eine AR-Kollaborationsplattform und eine MR-Brille. Eine AR-Kollaborationsplattform muss die Möglichkeit bieten, ein 3D-Modell in eine Cloud hochzuladen und dann mit Hilfe eines AR-Devices wieder anzuschauen. Das zu holographierende Objekt muss aus verschiedenen Perspektiven abgescannt werden und danach ohne technische Verzögerung, sogenannter Latenz, an einem anderen Ort wieder zu sehen sein. Eine Herausforderung im Bereich der Holografie ist vor allem, dass die Visualisierung der Hologramme am Zielort möglichst ohne technisches Zusatzequipment stattfinden sollte, insbesondere wenn diese für die menschliche Kommunikation eingesetzt werden soll (Voss-de Haan 2021).

Die MR-Brille, welche AR umsetzt, muss die Funktion haben, dass sich mit Hilfe von Sprache und Gesten die AR-Anwendungen steuern lassen. Die MR-Brille blendet dabei eine 3D-Projektion in eine natürliche Umgebung innerhalb der realen Welt ein. Dadurch kann die Realität durch beispielsweise Grafiken, Texte, 3D-Modellen oder Informationsboxen erweitert werden. Die Einsatzmöglichkeiten sind dabei sehr vielfältig. Es können Prozesse effizienter gestaltet und Simulationen durchgeführt werden, um Objekte, die in der Realität noch nicht existieren, zu testen. Des Weiteren lassen sich Produkte und Services unabhängig vom Ort in Echtzeit vorstellen und den aktuellen Gegebenheiten und Anforderungen anpassen (Luber und Litzel 2018; Microsoft Corporation 2020).

9.2.5.2. Praktische Ausgangssituation

VR-Anwendungen versetzen den Nutzenden in eine simulierte 3D-Umgebung. Durch die Verwendung von VR-Brillen werden Videos und Bilder in 3D-Format gezeigt. Die Bildausschnitte passen sich den Augen- und Kopfbewegungen der Nutzenden an und ermöglichen in Kombination mit Bewegungssensoren die Erkundung von 3D-Welten (Anthes et al. 2016). Die Einsatzmöglichkeiten für VR reichen von Videospielen über das Bereisen von Orten, bis hin zur Bildung und Gesundheitsanwendungen. Das Thema AR ist spätestens seit dem Durchbruch von Spielen wie Pokémon Go populär und die Potentialentfaltung befindet sich auf dem Vormarsch. Für die Entwicklung von AR ergeben sich aufgrund der

standortunabhängigen Nutzungsmöglichkeit sowie der einfachen Integrationsmöglichkeiten in den Alltag der Konsumenten zahlreiche Anwendungsfelder.

So wie Smartphones und Tablets es bereits heute ermöglichen, zu jedem Zeitpunkt auf Informationen und nützliche Funktionen zurückzugreifen, könnte durch die direkte Einbindung von virtuellen Elementen in die reale Umgebung eine beschleunigte und intuitive Informationsaufnahme erfolgen (auch im Bereich der Kommunikation). Marktstudien zeigen, dass derzeit von einem Marktpotenzial hinsichtlich der Entwicklung von VR und AR ausgegangen werden kann (Statista 2020). Auch in Deutschland wird ein hohes Marktpotential vorausgesagt (Hochrechnungen für 2020 schätzen einen Umsatz von über 800Mio. C) (Statista GmbH 2020), allerdings sind gerade im B2C-Sektor noch wenige Anwendungen marktreif. So bieten zwar die beiden herrschenden mobilen Betriebssysteme Android (Google) und iOS (Apple) für Entwickelnde sogenannte Software Development Kits an, bisher ist jedoch eher eine kleine Anzahl von AR-Apps veröffentlicht (Apple 2020).

9.3 Methodisches Vorgehen

9.3.1 Methodenwahl und Datensammlung

In unserem Papier haben wir einen qualitativen Ansatz (Flick et al. 2004) verwendet, um zu erforschen inwieweit neue Technologien, vor allem die Kombination von AR und Holografie, von den Teilnehmenden genutzt und akzeptiert werden, um sich zu vernetzen. Wir sind dabei deduktiv vorgegangen, indem wir sowohl die Experten- als auch die Kunden-Perspektive betrachtet haben, um Schlussfolgerungen zu ziehen. Im Rahmen unseres Papiers haben wir virtuelle Interviews mit einer durchschnittlichen Länge von 60min durchgeführt. Die Interviews wurden im Juni, Juli und Oktober 2021 in Deutschland durchgeführt. In Tab. 9.2 sind die Informationen zu den Interviewteilnehmenden angegeben, wobei wir zwischen Experten und Kunden differenziert haben. Wir befragten also Mitarbeitende von Unternehmen, die sich alltäglich mit VR, AR und MR beschäftigen, jedoch in der Größe (d. h. kleine und mittlere Unternehmen und Start-ups) variieren. Diese Verteilung über die Hierarchie ebenen war zufällig, kann aber in Kombination mit der unterschiedlichen Anzahl an Berufsjahren sicherstellen, dass individuelle und elitäre Verzerrungen vermieden und unterschiedliche Perspektiven berücksichtigt werden (Miles und Huberman 1994). Um ein breiteres Spektrum an Antworten zu erhalten und den Befragten zu ermöglichen, frei und offen zu sprechen, verwendeten wir einen halbstrukturierten Leitfaden mit offenen Fragen (Pumplun et al. 2019). Wir folgten Sarkers Leitfaden für qualitative Forschung, um typische Fallstricke qualitativer halbstrukturierter Interviews zu vermeiden (Sarker et al. 2013; Pumplun et al. 2019).

Nr.	Interview-teilnehmer	Geschlecht	Alter	Ausbildung	Beruf
1	Experte (EX1)	M	38	Studium	Gründer und Geschäftsführer eines Startups, dass sich mit skalierbaren AR/MR-Anwendungen für die Industrie beschäftigt
2	Experte (EX2)	W	36	Studium	Technische Projektleiterin in einem mittelständischen Unternehmen
3	Experte (EX3)	M	30	Studium	IT-Stabstellenleiter u. a. verantwortlich für die Einführung von VR und AR Anwendungen im Unternehmen
4	Kunde (KU1)	M	54	Promotion	Betriebswirt
5	Kunde (KU2)	M	28	Studium	Banker
6	Kunde (KU3)	M	40	Studium	Berater für Kommunen
7	Kunde (KU4)	W	28	Studium	Verkehrsplanerin
8	Kunde (KU5)	M	39	Studium	CEO eines Mobilitätsdienstleister
(-)	(-)	Im Durchschnitt	36,6	(-)	(-)

Table 9.2: Demographische Angaben der Interviewpartner

Um ein breiteres Spektrum an Antworten zu erhalten und den Befragten zu ermöglichen, frei und offen zu sprechen, verwendeten wir einen halbstrukturierten Leitfaden mit offenen Fragen (Pumplun et al., 2019). Wir folgten Sarkers Leitfaden für qualitative Forschung, um typische Fallstricke qualitativer halbstrukturierter Interviews zu vermeiden (Pumplun et al., 2019; Sarker et al., 2013b).

Der Interviewleitfaden ist in vier Kategorien unterteilt. Die erste Kategorie umfasst Fragen zum Befragten (z. B. Alter, Hintergrund, IT-/VR-/AR-Kompetenz). Die zweite Kategorie beschäftigt sich mit Netzwerken im Allgemeinen, beispielsweise „Wie haben Sie sich vor Covid-19 vernetzt? Wie sind Sie auf Partnerakquise gegangen? Wie hat sich dies durch die Pandemie verändert?“. Die dritte Kategorie fokussiert das Netzwerken mit Hilfe von VR, AR und Holografie. Beispielhafte Fragen sind hier „Wie umfangreich hat virtuelles Netzwerken vor Covid-19 stattgefunden? Welche Technologien (VR, AR und/oder Holografie) haben Sie

vor Covid-19 schon mal zum virtuellen Netzwerken genutzt? Und wenn ja, wie haben Sie dies empfunden?“. Danach haben wir einige Fragen zum Netzwerken nach Covid-19 gestellt, um Veränderungen mit einzubeziehen, z.B. „Was hat sich durch Covid-19 verändert? Welche Technologien (VR, AR und/oder Holografie) haben Sie im Laufe der Covid-19 Zeit zum virtuellen Netzwerken ausprobiert? Wer ist Treiber dieser Veränderung?“. In der vierten Kategorie stellten wir schließlich Fragen zu den Vor- und Nachteilen von VR, AR und/oder Holografie, im Gegensatz zum traditionellen Netzwerken, z.B. „Welche Vor- und Nachteile sehen Sie bei der Nutzung und Umsetzung von VR, AR und/oder Holografie zum virtuellen Netzwerken?“.

9.3.2 Datenanalyse

Die Interviews wurden aufgezeichnet, nonverbal transkribiert und mit der Software MAXQDA (VERBI Software. Consult. Sozialforschung GmbH 2021) ausgewertet. Für die Analyse der Interviews wurde Bottom-up Coding verwendet. Zwei Forschende wendeten unabhängig voneinander das offene Kodieren an, d. h. den Sätzen und Absätzen wurden Code-Phrasen zugeordnet, die den Inhalt am besten repräsentieren (Corbin und Strauss 2014; Glaser und Strauss 2017). Anschließend haben wir die Ergebnisse verglichen und gruppiert (axiales Kodieren), um akzeptanz- und nutzungsspezifische Aspekte zu finden (Corbin und Strauss 2014). Unterschiedliche Meinungen wurden mit einem dritten Forschenden diskutiert und einvernehmlich geklärt. Zum Beispiel bei dem folgenden Zitat: „Also sprich ich bin an dem einen Tag in Berlin und dann klappere ich mal einfach alle Kunden ab. Und wenn es einfach nur eine halbe Stunde ist. Ich schau einfach mal vorbei und guck, was sich Neues ergibt bei den Bestandskunden.“ (EX2), wurden zwei unabhängige Codes („Kundenkontakt“ und „neue Kontakte treffen“) gefunden. Schließlich wurde „Kundenkontakt“ als axialer Code verwendet. Anschließend wurden die axialen Codes nach Aspekten gruppiert. Wir beendeten die Analyse mit Sättigung, d.h. wenn keine neuen übergeordneten Aspekte gefunden wurden.

9.4 Ergebnisse

Netzwerken hat eine große Bedeutung für Menschen. Der Austausch, die Diskussion und gemeinsame Kommunikation mit anderen Menschen gehören sowohl im privaten als auch im beruflichen dazu. Die Vernetzung mit anderen Menschen ist essenziell und von großer Relevanz, wobei es viele verschiedene Arten und Wege zum Netzwerken gibt. Sei es per Telefon, in Präsenz vor Ort z.B. bei Messen, Veranstaltungen, etc. oder auch das virtuelle Netzwerken. Die Experten haben hierbei unterschiedliche Ansichten. EX1 ist ganz klar der Ansicht, dass virtuelles Netzwerken ein Generationsthema ist.

„[...] [W]eil wir alle IT verstehen, und noch zu der jüngeren Generation gehören, ist es einfacher. Aber wenn ich mir jetzt angucke – das ist übrigens ein Generationsthema [...] – ich habe eine Mitarbeiterin, die macht für uns SocialMedia-Kommunikation, die ist ganz anders unterwegs, als ich es jetzt bin und wir sind nur 15 Jahre auseinander. [...] Da ist schon ein deutlicher Unterschied und damit steht und fällt natürlich auch die Art und Weise, wie ich darüber kommuniziere und ob ich bereit und offen bin." (EX1)

Anderer Meinung sind jedoch die Experten 2 und 3. Sie verdeutlichen, dass die Art und Weise wie man kommuniziert und netzwerkt nicht vom Alter, sondern von der Persönlichkeit und Technikaffinität abhängt und nach Belieben gewählt und genutzt wird.

„Leute, die technisch affin sind und Spaß an sowas haben. [...] [D]as ist glaub ich zumindest teils altersunabhängig. [...] [I]m Kollegenkreis [...] ist einer meiner ältesten Kollegen derjenige, der am meisten Spaß dran hat, weil er einfach vom Typ her so ist. Ganz generell würde man vermuten, dass die jüngeren Leute, weil sie mit Gaming, Smartphone und so weiter groß geworden sind, dann noch mehr Interesse haben. Ich glaube sie bringen einfach noch mehr Basiswissen mit und finden sich einfach schneller in grundsätzlichen Funktionsweisen ein. Das heißt aber noch lange nicht, dass diejenigen mehr Interesse haben an neuen Technologien. Das ist schon ein Persönlichkeits-Thema." (EX2) „Wir führen gerade eine Studie durch, wo wir fast jeden Mitarbeiter [...] mal in die VR oder AR gesteckt haben. Ich finde sehr spannend, dass es so einen Altersgap in meinen Augen nicht gibt. Es gibt glaube ich eher ein Technikgap, also ob einer so ein bisschen neugierig auf neue Technik ist. Also das Alter alleine ist glaube ich keine Größe, die das limitiert." (EX3)

9.4.1 Netzwerken vor der COVID-19 Pandemie

Netzwerken hat auch vor der COVID-19 Pandemie eine entscheidende Rolle eingenommen. Die Art und Weise wie kommuniziert wurde war eine andere, mehr in Präsenz und von Angesicht zu Angesicht.

„Vor Corona ging das relativ gut. Man konnte zu irgendwelchen Veranstaltungen fahren und irgendwelche Leute treffen. Das funktioniert aber heute leider nicht mehr." (EX1)

„Rein beruflich gesehen waren viele Kundenworkshops vor Ort. [...] Also normalerweise waren gerade diese Kick-off Phasen im Projekt vor Ort." (EX2)

> *„Vor COVID [...] war gerade der Austausch rechts, links, davor oder danach von Workshops [...] sehr gewinnbringend. Man hat sich bei einem Kaffee oder einer Cola [...] einfach zusammengesetzt und hat über [den Workshop] gesprochen [...]. Und man war relativ schnell durch Smalltalk in einem sehr guten Netzwerk unterwegs oder hat sich seine Kontakte gebildet. Dann tauscht man irgendwann Visitenkarten aus [...] und dann war das ein Selbstläufer. Also das ist häufig so bei vor-Ort Veranstaltungen." (EX3)*

Bestehende, aber auch neue Kunden konnten so an einem Tag direkt vor Ort besucht werden, um sich auszutauschen, an möglichen Problemen direkt zu arbeiten und zu zeigen, dass sich jemand kümmert. Diese Netzwerkpflege wurde vor der COVID-19 Pandemie meist in Präsenz durchgeführt.

> *„Ich bin an dem einen Tag in Berlin und dann klappere ich mal alle Kunden ab und wenn es einfach nur eine halbe Stunde ist. Ich schau einfach mal vorbei und guck, was sich Neues ergibt bei den Bestandskunden." (EX2)*

> *„Wir wurden im Sommer immer von unseren Verkäufern zum Sommerfest eingeladen. Es gab Essen und man konnte in entspannter Atmosphäre sprechen. Da haben wir sogar unseren letzten großen Deal abgeschlossen." (KU5)*

Virtuelles Netzwerken war auch vor der COVID-19 Pandemie präsent, jedoch wurden die Möglichkeiten der digitalen Technologien nur wenig bis gar nicht umgesetzt und genutzt. Viele Veranstaltungen und Meetings wurden in Präsenz vor Ort und kurze Absprachen per Telefon durchgeführt. Videotelefonie wurde gelegentlich als Ausgleich zum Telefonieren genutzt. Die Technologie gab bereits, diese wurde jedoch nicht im vollen Ausmaß genutzt.

> *„Also was da mal passiert ist, ist dass Du mal mit einem Kunden einen Videocall hattest. Das war aber dann auch schon das Höchste der Gefühle. So nach dem Motto, wir müssen uns ja jetzt nicht treffen, lass uns doch einen Webex Call oder so machen, anstatt zu telefonieren. Aber schlussendlich gab es das nicht. Es gab keine virtuellen Veranstaltungen." (EX1)*

> *„Vor COVID hat es anders stattgefunden, wenn es schon virtuelle Termine gab [als heute]. [...] All diese Kommunikation in der ersten Runde hat meistens virtuell stattgefunden. Spannend sogar ohne Kamera – alle haben nur so ein bisschen gequatscht, so Telefonkonferenz-mäßig." (EX3)*

Weiter haben die Interviewpartner verstärkt darauf hingewiesen, dass die Hürden des virtuellen Netzwerkens vor der COVID-19 Pandemie insbesondere daran lagen, dass Menschen sich gerne vor Ort mit anderen Menschen unterhalten wollten. Es ist zum einen einfacher, da keine weiteren Gegenstände bzw. Fähigkeiten benötigt wurden und zum anderen haben sie von einem anderen Gefühl gesprochen. Das Gefühl mit echten Menschen zu reden, sie zu sehen, ihre Gestik und Mimik richtig deuten zu können und unbeschwert ohne vorherige Zeitabstimmung sich unterhalten zu können.

> *„Menschen sind persönlich. Menschen wollen Menschen treffen. Einfach das echte Miteinander und deswegen wollen die Menschen halt auch Veranstaltungen und deswegen sind Messen so groß, weil da kann ich viele Leute treffen. Ich kann ein bisschen quatschen und dabei auch versuchen Business zumachen. Durch Corona ging es nicht mehr – alle mussten umlernen.“ (EX1)*

> *„Sich Treffen ist immer noch etwas anderes als digital, also wenn man mit der Person dann tatsächlich an der Ecke steht, am Tresen steht, am Tisch sitzt und Miteinander isst oder sowas. Das sind andere Emotionen.“ (KU3)*

> *„Wenn ich virtuell das mache, was auch möglich wäre, so rein vom Informationsgehalt her, fällt aber dieser informelle Austausch massiv weg und das ist für mich der eigentliche Punkt vom Netzwerken oder Beziehungsaufbau, um dann eigentlich erst über das Fachliche und gemeinsame Projekte zu sprechen.“ (EX2)*

9.4.2 Netzwerken während der COVID-19 Pandemie

Durch die plötzliche Distanz, bedingt durch die COVID-19 Pandemie, wurde persönliches und gemeinsames Arbeiten und Netzwerken unmöglich und neue Methoden des virtuellen Netzwerkens wurden benötigt, die insbesondere durch den digitalen Wandel immer mehr an Zuspruch gewonnen haben. Zunächst wurde auf Vorhandenes zurückgegriffen, wie Telefonate, Videobesprechungen und Social-Media wie LinkedIn und XING.

> *„Ich habe Instagram und auch von der Firma haben wir alle [Social-Media] Kanäle eigentlich. [...] Aber das Meiste kommt über LinkedIn.“ (EX1)*

> *„Grundsätzlich [nutze ich Social-Media-Accounts] ja. Wenn ich Kontakt mit jemandem hatte, über LinkedIn oder XING, gerade im beruflichen Kontext, schreibe ich teils über diese Kanäle die Leute noch an.“ (EX2)*

> *„Das hat in der Tat zugenommen. Also Social Media, XING, LinkedIn nutze ich für berufliche Zwecke, um mich zu verlinken und mit Menschen in Kontakt zu treten. Also LinkedIn, XING hat beruflich extrem zugenommen. LinkedIn sogar noch mehr als XING. [..] Das habe ich vor Covid gar nicht so auf dem Schirm gehabt, wenn ich ehrlich bin." (EX3)*

Dabei wurde jedoch schnell deutlich, dass es in naher Zukunft keine Alternative geben wird und dass Alternativen für Veranstaltungen, Messen etc. gefunden werden müssen. Hier wurden durch die Experten initiale Lösungen, wie Erkundungstage, BarCamps oder Kaffeerunden beschrieben und auch das Gefühl des Nutzungszwangs wurde deutlich.

> *„Wir haben viele Veranstaltungen [...] und das ist eigentlich auch nach wie vor so, bloß dass wir es einfach digital machen. Also diese Discovery Days und dergleichen finden jetzt einfach kürzer und digital statt. Das geht auch online, aber [...] für mich persönlich, ich muss mich dazu zwingen. Es gibt bei vielen solcher Veranstaltungen inzwischen so Kaffee-Talks oder sowas. Das heißt, Du gehst aus dieser Session raus und wählst dich in eine Neue ein, um dann quasi informell zu sprechen. Das fühlt sich so gezwungen an. [..] Das finde ich schwierig." (EX2)*

> *„Wir hatten jetzt vorletzte Woche einen Vortrag bzw. eine Tagung in der virtuellen Realität mit virtuellen Avataren. Also Du bist wie bei einem Computerspiel da durchgelaufen und hattest deinen Avatar und konntest dann mit den Leuten in deiner Umgebung reden. Du hattest auch einen menschlichen Avatar, also das war jetzt keine Pixelfigur, sondern das sah schon alles sehr realitätsnah aus. So bei 75% von der Realität [...]." (EX3)*

Diese initialen Lösungen stellen jedoch keinen adäquaten Ersatz für Netzwerkveranstaltungen in Präsenz dar, weshalb wir mit den Experten und Kunden innovative Lösungen diskutiert haben. Die Interviewteilnehmer bedauern jedoch, dass es bis heute keine zufriedenstellende Lösung gibt.

> *„Ich mag zum Netzwerken sehr gerne wonder.me. Ich finde Konferenzen dann nicht effektiv, wenn sie komplett geschlossen sind, sprich ich kann nicht mal sehen, welche Teilnehmer da sind. Dann ist das wie ein Film, den ich mir angucke, aber ich habe keinen Netzwerk-Effekt." (EX1)*

„Ja also, wir hatten eine Konferenz. Eine Fachkonferenz mit diversen Vorträgen und auch Räumen, wo Detailthemen dann näher beleuchtet worden sind, Workshops hatten und die Konferenz war vorbei. Und man konnte sich später in einem virtuellen Raum treffen. Man hatte so ein Avatar, mit dem man sich dann durch den Raum bewegen und sich zu anderen Personen dazu stellen konnte. Also technisch sicherlich eine echt gute Leistung und auch beeindruckend irgendwie. Aber ich bin in dem Sinne nicht der Netzwerker, der auf jemanden zugeht und sagt „Hallo, ich bin der und der, arbeitete für den und den, und ich möchte mich jetzt mit dir vernetzen." Bei mir entstehen Netzwerke irgendwie anders. Na also, informeller und auch klar, irgendwo durch Sympathie geprägt und nicht wenn jemand sagt, Du musst jetzt da auf der Konferenz zu dem und dem gehen. Dann funktioniert das Netzwerken zu 90% nicht." (KU3)

Erste Ansätze für Netzwerkveranstaltungen mit AR empfinden die Experten als spannend und bereichernd, da somit fehlende Aspekte des Netzwerkens, wie das Gefühl des Raumes, der Nähe und der ungezwungene, spontane Kontakt möglich werden. Hierbei sind jedoch auch die Hürden des AR-Netzwerkens deutlich geworden. Es beginnt bei den digitalen und technischen Kompetenzen der Teilnehmenden und endet beim aktuellen Stand der technischen Umsetzbarkeit.

„AR ist erklärungsbedürftig. Du musst zu den Leuten hin, Du musst denen Brillen aufsetzen, Du musst denen was zeigen und das funktioniert nicht über die Distanz." (EX1)

„Ich war teils nur überrascht [...] wie unterschiedlich die [digitalen] Kompetenzen sind. Also für mich war das keine Umstellung, weil ich habe davor schon viele Online-Meetings gehabt und auch viel mit den Microsoft Produkten gearbeitet usw. Aber es gibt auch Abteilungen [...], die kannten das so gar nicht." (EX2)

„Wenn alle aus dem Team so eine Brille hätten und wirklich teilnehmen könnten und man nicht dann aufgrund von Technologiemangel jemanden ausgrenzt, da könne ich mir das schon ganz gut vorstellen. Vor allen Dingen, wenn es ums Netzwerken geht, dass man sich einfach vor den Veranstaltungen noch trifft und den Austausch hat. Aber so diese Firmenevents mit einem Grillfest oder sowas, da könnte ich mir schlecht vorstellen, solche Events [über VR oder AR] zu machen. Aber so ein Austauschtreffen kann ich mir gut vorstellen." (KU4)

> *„Ich glaube, wenn man sich in so einer virtuellen oder erweiterten Realität befindet, mit einer Brille auf und nichts um sich Drumherum mitbekommt, weil man auch mit Ton arbeitet, mit anderen Personen spricht, dann sollte man sich auch sicher sein, dass jetzt nicht irgendwann einer reinkommt und einen beobachtet zum Beispiel. Das könnte für viele auch unangenehm sein.“ (KU2)*

> *„Eine AR-Veranstaltung hat noch nicht stattgefunden, weil es technologisch extrem schwierig ist und noch gar nicht so funktioniert tatsächlich. Es gibt zwar einzelne Möglichkeiten, wie Du das machen kannst, aber noch nicht so stabil, dass Du das hinkriegst. Wenn ich einen Menschen in 3D erzeugen möchte [...] ist das Problem, dass Du den Menschen von allen Seiten abscannen musst, und zwar dauerhaft, um ihn dann auch wieder so zusammen zu setzen. Denn es bringt ja nichts, wenn ich [eine Person] von vorne 3D scanne und wenn ich dann aufstehe, ist [die Person] von hinten flach.“ (EX1)*

Netzwerken lebt nun mal von vielen Menschen an einem Ort und hier erlangt die technische Umsetzbarkeit heute ihre absolute Grenze. Möchte man dies um Echtzeit und mit sowohl holografischer Gestik als auch Mimik kombinieren, ist dies heutzutage nicht möglich. Auch ist das Gewicht der Brillen auf Dauer zu hoch.

> *„Mit einer Person mag das noch funktionieren. Wenn ich jetzt hier im Raum vier Kameras aufhänge, dann kriege ich das schon irgendwie hin, mich abzuscannen und mich woanders hin zu positionieren und ich weiß, dass der andere sich das auch angucken kann. Aber wenn Du nun das mit einer Gruppe von Personen machen willst, die in einem Raum sind, stößt Du an technische Grenzen. Daher hast Du alleine schon so technische Herausforderungen wie, was mache ich, wenn der eine Sensorstrahl, den einen Menschen gar nicht erwischt, weil der durch einen anderen Menschen versteckt wird.“ (EX1)*

> *„Was ich als einen Hauptpunkt sehe, ist ein bisschen auch Kompetenz. Also so eine VR/AR-Brille entsprechend zu nutzen, bedarf ein bisschen technisches Geschick. Bei VR auch entsprechend viel Platz. Das sind limitierende Größen.“ (EX3)*

Zuletzt hängt der Erfolg einer solchen Netzwerkveranstaltung von der Akzeptanz der Teilnehmenden ab. Selbst wenn alle technischen Probleme beseitigt wären und auch bei allen Teilnehmenden die Kompetenzen und das Equipment für AR und Holografie Netzwerkveranstaltungen vorhanden wäre, müsste es genutzt werden. Daher stellt die

Akzeptanz einen wichtigen Faktor dar. In den Interviews haben wir jedoch auch erfahren, dass die Altersklasse bei der Akzeptanz eine untergeordnete Rolle spielt. Viel entscheidender ist, ob hybride Arbeit vor der COVID-19 Pandemie schon gelebt wurde. Denn in diesem Fall besteht laut den Experten eine höhere Akzeptanz für innovative Methoden, als wenn zuvor alles in Präsenz stattgefunden hat.

> *„Ich finde es erstaunlich, wie stark wir es unterschätzt haben, wie lange es dauert, bis alles Akzeptanz findet und es auch wirklich funktioniert. Natürlich gibt es immer [einen Prozentsatz], die vorrennen und wo es funktioniert. [...] Aber es gibt auch die große Masse, die dann erst nachzieht. Selbst wenn ich das technologisch beherrschen würde, muss meine Führungskraft das ja auch noch wollen und auch noch akzeptieren. [...] Aber ich glaub schon, dass die Akzeptanz nach oben gerutscht ist [...], weil auch die Formate besser geworden sind." (EX1)*

> *„Also fast alles ist irgendwie technisch machbar, aber es wird halt nicht richtig genutzt. Also ob wir jetzt wirklich mangelnde Kompetenz oder mangelnde Regeln drum herum oder auch Prozesse oder auch der Mut fehlt, sich mit Dingen mal auseinanderzusetzen, ist nicht entscheidend. Es muss genutzt werden." (EX2)*

> *„Akzeptanz ist ein ganz großes Thema und eine entsprechende Heranführung für alle Altersgruppen und alle Wissensstände ist hierbei notwendig. Also, in der kommunalen Verwaltung ist es ja so, dass der Großteil der Menschen, die dort arbeiten, zwischen, ich schätze mal, 45 und 56 sind. Entsprechend hängen die IT-Entwicklung und Akzeptanz hinterher. Wenn ich jetzt meine Kollegin angucke, die auch mit den ganzen neuen Dingen wie TikTok und wie sie alle heißen vertraut ist – bei mir hat es irgendwo bei WhatsApp und Facebook aufgehört. Heute mache ich das und das; ich habe ein komplett diverses Feld an Wissen und auch an Akzeptanz entwickelt und da muss ich schon darauf achten, dass ich meine Begeisterung beibehalte und auch die Akzeptanz nochmals Neues zu lernen aufrechterhalte und mich selbst motiviere. Vielleicht ist es auch dann eher was, wo man sagt, neue Technologien, fangen wir mit den Jüngeren an, weil dann kann ich so etwas auch schneller einsetzen und die älteren Menschen oder nicht so bereitwilligen Menschen, lernen dies später." (KU3)*

9.4.3 Netzwerken nach der COVID-19 Pandemie – ein Ausblick

Netzwerken bleibt nach all den Veränderungen durch die COVID-19 Pandemie Teil der beruflichen DNA. Nur durch ein effektives Netzwerk können neue Kunden akquiriert werden

und Bestandskunden gehalten werden. Die Experten denken, dass eine Veränderung in der Welt des Netzwerkens entstehen wird. Eine Hypothese ist, dass die beiden Teile einer klassischen Veranstaltung (inhaltliche Präsentation und anschließendes Netzwerken) getrennt werden.

> *„[Ich glaube,] dass es keine Großveranstaltungen mehr geben wird. [...] Also eher wird es kleineren Netzwerk-Events geben, wo Du so 50 Leute zusammenbringst als 50.000." (EX1)*

> *„Ich finde, dass man eine klarere Trennung hat zwischen dem fachlichen, relevanten Teil. Dass man den halt einfach konzentrierter rüberbringt und dann ganz bewusst, aber dann auch mehr Zeit für Informelles hat. Und dann ist es aber auch die informelle Zeit. [...] Denn ich denke mir, den Inhalt hätte ich mir auch einfach auf einer Seite durchlesen können oder fünf Minuten YouTube Video anschauen oder was auch immer. Das heißt dafür muss ich nicht vor Ort sein. Wiederum für den informellen Teil, einfach austauschen, auf Ideen kommen, so diese kurzen Impulse auch in Gesprächen aufzuschnappen, Menschen kennenzulernen – das ist für mich schon eher noch in Persona vor Ort." (EX2)*

> *„Kontakte hier aus der Region, mit denen man auch in Zukunft noch sprechen möchte oder wo der Kontakt einem was bringt, sind wichtig für Präsenz. Digital gerne da, wo ich 1–2 h hinzufahren müsste und der Inhalt nur mäßig relevant ist, im Zweifel nehme ich dann auch in Kauf einen Tick weniger zu Netzwerken. Aber die Veranstaltungen, die mir am Herzen liegen, wo ich mir vom Netzwerken etwas [...] da möchte ich hinfahren, weil da sind Firmen hier aus der Region, [...] da geht es hin, da will ich mit den Leuten reden, die möchte ich Face-to-face kennenlernen." (EX3)*

Die zuvor formulierte Hypothese könnte durch die neusten Erscheinungen, der Angst vor der plötzlichen Normalität, dem Treffen von Menschen und die damit verbundene Angst vor der Ansteckung, bekannt unter dem Cave-Syndrom (engl. Höhle), erklärt werden (Nebe 2021). Daher stellen alternative Formen, wie Netzwerkveranstaltungen mit Hilfe von AR und Holografie, eine gute Option dar. Die Interviewteilnehmer stellen sich durch AR-Netzwerken eine neue Art der Zusammenkunft und auch des Netzwerkens vor. So kann standortunabhängig miteinander kommuniziert und interagiert werden, ohne dass die Menschlichkeit verloren geht.

Zudem werden Reisekosten gespart und es wird ein Anreiz für Innovationen gesetzt. AR und Netzwerken ist eine neue Form der Kommunikation und kann Neugierde wecken. Als gute

Einstiegsformate stellen sich die Experten spielerische Ansätze, Produktvorstellungen oder Themen der Kollaboration oder Arbeitssicherheit vor.

> *„Es eignen sich sehr gut Großkonzerne, die Geld haben, um genau sowas auszuprobieren. Die sagen ja, das ist die Zukunft und wir verändern das jetzt mit und dann machst Du das halt so: zwei Holografie-Räume und viele Aspekte zum Testen.“ (EX1)*

> *„Wenn wir Akquise machen, da könnte man in Richtung Gamification viele lustige Sachen machen. Dass man so eine Art Rallye, Schnitzeljagd oder sowas veranstalten, wo es verschiedene Dinge zu entdecken gibt. Also mit den HoloLens kannst Du Objekte vorab in einem Raum platzieren und jemand anderes kann dieselbe Brille aufsetzen und muss dieses Objekt zum Beispiel wiederfinden und irgendetwas damit tun.“ (EX2)*

> *„Wir haben auch probiert Online-Spiele wie Fortnite zu spielen [...]. Das in einer AR Umgebung zu spielen, stelle ich als sehr effektiv fürs Teambuilding im Networking vor.“ (KU1) „Wir haben Verkehrsbetriebe als Kunden, wo es einfach viel [...] um Busse, Straßenbahnen, Umbauten und dergleichen geht. Da gibt es auch ganz, ganz viele unterschiedliche Vorstellungen davon, was man damit machen könnte. Also zum Beispiel Bürger abholen, wenn irgendwelche Veränderungen anstehen, beispielweise eine neue Straßenbahnlinie. Wir sensibilisieren die Bürger schon mal, wie es dann später aussehen könnte und dann kannst Du [...] die HoloLens aufsetzen und es poppt eine Straßenbahn auf, die dann später dort durchfahren wird. Also so ein bisschen das Gefühl für Räume kriegen.“ (EX2)*

9.5 Diskussion und Ausblick

Das Ziel dieser Arbeit war es, Faktoren für und gegen die Nutzung von AR und Holografie zum Netzwerken zu eruieren. Im Austausch mit den Experten und Kunden wurde deutlich, dass in der Lösungsmöglichkeit hohes Potenzial steckt und bedingt durch die COVID-19 Pandemie eine Alternative zum Traditionellen darstellt. Im Folgenden möchten wir die wichtigsten Faktoren noch einmal aufgreifen, um unsere Forschungsfrage zu beantworten.

Zusammenfassend lässt sich festhalten, dass es einige Faktoren für und gegen die Nutzung von AR und Holografie zum Netzwerken gibt, aber auch neutrale Faktoren. Eine allumfassende Darstellung der Faktoren ist in Tab. 9.3 zusammengefasst. Die neutralen Faktoren variieren mit jedem Menschen. Jeder Mensch hat unterschiedliche digitale Kompetenzen und so hängt

es von den Vorkenntnissen ab, ob der Mensch die Möglichkeit des Netzwerkens mit AR und Holografie nutzt und akzeptiert. Gleiches gilt für das Alter der Teilnehmenden. Wie bereits in Kap. 9.4 diskutiert, haben die Interviewteilnehmer eine unterschiedliche Auffassung über den Einfluss des Alters auf die Nutzung und Akzeptanz von AR/Holografie Nerzwerken, weshalb wir es als neutral einstufen. Ebenso als neutral stufen wir die Gestik und Mimik ein. Sieht man die Gestik und Mimik in Echtzeit und von der realen Person (Kombination von AR und Holografie), so spricht dies für die Nutzung von AR/Holografie Netzwerken. Kommt es jedoch zu Verzögerungen und technischen Ausfällen spricht dies dagegen. Insgesamt also neutral. Dagegen sprechen jedoch auch Argumente, wie dass Netzwerken nicht ohne reale Menschen geht. Die Experten sprachen auch von einer gezwungenen Atmosphäre, wenn beispielsweise ein separater digitaler Raum zum Netzwerken eröffnet wurde. Hinzu kommen auch technische Hürden einerseits in diesen Räumen, wie das nur einer sprechen kann, und andererseits das AR und Holografie Netzwerken technisch momentan nicht umsetzbar ist und es viel technisches Equipment bedarf. Ein Gegenargument hierzu ist, dass es schon erste Probeläufe für solche neuen Veranstaltungsformate gab, beispielsweise von der 5-HAT Digital Hub der Chemie und Gesundheit (5-HT 2021) und der GROB Werke (zreality 2020).

Argumente ...		
Dafür	**Neutral**	**Dagegen**
Digitale Alternative mit viel Potenzial	Alter	Keine realen Menschen
Social-Media-Kanäle als Grundlage	Kompetenzen	Gezwungene Atmosphäre
Gegenseitige Sichtbarkeit	Gestik und Mimik	Fehlende technische Umsetzbarkeit von AR und Holografie
Mehr Menschlichkeit als bei 2D-Anwendungen		Es wird viel technisches Equipment benötigt
Teil der eigenen Umgebung		
Netzwerken in kleinen Runden, die Intimität schaffen		
Alternative für Menschen mit dem CaveSyndrom		
Finanzielle und zeitliche Vorteile		

Table 9.3: Zusammenfassung der neutralen, pro und contra Faktoren zum Netzwerken mit AR und Holografie

Weiter gibt es auch Faktoren, die für das Netzwerken mit AR und Holografie sprechen. Ein Argument sind die bereits bestehenden Social-Media-Kanäle, die als Grundlage genutzt werden können, um technikaffinen Menschen in Pilotprojekten mit AR und Holografie zu vernetzen. Vorteile der AR und Holografie Kombination zum digitalen Vernetzen sind, dass die Menschen als 3D-Menschen komplett wahrgenommen werden können und so auch das Wohlfühlen gestärkt werden kann. Aufgrund der technischen Grenzen kann der informelle Teil einer Veranstaltung in kleinen Runden getestet werden, was Intimität schafft. Mit der AR und Holografie Alternative könnte auch die Übergangszeit, die Zeit bis ein sicheres Reisen und Treffen von Menschen wieder möglich ist, überbrückt werden und eine Inklusion der Menschen mit dem Cave-Syndrom geschaffen werden (Nebe 2021).

Das Hauptargument unserer Interviewteilnehmer für die Nutzung von AR und Holografie Netzwerkveranstaltungen ist die Einsparung von Zeit und Geld. An diesen Events kann von Zuhause teilgenommen werden, es bedarf keiner Reisetätigkeiten für lediglich ein paar Stunden und damit fallen viele Kosten weg, was gerade für Unternehmen ein ausschlaggebendes Argument ist.

Zuletzt werden, wie in jeder wissenschaftlichen Arbeit, die Limitationen sowie die Implikationen für Wirtschaft und Wissenschaft erörtert. Wir haben im Rahmen dieser Arbeit lediglich mit drei Experten und fünf Kunden aus dem Bereich AR und VR interviewt, weshalb hier ein Bias auftreten kann. Dies war jedoch bewusst gewählt, damit wir möglichst viele Faktoren für diese neuartige Möglichkeit des Netzwerkens analysieren konnten und auch die Barrieren durch die Expertise der Experten aufdecken konnten. Außerdem könnten zukünftige Forscher die Interviewteilnehmer der verschiedenen Branchen in verschiedene Kategorien einteilen und Unterschiede aufzeigen. Unsere Arbeit bietet sowohl für die Wissenschaft als auch Wirtschaft Implikationen. Im Wissenschaftsbereich konnten erste Vermutungen zu Nutzungs- und Akzeptanzfaktoren mit Hilfe der Interviews überprüft werden. Im Wirtschaftsbereich konnten wir feststellen, dass in der Möglichkeit des Netzwerkens mit AR und Holografie viel Potenzial und Bedarf für Lösungen stecken. Hier können Start-ups und Unternehmen innovative Geschäftsfelder gründen und die Marktlücke schließen. Wenn ein Unternehmen also nun solch ein Event zum Netzwerken testen möchte, sollten zu Beginn die Mitarbeiter spielerisch an die neue Technologie herangeführt werden. Danach sollte ein technischer Partner gesucht werden, um die Anschaffungskosten zu umgehen. Zuletzt sollte ein potenzieller Bereich aus Kapitel 9.4.3 gewählt werden, um zu starten. Es kann Gegenstand

zukünftiger Forschungsarbeiten werden, wie sich das Netzwerken mit technologischer Hilfe weiterentwickelt und wie AR und Holografie hierbei genutzt und eingesetzt werden können.

9.6 Acknowledgement

Das Paper wurde im Rahmen des Projekts inNOVATION gesponsert durch die Hessen Agentur (2695 3030 20 HA 0977) geschrieben.

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10 Age-Related Differences on Mind Wandering while Using Technology

Title	**Age-Related Differences on Mind Wandering while Using Technology: A Proposal for an Experimental Study**
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Publication Type	Conference Paper
Publication Outlet	Proceedings of the Neuro IS Retreat 2022
Status	Published
Full Citation	**Zeuge, A.**, Oschinsky, F. M., Klesel, M., Reßing, C., & Niehaves, B. (2022). Age-related differences on mind wandering while using technology: A proposal for an experimental study. *Proceedings of the NeuroIS Retreat 2022*. (published)

Table 10.1: Fact Sheet Publication

Age-Related Differences on Mind Wandering while Using Technology: A Proposal for an Experimental Study

Abstract. Mind wandering (MW) is a mental activity in which our thoughts drift away and turn into internal notions and feelings. Research suggests that individuals spend up to one half of their waking hours thinking about task-unrelated things. Being the opposite of goal-directed thinking, empirical evidence suggests that MW can forester creativity and problem solving. However, and despite growing efforts to understand the role of MW in technology-related settings, the role of individual differences remains unclear. We address this gap by proposing a research model that seeks to shed further light on age-related differences in MW while using different types of technology (i.e., hedonic and utilitarian systems). Thereby, we provide a point of departure for further research on how individual characteristics influence MW while using technology.

Keywords. Mind Wandering · Technology Use · Age · Hedonic and Utilitarian Systems.

10.1 Introduction

Mind wandering (MW) is one of the most ubiquitous mental activities [1] and happens up to 50 % of our waking time [2]. MW occurs when the mind stops being focused on the present and instead starts pondering about task-unrelated things [3]. Literature has shown that MW can be related to both negative job-output (e.g., reduced performance) and positive job-output (e.g., increased creativity) [4,5]. Due to its complexity, the investigation of MW is important to further understand how it affects human behavior.

Since MW is a ubiquitous experience, it is most likely that our minds frequently wander when using technology. In fact, there is initial evidence that the degree of MW varies among different types of systems, i.e., hedonic and utilitarian systems [6]. Hedonic systems aim to provide self-fulfilling value, while utilitarian systems aim to provide instrumental value [7]. Sullivan, Davis and Koh [3] suggest that MW, while using technology, has a notable impact on creativity [8]. To this end, we argue that MW is increasingly important in the context of technology use but needs further clarification.

Despite valuable first efforts to understand MW as a subject of information system (IS) research, little is known about individual differences in terms of MW and technology use so far. This gap is critical because literature on MW has stressed the role of individual differences [9,10,11]. Moreover, research concerning technology-related phenomena put further emphasis

on them [12,13,14]. Studies demonstrate that older people's minds wander less in their daily life compared to younger people [9], [15], because cognitive abilities decrease with age [16,17,18]. As cognitive ability influences how technology is used [19], it is important to understand how IS artifacts need to be adapted to support human computer interaction.

Our paper aims to investigate the relationship between MW and age by raising the following research question (RQ):

RQ: Is there an age-related difference on MW while using different types of systems (i.e., hedonic, utilitarian)?

We contribute to a more holistic understanding of how humans of different ages use technology when their minds trail off.

10.2 Theoretical Background

Christoff et al. [18, p. 719] define MW as "a mental state, or a sequence of mental states, that arises relatively freely due to an absence of strong constraints on the contents of each state and on the transitions from one mental state to another". Psychology and neuroscience research demonstrates that MW predominately occurs in non-demanding circumstances and during task-free activity, e. g., during reading or driving [20,21,22].

MW has been associated with negative and positive consequences: Since thoughts wander from topic to topic, MW induces a lack of awareness and is seen as a cause of poor performance, errors, disruption, disengagement, and carelessness [4], [23,24]. Moreover, MW is perceived as adverse, as it is enhanced by stress, unhappiness, and substance abuse [25,26,27]. However, besides its negative effects, studies suggest that MW offers unique benefits [1]. MW can lead to an increased ability to solve problems and positive predicts creative performance [3], [5], [11]. Moreover, MW is useful as it provides mental breaks to reduce boredom from monotonous activities [11].

In general, two types of MW can be distinguished: Deliberate and spontaneous MW [28]. This differentiation goes back to Giambra [20], [29]. Deliberate MW is characterized by intentional internal thoughts such as planning the weekend while driving to work. In contrast, spontaneous MW is unintentional, for example, when drifting away during a conversation [28]. Agnoli et al. [5] demonstrate that this distinction has indeed an effect as deliberate MW is a positive predictor of creative performance, whereas spontaneous MW is a negative predictor of creative

performance. Moreover, MW can occur both as a state in specific situations or as trait in everyday life [30].

IS researchers acknowledge the relevance of MW [3], [6], [31,32]. Sullivan, Davis and Koh [3] showed that MW while using technology influences creativity and knowledge retention. The authors came up with a domain-specific definition for technology-related MW: "task unrelated thought which occurs spontaneously, and the content is related to the aspects of computer systems" [3, p. 4]. Moreover, it has been shown that using different types of IS (i.e., hedonic, or utilitarian systems) relates to the degree of MW [6]. The use of hedonic systems indicates a higher level of MW compared to the use of utilitarian systems. Despite growing efforts to investigate MW in IS research, several questions remain unanswered. Most notably, the influence of individual characteristics on MW while using technology have not been investigated so far.

This gap is critical because individuals differ in the frequently and intentionality of their MW [9,10,11]. For example, Maillet et al. [9] assessed age-related differences in (1) MW frequency, (2) the relationship between affect and MW and (3) content of MW. The authors suggest that older people wander less in their daily life compared to younger people. Moreover, the authors showed that older people report their off-task thoughts were more "pleasant, interesting, and clear", while the thoughts of younger people were more "dreamlike, novel, strange, and racing" [9, p. 643]. Moreover, it has been shown that impairments can affect individuals MW. For instance, attention deficit and hyperactivity disorder symptomatology positively correlate with spontaneous MW frequency and lack of awareness of MW engagement [10], [33]. Christian et al. [34] suggest that individuals' gender and culture has an impact on the visual perspective while MW. They found out that females and residents from western nations most frequently adopted a first-person point of view, whereas a third-person perspective was more common among residents from eastern countries. Taken together, individual characteristics such as age, gender, origin, or impairments should be considered when studying MW in technology-related settings.

In this study we focus on age-related difference on MW while using different types of systems. Age should be investigated because perceptual (e.g., vision, auditory), cognitive (e.g., memory capacity, attentional control) and psychomotor (e.g., fine motoric, coordination) abilities decline with age [19]. Research has shown that these abilities influence the degree of MW (e.g., [9], [15]). Moreover, these abilities are powerful predictors of technology use [19]. Therefore,

age-related changes in ability must be considered, e.g., when designing IS [19]. For example, as demographic change leads to an aging workforce, this critical aspect should be considered when introducing new IS in workplaces.

10.3 Research Model

According to literature, our research model distinguishes between hedonic and utilitarian systems [6]. Hedonic systems are systems that "aim to provide self-fulfilling rather than instrumental value to the user, are strongly connected to home and leisure activities, focus on the fun-aspect of using information systems and encourage prolonged rather than productive use" [7, p. 695]. Utilitarian systems "provide value that is external to the interaction between the user and system (e.g., improved performance)" [35, p. 445]. Based on this distinction, we propose a research model that investigates whether the relationship between the underlying system and the degree of MW is moderated by age (Figure 10.1).

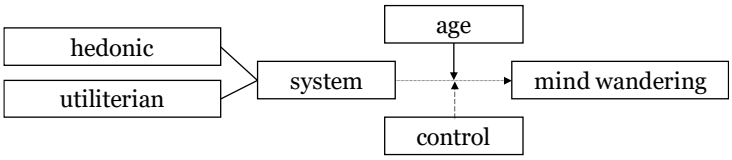

Figure 10.1: Proposed Research Model

Research suggests that the use of hedonic systems differs from the use of utilitarian systems. For example, Lowry et al [36] showed that cognitive absorption is stronger in a hedonistic context than in a utilitarian context. This may be explained by the fact that there are different motivational factors when it comes to hedonic (e.g., enjoyment) or utilitarian systems (e.g., job relevance). In line with [6], we argue that the use of hedonic systems leads to a higher degree of MW since users are primarily interested in enjoying a system instead of following instrumental goals. Hedonic usage is an effortless activity, which facilitates MW [6]. In this line, we propose our first hypothesis:

H1: The use of hedonic systems results in a higher degree of MW than utilitarian systems.

An important finding on cognitive aging is that older people have lower working memory capacity than younger people. (e.g., [19], [37]). Literature emphasized that older people have less capacity in working memory to attend to a task, leaving them with less residual capacity for MW [9], [15].

Utilitarian systems are mostly employed provide users value and improve productivity [7], [38]. In contrast, hedonic systems are mainly used in homes or leisure environments and are

employed for pleasure and relaxation [7], [38,39]. Thus, we argue that utilitarian systems require a higher working memory capacity than hedonic systems. Combining the above arguments, we propose our second hypothesis:

H2a: The thoughts of older individuals wander less than those of younger individuals while using utilitarian systems.

H2b: The thoughts of older and younger individuals wander in the same degree while using hedonic systems.

Moreover, we consider additional demographic variables (e. g., gender) to control for randomness or biases.

10.4 Methodology

Experimental design. Based on our research model (cf. Figure 10.1), we use a between-subject design to manipulate the system type (hedonic/utilitarian). Building up on the work of [15], who investigated the age-related differences between young and older adults on MW in a non-technology context, we acquire data from young-young adults (20–30 years old), young adults (31-64 years old), young–old adults (65–74 years old), and old–old adults (75–85 years old). Since we investigate MW in a technology context, we assume that the investigation of MW requires some degree of habitudinal use of technology because otherwise, when individuals use technology for the first time, the demands are too high to let the mind wander [40]. In other words, habitudinal use of technology was expected to lead to some degree of cognitive ease, which is a prerequisite for MW [41]. Consequently, we only collect data from individuals who indicate that they use their smartphones on a daily basis. Moreover, we ask the participants to use their own smartphones as users perceive their own devices as easier to use and more intuitive [42,43].

Measurement Instruments. Since MW is an "internal mental experience" it can be measured by self-reports [11, p. 489]. We use established measurement scales for MW on seven-point Likert-Scales. To investigate the psychometric attributes of MW, we select four items from existing multi-measure scales [6], [32].

Experimental Procedure. The experimental procedure will be carried out in four phases: First, participants will be welcomed and informed about the general setting. Second, the participants will be asked to accomplish one of two tasks on their smartphone (approximately 5 minutes), which are briefly described below. Third, they will be asked to complete a questionnaire

assessing their self-reported degree of MW, along with demographic questions. Fourth, they will be thanked and debriefed.

Task 1 ("Facebook"): A common type of hedonic systems relates to social media use. Therefore, we will ask the participants to do tasks on Facebook including navigate through commercials, comments, and postings.

Task 2 ("Email"): A common type of utilitarian technology is writing email. We will ask the participants to write an email to make a hotel reservation.

10.5 Outlook and Contribution

Our research will contribute to theory, practice, and design alike: From a theoretical perspective, our paper seeks to extent literature on the role of MW in technological settings with a particular emphasize on age-related differences. This goes in line with current literature on MW, emphasizing the relevance of age [9], [15]. Our paper contributes to a better understanding of how age influences individuals' MW while using different types of systems, i.e., hedonic and utilitarian systems. Therefore, research can benefit from this study as a point of departure for further research on how individual characteristics influence MW while using technology. For example, other individual differences (e.g., culture, gender) can be explored. Furthermore, in addition to the measurement scales we use, eye-tracking [44] or Electroencephalography (EEG) [45] could be integrated to provide not only a subjective but also an objective insight into individuals' MW. The investigation of MW as supplement to established concepts in IS, including mindfulness (e.g., [46]) and cognitive absorption (e.g., [47]), is an important step to a more holistic understanding of human cognition and behavior in technology-related settings.

From a design perspective, our research provides insights in how the design and the use experience of certain systems affect MW in light of age. We contribute to a better understanding of how IS should be designed by considering individual characteristics (e.g., age) to influence individuals' MW. This goes in line with literature on human computer interaction, emphasizing the importance of individual characteristics [48,49].

Our research is also beneficial from a practical perspective. It contributes to a better understanding of the relationship between use behavior and MW. Therefore, it provides important insights to stimulate (e.g., creative jobs) and reduce individuals' MW (e.g., jobs that depend on productivity). Organizations should take MW in consideration when designing

future workplaces since MW can provide unique benefits, including a positive influence on creativity, which can lead to performance increases in the long term [8]. Our paper contributes to a better understanding how to consider individual characteristics, such as age, to enhance individuals' creativity or productivity.

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11 To Be or Not to Be Stressed

Title	**To Be or Not to Be Stressed: Designing Autonomy to Reduce Stress at Work**
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Publication Type	Journal Paper
Publication Outlet	WORK: A Journal of Prevention, Assessment & Rehabilitation
Status	Accepted
Full Citation	**Zeuge, A.**, Lemmer, K., Klesel, M., Kordyaka, B., Jahn, K., & Niehaves, B. (2022). To be or not to be stressed: Designing autonomy to reduce stress at work. *WORK: A Journal of Prevention, Assessment & Rehabilitation*. (accepted)

Table 11.1: Fact Sheet Publication

To Be or Not to Be Stressed: Designing Autonomy to Reduce Stress at Work

Abstract.

Background

Many organizations are undertaking efforts to reduce the stress of (oftentimes overworked) employees. Information Technology (IT) (e.g., smartphones) has the potential to be a key instrument for reducing stress. One design-relevant factor considered to reduce stress is the concept of autonomy. Unfortunately, little research exists using autonomy as a characteristic of technology design.

Objective

Against this background, this study aimed to investigate specific autonomy-related design options with the potential to prevent stress.

Methods

In a factorial survey, this experimental study tested three design options in an overwork scenario: 1) autonomy (no intervention by design), 2) nudge ("nudging" by design), and 3) enforcement (hard stop by design). 51 participants (mean age 38 years, 50% women, mean work experience 18 years) from the Netherlands, United Kingdom, United States of America, and Germany participated in the experiment for 330 seconds on average. To test our hypothesis, we used a two-step approach. First, a multiple linear regression was applied. Second, we carried out a one-way ANCOVA comparing the effects of our design options.

Results

Our results indicate that autonomy can be manipulated through technology design and is negatively correlated with stress. Additionally, the design options *autonomy* and *nudge* were associated with lower levels of perceived stress than was *enforcement*.

Conclusions

The study proposes a careful use of IT and policies that limit the perceived autonomy of employees. Overall, this study offers a set of design recommendations arguing that organizations should implement technology that helps employees prevent overwork and maintain their autonomy.

Keywords. Technology-Induced Stress · Stress Prevention · Work Autonomy · Experimental Study · Design Options.

11.1 Introduction

The negative consequences of modern workplace design, including stress and work–life balance, are currently part of an employee's daily work more than they have ever been [1]. One

commonly referred example is overwork, which has a significant impact on stress [2, 3]. Working overtime is a common phenomenon: in 18 out of 29 European countries, the average actual working hours exceed the collectively agreed working hours [4]. In Japan, where employees regularly work too long, the term “karōshi”, meaning “death from overwork”, has already been established to refer to work-related sudden death [5, 6]. In line with this, overwork has been indicated as a reason for stress development and, therefore, a negative influence on employees’ health [7].

Information Technology (IT) has the potential to both reduce stress [8] and increase stress [9]. Through the ubiquity of technology in contemporary workplaces, new conflicts as well as new chances to reduce stress (e.g., by means of a better work-life balance) have emerged [10]. Therefore, it is crucial to identify technology characteristics that can be designed to enhance positive and buffer negative effects. Regarding overwork, the job demand control model [11–13] and the construct of autonomy [14, 15] have been proposed as promising ways to design technology. This also covers the freedom to decide when to stop work [16, 17]. However, organizations have already started to reduce the degree of autonomy by enforcing that individuals work only during business hours. For instance, Volkswagen implemented technology-supported policies that allow e-mail communication solely between 8 a.m. and 5 p.m. [18].

Although previous research has addressed the issue of overwork from a technology-design perspective (e.g., [16, 19-22]), research that focuses on how to design technology that maintains the individual’s autonomy to reduce stress is still missing. With the paper at hand, we want to address this important question. Specifically, we aim to develop and test different design options intended to prevent employees’ stress. Thus, our paper is guided by the following research questions (RQs):

RQ1: How can autonomy be integrated into technology design?

RQ2: How do specific design choices influence the perception of stress?

11.2 Theoretical Background and Hypothesis Development

In a subsequent section, we introduce the theoretical background of the paper. This comprises an explanation of the transactional perspective on stress [23] and its relation to stress in the workplace. Afterward, the specific role of technology in the creation of stress is elaborated. By

building upon the job demand control model and nudge theory, we propose hypotheses for the creation of design options that reduce technology-induced stress.

11.2.1 Transactional Perspective on Stress

Against the background of strain, which describes "the psychological and physiological responses made by individuals based on the fit between perceived stress and coping behaviors (e.g., rapid heart rate)" [24:3], stress has been conceptualized in different ways: as a stimulus, a response, or a condition that resides in the environment—to name only a few (an overview of the most relevant stress-related constructs used in this paper is given in Table 11.2).

Construct	Definition	Source
Stress	Stress refers to "the overall transactional process".	[9:834]
Perceived stress	Perceived stress is defined as "the feelings of overload and conflict toward the demands and the forms of control in an environment".	[23:3]
Technology-induced stress	Technology-induced stress is "the stress caused by an inability to adapt to or cope with IT in a healthy manner".	[28:302]
Autonomy	Autonomy refers to the *actual* "degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out".	[29:162]
Perceived autonomy	Perceived autonomy refers to the *perceived* "degree to which a worker has control over 'how' and 'when' work is done".	[30:992]
Overwork	Overwork describes "any work that exceeds the […] contract".	[31:570]
Technology-induced overwork	Technology-induced overwork defines the work after hours which is possible with mobile technologies like smartphones, tablets and laptops. Having the possibility to access, e.g., e-mails anywhere at any time, gives rise to work after hours, even though it is not necessary. Technology-induced overwork describes this phenomenon of employees working after hours due to their mobile technologies and the possibility to interfere with their work.	[32]

Table 11.2: Definitions of Core Constructs

In our research, we have built up on the transactional perspective on stress (cf. Figure 11.1) developed by Lazarus and Folkman [23].

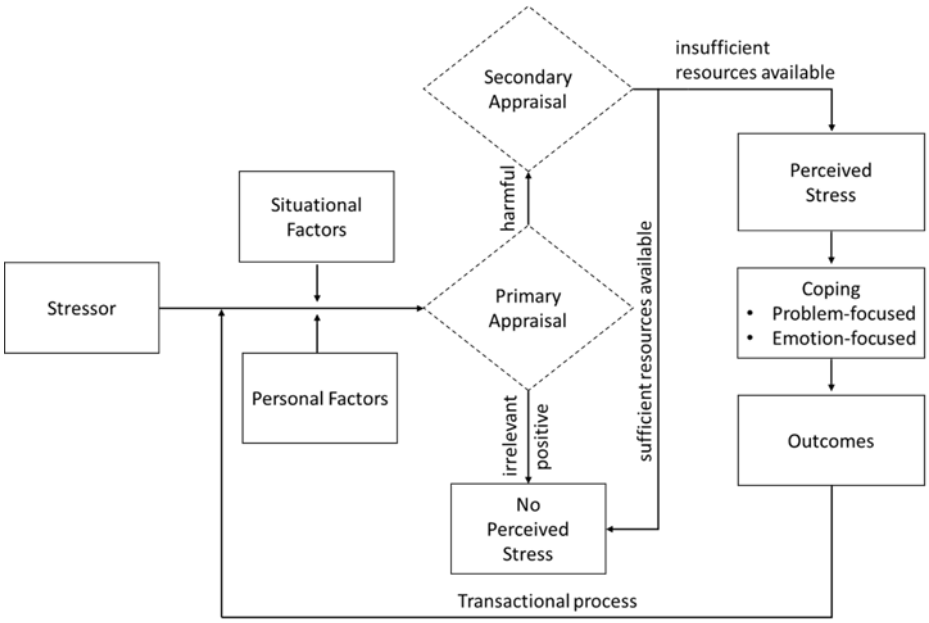

Figure 11.1: Transactional Perspective on Stress (Adapted from [25])

According to the transactional perspective on stress, perceived stress can be understood as a durable process involving individuals who deal with their environment. This is characterized by constant appraisal and reappraisal in response to stressors [24, 26]. Stressors are direct or indirect demands created by an individual's internal or external environment, which upsets balance and, thus, affects wellbeing and requires action to restore balance [27]. When individuals are confronted with a stressor (e.g., a computer-generated message requesting that they stop working), they evaluate the relevance of the stressor in the phase of primary appraisal against the background of their individual characteristics (e.g., past experiences with the same situation) and situational characteristics (e.g., supervisor expectations).

In the first step, an individual evaluates whether a stressor is harmful. For example, a stressor could be considered harmful when a person is already working overtime but wants to finish his or her work. In that case (i.e., a harmful evaluation of a stressor), a secondary appraisal process follows where the individual has to assess if there are sufficient resources, including time, to change the situation. Should the result be negative, i.e., there are not enough resources available, the situation is perceived as stressful. In that case, coping mechanisms are applied to handle the situation. These coping mechanisms can be behavioral (e.g., problem-focused coping) or emotional (e.g., emotion-focused coping). As a consequence, individuals experience

specific outcomes of this overall process, which can result in high blood pressure and strain. Finally, this process restarts with the evaluation (see arrow pointing back in Figure 11.1).

Based on this line of argument, overwork as addressed in this study may result in strain because the resources to cope with the work at hand are not sufficient.

In the context of work, a balance between stressors from the environment and individual coping abilities is essential for the wellbeing of employees and employers' productivity concerns [33]. As a result of misbalance, stress can lead to dissatisfaction with the job [34, 35], decreased commitment to the organization [33], decreased productivity [28], [36] or role conflict [26]. Factors that lead to perceived stress can be manifold and depend highly on situational and individual characteristics. Thus, if individuals can rely on resources that help them cope, negative effects from perceived stress can be diminished or buffered.

11.2.2 Technology-induced Stress and Overwork

Research has highlighted the relevance of technology as an antecedent to stress [9]. This has been conceptualized as technology-induced stress, which can be described as a modern disease caused by an inability to cope with technologies in a healthy manner [37]. In terms of technology, technology-induced stress arises when IT requirements exceed the user's situational level of competence. A central category of stressors is job characteristics, which was, for example, included in previous research to analyze technology-induced stress (for an overview see, for instance, [9]).

Technology-induced overwork can arise when technology offers the opportunity for employees to work after hours. With technology pervading not only work life but also private life, employees are faced with the constant possibility of working anywhere at any time. This is especially facilitated if employees perceive high levels of after-hours availability expectations [38, 39]. Subsequently, employees who do not manage to set their boundaries between work and private life experience a lower level of psychological detachment from work—even in countries with high work environment legislation, such as Sweden [38]. Additionally, such decreased psychological detachment is related to higher levels of strain [40].

11.2.3 Reducing Technology-Induced Stress with Technology Design

Technological characteristics have a significant impact on how individuals perceive (technology-induced) stress (e.g., [9]). Accordingly, technology can also be manipulated in a way to reduce negative consequences. Based on the literature, the concept of autonomy is highly relevant, since empirical evidence suggests that perceived autonomy affects technology-

induced stress (e.g., [41-43]). Perceived autonomy is commonly understood as the *"degree to which a worker has control over 'how' and 'when' work is done"* [30:992]. This is surprising, as it is a resource for individuals' coping abilities, a central component of one of the most influencing theories of work design—the job characteristics model [44]. Furthermore, it has already been used in other stress-related theories, including the job demand control model [45-47]. Regarding overwork, autonomy is most relevant, as it enables individuals to decide when and when not to stop working. Due to mobile technologies, the perceived autonomy of a large number of employees increases [48], which in turn further aggravates the issue of overwork.

Technology design allows the use of technological characteristics to support individual behavior. By aligning with design concepts, such as value-sensitive design (e.g., [49]) and design science theories (e.g., [50]), technology can be designed with characteristics and values to prevent an individual behavior (e.g., by manipulation with nudging to reduce stress) or to support a behavior (e.g., by limiting access to e-mails after 11 p.m.). Previous research shows that technology design supports the usability and innovativeness of technology for individuals [51-53].

11.2.4 Hypotheses on Autonomy and Stress in Technology Design

Mazmanian et al. [48] found that the use of mobile devices both increases and decreases the perceived autonomy of employees. The authors referred to this phenomenon as the autonomy paradox. The autonomy paradox describes the idea that mobile devices, such as laptops and smartphones, increase the perceived degree of autonomy, as they allow for work to be conducted in a much more flexible manner than in a stationary work environment. Consequently, one may argue that technology itself has a major influence on the individual's perceived autonomy. Whereas previous literature on the use of mobile technologies indicates that technology can influence perceived autonomy, only a few studies dealt with perceived autonomy through technology design. Notable exceptions include the work by Marshall [54], which focuses on how autonomy can be designed from a design prospect perspective, Murray and Häubl [55], who analyze the effects of freedom of choice regarding different user interfaces, and Klesel et al. [56], who investigate the impact of freedom of choice with regard to mobile devices. As design research is still in an early stage regarding the inclusion of the concept of perceived autonomy, it is unclear whether perceived autonomy can be manipulated with technology design per se. Since the manipulation of freedom of choice toward a specific user interface is similar to perceived autonomy, there is reason to believe that technology

design can also be manipulated with regard to perceived autonomy. Therefore, we propose the following hypothesis (H):

Hypothesis 1: Perceived autonomy can be manipulated through technology design.

According to well-known stress theories, including the job demand control model [45], perceived autonomy has a major influence on perceived stress. As perceived autonomy has rarely been included in design research thus far, it is uncertain whether there is also a negative relationship with perceived stress. Based on strong support from previous research on technology-induced stress (e.g., [9, 42, 57]), we argue that a technological manipulation that leads to perceived autonomy has a negative influence on perceived stress. Consequently, we hypothesize that:

Hypothesis 2: Overall, perceived autonomy is negatively correlated with perceived stress.

Based on these two hypotheses, we propose our research model (cf. Figure 11.2), which includes the relationship between technology design and perceived autonomy (H1) and the relationship between perceived autonomy and perceived stress (H2). Furthermore, our research model includes design options and their influence on perceived stress, which is described in the following section (H3 to H5).

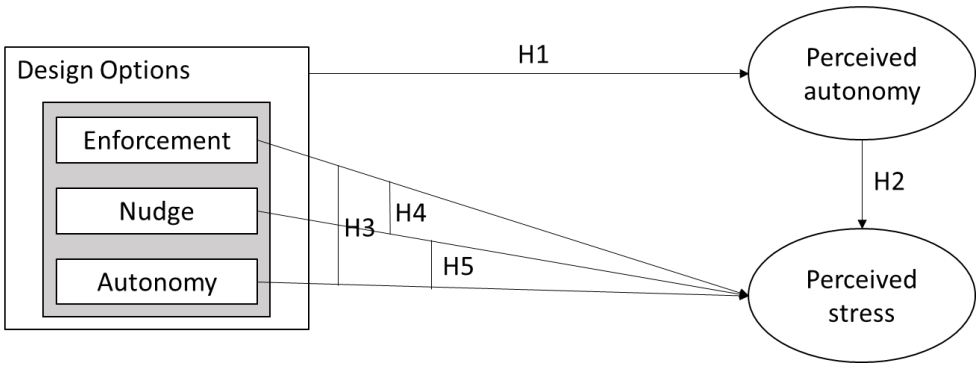

Figure 11.2: Research model

11.2.5 Hypotheses on Technology Design Options

In line with our previous expositions, we now propose our hypotheses with regard to three different technology design options.

11.2.5.1. Enforcement vs. Autonomy

According to the job demand control model [45], the degree of autonomy influences employees' perceived stress. The strain hypothesis of the job demand control model suggests that low control (i.e., enforcement) has a negative influence on employees' health (strain

hypothesis). The strain hypothesis of the job demand control model has received extensive support. For example, in a laboratory experiment, Häusser et al. [58, 59] manipulate job control through human-controlled or computer-controlled pacing and job demands through a number of requested tasks. Their experiment finds support for the strain hypothesis [58, 59]. Therefore, we propose the following hypothesis:

Hypothesis 3: Enforcement results in higher levels of perceived stress than does perceived autonomy.

11.2.5.2. Enforcement vs. Nudge

Enforcement and autonomy are two sides of the same coin, as enforcement can be understood as an external determination (i.e., a lack of autonomy). On this continuum, forms of soft paternalism can be used as an intermediate form of enforcement and autonomy. A well-known theory, which can be considered a form of soft paternalism, is nudge theory [60]. Nudge theory suggests that individual behavior can be "nudged" by presenting a set of choices that is developed by a *choice architect* (in our case, this role is occupied by a team of researchers [61]). The individual's behavior is guided by the creation of nudges and without enforcing a predefined direction, which follows the idea of soft paternalism. Nudges can be operationalized in various ways [62, 63], especially in the digital age [64]. A commonly known example of how to operationalize nudges is the use of default settings in software applications. Consequently, by predefining a default value toward an intended behavior, the individual's behavior can be shaped.

As hypothesized in H3, enforcement results in a higher level of stress than does autonomy. As nudge theory maintains freedom of choice, we further argue that enforcement has a significantly negative effect on the perceived stress, in contrast to nudge. Hence, we propose the following hypothesis:

Hypothesis 4: Enforcement results in higher levels of perceived stress than does nudging.

11.2.5.3. Nudging vs. Autonomy

Nudge theory is supposed to be a form of soft paternalism [60, 61] that allows individuals to make their own decisions. Based on that assumption, it can be assumed that there is no significant difference between nudging and autonomy. Therefore, we hypothesize the following:

Hypothesis 5: Autonomy and nudging result in a similar level of perceived stress.

Although all three design options have already been applied in previous research and practice (e.g., for enforcement, see [18]; for nudges, see [62], and for autonomy, see [55]), they have not been tested in a competing model, as proposed in our study.

11.3 Research Method

11.3.1 Method Selection

To address our RQ, we conducted an experimental study. Specifically, we used a factorial survey method that included experimental scenarios to aim for strong internal consistency [65, 66]. For this, we experimentally used textual elements that varied in each scenario. This method was applied successfully in similar research areas [67-69].

In our study, we used three treatments (i.e., design options *enforcement, nudge, autonomy*). Participants were randomly assigned to one of the three scenarios (enforcement vs. nudge vs. autonomy). Since parts of the initial sample of our experiment had to be excluded from the main analysis (see the following section with the characteristics of the participants), the cell occupations were not homogeneous (11 participants for the design option *enforcement*, 21 for the design option *nudge*, 19 for the design option *autonomy*). Since the statistical requirements were met, this inhomogeneity does not present an issue in our hypothesis [70]. To ensure the validity of the data, the participants had the opportunity to inform themselves in an open text field about potential problems and ambiguities when answering the questionnaire (the qualitative answers did not indicate any problems). Additionally, a pilot study was used with three respondents in every group to ensure that the context and the experimental setup were comprehensible.

11.3.2 Data Collection and Participants

We collected data from an online crowdsourcing platform (clickworker) that has already been used in many meaningful academic publications [71]. Since the platform has access to a wide variety of potential respondents, we had the chance to use different selection criteria to collect a representative sample for the purpose of the study (e.g., participants had to be knowledge workers with perennial work experience).

We analyzed our data using a two-step approach combining multiple linear regression with a one-way ANCOVA (Section 4). After collecting the data, we cleaned them, and the experiment was completed with 51 participants. To ensure the quality of the data, different eligibility checks were done. First, missing values were dropped. Subsequently, we removed values that undercut the minimum duration of the experiments, which was 270 seconds, or exceeded the

maximum duration, which was 480 seconds. (The average duration was 330 seconds.) In a third step, we checked for a minimum retention time on different pages of the experiment. Finally, stated confirmability was applied to buffer against the unwanted effects of the online procedure [72]. Excluding unserviceable observations from our data collection, the final sample yielded *51 participants.*

Our study included 25 females and 26 males. Participants had an average age of *38 years (*$M = 38.29,\ SD = 11.40$). Our participants came from the Netherlands (47%), the United Kingdom (21%), the United States of America (21%), and Germany (11%). Eighty percent of the participants stated that they had studied at a college (more than 2 years) and could prove an average work experience of almost 18 years ($M = 17.59, SD = 12.64$). Most participants worked full-time ($M = 38.45, SD = 12.71$), and 59% were employees, followed by freelancers (18%) and managers (14%). The participants came from a wide area of work (e.g., manufacturing, IT-consulting, government), which meets the requirement of a sample comprising a variety of different types of knowledge work. Additionally, the participants stated that their yearly income average (after taxes) was approximately $38,000 ($M = 37{,}800, SD = 17{,}45$), which is approximately the average mean score ($36,000) of the yearly income in their countries of origin and, thus, can be considered a representative reflection. The demographics are summarized in Table 11.3.

Variable	**Mean**	**SD**
Age (years)	38.29	11.40
Work experience (years)	17.59	12.64
Working hours (per week)	38.45	12.71
Income (€ per year)	37,800	1,745

Table 11.3: Demographic Characteristics

11.3.3 Procedure

The scenario-based experiment covered four phases. First, participants were informed about the general setting and goal of the study. To be transparent about the experimental procedure, we also ensured that we explained our procedure holistically at the beginning of the questionnaire. Second, the manipulation was carried out using different mockups, including different instructions and pictures of our design options (scenarios, cf. Table 11.4). Participants interacted from afar only via a computer. As our participants could not contact us during the experiment, we added an open text field to our questionnaire so that they could leave remarks.

Third, the dependent variable and the control variables were measured. Finally, participants were asked demographic information.

11.3.4 Experimental Setup

Context. We chose e-mail management to contextualize the experiment, as this is a well-known situation relating to stress [73]. To that end, we provided the following information: "At the end of your workday after a long meeting, you are *returning to your working place*. The screen of your computer is locked by now. First, you are deactivating your screen lock. Now you *can see the following picture (see next page) of your e-mail program*." On the following page, we presented the participants with a picture of their e-mail inboxes where new e-mails had arrived. To manipulate the level of perceived autonomy, we varied the instructions in the presented design options as described in the following.

Design Options. Based on the theoretical assumptions presented earlier, we derived three distinct design options that are implemented by means of textual variations in a message box mockup (cf. Table 11.4, Figure 11.3).

Design Option	**Textual Variation**
Enforcement	Your working time is over. Your computer is locked until tomorrow.
Nudge	Overwork limits your leisure time.
Autonomy	Control group: no manipulation realized.

Table 11.4: Variation of Textual Elements

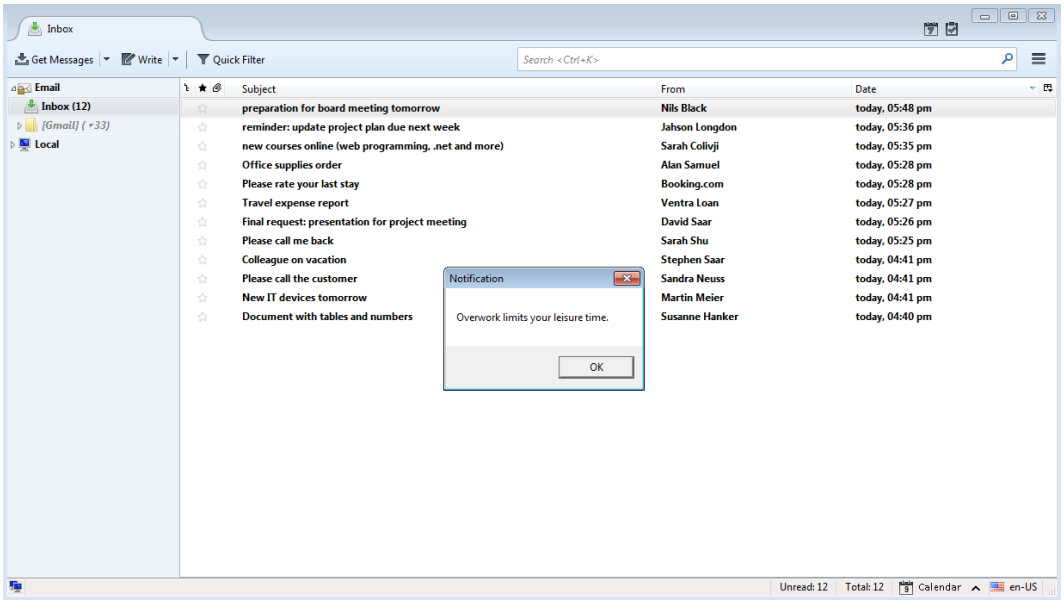

Figure 11.3: Mockup Manipulation (Nudge Variation)

First, in the design option *enforcement*, the user was forced to stop working. Therefore, there was no autonomy to decide when and when not to continue working. Consequently, the text told the user that the working time was over, and the computer was locked until the following day. This scenario is close to existing approaches, e.g., terminating e-mail usage [18].

Second, in the design option *nudge*, the user was nudged to stop working. As mentioned earlier, there is a great variety of possibilities for implementing nudges [60, 62]. For the design of the nudge option, we carefully searched for existing theories that have been successfully used to influence behavior. To that end, we implemented a textual description guided by the endowment effect [74, 75], which is also part of prospect theory [76]. The endowment effect states that individuals value things more when they already own it. In our context, assuming that a large number of employees have to work contracted hours, we understand leisure time as something that is already owned by an employee. Hence, the design option brings forward the idea of losing leisure time to nudge the individuals to stop working.

Finally, in the design option *autonomy*, there was no intervention by technology. This alternative can be considered the current state of the art in a large number of organizations where no technological interventions exist to reduce overwork [77]. This scenario widely exists in the field of knowledge work [14, 48]. At the same time, this alternative is used as a control group.

11.3.5 Measures

Manipulation Check/Autonomy. To test our hypotheses and conduct a manipulation check, we used a single measurement item for the degree of perceived autonomy on a 7-point Likert scale, as used in previous studies [58, 59].

Stress. The dependent variable perceived stress was measured on a 7-point Likert scale with one item that asked the participants how stressed they felt when they finished working after the described situation. Using only one variable to measure perceived stress is a common practice regarding the validity of data and economy in research design [78].

Control variables. To control our models, we included the following single-measurement variables: knowledge work ("To determine if the given context of our investigation is relevant to you, please indicate how regularly you are using a computer/laptop for work?"), comprehensibility ("Could you put yourself in the described situation?"), overtime ("How likely is it that you have to work overtime?") and one attention check ("How many new emails have you received in the described situation?").

Sociodemographic variables. We measured sociodemographic variables, including gender, age, education, experience, working hours per week, and income per year [71].

11.4 Results: Hypothesis Testing

11.4.1 Manipulation Check and Hypothesis H1

To test the effectiveness of the manipulation and Hypothesis 1, we used a two-step approach.

First, we explored whether any of the sociodemographic variables (gender, age, education, experience, working hours per week, and income per year) affected the level of perceived autonomy, which had to be considered for the subsequent analysis. For this purpose, we carried out three different stepwise multiple linear regressions (one for each of the enforcement, nudge, and autonomy design options) to predict perceived autonomy. We tested the requirements to apply regression analysis. The data met the assumptions of independent errors ($d = 2.02$), and multicollinearity was not a concern ($Tolerance = 1.00, VIF = 1.00$). Only the regression weight of education ($\beta = .54, t(17) = 2.67, p < .05$) in the design option *control/autonomy* showed significant results. Regarding the remaining two design options (*enforcement, nudge*), none of the sociodemographic variables had a significant effect.

Second, a one-way ANCOVA with fixed effects was conducted to compare the effects of the three different design options (enforcement vs. nudge vs. autonomy) on the dependent variable

perceived autonomy, which controls the confounding effect of education. To test the requirement of equality of variances, a nonsignificant Levene´s test indicated that the data met the assumptions of homogeneity of variances ($p = .472$). The results of the ANCOVA showed a significant effect of the design option factor on perceived autonomy, which controls education ($F(2,47) = 4.65, p = .014, \eta^2 = .24$). Scores of perceived autonomy were lower in the design option *enforcement* ($M = 2.27, SD = 1.55$) than in the design options *nudge* ($M = 4.24, SD = 2.17$) and *autonomy* ($M = 5.00, SD = 2.08$). Post hoc analysis using Tukey´s HSD to test differences among the three individual design options conformed to the descriptive picture and indicated that perceived autonomy was lower for participants in the design option *enforcement* than for participants in the design options *nudge* ($p < .01$) and *autonomy* ($p < .01$). However, the design options *nudge* and *autonomy* ($p = .673$) did not differ significantly. The results are summarized in Table 11.5.

Design Option	Mean	SD
Enforcement	2.27	1.55
Nudge	4.24	2.17
Autonomy	5.00	2.08

Table 11.5: Means and Standard Deviations of Design Options on Perceived Autonomy

In conclusion, the manipulation showed the intended effects, and we were able to support Hypothesis 1. Therefore, our results indicate that it is possible to manipulate perceived autonomy through different technology designs.

11.4.2 Hypotheses H2 to H5

To test Hypothesis 2, we once again used an approach consisting of two steps.

First, to control for potential confounds, we investigated whether any of the sociodemographic variables (gender, age, education, experience, working hours per week, and income per year) had significant effects on perceived stress. Thus, we used a stepwise multiple linear regression to predict perceived stress on the sociodemographic variables. We tested the necessary requirements to apply regression analysis. The data met the assumptions of independent errors ($d = 2.03$), and multicollinearity was not a concern ($Tolerance = .82, VIF = 1.22$). None of the inserted predictors showed significant results. Therefore, we used the derived information and analyzed the relationship between perceived autonomy and perceived stress by means of simple correlation calculations. The results showed a medium-sized correlation

($r(50) = -.33, p < .05$), which supports the postulated negative relationship between perceived autonomy and perceived stress (Hypothesis 2).

To test Hypotheses 3 to 5, we used an approach consisting of two steps. First, we carried out three separate stepwise multiple linear regressions (one for each of the design options of enforcement, nudge, autonomy) to predict perceived stress on the sociodemographic variables (gender, age, education, experience, working hours per week, and income per year). Considering the requirements to carry out a regression analysis, we observed that the data met the assumptions of independent errors ($d = 1.74$; $d = 1.21$), and multicollinearity was not a concern ($Tolerances = 1.00, VIFs = 1.00$). The results of the regression analysis are summarized in Table 11.6.

Design Option	**Sociodemographic Variable**	**β**	**P Value**
Enforcement	-	-	-
Nudge	Experience	-.44	.048
Autonomy	Working Hours	-.51	.025

Table 11.6: Sociodemographic Effects on Perceived Stress

The regression weights of experience ($\beta = -.44, t(19) = -2.11, p = .048$) in the design option *nudge* and working hours ($\beta = -.51, t(17) = -2.46, p = .025$) in the design option *autonomy* had significant effects, which could confound our results. We used the derived information in the subsequent analysis.

Second, a one-way ANCOVA with fixed effects was conducted to compare the effects of the three design options (enforcement vs. nudge vs. autonomy) on perceived stress as the dependent variable to control for the effects of experience and working hours from the prior step. An overview of the descriptive values of the different groups of design options is given in Table 11.7.

Design Option	**Mean**	**SD**
Enforcement	5.45	1.64
Nudge	4.00	2.05
Autonomy	3.42	1.82

Table 11.7: Means and Standard Deviations of Design Options on Perceived Stress

The ANCOVA showed a significant effect of the design option factor on perceived stress to control for experience and working hours $F(2,46) = 4.09, p = .023, \eta^2 = .14$). Furthermore, regarding the requirements to carry out ANCOVA, a nonsignificant Levene´s test indicated that the data met the assumptions of homogeneity of variances ($p = .370$). The post hoc analysis by means of Tukey´s HSD test to determine the individual difference between the groups showed that perceived stress was significantly higher for participants in the design option *enforcement* than for participants in the design options *autonomy* ($p = .007$) and *nudge* ($p = .049$). The design options *nudge* and *autonomy* ($p = .242$) did not differ significantly.

In summary, the results indicate that enforcement leads to more perceived stress than do perceived *autonomy* (Hypothesis 3, $p = .007$) and *nudge* (Hypothesis 4, $p = .049$), as we predicted. In the case of Hypothesis 5 (*nudge* does not lead to more perceived stress than does perceived *autonomy*, $p = .242$), the nonsignificant result shows that we should not reject the null hypothesis, which is consistent with the deductive postulate. Thus, we can conclude that the results of the scenario-based experiment show gratifying and postulated effects (cf. Table 11.8).

Hypothesis (H)		**Result**
H1:	Perceived autonomy can be manipulated through technology design.	supported
H2:	Overall, perceived autonomy is negatively correlated with perceived stress.	supported
H3:	Enforcement results in higher levels of perceived stress than does perceived autonomy.	supported
H4:	Enforcement results in higher levels of perceived stress than does nudging.	supported
H5:	Autonomy and nudging result in a similar level of perceived stress.	supported

Table 11.8: Hypothesis Testing

11.5 Discussion

11.5.1 Discussion of the Findings

Based on our findings, we can address our first *RQ: How can autonomy be integrated into technology design?* We build upon generic variations in a well-known context (i.e., e-mail management), and our findings support perceived autonomy being manipulated within technology design ($F(2,47) = 4.65, p = .014, \eta p^2 = .24$); hypothesis 1). Our discoveries

also revealed an interesting finding, as education had a significant influence on the autonomy group option ($\beta = .54, t(17) = 2.67, p = .016$). This result indicates that in a situation where autonomy is granted, education has an influence on perceiving autonomy as such. Furthermore, it can be assumed that education is a relevant factor regarding the sensible use of autonomy. According to the OECD, the percentage of individuals with a bachelor's degree or higher has increased in the last few years [79]. Therefore, perceived autonomy is increasingly recognized by individuals as their level of education has increased.

We now address our second *RQ: How do specific design choices influence the perception of stress?* Our study provides references that show that a higher degree of perceived autonomy is associated with smaller levels of perceived stress ($r(50) = -.33, p = .018$; Hypothesis 2). Regarding the specific design options, *enforcement* ($M = 5.45$) increases perceived stress in contrast to perceived *autonomy* ($M = 3.42$; Hypothesis 3) and *nudge* ($M = 4.00$; Hypothesis 4). Finally, *nudge* does not lead to higher levels of perceived stress than does perceived *autonomy*, which supports Hypothesis 3. Building upon these findings, we discuss contributions for technology design, theory development, and practical implications in the following.

11.5.2 Contribution to Technology Design

This paper is one of the first approaches to provide initial insights into how to design technology regarding autonomy. Our results indicate that autonomy is in fact relevant in technology design [16, 77], especially in a specific context (e.g., overwork) [89]. Thus, in contrast to the findings in previous studies (e.g., [16, 17]), when designing technology to motivate employees to reduce overtime, (technological) enforcement measures might be misleading, as they are related to a higher level of perceived stress. In this case, nudge elements can be used as a valuable alternative, as they decrease perceived stress on a similar level. It is noteworthy that autonomy is a central element of modern workplaces (referring to the job demand control model [14, 48]). Moreover, the various opportunities to nudge [62, 80] are well suited for the design of technology.

One reason to choose the context of e-mail management for our study is that it was previously used for related research [73]. Furthermore, e-mail management is comparable to other technology-supported work, such as managing booking entries or accomplishing tasks in enterprise systems. Therefore, we argue that using technology design to influence users' perceived autonomy may be a promising way to prevent stress among employees in other contexts as well (e.g., [16]).

11.5.3 Contribution to Theory Development

Our research can inform future research from different viewpoints. First, our results contribute to theories on stress even though these theories emerged in the 1970s, before modern workplace technology was introduced. We argue that those theories are experiencing a renaissance rather than being buried, which is reflected in current studies [17, 34, 89]. In relation to our study, there are also important references, including research on e-mails and interventions [23, 77]. Similarly, the job demand control model is still used to explain negative consequences, such as the work–life conflict that describes the struggle that employees may be subject to in their need to live up to different roles throughout their lives. In the case of a work–life conflict, the work role may interfere with different life roles, e.g., the role as a parent, as a spouse, as a friend, or as a caring child of one's own parents [13, 34, 81, 82]). Therefore, the result of our study that enforcement increases perceived stress strengthens the stress hypothesis of the job demand control model [45]. Likewise, the result that the use of *nudge* or *autonomy* instead of *enforcement* reduces perceived stress provides support for the buffer hypothesis that perceived autonomy decreases perceived stress. These results are especially interesting because previous research could only show support for increasing stress measured by endocrinological indicators but not for increasing perceived stress [58]. One explanation for this difference might be that, in our case, the design of autonomy, nudge and enforcement was embedded more thoroughly into a context that individuals can relate to because being forced to restart a computer is a situation that computer users are faced with frequently (e.g., when the operating system enforces a reboot for an update). In contrast, Häusser et al. [58] change the degree of autonomy using pacing control in a repetitive task, which might have lower ecological validity.

Furthermore, our research has contributed to nudge theory [60, 61]. According to the literature, *nudge* can positively influence various behaviors, such as reducing smoking (e.g., [83]), promoting the motivation to vote [84], enhancing tax compliance [85], or increasing physical activity [86]). We addressed the call of previous research [87, 88] and started to investigate nudge theory as a valuable theory to shape behavior. We illustrate an instantiation of a nudge within technology design and show that nudging users to stop working provides a comparable level of perceived autonomy by letting them decide completely on their own when to stop working. This indicates that nudging is promising in designing technology in a way that reduces perceived stress. We operationalized autonomy in a generic manner through different textual variations. In line with previous research (e.g., [64, 77]), we encourage future research to further consider testing the effects of specific design elements (e.g., interfaces). Regarding our

context, changes in the color or arrangements of widgets could be a fruitful approach. For example, when employees get to the end of their business day, the shutdown button could become highlighted by color and/or shape.

11.5.4 Implications for Practice

Based on our practical-oriented context (i.e., e-mail management), we can derive further implications for organizations.

First, our research suggests that enforcement increases perceived stress. As perceived stress is negatively correlated with performance [17, 36], organizations are well advised to look for alternative approaches [89]. Therefore, existing endeavors, such as limiting e-mail access [18], should be questioned. Based on our findings, we encourage organizations to further use nudging techniques to address issues related to employees' wellbeing, including perceived stress reduction. Examples for different nudging techniques are a reminder stating the performed working hours for the day or family pictures coming up on the screen. Other techniques to reduce stress are the introduction of communication rules and being transparent about communication after hours instead of limiting access to e-mails. In practice, this could be conducted by e-mail rules, such as "no e-mails after 11 p.m.". For example, such rules and communication allow access to e-mails and remind employees of not answering right away if there is no explicit and important reason to do so.

Moreover, our research shows that technology is well suited to complement current undertakings, including organizational policies. Therefore, design research is increasingly important for psychological issues, including (perceived) stress. Consequently, design research can be used to shape the individual's behavior to address negative consequences in organizations. Managers and software organizations can align with different design techniques offered on the market to shape employee behavior in organizations. During COVID-19, an example of this might be a reminder that shows up every 20 minutes on employees' screens to ventilate their offices.

11.6 Conclusion

We have extended previous work on overwork, perceived stress, and design research using a scenario-based experiment. Our study shows that differences in the perceived level of autonomy can have different impacts on perceived stress. Since we used a fully randomized experiment, the findings can be traced back to the different design options. Specifically, we

found that the autonomy and nudge design options were associated with significantly lower levels of perceived stress than was enforcement.

We therefore propose that organizations should be careful using technology and policies limiting the perceived autonomy of their employees. Furthermore, we showed one promising way to influence employee behavior using nudging without a perceived loss of degrees of freedom. Overall, implications from this study may have a significant impact in areas beyond e-mail usage as a context, namely, aspects in addition to functionality, which should not be neglected. More generally, we propose a set of design recommendations and argue that organizations should implement technology that gives employees the opportunity to prevent overwork and maintain their autonomy.

11.7 Limitations

As with every empirical study, this research has limitations that need to be acknowledged. First, the experimental procedure is designed for workstation computers from the perspective of an employee in a fictional setting. Thus, the results are limited to that specific domain. However, based on the generic approach, we argue that similar results can be obtained using different technologies, such as tablets. As we did not manipulate situational or personal factors regarding overwork, which are not technology-related, we cannot draw conclusions regarding how these variables relate to technological design options that vary in their degree of perceived autonomy. Personal factors, such as mindfulness or personal attitudes, might also be relevant for the primary and secondary appraisals. Similarly, situational factors, such as organizational culture (e.g., expectations of team members or the supervisor) or private life obligations (e.g., caring for children), are likely to influence the appraisal process of technological design options, especially regarding enforcement design. Therefore, future research could investigate the effect of supervisor and team member expectations as well as preferences and obligations regarding private life in relation to the design of autonomy in different technologies.

Second, although the results of our study support the main argument and show a highly significant manipulation, different effects of potential bias could have influenced the results, since we used a digital scenario-based experiment with less control than laboratory experiments.

Third, the subjective measurement of the dependent variable *perceived stress* should be interpreted prudently. In this regard, it would be interesting to compare the results of the setting with objective measurements of stress, such as the skin conductance response. Furthermore,

using a work-related context and the handling of e-mails could have limited potential effect sizes. Using different contexts in the future is desirable.

Fourth, even though we conducted a G-power analysis to calculate our data sample, our N was rather small (N=51) after cleaning the data. Although this might have increased the possibility of a Type I error, the findings of the paper can be understood as a valid reference that show that the design of technology at the workplace has an impact on perceived stress, since the chances of detecting meaningful impacts in small sample studies are impeded. Nonetheless, future studies should use larger samples to test differential impacts between different subsamples.

Finally, it should be noted that our manipulation was not based on the level of interfaces and had a rather explorative character, since nudging is still an unexplored theory in combination with design.

11.8 Outlook

In addition to addressing the aforementioned limitations, our research offers fruitful avenues for future research. Most importantly, we have provided promising insights into the conflict between perceived stress and the opportunities to buffer the phenomena by means of technology-based design. Thus, in future research, it might be promising to test other aspects of these models combined with the degree of perceived autonomy. Regarding the job characteristics model [29], skill variety as a context variable might be promising. Regarding the job demand control model [45], it would be interesting to identify the interaction effects that might result from including different levels of demand in an experimental design. Furthermore, future research could investigate how technology design relates to social and cultural factors (e.g., availability expectations) in the organization.

11.9 References

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11.10 Acknowledgements

This publication has been partially funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project-ID 416228727 – SFB 1410, the German Ministry of Culture and Science of the Land of North Rhine-Westphalia (reference number: 005–1706-0006), and the research initiative "Instant Teaming between Humans and Production Systems" co-financed by tax funds of the Saxony State Ministry of Science and Art (SMWK3-7304/35/3-2021/4819) on the basis of the budget passed by the deputies of the Saxony state parliament.

12 Crisis-driven Digital Transformation as a Trigger for Process Virtualization

Title	**Crisis-driven Digital Transformation as a Trigger for Process Virtualization: Fulfilling Knowledge Work Process Requirements for Remote Work**
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Publication Type	Journal Paper
Publication Outlet	International Journal of Information Management
Status	Under review / 2nd round
Full Citation	**Zeuge, A.**, Schaefer, C., Weigel, A., Eckhardt, A., & Niehaves, B. Crisis-driven digital transformation as a trigger for process virtualization: Fulfilling knowledge work process requirements for remote work. *International Journal of Information Management*. (under review)

Table 12.1: Fact Sheet Publication

Crisis-driven Digital Transformation as a Trigger for Process Virtualization: Fulfilling Knowledge Work Process Requirements for Remote Work?

Abstract. Process Virtualization Theory (PVT) proposes a set of requirements and relationships to explain and predict whether or not a knowledge work process can be successfully virtualized. However, at least in remote work, the crisis-driven digital transformation (e.g., during the COVID-19 pandemic) shows that almost all knowledge work processes can be virtualized unexpectedly and immediately. Since the requirements for these knowledge work processes remain the same and need to be met to continue the processes remotely, the interesting question arises of how information technology (IT) can help to meet these requirements in a crisis-driven digital transformation of knowledge work. To address this question, we conduct 40 semi-structured interviews in a multiple case approach using a critical realist perspective. Our findings contribute to information systems (IS) research in a twofold way. First, we demonstrate that the crisis-driven digital transformation of knowledge work triggers a revisited perspective on PVT by turning virtualized knowledge work processes into a prerequisite. Second, we show how the IT characteristics of PVT (representation, reach, monitoring capability) help to fulfill knowledge work process requirements in remote work settings and outline two additional IT characteristics (social presence and situation awareness) that positively support the fulfillment.

Keywords. Crisis-driven Digital Transformation · Process Virtualization Theory · Knowledge Work Process Requirements · IT Characteristics · Remote Work.

12.1 Introduction

The virtualization of knowledge work processes by means of information technology (IT) has long been a subject of interest in the information systems (IS) field (e.g., Fonner & Stache, 2012; Mäntymäki et al., 2019; Suh & Lee, 2017). Based on Overby (2008), the virtualization of a knowledge work process can be defined as *"the transition from a physical knowledge work process to a virtual one by means of IT"*. That is, the physical interaction between employees and/or objects is replaced by virtual interaction. This is often understood and referred to as a transition to working from home instead of working from the office (Olaisen & Revang, 2017). However, this understanding does not go far enough, as it basically includes all forms of location-independent work (Coakes et al., 2008) or remote work (Tarafdar & Saunders, 2022). Indeed, some knowledge work processes are better suited for virtualization, and to this end for remote work, than others (Overby, 2008, 2012). A major theoretical framework to explain this suitability is Process Virtualization Theory (PVT), which has been developed to explain whether or not a process can be successfully virtualized (Overby, 2008, 2012). Four major requirements are decisive for the virtualizability of a process: sensory, relationship,

synchronism, as well as identification and control requirements. A key premise of PVT is that IT makes a process more amenable to virtualization (Overby, 2008, 2012). To this end, PVT includes three IT characteristics that influence process virtualization: (1) representation, (2) reach, and (3) monitoring capability (Overby, 2008).

A new perspective on knowledge work process virtualization arose due to the crisis-driven digital transformation of knowledge work induced by the coronavirus disease in 2019 (COVID-19). Researchers describe crisis-driven digital transformation as the immediate and unexpected transformation of non-digital organizational processes into virtual equivalents due to an internal or external crisis (Di Gangi et al., 2021; Haslam et al., 2021). COVID-19 led to a global and unprecedented crisis-driven digital transformation of knowledge work (Di Gangi et al., 2021; Kniffin et al., 2021; Waizenegger et al., 2020) and demonstrated that almost all knowledge work processes can be virtualized, even those considered less amenable for virtualization (Waizenegger et al., 2020). This crisis-driven digital transformation of knowledge work brings up the interesting conundrum of what has changed and how knowledge work processes continued remotely when virtualization had to take place unexpectedly and immediately.

The COVID-19 pandemic shows that as long as digital transformation is driven by a crisis, processes of all kinds in knowledge work can be virtualized unexpectedly and immediately (Kniffin et al., 2021; Soto-Acosta, 2020; Whillans et al., 2021). In addition, the basic process requirements in PVT (Overby, 2008) are no longer decisive for the success of this virtualization, but rather, the virtualized knowledge work processes impose process requirements that have been met during the crisis (Waizenegger et al., 2020). To the best of our knowledge, there is no research that focuses on how knowledge work process requirements could be met by means of IT in a crisis-driven digital transformation. To this end, we have conducted an explorative multiple case approach including 40 semi-structured interviews in Germany using a critical realist perspective to begin to fill in this knowledge gap. We observe this phenomenon by contextualizing PVT for the case of enforced remote work during COVID-19. To this end, we raise the following research question (RQ):

RQ: How can knowledge work process requirements be fulfilled in a crisis-driven digital transformation by means of IT?

The paper is structured as follows: In Section 2, we introduce crisis-driven digital transformation of knowledge work and outline the PVT by Overby (2008, 2012). Further, by

drawing on the COVID-19 pandemic as an example of a global and unprecedented crisis, we demonstrate how the COVID-19 pandemic led to a revised view on PVT. In Section 3, we discuss our research design. In Section 4, we outline the findings of our qualitative research. In Section 5, we discuss our findings considering crisis-driven digital transformation of knowledge work and derive theoretical as well as practical implications. Finally, we conclude in Section 6 by highlighting some limitations of our research and providing fruitful avenues for future research.

12.2 Related Work

12.2.1 Planned and Crisis-driven Digital Transformation of Knowledge Work

Digital transformation of knowledge work is commonly described as a broad organizational change enabled by technology and transforming the way knowledge work processes are carried out (Bilgeri et al., 2017; Mueller & Renken, 2017; Wessel et al., 2021). Usually, digital transformation of knowledge work is driven by internal planning (Chanias et al., 2019; Nelson et al., 2017) caused by internal and external influences (e.g., employee support, customer demands, supply chain, innovation push, market pressure, and laws/government (Bharadwaj et al., 2013; Matt et al., 2015; Mergel et al., 2019)). However, digital transformation can also be driven by circumstances that occur unexpectedly and require an immediate response, commonly referred to as a crisis (Ayoko et al., 2017; Di Gangi et al., 2021; Haslam et al., 2021). In recent years, research has begun to acknowledge the importance of crisis as a driver of the digital transformation of knowledge work (Bounfour, 2016; Haslam et al., 2021; Heilig et al., 2017). To this end, the terminology “crisis-driven digital transformation of knowledge work” has been coined, which can be commonly understood as the immediate and unexpected virtualization of knowledge work processes due to an internal or external crisis (Di Gangi et al., 2021; Haslam et al., 2021). Examples of internal crisis are human resource crises, as well as corruption scandals or strikes (Scavarda et al., 2019). Examples of external crises include crisis such as financial insecurity (Chanias et al., 2019), climate change (Majchrzak et al., 2016), political uncertainty (Finegold & Frenkel, 2006), or most recently the COVID-19 pandemic (Di Gangi et al., 2021).

In the last years, research has focused mainly on investigating the internal planned digital transformation of knowledge work (Chanias et al., 2019) and internal crisis-driven digital transformation of knowledge work (Ayoko et al., 2017). However, the COVID-19 crisis, which is requiring an unprecedented and global virtualization of knowledge work, emphasizes investigating the crisis-driven digital transformation caused by external crises (Di Gangi et al.,

2021). The COVID-19 pandemic forced the immediate and unexpected virtualization of nearly all knowledge work processes (Haslam et al., 2021; Netz et al., 2022). During the height of the pandemic, organizations were mandated to adopt new setups where people worked remotely to utilize (new) IT for communication, and to rethink their knowledge work processes to maintain regular business while complying with the new demands of infection protection and social distancing (Herath & Herath, 2020; Leidner, 2020; Richter, 2020). In this context, new challenges for knowledge work emerged (Faraj et al., 2021). Access to digital infrastructures for employees and organizations is unequal (DiMaggio et al., 2004; DiMaggio & Hargittai, 2001). In addition, the pandemic also led to the realization of the fragility of the digital transformation of knowledge work (i.e., many processes remain vulnerable to extreme and ahistorical events). The major challenge has been to virtualize knowledge work processes that were considered not ready for virtualization or not virtualizable because, for example, they still relied on analog elements (De' et al., 2020; Faraj et al., 2021).

12.2.2 Process Virtualization Theory

PVT was introduced by Overby (2005, p. G1) and serves as a general theory to explain *"which factors predict if a process can be virtualized successfully"* (see Figure 12.1). Therefore, PVT is a theory for mapping the digital transformation of processes. The necessary basis is the virtualization of processes by IT in the first place. In context of the theory, the term "process virtualizability" takes a central role and is described by Overby (2008, p. 279) as *"how amenable a process is to being conducted without physical interaction between people or between people and objects."* (Overby, 2008, p. 279). This implies that virtualizability is the basis for the digital transformation. So, if an organization, department, process, or task is to be digitally transformed, it must be virtualizable.

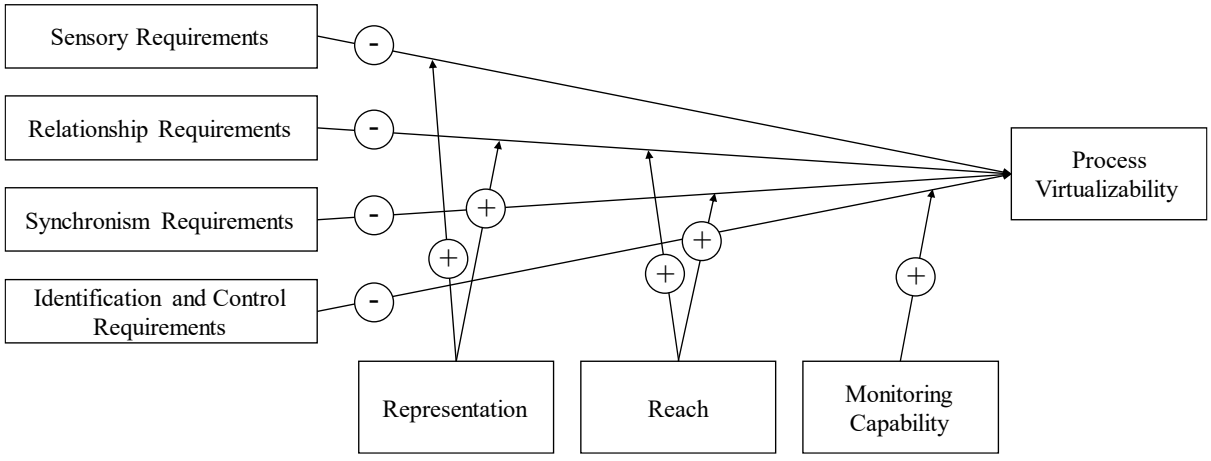

Figure 12.1: Process Virtualization Theory (Overby, 2008, 2012)

The dependent factor in PVT is "process virtualizability" (PV), which describes how amenable a process is to being virtualized (Overby, 2008).

The independent factors in PVT can be divided into process requirements and IT characteristics of the virtualization mechanism (Overby, 2012). Process requirements are: (1) sensory requirements, (2) relationship requirements, (3) synchronism requirements, and (4) identification and control requirements. Overby (2008) defines these characteristics as follows: **sensory requirements** represent process participants' need of a full sensory experience of the process, all related objects, as well as the other participants. **Relationship requirements** describe the need for process participants of interacting with each other in both professional and social contexts. **Synchronism requirements** specify the degree to which activities that make up a process need to occur quickly and with minimal delay. **Identification and control requirements** refer to the degree to which a process requires unique identification of process participants and the ability to control and influence their behavior. If everything else remain constant, those four factors negatively affect PV, i.e., as each of these requirements increases, the process becomes less amenable to virtualization (Overby, 2008).

PVT underlies the premise that IT can be used to make a process more amenable to virtualization (Overby, 2008). Overby (2008) introduced three characteristics of the virtualization mechanism ("IT characteristics") that impact process virtualization and represent moderating factors in the theory: (1) representation, (2) reach, and (3) monitoring capability (Overby, 2008). Overby (2008) defines these IT characteristics as follows: **representation** is the capacity of IT to present information relevant to a process (i.e., including simulations of actors and objects, their properties and characteristics, and how we interact with them). **Reach** is the capacity of IT to enable participation in processes across time and space. **Monitoring capability** is the capacity of IT to authenticate process participants and track their activities.

Those three IT characteristics influence the relationships between the independent factors and PV (Overby, 2008, 2012). IT can be used to stimulate sensory elements of the physical world. Thus, representation positively influences the relation between sensory requirements and PV. Since IT can be applied to capture highly representative profiles of process participants, representation positively influences the relation between relationship requirements and PV. Reach allows process participation regardless of the participants' location and therefore, positively influences the relation between relationship requirements and PV. Moreover, reach enables synchronous process participation and consequently, positively influences the relation

between synchronism requirements and PV. IT allows participants to be uniquely identified and tracks and analyzes their actions. This, consequently, positively influences the relation between identification and control requirements and PV.

PVT has been applied in over 35 IS-related papers and IS research contexts (e.g., IS in general, communication and/or relationship, business processes, healthcare and mobile technology) (Balci, 2014). For example, PVT has been used to identify the processes in e-commerce that are not suitable to be virtualized from the user's perspective (Barth & Veit, 2011). Another example is from the financial sector, where PVT has shown that when organizations implement financial technologies in their processes, users have a higher propensity to use those processes (Verbovetska, 2019). Furthermore, there are also studies that focus on the application of PVT as the part of digital transformations. Examples include augmented reality solutions for security critical services (Osterbrink et al., 2021) and how consulting approaches can be digitalized (Seifert & Nissen, 2018).

In our research, we apply PVT to knowledge work processes in the context of remote work. Knowledge work is often characterized by the combination of high cognitive work demands with a high degree of autonomy and is often highly iterative and collaborative (Davenport et al., 1996; Holsapple, 2003). Knowledge work processes are therefore not to be understood in a narrow sense from an engineering-oriented perspective, but more broadly and holistically (Holsapple, 2003). Previous studies show that PVT is suitable for investigation of the virtualization of knowledge work processes For example, PVT has been applied to investigate how co-working space processes can be virtualized (Hofeditz et al., 2020). The requirements for a virtual co-working space were identified along the requirements of the PVT and, in addition, organizational requirements were identified. Furthermore, it was shown how IT characteristics enable virtualization. In addition, PVT was used to investigate which process requirements influence the intention to do work processes from home (Agrawal et al., 2020). Here, it was shown that sensory, relationship, and identification requirements drive the intention to virtualize work processes. Furthermore, PVT was applied to virtual team collaborations and further developed into Collaboration Virtualization Theory (Fan et al., 2012).

12.2.3 A Crisis-driven Revisited Perspective on Process Virtualization Theory

The COVID-19 pandemic led to a global and unprecedented crisis-driven digital transformation of knowledge work (Di Gangi et al., 2021; Kniffin et al., 2021; Waizenegger et al., 2020). Thus, the COVID-19 pandemic represents an appropriate example to outline how a

crisis-driven digital transformation of knowledge work leads to a revisited perspective on our initial theoretical understanding of virtualization of knowledge work processes based on PVT. Prior to the outbreak of the pandemic, the overwhelming majority of knowledge work processes were not conducted remotely because many knowledge work process requirements could not be met as previous research has shown. For example, remote work settings were problematic for the sensory requirements of knowledge work processes because knowledge work transforms work from a sensory activity to a computer-mediated activity, thereby preventing people from interacting in a personal and intimate way (Eisenberg & Krishnan, 2018). Also, the requirements for relationships in the context of knowledge work processes posed a particular challenge in virtual teams, and the likelihood of developing trust was regarded to be significantly lower (Robert et al., 2009). Differences in time, distance, organization, and culture also made the building of trust particularly fragile in virtual teams (Watson-Manheim et al., 2012). In particular, synchronism requirements of knowledge work processes could not be met in remote work because virtual collaboration tools (e.g., audio or video conferencing) reached their limits when it came to synchronous, interactive collaboration, such as required for prototyping (Nor'a & Ismail, 2019). Difficulties in meeting the synchronization requirements of knowledge work processes have also confirmed for remote work when resources and knowledge are shared across project boundaries in a virtual environment (Coakes et al., 2008). Further, working remotely was problematic for control requirements of knowledge work processes because, employees were not visible face-to-face for their leaders, and the organization's cultural engineering exercises were undermined due to the lack of employees' presence on-site (Felstead & Henseke, 2017). However, the pandemic has enforced the virtualization of almost all knowledge work processes unexpectedly and immediately and has thus reshaped taken-for-granted day-to-day business (e.g., Almeida et al., 2020; Faraj et al., 2021; Kniffin et al., 2021). Nearly all knowledge work processes were virtualized almost overnight, and those that could not be virtualized as immediately followed in the subsequent weeks (Lal et al., 2021). To this end, COVID-19 turned PV into a prerequisite in COVID-19 studies (Kniffin et al., 2021; Soto-Acosta, 2020; Whillans et al., 2021). Thus, regarding PVT, we argue that PV turned from a determined factor into a determining factor (labeled as: Established Process Virtualization in Figure 12.2) for the fulfillment of knowledge work process requirements.

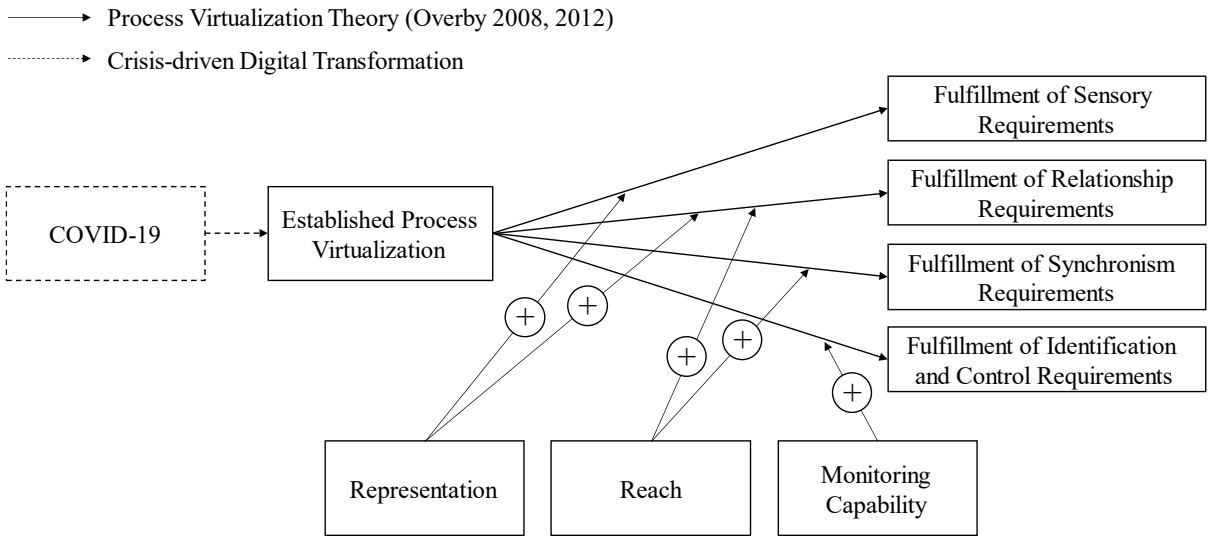

Figure 12.2: A Crisis-driven Revisited Perspective on Process Virtualization Theory

As knowledge work process requirements have been stable and seemingly fulfilled during this crisis (Waizenegger et al., 2020), this raises the question of "how" knowledge work process requirements are met in a crisis-driven digital transformation of knowledge work. On this verge, Overby argues that IT can be used to fulfill process requirements (Overby, 2008, 2012). Therefore, we aim to understand in our research how the knowledge work process requirements (sensory, relationship, synchronism, as well as identification and control requirements) from PVT are fulfilled by means of different IT characteristics (representation, reach, monitoring capability) in a crisis-driven digital transformation of knowledge work.

12.3 Research Design

In this research paper, we followed a critical realism approach (Mingers et al., 2013). We assumed the existence of an independent reality and an open systems perspective in our research and searched for the mechanisms leading to a successful fulfillment of various requirements in a crisis-driven digital transformation. We wanted to understand how knowledge work process requirements are fulfilled by means of IT in remote work settings in the "real world" (changed by crisis). Since the "real" world (understood under critical realism approach), that is the world we are living in right now, where real cases are happening, and we are experiencing, is only observable and is composed of different perspectives (for example, of a leader, employees, chief financial officer, or diversity coordinator), we conducted a multiple case approach with different organizations (Kilani & Kobziev, 2016; Yin, 2009).

Therefore, we used a qualitative multiple case approach (Flick et al., 2004) to investigate 'how' different knowledge work process requirements (*sensory*, *relationship*, *synchronism*, as well

as *identification and control requirements*) have been fulfilled by means of IT characteristics proposed by PVT (*representation*, *reach*, and *monitoring capability*) and explored whether further IT characteristics positively impacted the fulfillment of the requirements.

We conducted virtual interviews (60 minutes on average) with 40 employees from German organizations. Most of the interviewees were interviewed as part of a research project exploring the digital transformation of organizations with a particular focus on processes. Since some organizations were represented by only one or two employees, we asked to interview some of the interviewees' colleagues to get multiple perspectives on the organization. To make our sample even more comprehensive and balanced (e.g., in terms of size), we contacted additional suitable organizations via social media. So, they fit in total very well to our multiple case approach with different organizations to observe their perspectives and get as close as possible to the new real-world setting. To assure the highest possible degree of contextual similarity, we conducted all 40 interviews within a brief period of one month: from 18 January 2021 to 18 February 2021.The interviewees were between 20 and 61 years old (average age: 38 years). 30% percent of the interviewees were female and 70% were male. Our interviewees were from a broad range of sectors (e.g., mobility & logistics, banking, insurance, municipalities, press & media, consulting, telecommunications, or manufacturing) so our findings would be robust to industry-specific aspects. For better readability, we use the term "organization" in the following, which encompasses both enterprises and municipalities. Nevertheless, in Section 4, we also highlight the distinction between the organization types as follows: large-scale corporations (C) with 14 interviews, municipalities (M) with 10 interviews, and small- and medium-sized enterprises (SME) with 16 interviews. For an overview of interviewees, see Appendix A.

To get a wide range of answers and to give the interviewees the chance to speak freely, we used a semi-structured interview guide with open-ended questions (Sarker et al., 2018a, 2018b). We followed the guidelines for qualitative research by Sarker et al. (2013) to avoid the standard pitfalls of qualitative semi-structured interviews (Sarker et al., 2013). We revised the first version of our interview guide after three pre-interviews and made some minor changes to our interview guide. After ten additional interviews, we reevaluated our interview guide again but did not identify any reason to make additional changes. The interview guide is in Appendix B.

The interviews were recorded in German, transcribed non-verbatim, and translated into English for analysis. The interviews were then analyzed using the MAXQDA software using deductive and inductive content analysis methods by Mayring & Fenzl (2014). For this purpose, we took a crisis-driven revisited perspective on PVT as the basis for the deductive content analysis. We independently analyzed the interviews by coding for IT activities that helped to fulfill knowledge work process requirements (*sensory*, *relationship*, *synchronism*, as well as *identification and control requirements*). These activities were mapped to the IT characteristics (*representation*, *reach*, and *monitoring capability*) identified by Overby (2008, 2012). We noted those activities that could not be clearly assigned to one of the IT characteristics. Following inductive content analysis (Mayring & Fenzl, 2014), we discussed these activities after ten interviews and combined them to form a new, undefined IT characteristic. After agreeing on the new and undefined IT characteristic as part of the extended coding scheme, we reviewed their already coded interviews and coded ten more. In line with Mayring and Fenzl (2014), this formed a second loop and led to a revised coding scheme. This process continued (four times in total) until all 40 interviews were coded. At the end of the 40 interviews, we discussed the new and undefined IT characteristics. We found that the activities that could not be mapped to the IT characteristics of PVT had some commonalities. Thus, we were able to split them into two new IT characteristics. Considering literature, we have labeled these new IT characteristics as *social presence* and *situation awareness*. We then independently re-coded all interviews again with the final coding scheme in order to have coded all inductively found IT characteristics (Mayring & Fenzl, 2014). We discussed differing opinions and arrived at a consensus. We ended the analysis with theoretical saturation (i.e., when no new aspects were found). See Appendix C for the final coding scheme.

12.4 Findings

In this section, we present our findings on how knowledge work process requirements were met during the COVID-19 pandemic by means of IT in remote work settings. To present our findings in a structured way, we organized them along the IT characteristics identified by Overby (2008, 2012): *representation*, *reach*, and *monitoring capability*. In addition, we identified two additional IT characteristics (*social presence* and *situation awareness*) that positively impacted the fulfillment of the requirements. We first present how knowledge work process requirements were met prior to COVID-19 and then describe how they were fulfilled by various IT characteristics during the crisis. Thereby we only provide examples of the

identified activities that helped to fulfill the requirements. See Appendix D for an overview of all the identified activities.

12.4.1 Representation

Although physical encounters in the office have almost been entirely eliminated due to the pandemic, for many knowledge work processes it is still or even more necessary to see and hear colleagues, leaders, or externals (Waizenegger et al., 2020). IT can be used to fulfill these *sensory requirements* by *representing* the sensory elements of the physical world (Overby, 2008, 2012). For example, nearly all interviewees stated that they used e-mails or chats mainly for short questions or task coordination before the pandemic. They barely called their colleagues spontaneously to reduce work interruptions.

> *"I always sent an e-mail. Or a short message via Skype. Otherwise, I don't know: am I disturbing the other person or not? And that's what everyone did." (C_1_1)*

By working only remotely during the pandemic, more than 75% of interviewees stressed that they now make more phone calls because what they had previously written e-mails for, they now did on the phone, due to the lack of spontaneous contact. The reason was that they need to hear each other's voices and the emotions that resonated. They believed that this made it possible to convey information more efficiently and comprehensively.

> *"Just keeping in touch. Just make a call. In the past, I would have written an e-mail, but now I call [...]. I do that a lot more so that I can also hear the other person's voice sometimes." (SME_1_2)*

Before the pandemic, most interviewees preferred audio to video conferencing while working remotely. One reason being that the employees were not equipped with the appropriate hardware and/or software. Other interviewees wanted to protect their privacy. In addition, many of the interviewees felt that they did not need video due to their regular physical encounters at the office.

> *"Even before the pandemic, we always used Zoom to work together. However, we as a team didn't turn on the webcam. So, the voice was on. We didn't need it because we met regularly." (C_5_1)*

With the outbreak of the pandemic, however, almost all interviewees indicated that they used video conferencing exclusively. They felt that video conferencing helped to fulfill the need to

see one another. Interviewees could see the body language of others, which made it easier for them to see who was expressing concerns and who might want to say something.

> *"And I think it's also very important to turn on the webcam. […], it's important to see others, to have the feeling that you're not just talking to a picture but instead to a real person, who still has facial expressions and gestures." (C_3_2)*

Since IT allows the representation of rich personal profiles, the *relationship requirements* of knowledge work processes can also likely be fulfilled (Overby, 2008, 2012). To this end, IT has the potential to strengthen relationships among colleagues, as well as bonds to the organization. For example, the interviewees that used video conferencing prior to the pandemic reported that they used virtual wallpapers to avoid giving colleagues insights into their physical surroundings. They highlighted that this prevented colleagues from gaining insights into private rooms or their whereabouts.

> *"We always used a digital wallpaper before." (SME_1_3)*

Nearly all of the interviewees reported that they no longer use virtual wallpapers during the pandemic. For them, the insight into the personal "office" space (e.g., living room, kitchen) allowed them to identify common interests or learn more about the private lives of their colleagues. The interviewees emphasized that this allowed them to present themselves and their personalities more authentically.

> *"So, a picture, for example, as a background I find distracting. So, you have the feeling that someone wants to hide something. [...] I think you have more insights into the privacy of the other person, which also makes working together a bit more pleasant. And I think this personal aspect is especially important when exclusively working from home." (SME_8_1)*

Prior to moving exclusively to remote work, an important part of the interviewees' work had been carried out at the office. This enabled them clearly identify with the organization, its culture, and values, and made them feel they were part of it.

> *"Before the pandemic, I was on a regular basis in my office. This gave me the feeling of belonging to the organization. Just walking through the entrance with the big organizational logo made me feel like I was part of the organization." (C_2_3)*

By moving the work from the organizational premises to remote work, the interviewees felt that their ties to the organization could be lost. To ensure their organizational identity, many interviewees suggested, for example, using the organization-related desktop wallpapers (e.g., photos of the department members and/or organizational logo) or the same background in networks (e.g., LinkedIn). Thus, the sense of organization identity could be virtually created and maintained.

> *"But we try to formulate a common vision because I think we need something we can unite behind. […] For example, by using the same logo in our Linked-In profiles. [...] In addition, our leader created a picture with photos of our department and our organization's logo. We all use that as our desktop background." (C_2_1)*

12.4.2 Reach

Unrestricted participation (*reach*) is a prerequisite to fulfill the *relationship requirements* of many knowledge work processes (Choudhury, 2020). All interviewees reported that remote work made communication among colleagues challenging, as not all colleagues used the same communication platform. The interviewees who had a platform stated that the platform should at least be equipped with chat, telephone, and video functions. But before the pandemic, these platforms were not always sufficiently used and maintained.

> *"Document management, cloud services and the like were not used for the most part. Therefore, the exchange of data and communication is not quite as simple [...] and the colleagues then have to use our infrastructure, which we already had before. Using a platform means certain hurdles for the colleagues. If not, it makes communication very difficult." (SME_1_3)*

Since the pandemic, communication platforms have been used much more intensely for short exchanges for business and private purposes. Within the organization, interviewees reported that there were too many different platforms, so that there was a general lack of awareness about who to reach where. Therefore, many organizations decided to use one platform for internal communication.

> *"So, I would say that first our tools had to be rethought because we had too many. [...] We had WebEx, Teams, Jabber. Zoom was used in some cases. [...] We unified that since we depended on regular communication through these tools." (C_2_2)*

Another aspect that implied participation in remote work was that all employees were involved in decisions. Before the pandemic, this was done in a classic way, as interviewee SME_2_1 aptly stated:

> *"Quite normally, by e-mail, on-site, in meetings, or on the phone. The classic way." (SME_1_2)*

The pandemic complicated this process, which was why many leaders have worked on how to enhance employee participation in decision-making. Some leaders first captured the mood in group rounds and individual discussions and then picked up the majority in small surveys. These options were then used to make decisions.

> *"When it affected, let's say, every structure or every employee, we also built small surveys in Microsoft Forms, where you could then decide for or against it." (SME_2_1)*

A quick and delay-free participation is a prerequisite to enable *reach* and requires a stable process at the technological level (i.e., availability of hardware and software), so that all systems and functions run smoothly. To fulfill these *synchronism requirements*, all employees in an organization should have access to (shared) data at the same time. Before COVID-19, initial drives or even partially online drives were provided, but these could usually only be accessed via VPN. The interviewees reported that these basic prerequisites were not always provided in their organizations, which is why a lot of work was done using local versions that were subsequently sent by e-mail.

> *"Documents were mostly not done via any SharePoint or so but actually just went back and forth with e-mail. If it was something internal, i.e., no customers or anything had to do with it, then there were corresponding shared folders even back then." (C_1_2)*

During the pandemic, shared data access has taken a more present role because frequent transmissions via e-mail have not been possible any longer. Also, many interviewees reported that they often obtained a lot of important information during spontaneous conversations. This is now lost in many cases but is gathered through their own research in the shared data. In the interviewees' organizations, platforms such as SharePoint or OneDrive were set up to store data and to edit it simultaneously.

> *"Of course, I'm using OneDrive and SharePoint, that's essential. I'm always amazed at how it works, that you can share individual files, folders, or other things outside the company and grant permissions and so on. For example, with our customers or our tax*

> *office. I keep the accounting on the drive here and then I just give them the folder. I don't have to move anything back and forth; they can pull it out of there. That saves an incredible amount of work." (SME_9_1).*

Another aspect of smooth participation, according to nearly all interviewees, is that knowledge work processes run as they would work in the present. For example, pre-pandemic meetings took place with the necessary tools in the room. If someone wanted to show something (e.g., presentation or document), the laptop was connected to a projector, or a screen everyone could see.

> *"So technically it was easy. If you wanted to show a presentation, it was thrown on the projector on-site." (C_2_3)*

During the pandemic, this aspect changed significantly as nearly all meetings did not take place in an office room but virtually. In this environment, screen sharing crystallized as a new key function for smooth work and participation. The interviewees described some features such as screen sharing as well-known, but many did not use it for their daily business. With the help of this tool, activities from the presence, such as drawing on the flipchart or showing on one's own screen, could be implemented virtually and it enabled a simultaneous virtualization of the meeting or any similar without having to write it down afterward. This also led to a simplified way of working.

> *"In the past, everything was sent around, and everyone gave their comments. Everyone had their change mode turned on in Word, for example, and you clicked through there. Now you throw it up on a screen, discuss the common thing to change, and someone changes the central thing. Of course, that's all much faster, I think. And no one is lost by the fact that you share screen. You are talking about one and the same. There are fewer misunderstandings. Before, you had a lot of misunderstandings. As I said, outdated statuses or you didn't talk about the same thing because maybe you only did it over the phone or by e-mail. So that's already easier now with video conferencing and you can throw everything on the table somehow. I find the way of working already considerably easier." (C_1_3)*

12.4.3 Monitoring Capability

IT enables *monitoring* of process participants and their activities (Overby, 2008, 2012), which is essential to fulfill the *identification and control requirements* of knowledge work processes. For example, by working in the office before the pandemic, it was easier to notice if employees

are in fact working. Even if one did not know what colleagues were working on, one could see that they were present and busy.

> *"Previously in the office, my supervisor and my colleagues were able to see that I was really doing my job, that I was really delivering and performing." (SME_2_2)*

Since some individuals no longer work together in the same physical workplace, work inevitably became spatially and temporally separated. The interviewees emphasized that when working remotely, it has become difficult for them to perceive if their colleagues are actually working. Therefore, they need ways to see who is present at the very moment. Many interviewees reported that they have implemented various tools to monitor the availability status of others. For example, the traffic light systems of communication tools were assigned with clear connotations (i.e., red: in a meeting; yellow: working/no calls; green: available for calls).

> *"We use a traffic light system. This makes me feel more confident that it's not just me working. [...] Once on red, then the "door is closed", then you should also not "come in". Green then the "door is open", and then everyone is also welcome." (C_6_1)*

In this context, the interviewees elaborated that before the pandemic it was also very easy for them to follow their colleagues' activities. By working on-site, they had the opportunity to spontaneously exchange information about who was working on what, what the state of progress was, which (partial) results had already been achieved, and what problems had occurred. If they did not know what a colleague was working on or what the status of a task was, they could just step into the colleague's office, tip on their shoulders, and ask.

> *"I don't want to use the word "control." But basically, this is what I mean. [...] It is not as simple as in the classic sense in the office and where you can just open the door and see what he or she is working on, what the progress is and if everything is okay, and if everyone is coping with his or her tasks." (M_5_1)*

While working remotely, many interviewees lacked the ability to monitor colleagues' availability and project progress. Therefore, project management tools were increasingly introduced (e.g., Kanban boards). This gave both leaders and colleagues an overview of who was working on what, who has free capacity, and had achieved which results, thereby somewhat compensating for the physical monitoring capabilities.

> *"So, what's important is documentation. [...] Since we've been working from home, we've been using digital Kanban boards to maintain a level of monitoring. We know who is working on what and what the current status is, and we know who to contact if we have any queries. That way we avoid wasting time or heading in the wrong direction." (SME_2_1)*

12.4.4 Social Presence

IT enables the presence of process participants, thereby supporting the interactions between employees in a professional and social context (Srivastava & Chandra, 2018). Presence refers to the feeling of being present in a virtual environment (Schultze, 2010). Thus, social presence is not only the feeling of "being there" in a virtual environment but the feeling of "being there together" (Ma & Agarwal, 2007).

Social presence can help to fulfill the *relationship requirements* of knowledge work processes. Nearly all interviewees emphasized that they did both, starting and closing the week together, in the pre-pandemic period. The goal of the joint start of the week was to communicate what was coming up in the week and to plan the week. In the joint closing, the week was evaluated retrospectively, and a glance was taken at the next week.

> *"So, we always had a substantive exchange on Mondays. [...] We came together and discussed things that were planned for the week. At the end of the week, [...] we have discussed the week retrospectively and maybe also the next week's agenda." (SME_2_2)*

The joint start and closing of the week have been maintained virtually during the pandemic. Instead of holding physical meetings, they were (mainly) held via video conferences. However, while the focus before the pandemic had been on the exchange of work-related information, during the pandemic the employees came together and took time to talk about more personal matters. For example, plans for the upcoming weekend were shared or sports results.

> *"We start Monday morning at nine, we always start the week together, and then we simply talk about personal stuff for 20 minutes. We wouldn't have done that in the past, I would have pretty much said chop, chop, chop, that's what we're doing now. Now it's important for us to start and end together more personally." (C_2_4)*

Many interviewees emphasized that joint lunch or coffee breaks with colleagues were a very important social factor in everyday working life. In their opinion, breaks offered the chance to

exchange news ("office grapevines") or chat about tasks or customers, which could strengthen the feeling of togetherness.

> *"Before the pandemic, of course, we had lunch together. [...] We simply spent the lunch break with colleagues in a restaurant or somewhere else. [...] Or had coffee breaks. Just a regular get-together." (M_4_1)*

To facilitate joint breaks when working from home, most organizations have opened permanent virtual break rooms. The virtual break rooms have offered employees the opportunity to dial in at any time and spend their breaks with their colleagues. The interviewees believed that this strengthened the feeling of togetherness. They highlighted that the virtual break rooms not only replaced the previous coffee and lunch breaks but also offered new possibilities: for example, break rooms could be used to set up topic-specific exchange rooms (e.g., traveling).

> *"Yes, we call it a virtual break room. And you can exchange thoughts and ideas there. [...] You ask what topics are on your colleagues' minds, what's new, and so on. Outside of normal work, more of a personal exchange. Then there are different groups, break-out rooms. Here you can find different topics. I must say that this is actually very well accepted and brings us together." (C_7_1)*

12.4.5 Situation Awareness

IT can also be the means of transmission so that people know each other or perceive each other situationally (i.e., IT creates situation awareness) (Malhotra & Majchrzak, 2014). In the literature, situation awareness is defined as *"the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future."* (Endsley, 1995, p. 36). Since our research is set in the context of remote work, not only is the situation awareness of each individual employee is necessary, but also an overarching team awareness between employees (e.g., in terms of their tasks, their competencies) (Endsley, 1995; Salas et al., 1995). Team situation awareness is defined as "the sharing of a common perspective between two or more individuals regarding current environmental events, their meaning, and projected future status" (Wellens, 1993, p. 272). Situation awareness can help to fulfill *relationship requirements* of remote work. Before COVID-19, employees simply had to walk through the office to get to know each other personally, to know how the other person is doing, and who they are in order to work well together. For example, the team leader could see when someone was unwell due to a broken leg.

> *"This was a regular exchange and presence on-site. People just got together for meetings, and sometimes chatted personally and privately. So, it wasn't just limited to the specialist topics, to the work, but of course it was interesting what might be going on in your private life, right?" (C_4_1)*

This has not been possible during the pandemic. Extra care-calls or care-chats were thus needed. This gave employees and colleagues the feeling that they know each other and are aware of each other's current status. Additionally, knowing the status of a task has helped to involve others.

> *"In everyday life, how are you? Where is the status? How far have we come? What's up? Is there anything we still need to discuss? What is the next step? It can also be that we just talk on the phone twice a day and realize that everything is great and then the phone calls are short." (SME_8_1)*

Many interviewees also reported that informal exchanges about work-related issues before COVID-19 were incidental and unobtrusive. They often took place during lunch, evening events, or at large conferences, where time and space are given for this kind of exchange.

> *"Well, before Corona we already made sure that we met once a quarter. I simply went to lunch with the people. [...] I picked up people on a one-to-one basis to find out sometimes how they were doing... did you really understand the task?" (C_2_4)*

With COVID-19, a virtual opportunity had to be created because this informal exchange is considered very important. Many organizations have created new activities, such as coffee roulette. In coffee roulette, there is a defined time in the afternoon where you take a virtual coffee break with colleagues for approximately 30 minutes. However, the pairs are always randomly assigned so that you always take a break with different colleagues.

> *"We have introduced this coffee roulette, simply talking to colleagues also simply about work because that is sometimes very rigid." (C_3_2)*

Just as important as knowing each other in person, is to learn what working skills colleagues have (Prasad & Green, 2016). This means that someone knows who to call or ask about certain questions or tasks These *synchronism requirements* can be somewhat fulfilled by situation awareness. For example, before COVID-19, this was achieved by informal exchanges or meetings.

> *"Before Corona, you just knew who was good at what. I just worked with him or asked my office neighbor, and he could tell me who to go to at the latest." (C_1_1)*

But the virtuality of remote work led to an invisibility of skills. For this purpose, for example, the employees' profiles have been used as a kind of information sheet, where competencies and strengths are mentioned, or special get-to-know rounds have been initiated.

> *"I believe that we should make individual appointments with all team members to introduce the new team member, what am I working on at the moment, what am I doing, what is important, or simply to pass on a bit of precise know how or, yes, to find out what the strengths and weaknesses are. So work-related, just getting to know the team member a little bit." (C_3_2)*

Building up on the knowledge of the skills, COVID-19-initiated cross-thematic exchanges so that informal exchange at the professional level had a place. This also is a process that was not considered necessary to virtualize prior to COVID-19, but the interviewees said that information leakage resulted in significant additional work. In this regard, the interviewees mentioned that some organizations also have initiated cross-departmental rounds.

> *"We also have an exchange round at the specialist level, where everyone from the specialist department reports briefly on what they are doing, so that we can also find out what the other departments are doing because this kind of exchange that takes place briefly in the office, no longer takes place." (SME_10_2)*

12.5 Discussion

In this research, we outline a crisis-driven revisited perspective on PVT by Overby (2008, 2012). We find that when virtualization of knowledge work processes takes place due to crisis-driven digital transformation (e.g., COVID-19 pandemic), the perspective on what can be considered independent and dependent in terms of virtualization flips. In more concrete terms, the dependent factor "process virtualizability" in PVT turns into a prerequisite; thus, from a determined into a determining factor (now labeled as Established Process Virtualization in Figure 12.3) for the fulfillment of knowledge work process requirements. Since, the knowledge work process requirements remain stable (Waizenegger et al., 2020) and therefore need to be fulfilled, we investigate in 'how' knowledge work process requirements have been fulfilled by means of IT within a crisis-driven digital transformation (Whillans et al., 2021).

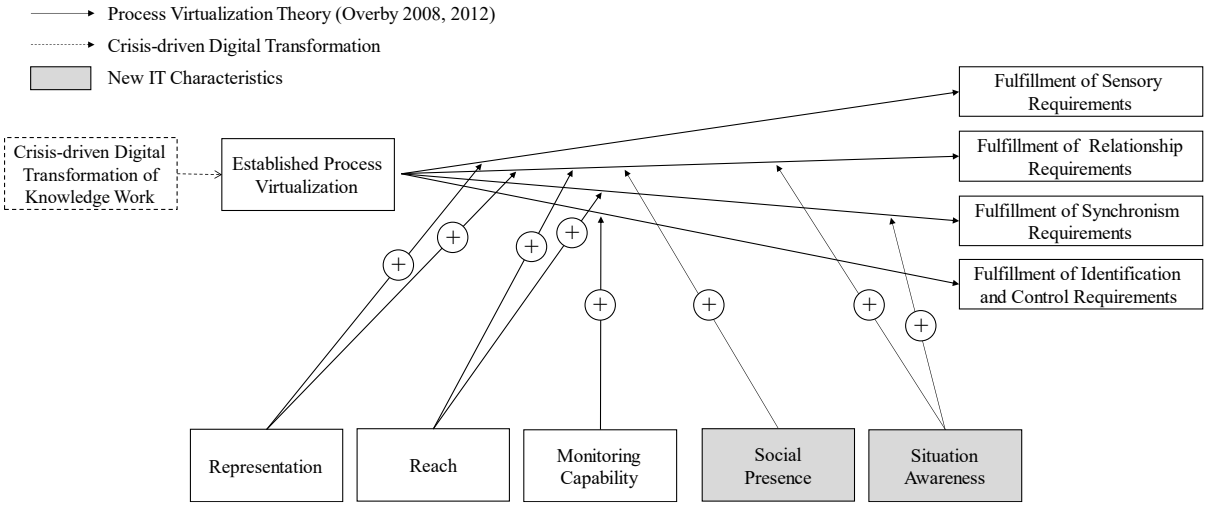

Figure 12.3: An Expanded Crisis-Driven Revisited Perspective on Process Virtualization Theory

With our research, we are able to show that those IT characteristics that enable PV (Overby, 2008, 2012) (representation, reach, monitoring capability) also positively contribute to fulfilling knowledge work process requirements, when the virtualization has to take place, unexpectedly and immediately. This means, to be able to work remotely, it is conducive to be able to present or perceive relevant information ("representation"), to be able to participate at any time ("reach"), and to be able to authenticate process participants and track their activities ("monitoring capability"). IT enables these aspects in the following way.

First, IT enables the **representation** of information including the representation of employees and objects (Overby, 2008, 2012). By replicating senses through IT use, the sensory requirements of knowledge work processes can be fulfilled (e.g., choosing talking on the phone over writing messages ["hearing"], or by turning on the webcam ["sight"]). Further, representation strengthens colleague relationships (e.g., by avoiding virtual backgrounds) and bonds to the organization (e.g., use of organization-related backgrounds). In this way, it contributes to meeting relationship requirements while working remotely.

Second, IT facilitates **reach**, which allows employees to participate in knowledge work processes across time and space (Overby, 2008, 2012). Reach enables interactions with colleagues (e.g., using participative decision-making tools, or a unified communication platform) and, thus, complies with relationship requirements. In addition, reach paves the way to perform knowledge work processes quickly and with minimal delay (e.g., providing shared data access or using real-time collaborative file editing), which contributes to meeting synchronism requirements.

Third, IT allows the **monitoring** of employees (Overby, 2008, 2012). Monitoring facilitates the identification of employees and activity assessment, thus complying with the identification and control requirements. So, IT can be used to monitor both, who is working (e.g., consistent use of availability status), and what everyone is working on (e.g., by using project management tools).

We also uncovered two additional IT characteristics: social presence and situation awareness. These previously unidentified characteristics can also positively support the fulfillment of the knowledge work process requirements.

IT supports the feeling of **social presence** among the employees, (i.e., the feeling of being together in a virtual environment) (Ma & Agarwal, 2007; Schultze, 2010). Thus, social presence supports employees' interactions (e.g., by implementing a joint start/closing of the week or a virtual permanent break room), thus contributing to the fulfillment of relationship requirements.

IT also enables **situation awareness** of the work environment while working remotely (Endsley, 1995; Seebach et al., 2011). On the one hand, situation awareness helps employees to be aware of their colleagues' needs and emotions (e.g., implementing care-calls or -chats or coffee roulette). Thus, situation awareness helps to fulfill the relationship requirements imposed on remote work. Situation awareness also enables employees to be aware of the competencies and knowledge of their colleagues, and to know who to ask about something to work efficiently together (e.g., implementing virtual substantive gatherings or virtual cross-departmental exchanges). Thus, situation awareness contributes to meeting synchronism requirements.

Overall, our findings make three main theoretical contributions. First, we contribute to research by providing an expanded crisis-driven revisited perspective on PVT (Overby 2008, 2012). We demonstrate that the crisis-driven digital transformation of knowledge work triggers a revisited perspective on PVT. Therefore, this revisited perspective of PVT can be applied to any research approach that takes the theoretical lens of PVT and investigates the crisis-driven digital transformation of knowledge work. For example, the employees' intentions to use virtual co-working spaces has been investigated (Hofeditz et al., 2020). Here, the crisis-driven revisited perspective on PVT provides an approach to discuss the implications for changing intentions in the event of unexpected and immediate virtualization. Enforced remote work could promote the intention of employees to use a complementary virtual coworking platform, as social

contact plays a crucial role during crises. At the same time, it can be investigated whether the proposed design principles along the PVT need to be adapted to respond to the crisis-driven digital transformation.

Second, we contribute to research by extending the crisis-driven revisited perspective on PVT (Overby, 2008, 2012) with two new IT characteristics: social presence and situation awareness. The first additional IT characteristic uncovered that positively impacts the fulfillment of knowledge work process requirements is social presence, especially during period of insecurity, internal crisis communication, and personal exchange among leaders and employees (Johansen et al., 2012). However, in times of enforced remote work, real social interactions between employees are limited and informal or spontaneous opportunities to connect are missing. This can negatively affect productivity, intrinsic motivation, or collaborative behavior (Kwak et al., 2019; Yang et al., 2015). To strengthen the feeling of "being there together" (social presence) by means of IT has gained in importance. Future research may explore how the feeling of the colleagues' virtual social presence helps to reduce negative feelings threatening the employees' wellbeing, while fostering their productivity and team cohesion. The second additional IT characteristic uncovered that exerts a positive impact on meeting knowledge work process requirements in crisis-driven digital transformations is situation awareness. Initial research has already underpinned the relevance of situation awareness: for example, research has shown that employees need to know about the emotional state of their colleagues in order to be able to access the individual, which in turn leads to effective collaboration (Seebach et al., 2011). It has also been shown that situational awareness is critical for the success of virtual teamwork processes (Endsley & Robertson, 2000). Here, research examined how virtual teams use IT to specifically facilitate situation awareness and the effects on team performance (Malhotra & Majchrzak, 2014). Our research indicates that situational awareness must be ensured in remote work in times of crisis-driven digital transformation and demonstrates how situational awareness can positively support the fulfillment of knowledge relationship and synchronism requirements.

Third, we conclude that, regarding remote work during crisis-driven digital transformation, IT became increasingly important to fulfill relationship requirements of knowledge work processes during the pandemic. This can be explained by the fact that the physical distance between employees can eventually turn into a psychological distance between them (Garro-Abarca et al., 2021). Psychological distance can affect the way individuals perceive their colleagues, leaders, or externals, leading to inaccurate perceptions of those individuals based

on categorizations and/or stereotypes (Wilson et al., 2006). This may also be due to the fact that crises make people feel more anxious and lonelier and therefore require more social contact, which can also be satisfied in a work context (Johansen et al., 2012). In addition, working with a physiological distance is more impersonal, distant, and task-focused (Sproull & Kiesler, 1986), and therefore can negatively affect the trust between employees (Altschuller & Benbunan-Fich, 2010, 2013). To bridge the psychological distance when working remotely (i.e., compensating for limited social interactions and spontaneous opportunities to informally connect) (Lepsinger & DeRosa, 2015; Yang et al., 2015), IT has been used to strengthen a sense of unity, togetherness, and collective identity. This is in line with the work of Roy (2012), who postulates that strong relationships between employees can help to overcome feelings of isolation. Many studies on remote work demonstrate that one of the biggest challenges in dispersed work settings is to overcome the psychological distance (e.g., Bailey & Kurkland, 1999; Tietze & Nadin, 2011; Wilson et al., 2006). With our crisis-driven revisited perspective on PVT, we present new ways to fulfill relationship requirements in remote work settings and, thus, help to reduce psychological distance in times of crisis-driven digital transformation.

The expanded crisis-driven revisited perspective on PVT is also beneficial from a practical perspective. Our findings are valuable to any organization that needs to transition unexpectedly and immediately to remote work (due to COVID-19 or any other crisis). In times of crisis-driven digital transformation, one main challenge many organizations face is maintaining knowledge work processes. Thus, first, our findings contribute to practice by providing a wide and comprehensible overview of practice-oriented measures to help to fulfill sensory, relationship, synchronism, and identification and control requirements of knowledge work processes. Organizations can build on our findings, implement suitable measures, and adapt those measures to their knowledge work processes. Second, our research addresses the special challenge for organizations to maintain relationships among employees and retain them, even when they work remotely. This research provides insights into how relationship requirements of knowledge work processes can be met even at a distance and during times of great insecurity. It is not a given that these relationships will work well without further action. For example, organizations in a pandemic situation have started to implement a digital start and/or end of the week. It is unique in a way that every employee actively schedules time for it and the sense of belonging is strengthened. Another example is that the interviewees' organizations have introduced communication platforms (Mäntymäki et al., 2019). These are not only useful for structuring knowledge work processes but also allow direct exchange (business and private)

via (group-) chat with emojis. This is easy for organizations to implement, and it creates a greater sense of belongingness. Moreover, it is important for organizations to celebrate successes (e.g., closing new contracts) and special occasions (e.g., birthdays or organization anniversaries) virtually, and to actively provide room for this. This has to turn into a regular practice by the management because it motivates remote employees in the home office even more if these events are appreciated despite the crisis. Finally, our research will contribute to a sustainable change in organizations that is less concerned with the "if" and more with the "how" of knowledge work processes, thus making a positive contribution to the sustainable process virtualization of organizations in the future.

12.6 Limitations and Future Research

We conducted a qualitative multiple case approach to examine the fulfillment of knowledge work process requirements in times of crisis-driven digital transformation. Although we tried to be as thorough as possible in our study, this research has some limitations that provide promising avenues for further research. First, our research focuses on the COVID-19 pandemic as an example of a crisis-driven digital transformation. Therefore, further research is needed to clarify whether our findings on how knowledge work process requirements were fulfilled can be transferred to other external crises (e.g., natural disasters, social disasters, wars) or if PVT needs further revision. In addition, the fact that we focused on COVID-19 as an example of a crisis-driven digital transformation caused a focus on external crises. Future research might address whether internal crises, which require an immediate and unexpected virtualization of knowledge work processes, also trigger a revisited perspective of PVT. Second, our research focused on knowledge work processes, but we cannot be sure if there are further influencing IT characteristics for other work processes that we did not uncover. We strongly encourage future research in remote work settings to use our research as a starting point and explore how process requirements for other work processes (e.g., sale processes, decision making processes, creative work processes) are fulfilled by means of IT. One possibility could be to explore whether there are further IT characteristics that positively support the fulfillment of work processes involving external stakeholders (e.g., selling goods to costumers). Third, we focused specifically on knowledge work processes and neglected individual feelings, such as anxiety or stress, in times of crisis-unless they impact the knowledge work process (e.g., through an increased need for social contact that can also be satisfied by the work context). Since these factors are important to understand crisis-driven digital transformation more holistically, we encourage future research to provide insight on them. Furthermore, our research is limited by

the fact that all interviewees are working in national work contexts with colleagues of the same nationality and cultural background. Therefore, we encourage future research to exclude possible cultural influences by examining the fulfillment of knowledge work process requirements in and across different countries and cultural contexts. Lastly, since this research is based on a qualitative multiple case approach, we cannot (yet) substantiate our findings with quantitative data. Future quantitative studies would allow us to validate the expanded crisis-driven revisited perspective on PVT.

12.7 References

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12.8 Appendix

12.8.1 Appendix A: Overview over Interviewees

No.	Interviewee	Organization Sector	Age	Gender
1	C_1_1	Mobility & Logistic	27	m
2	C_1_2	Mobility & Logistic	35	m
3	C_1_3	Mobility & Logistic	53	w
4	C_2_1	Telecommunication	35	m
5	C_2_2	Telecommunication	32	w
6	C_2_3	Telecommunication	56	w
7	C_2_4	Telecommunication	34	m
8	C_2_5	Telecommunication	28	m
9	C_3_1	Banking & Insurance	32	w
10	C_3_2	Banking & Insurance	32	m
11	C_4_1	Banking & Insurance	61	m
12	C_5_1	Consulting	54	m
13	C_6_1	Banking & Insurance	38	m
14	C_7_1	Mobility & Logistic	55	m
15	M_1_1	Municipalities	32	m
16	M_1_2	Municipalities	30	w
17	M_2_1	Municipalities	28	w
18	M_2_2	Municipalities	42	m
19	M_3_1	Municipalities	59	m
20	M_3_2	Municipalities	33	w
21	M_4_1	Municipalities	31	m
22	M_5_1	Municipalities	28	m
23	M_5_2	Municipalities	44	m

24	M_6_1	Municipalities	40	m
25	SME_1_1	Manufacturing	24	w
26	SME_1_2	Manufacturing	51	m
27	SME_1_3	Manufacturing	20	m
28	SME_2_1	Technology	24	m
29	SME_2_2	Technology	25	m
30	SME_3_1	Manufacturing	43	m
31	SME_3_2	Manufacturing	39	w
32	SME_4_1	Manufacturing	38	m
33	SME_4_2	Manufacturing	26	w
34	SME_5_1	Mobility & Logistic	40	m
35	SME_6_1	Consulting	49	m
36	SME_7_1	Consulting	48	m
37	SME_8_1	Press & Media	46	w
38	SME_9_1	Mobility & Logistic	39	m
39	SME_10_1	Innovation	33	w
40	SME_10_2	Innovation	35	m

12.8.2 Appendix B: Interview Guide: "Remote Work in Times of COVID-19"

Please note that this interview guide is an excerpt from a longer version. We have provided all sections required for this research.

1. Focus: Person
    - Age, gender
    - What organization do you work for?
    - What is your current profession?
    - What professional education do you have?
    - How would you rate your IT-competencies?
    - To what extent has COVID-19 affected you personally or your environment?
2. Focus: Knowledge work processes
    - Can you describe your workplace?
    - Why is it necessary for you to work from home?
    - How extensive was the work in the home office?
    - How were knowledge work processes [collaboration, coordination, communication, decision-making] organized on-site and how are they organized in home office settings? What are the most important changes? Where do you see challenges and opportunities?
    - How would you describe the role of working from home for your organization?
    - What work constraints have you encountered in the transition from working on-site to working from home?
3. Focus: Requirements of working from home and the implementation of home office
    - Which requirements (technical, organizational, collaborative, other) do you have for your work [knowledge work process]? Which effects does it have if these requirements are fulfilled or not fulfilled?

- What are your requirements (technical, organizational, collaborative, other) for working from home? Which effects does it have if these requirements are fulfilled or not fulfilled?
- How have your requirements for work changed in times of COVID-19? Which new requirements do you have?
- What technologies have been implemented for the collaboration when working from home?
- Which new technologies have been implemented?
- How are these technologies being used?
- What are the technical challenges or limitations?

4. Focus: Social Aspects

(a) Before COVID-19

- What do you do to foster feelings of togetherness [cohesion, belonging, organization identity]?
- What events have taken place in your organization?
- How do you get the feeling that your leader and other employees are present?

(b) With the outbreak of COVID-19

- How can a feeling of togetherness [cohesion, belonging, organization identity] be created when all employees are working from home?
- How do you build virtual relationships to your leader and colleagues?
- How are you virtually present when you are at home?
- What measures do you take to improve the atmosphere among your colleagues?
- To what extent do you think it is a challenge for new colleagues to get to know each other and integrate into the team when everyone is at home?
- Which events take place virtually?
- What technologies do you use to strengthen social presence / trust / mood?

12.8.3 Appendix C: Coding Scheme

Part	Content	Codes	
I	Demographics	*Age*	
		Gender	
		Organization sector	
		Organization size (C, SME, M)	
II	Representation (Before COVID-19, with the outbreak of COVID-19)	*Sensory Requirements*	*Seeing*
			Hearing
		Relationship Requirements	*Privacy insight*
			Organization identity
			Representation of person
			Representation of feelings
III	Reach (Before COVID-19, with the outbreak of COVID-19)	*Relationship Requirements*	*Communication platform*
			Participative decision-making
		Synchronism Requirements	*Data access*
			Editing
			Collaboration
			Collaboration tools
			Short term communication
IV	Monitoring capability (Before COVID-19, with the outbreak of COVID-19)	*Identification and Control Requirements*	*Transparence of availability*
			Transparence of progress
			Transparence of activity
V	Social Presence (Before COVID-19, with the outbreak of COVID-19)	*Relationship Requirements*	*Joint start/closing of the week*
			Joint Breaks
			After-work events
			Celebration of success and achievements
VI	Situation awareness (Before COVID-19, with the outbreak of COVID-19)	*Relationship Requirements*	*Personal exchange*
			Spontaneous exchange
		Synchronism Requirements	*Substantive exchange*
			Cross-departmental exchange

12.8.4 Appendix D: Overview of the Findings

IT Characteristic	Requirements	Specification of Require-ments	Activities	*Example Quote*
Representation	Sensory Requirements	Hearing	Phone calls instead of message/mail	*"Just keeping in touch. Just make a call. In the past, I would have written an e-mail, but now I call [...]. I do that a lot more so that I can also hear the other person's voice sometimes." (SME_1_2)*
		Seeing	Video- instead of audioconference	*"And I think it's also very important to turn on the webcam. […], it's important to see others, to have the feeling that you're not just talking to a picture, but instead a real person, who still has facial expressions and gestures." (C_3_2)*
	Relationship Requirements	Privacy insight	Avoid virtual wallpapers	*"So, a picture, for example, as a background I find distracting. So, you have the feeling that someone wants to hide something. [...] I think you have more insights into the privacy of the other person, which also makes working together a bit more pleasant. And I think this personal aspect is especially important when working from home exclusively." (SME_8_1)*
		Organization identity	Integration of virtual organization identity	*"But we try to formulate a common vision, because I think we need something we can unite behind. [...] For example, by using the same logo in our LinkedIn profiles. [...] In addition, our leader created a picture with photos of our department and our organization's logo. We all use that as our desktop background." (C_2_1)*
		Representation of feelings	Use of Graphics Interchange Format (GIF) and Emojis	*"We have been writing a lot more in the chat since the pandemic. And we also try to use the GiF function and emojis very extensively, […] to make the work a bit more fun and to virtualize our personal level." (SME_10_2).*
		Representation of person	Use of profile photos in user accounts	*"It starts with, for example, a profile photo. [...] We used to have dummies. Now we have all the profile photos in Outlook, so you know who you're writing to, so it's at least a little more personal." (C_1_1)*

IT Characteristic	Requirements	Specification of Requirements	Activities	*Example Quote*
Reach	Relationship Requirements	Communication platform	Use a unified communication platform	*"So, I would say that first our tools had to be rethought because we had too many. [...] We had WebEx, Teams, Jabber. Zoom was used in some cases. [...] We unified that since we depended on regular communication through these tools." (C_2_2)*
		Participative decision-making	Use of participative decision-making tools	*"When it affected, let's say, every structure or every employee, we also built small surveys in Microsoft Forms, where you could then decide for or against it." (SME_2_1)*
	Synchronism Requirements	Data access	Provide shared data access	*"Of course, I use OneDrive and SharePoint, that's essential. I'm always amazed at how it works, that you can share individual files, folders or other things outside the organization and grant permissions and so on. For example, with our customers or our tax office. I keep the accounting on the drive here and then I just give them the folder. I don't have to move anything back and forth; they can pull it out of there. That saves an incredible amount of work." (SME_9_1).*
		Collaboration	Use of real-time screen sharing	*"In the past, everything was sent around, and everyone gave their comments. Everyone has their change mode in Word, for example, and you clicked through there. Now you throw it up on a screen, discuss the common thing to change, and someone changes the central thing. Of course, that's all much faster, I think. And no one is lost by the fact that you share screen. You are talking about one and the same. There are fewer misunderstandings. Before, you had a lot of misunderstandings. As I said, outdated statuses or you didn't talk about the same thing, because maybe you only did it over the phone or by mail. So that's already easier now with video conferencing and or you can throw everything on the table somehow. I find the way of working already considerably easier." (C_1_3)*

IT Characteristic	Requirements	Specification of Require-ments	Activities	*Example Quote*
		Editing	Use of real-time collaborative file editing	*"So, I was totally excited when Office 365 was finally introduced in our organization, where the function was finally introduced that allowed us to work together on a document. I found that to be a very, very big improvement when working from home. [...] You unlock the document, can work on it together and see the result immediately." (C_1_3)*
		Collaboration tools	Use of real-time collaboration tools	*"Well, I've been using Miro since the beginning of the pandemic. It's a kind of digital whiteboard, and with it I've found what I was missing in digital meetings, that is, this interaction. You can really do brainstorming sessions. Just like in the office in the past. You can develop and record content directly together [...] And at the end you know what you have said and created. That becomes directly visible." (SME_10_1)*
		Short term communication	Use of chats for short term communication	*"We use the chat function for the short-term exchange of information. About the latest news, what is important, so it is definitely and just also appointment coordination as well as, I'll be there in half an hour or things like that. [...] To communicate in real time." (SME_7_1)*
Monitoring Capability	Identification and Control Requirements	Transparence of availability	Consistent use of availability status	*"We use a traffic light system. This makes me feel more confident that it's not just me working. [...] Once on red, then the "door is closed", then you should also not "come in". Green then the "door is open", and then everyone is also welcome." (C_6_1)*
		Transparence of progress	Use of virtual project management tools	*"So, what's important is documentation. [...] Since we've been working from home, we've been using digital Kanban boards to maintain a level of monitoring. We know who is working on what and what the current status is, and we know who to contact if we have any queries. That way we avoid wasting time or heading in the wrong direction." (SME_2_1)*
		Transparence of activity	Use of shared calendar	*"Yes, now since the home office we have access to all calendars, and we manage and maintain it accordingly. And we also use blockers when we are*

IT Characteristic	Requirements	Specification of Require-ments	Activities	*Example Quote*
				not in meetings. So, I know that the others are working and what they are working on. That creates transparency and trust." (SME_7_1)
Social Presence	Relationship Requirements	Joint start/closing of the week	Implement joint start/closing of the week	*"We start Monday morning at nine, we always start the week together, and then we simply talk about personal stuff for 20 minutes. We wouldn't have done that in the past, I would have pretty much said coop, coop, coop, that's what we're doing now. Now it's important for us to start and end together more personally." (C_2_4)*
		Joint Breaks	Implement virtual break room	*"Yes, we call it a virtual break room. And you can exchange thoughts and ideas there. [...] You ask what topics are on your colleagues' minds, what's new, and so on. Outside of normal work, more of a personal exchange. Then there are different groups, break-out rooms. Here you can find different topics. I must say that this is actually very well accepted and brings us together." (C_7_1)*
		After-work events	Implement virtual team games	*"Or that you simply create an online game that you can play against each other. Or play Ludo or whatever and let the team compete against each other virtually. Maybe also to split his team inside again. We play three against three in some online games." (SME_2_2)*
		Celebration of success and achievements	Implement virtual success acknowledge-ments	*"I think something like that strengthens the team spirit when you somehow celebrate successes together, just by implementing a chat for a small thank you or a special meeting for a big thank you to the team purpose. That also helps you in some way, in my opinion, to bring the team together. This is important for every work process from.". (G_4_1)*

IT Characteristic	Requirements	Specification of Require-ments	Activities	*Example Quote*
Situation Awareness	Relationship Requirements	Spontaneous exchange	Care Calls	*"In everyday life, how are you? Where is the status? How far have we come? What's up? Is there anything we still need to discuss? What is the next step? It can also be that we just talk on the phone twice a day and realize that everything is great and then the phone calls are short." (SME_8_1)*
		Personal exchange	Informal exchange	*"Well, before Corona we already made sure that we met once a quarter. I simply went to lunch with the people. [...] I picked up people on a one-to-one basis to find out sometimes how they were doing... did you really understand the task?" (C_2_4)*
	Synchronism Requirements	Substantive exchange	Knowing colleagues' competencies	*"I believe that we should make individual appointments with all team members to introduce the new team member, what am I working on at the moment, what am I doing, what is important, or simply to pass on a bit of precise know how or, yes, to find out what the strengths and weaknesses are. So work-related, just getting to know the team member a little bit." (C_3_2)*
		Cross-departmental exchange	Interdisciplinary exchange	*"We also have an exchange round at the specialist level, where everyone from the specialist department reports briefly on what they are doing, so that we can also find out what the other departments are doing because this kind of exchange that takes place briefly in the office, no longer takes place." (SME_10_2)*

II Team Perspective

13 Leading Virtual Teams

Title	**Leading Virtual Teams – A Literature Review**
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Publication Type	Conference Paper
Publication Outlet	New Future of Work Symposium
Status	Published
Full Citation	**Zeuge, A.**, Oschinsky, F. M., Weigel, A., Schlechtinger, M., & Niehaves, B. (2020). Leading virtual teams - A literature review. *New Future of Work Symposium*. (published)

Table 13.1: Fact Sheet Publication

Leading Virtual Teams – A Literature Review

Abstract. With the outbreak of COVID-19, many organizations are facing the challenge of switching to virtual work. A large number of teams suddenly need to work no longer physically but digitally together. However, switching to virtual teamwork is not only a special requirement for the team, but also for the leadership of virtual teams. Despite great efforts to explore virtual leadership, research still lacks an overview of the leadership of virtual teams. We address this gap by presenting the results of a narrative literature review conducted by five independent scientists to map the broadest possible spectrum of results with special attention to a heterogeneity of the results. Thereby, our work provides a point of departure for a structured exploration of virtual team leadership.

13.1 Introduction

Almost nothing is as it was before COVID-19. All over the world people are getting sick, schools and companies are closing, and the health system is overloaded in many places. The worldwide pandemic forces us to rethink many areas of life. At the same time, the crisis offers great opportunities. In the work context, for example, digital communication channels are increasingly used, and the remote or mobile working is becoming a matter of course (Gaudecker et al., 2020).

Even before COVID-19, many digitization projects were initiated, started and implemented, too (Oztemel & Gursev, 2020). With the advent of the virus, however, digitization had to be carried out much faster. In various organizations, it became necessary at short notice that both the actual work and the cooperation with colleagues had to be carried out digitally. In the past, multinational companies and organizations have faced this challenge with a slower pace. Due to COVID-19, all organizations have to face this challenge and replace the established meeting room with virtual solutions. That is why virtual team meetings are now as much a part of working life for many people as real meetings were before the crisis.

Digital collaboration is not only a requirement for team collaboration, but also for team leadership (Gibson & Cohen, 2003). The implementation of virtual teams had to be done quickly and consistently after the discovery of the virus. Where these processes had often been characterized by long consultations and inhibitions before the crisis, solutions now had to be implemented quite fast. The preparation time for employees and managers was correspondingly short. Best practices and examples of how this could be solved as effectively

as possible were of little or no use, as the framework conditions of these examples were completely different from those of the current situation.

Virtual teams have already been considered in research, but a comprehensive overview of the current situation is missing. Further research is needed because the future will continue to be shaped by virtual teams during and sometime after the rapid change. The aim of the paper is to give an overview of the current state of research on virtual leadership and its implementation. It provides a starting point for further research and suggests future studies to investigate virtual leadership in more detail.

To meet the objective, the following sections are structured as follows: First, we give an overview of the virtual teams. Then, we describe our methodological approach and discuss our findings. We conclude with providing potential contributions for theory and practice and highlight the limitations of our work.

13.2 Related Work

What are virtual teams and how are they defined? Existing literature provides different definitions, for example: “Virtual teams are geographically and organizationally dispersed teams […]. Due to such dispersion, physical contact in virtual teams is reduced or lacking altogether which means that collaboration is enabled by IT-solutions such as computer-based communication“ (Lilian, 2014, p. 1251). Under the conditions of COVID-19, many people were enabled to work in such a virtual team, even if they were not actually geographically dispersed. Consequently, this definition does not give a comprehensive answer in the current pandemic. This shows that it is necessary and possible to use hybrid approaches. There is not only one definition of a virtual team but rather a continuum between the design of presence and virtual work (Bell & Kozlowski, 2002). Another study offers a literature review with definitions of virtual teams. It identifies and extends 12 key factors that need to be considered and describes a methodology that focuses on supporting work in virtual teams. (Ebrahim et al., 2009).

The change from presence to virtual work is foremost a process change that must be established itself, like the introduction of software in companies, which is often understood as a process change. Effectiveness increases with the experience of working in virtual teams. Employees need time to get used to the new situation. In addition, communication in virtual teams must be more precise, concise and unambiguous (Bakshi & Krishna S., 2008). This explicit communication is essential to avoid misunderstandings, which can arise practically faster than

in personal communication. It is therefore necessary to clearly define areas of responsibility and to set standards and fixed deadlines. The establishment of structures and fixed virtual meetings are important to enable regular 'personal' exchanges, e.g. through video conferences. This increases trust in the team, strengthens cooperation despite distance and reduces the feeling of 'being alone'. Teams generally benefit from communication and from the exchange of personal information between team members. Consequently, this must be possible or made possible in the virtual space (Pierce & Hansen, 2008). Virtual leadership plays a special role in discovering common ground. This strengthens the bond within the team and creates trust among team members and in the leader herself or himself. To achieve this, it is even more important that the team members have the feeling that they are working towards the same mission and master the same challenges. The leadership of virtual teams is a decisive factor. In the literature it is assumed that the establishment of availability times is important, because working hours can vary, and constant availability can lead to an increased stress level (Naik & Kim, 2010).

13.3 Methodological Approach

To answer our research question, we took a close look at existing research (Rowe, 2014; Schryen, 2015). We proceeded our literature review in a narrative manner and carried out the search with five independent scientists in order to map the broadest possible spectrum of results. We searched in common search engines such as Google Scholar, Web of Science, Scopus and PUBMED. We did not make any restrictions according to the year of publication or subject area, because we wanted to cover the widest possible range of sources. In addition, each scientist chose her or his own keywords to ensure the greatest possible variance. Even if some terms were similar (e.g. "virtual teams", "virtual leadership", "remote work"), a great heterogeneity was achieved.

After searching, the five researchers gathered the results in a joint workshop, discussed the manuscripts, prioritized them and – if necessary – excluded them. After a comprehensive literature database with all articles was created, every scientist read the texts and was able to gain a broad impression into the state of research on virtual teams. The first insights and intermediate results were then discussed and reflected in workshops with practitioners. Against this background, the current work is composed of theoretical and practical insights.

13.4 Findings

13.4.1 Changing from Presence to Virtual Work

Digital technologies are a prerequisite for digital teamwork. However, the introduction of digital technologies is not adequate to make a virtual team effective (Ebrahim et al., 2009). Internal group dynamics and external support mechanisms should also be considered (Lurey & Raisinghani, 2001). One key task of leaders in the initial phase, is to ensure role clarity, i.e. all team members are aware of the different roles and responsibilities, as a lack of visibility can make the team members feel less able to achieve results (Ebrahim et al., 2009).

In addition, research suggests that virtual team leaders should complement virtual teamwork with structural support (Bell & Kozlowski, 2002; Hoch & Kozlowski, 2014; Kiesler & Hinds, op. 2002). Virtual teamwork is characterized by turbulence and unpredictability, which can be compensated by stability and the reduction of ambiguities provided by structural support (Zaccaro et al., 2001; Zigrus, 2003). Structural support indirectly influences the motivation and behavior of team members via structural attributes (Bell & Kozlowski, 2002). Hoch and Kozlowski (2014) highlight that structural support in virtual teams has a strong positive effect on team performance. Structural support can be provided by a fair, motivating and reliable reward system (Hertel et al., 2005; Hoch & Kozlowski, 2014; Nunamaker et al., 2009), and by a transparent communication and information management (Hoch & Kozlowski, 2014).

Furthermore, literature suggest that virtual team leaders should create a flexible environment by incorporating principles of agile development. This helps to reduce risks related to communication, coordination, and control inherent in virtual teams, and helps teams to improve their communication (Paul et al., 2016; Yadav et al., 2009). To ensure a flexible environment, Paul et al. (2016) emphasize that it is crucial (1) to provide an opportunity to meet together face-to-face at least once initially or, if that is not feasible, to provide an intentional socialization phase, (2) to encourage the teams to discuss and establish project coordination protocols, and (3) to provide adequate technical support, with recommendations of appropriate technology use and support for the technology itself.

However, in addition to the support provided through the leader in switching from physical to digital work, the most important thing is that the leadership acts as a role model (Kayworth & Leidner, 2002; Roy, 2012). Since the team members look to the leader for guidance, it is their responsibility to set a good example (Roy, 2012).

13.4.2 Computer-meditated Communication

Communication in virtual teams includes the use of computer-mediated communication and thus differs from face-to-face communication (Haines et al., 2018; S. K. Johnson et al., 2009). First and foremost, virtual team communication is usually based on computer-mediated asynchronous information and knowledge dissemination, i.e. different conversations on different topics can be conducted simultaneously by several team members (Lilian, 2014).

Furthermore, research has shown that individuals on virtual teams communicate and participate more evenly (Dennis & Garfield, 2003; Fuller et al., 2016, 2016), but the communication is also more impersonal (Lepsinger & DeRosa, 2015; Schlenkrich & Upfold, 2009). Encounters in the coffee kitchen and office grapevines are missing. One of the most important challenges for managers is therefore to motivate their team to engage in continuous communication, which increases cohesion and motivation, and to build trust, which together leads to successful team performance. (Lilian, 2014; Purvanova & Bono, 2009).

Since virtual teams lack informal spontaneous opportunities to connect, Lepsinger and DeRosa (2015) highlight strengthening the team members' relationships as another important task of the leadership. They suggest different ways to strengthen team cohesion: (1) If celebrations (e.g. birthday parties or debuts) cannot take place physically or some team members cannot be physically present the celebrations should be hosted online. (2) Virtual coffee breaks should be introduced, to give room for informal spontaneous conversations. (3) The virtual team leaders should make "care calls" to get to know the team members on a personal level.

13.4.3 Leadership Style

The leadership style of the team leader is the key to minimize motivation and coordination losses and sustain the effectiveness of virtual teams (Hoch & Kozlowski, 2014).

Existing literature suggests that the transformative leadership style is particularly suitable for virtual teams using computer-mediated communication (Purvanova & Bono, 2009; Ruggieri, 2009). Researchers proposed that transformational leadership is based on four principal factors: Inspirational motivation, idealized influence, individualized consideration, and intellectual stimulation (Kark et al., 2003). To this end, transformation leaders put the interests of their team first, respect the commitments and mission, show qualities that inspire respect and pride, become role models and explore new perspectives for solving problems and achieving goals (Ruggieri, 2009). Purvanova and Bono (2009) suggest that transformational leadership in virtual teams has a stronger impact and that leaders who increase their transformational

leadership behavior in such teams achieve a higher level of team performance. Ruggieri (2009) also revealed that a transformational style is more suitable for virtual teamwork than a transactional style, and that a transformational leader is better judged by the team than a transactional leader. The author found that a leader with a transformational style of leadership is associated with more positive adjectives and is perceived as more intelligent, creative and original.

Another research stream shows that in virtual teams the leadership is shared between several team members, i.e. virtual teams usually have not only one but several leaders. (Hoegl & Muethel, 2016; Robert & You, 2018; Ziek & Smulowitz, 2014). The shared leadership style is defined as "a collective leadership process, whereby multiple team members step up to take the lead or to participate in team leadership functions" (Hoch & Dulebohn, 2017). Shared leadership includes every team member in team decisions, promising more inclusion and better team experiences (Marissa L. et al., 2010). Hoch and Dulebohn (2017) have identified from existing literature that shared leadership is advocated as beneficial for virtual teams because it is associated with (1) collaborative decision making (e.g. Conger & Pearce, 2010), (2) collaborative behavior that increases trust and knowledge sharing among other team members (e.g. Hill, 2005), and (3) positive team and organizational outcomes such as performance (e.g. Hoch & Dulebohn, 2013).

13.4.4 Leadership Behavior

13.4.4.1. Presence in Virtual Worlds

The physical, operational as well as the cultural distance inherent in virtual teams confronts leaders of such teams with unique challenges such as successfully influencing team members despite computer-mediated communication (Purvanova & Bono, 2009).

To ensure that virtual team leaders are perceived as such by their team, they need to create a sense of "presence" among their team members (Hoegl & Muethel, 2016). However, the focus should not just be on creating presence in the sense of "being there" but rather "being there together" (Altschuller & Benbunan-Fich, 2010). This creates for one thing a feeling of connection and at the same time strengthens the ties and interpersonal relationships in the team. (Altschuller & Benbunan-Fich, 2010).

Literature reveals various ways in which leaders of virtual teams can create a sense of presence among their team members. First and foremost, it is crucial that the leader also in a virtual environment is always available to the team, i.e. he or she should try to communicate regularly

and promptly. (Kayworth & Leidner, 2002; Morgan et al., 2014; Roy, 2012). This is especially important for global teams, since the leadership must be available for all team members regardless of time zones (Lilian, 2014). Thereby, the virtual team leaders should be sensitive to the schedules of the different team members (Kayworth & Leidner, 2002). In addition, the virtual team leader can create presence by providing continuous and timely feedback as well as suggestions for improving team activities. (Kayworth & Leidner, 2002; Mukherjee et al., 2012; Petrucci & Rivera, 2018). Furthermore, the leader should be empathetic, e.g. by being understanding and sensitive to the problems of the team members and expressing personal interest in the individual team members (Kayworth & Leidner, 2002; Roy, 2012).

13.4.4.2. Establishing a Culture of Trust

Sarker et al. (2003) describe trust as the "glue" that propels a team to the successful completion of the project. Trust within a team has a positive effect on the efficiency, effectiveness, and satisfaction levels of global virtual teams (Edwards & Sridhar, 2005). Wilson et al. (2006) defined trust as "confident positive expectations about the conduct of another". In addition, trust also includes the freedom to test assumptions, to experiment, to make and talk about mistakes (Dixon, 2017).

Since virtual teams are often composed of individuals who have never worked together before, a trusting environment within the team is required (Altschuller & Benbunan-Fich, 2010). Trust is seen more critical in virtual environments than in traditional team settings (Cascio & Shurygailo, 2003) being the necessary condition for cohesiveness and successful work in virtual teams (Child, 2001; Sarker et al., 2003). Trust is based on the belief that team members are dependable meeting the team expectations by delivering what they promise (Cascio & Shurygailo, 2003; Malhotra et al., 2007).

Drawing on literature, Sarker et al. (2003) identified three different bases of trust applicable to virtual teams. Since, trust is significantly evoked, enhanced, developed, and influenced by one's personality, one basis of trust in virtual teams is the innate personality of their members. The second basis of trust in a virtual team is the institutionally based trust. The institutional trust approach, which is grounded in institutional theory, assumes that norms and rules of institutions surrounding individuals guide their behavior. A third base of trust that occur during interactions between remote members of virtual teams is associated with three cognitive processes (unit grouping, reputation categorization, and stereotyping).

Leaders can foster trust by setting clear and mutual expectations, improving coherence, and inspiring and motivating team members to improve the team's performance and the organization's value creation (Cascio & Shurygailo, 2003; Jarvenpaa et al., 1998). Germain (2011) emphasizes that the leadership of virtual teams should encourage continuous communication to increase trust in the team. Encouraging continuous communication provides the reassurance that others are involved in the task, thereby increasing a member's early confidence in the team. If there is a low level of trust, continuous communication helps to constantly confirm that other team members are present and also working on the project.

13.4.4.3. Embracing Diversity

A natural consequence of global virtual teams is that individuals increasingly interact with others who are different from themselves (Martins & Shalley, 2011). Virtual teams are composed of individuals with a diverse range of stakeholders, experiences, functions, organizations, decision-making styles and interests (Malhotra et al., 2007). The leaders of virtual teams face the challenge of acknowledging this diversity (Cordery & Soo, 2008). All team members should be aware of the diversity within the team and be encouraged to engage with the diversity of the different team members (Barnwell et al., 2014).

The team's ability to succeed depends strongly on how well diversity is being understood, appreciated and leveraged (Malhotra et al., 2007). A pivotal task of team leadership is to transform existing challenges into opportunities in order to improve team success and organizational value creation (Mukherjee et al., 2012; Nunamaker et al., 2009). Literature highlights the need to promote specific team-building activities addressing the individual needs of different team members and promote a sense of belonging (Nunamaker et al., 2009). Moreover, communication within virtual teams can be complicated by dimensions such as different time zones, nationalities, and cultures, working styles, and languages. It is up to the virtual leader to address these difficulties. Ford et al. (2017) propose the following approaches to address these difficulties: (1) Provide and organize language lessons for those not speaking the predominant language and, if necessary, provide translation assistance for team meetings. (2) Team members should be reminded of possible communication problems when using slang or regionalized terms. (3) Meeting times should be varied and deadlines as well as turnaround times should be adjusted to take into account the different time zones and working hours of the different team members.

13.4.5 Competencies of a Virtual Leader

Literature highlights that leaders should be competitive, self-confident, visionary and supportive at first (Raisiene et al., 2018). However, leaders of virtual teams are confronted with complex and unique environments where change is constant and group challenges, process complications, and project setbacks might be more commonplace than for traditional co-located teams. Therefore, they often need different or additional skills to effectively lead and guide virtual teams. (K. Johnson, 2010; Ziek & Smulowitz, 2014)

First and foremost, existing literature emphasizes the ability to communicate (Berry, 2011; Kayworth & Leidner, 2002; Roy, 2012; Ziek & Smulowitz, 2014). Through communication, virtual leaders take their position and status within the team (Ziek & Smulowitz, 2014). They must ensure that all communication is clear, concise, and is understandable by members of different cultures (Roy, 2012).

Furthermore, virtual team leaders should be able to defuse frustrations and be involved in conflict management (Brake, 2006; Roy, 2012). Since there are many sources of frustration in virtual teams due to national, cultural and linguistic heterogeneity, defusing frustration and conflict management skills are essential for the success of the head of a virtual team leader (Roy, 2012). Examples of sources of frustration are: Lack of non-verbal communication, technological breakdowns and cultural differences (Brake, 2006; Cleary & Marcus-Quinn, 2008; Roy, 2012).

In addition, virtual team leaders need emotional intelligent skills. Emotional intelligence includes (1) self-awareness i.e., the ability to understand the effects of the leader's behavior on team members, (2) self-regulation i.e., the ability to think prior to action, and (3) the ability to motivate team members, empathize with them and communicate with them in a skillful way and build relationships (Roy, 2012). Emotional intelligent skills promote the exchange of knowledge and information, create an environment where honest communication can thrive, and can even support problem-solving.

13.5 Conclusion

Our literature review on leading virtual teams has shown the significant importance of leadership in the virtual world. It underlines how important it is, especially, but not exclusively, in times of the corona pandemic. It is the strong leader who show their employees how to switch from working on site to a digital workplace. The changeover is more likely to succeed if they act as role models and always try to support the team members as good as possible, e.g.

by communicating transparently and by caring for constant involvement. Our overview shows which behavior and which traits a good virtual guide should have. Among other things, she or he should build trust, be empathetic and be open to diverse groups (starting with the tolerance for several time zones). At the same time, it is her or his responsibility to create a culture of "belonging" and "being there for one another", "caring", "listening" and empathy. What is required here is the ability to communicate and to have emotional intelligence. A virtual leader is always available, approachable, addressable, and open. She or he demands by promoting an open mindset, because she or he is a good example herself or himself.

Finally, social factors are also of central importance. If team socialization does not work, there is no trust and no culture of cooperation and support. In this case, one will miss motivation, because the employees will not feel addressed, included, and thus, responsible. If leaders lead in a transformational manner instead, possibly even together with other leaders at the same time, the leadership of virtual teams can be successful. This also includes managing conflicts and recognizing frustration in a team at an early stage. Common successes can be celebrated together and there are regular appointments, professional or casual, where team members can meet and get to know each other as a person.

13.6 Discussion

13.6.1 Implications for Theory

Our work has opened the door for a structured inventory of knowledge about leading virtual teams. It is a first step to get a theoretical overview and an impression about the state of research, but it became obvious that a structured review is needed to continue.

An initial idea for further theoretical work is a detailed examination of the characteristics and personality traits of the leaders. For instance, our work indicated how important emotional intelligence is. This can be further explored to determine the context in which this skill is particularly relevant and how it may be better learned and used.

Another direction can be to look closer at the networks within the team and at the role of trust, commitment, and 'presence'. How to recognize and address conflicts and how to prevent frustration of individual team members would be another question.

An additional route is to consider literature from the communication sciences to get to the bottom of how to communicate effectively in virtual teams and in a way that is pleasant for everyone. In the digital world, new rules of conversation and innovative communication

channels are applied. We see potential in answering how one can use this to strengthen team satisfaction and closeness, or how to prevent misunderstandings. It might be worth to take a closer look on this topic, especially when communicating in different languages and mostly asynchronously.

13.6.2 Implications for Practice

Our research is also beneficial from a practical perspective. From the perspective of effective leaders of virtual teams, our review reveals that an extensive application of management-related social skills (e.g. being empathetic and open towards employees) can be advantageous. By creating a team atmosphere that is characterized by trust, leaders of virtual teams may increase the projects' successful completion rates (Edwards & Sridhar, 2005; Sarker et al., 2003). This can especially be achieved by performing classic team building measures, such as celebrations, virtual coffee breaks, or 'care calls'. These measures could also lead to stress mitigation as well as an increased communication between team members. With the help of our research, practitioners might be able to increase their knowledge about the effects of information and communication technology on teamwork.

Where possible, virtual and physical collaboration should ideally be alternated and combined. Lots of measures described by literature to increase the success of virtual teams essentially comprise a return to a face-to-face work environment. Virtual team leaders are thus compelled to introduce opportunities that enable most of the team members to be physically present. A measure to compensate the missing aspects of a face-to-face work environment might be a team meeting on a non-regular basis.

As a member of a virtual team, one might benefit from this research by realizing that work unrelated communication is not considered as a bad habit. Due to missing encounters in the coffee kitchen as well as office grapevines, teambuilding is usually only supported within measures arranged by the team leader. Thus, employees should schedule regular virtual lunches or coffee breaks to keep in touch with their co-workers and exchange work unrelated information.

13.7 Limitations and Future Work

As with all research, our study has several limitations that provide promising avenues for future research. Our chosen literature review method does not offer a comprehensive overview across the virtual teams' research, as the considered literature expands across multiple lines of

research including thousands of articles. Future studies could therefore use a different procedure (e.g. structured literature review) to examine a more specialized part of literature.

Although we presented an extensive range of measures that can be applied by virtual team leaders to improve their virtual team's success, we did not present a specific way to achieve the given mindset. This is a vital issue for further studies, as characteristics like empathy or trustworthiness are usually considered as traits and thus cannot easily be adopted by leaders that are not acquainted with the necessary skills.

This research focuses on leadership of virtual teams, however we did not concentrate on the main medium used by virtual teams: Communication. As communication technology usually defines an enabler of geographically divided workforces, it is important for researchers to investigate new methods of communication aside from video-telephony, online chat or teleconferencing. To address this issue, our future work will concentrate on collaboration using Virtual Reality (VR). Compared to current ways of internet-communication, VR can provide a diverging interaction where the software might be able to transfer more or different information, depending on the use case. We plan on using innovative VR hardware and software solutions to examine constructs such as social presence or trust.

13.8 Acknowledgements

We would like to acknowledge that this research is part of the aSTAR research project. The project was funded by the Federal Ministry of Education and Research of the Federal Republic of Germany (BMBF, funding code 02L18B010), the European Social Fund and the European Union.

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14 Happy Together

Title	**Happy Together - How can Virtual Leaders Foster Team Cohesion?**
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Publication Type	Conference Paper
Publication Outlet	Proceedings of the 27th Americas Conference on Information Systems
Status	Published
Full Citation	**Zeuge, A.**, Schaefer, C., Weigel, A., & Niehaves, B. (2021). Happy together - How can virtual leaders foster team cohesion? *Proceedings of the 27th Americans Conference on Information Systems*. (published)

Table 14.1: Fact Sheet Publication

Happy Together - How can Virtual Leaders Foster Team Cohesion?

Abstract. The impact of COVID-19 on teamwork came abrupt and transformed nearly all teams into virtual teams. A special challenge for leaders of virtual teams, not only in the pandemic, is to foster team cohesion, which positive influences team performance. However, many virtual leaders do not implement cohesion-empowering measures, which in turn can reduce team members' feeling of belonging to both the team and the organization. Our research responds to this short-coming and presents measures which virtual leaders can integrate to strengthen cohesion. Within 40 interviews in 24 organizations, we identify a wide and comprehensible overview of measures, which can be categorized into "on the job" and "off the job". Hereby, we not only want to help to overcome the feeling of "loneliness" and "isolation" in the pandemic, but rather contribute to develop a profound feeling of cohesion in virtual teams in the long-term.

Keywords. Team Cohesion · Virtual Leadership · Virtual Teamwork · Grounded Theory.

14.1 Introduction

On the 11th March 2020 the World Health Organization declared the coronavirus disease of 2019 (COVID-19) a pandemic (WHO 2020). The outbreak of the virus has changed the way we live and work (AbuJarour et al. 2021). During the crisis, millions of teams worldwide transitioned into virtual teams, which led to enormous challenges (Kohn 2020). Among other things, virtual teams are confronted with social isolation and the lack of informal spontaneous opportunities to connect.

Since remote work has already increased over the past few years but was far from being the norm, the pandemic faces teams, and their leaders with tremendous challenges (Bekirogullari and Thambusamy 2020). Whereas the transformation and implementation of virtual work were often characterized by time-consuming rollout processes, solutions needed to be implemented at short notice (Zeuge et al. 2020). The preparation time was correspondingly short. Leaders transformed to virtual leaders and were forced to modify, adapt, and rethink their leadership behavior to respond to these changes (Hoch and Kozlowski 2014).

Fostering team cohesion poses a special challenge for leaders of virtual teams, not only in the pandemic (Lilian 2014; Malhotra et al. 2007). Team cohesion refers to a team member's sense of belonging to a team and his or her feeling of morale associated with membership in that team (Bollen and Hoyle 1990). Literature demonstrates that team-building activities (e.g., work outings, lunches, or after-work drinks) improve team cohesion and thereby positive influence

motivation, collaboration, and team performance (Bajaj and Russel 2008; Kwak et al. 2019; Yang et al. 2015). However, strengthening the feeling of cohesion is a special challenge for virtual leaders due to the decentralized nature of the teams, the lack of spontaneous opportunities to communicate and interact. Therefore, previous approaches cannot be pursued in virtual teams in the same way. New and innovative approaches are needed to enhance the feeling of team cohesion in virtual teams. This research aims to investigate measures to strengthen team cohesion in virtual teams. Therefore, we aim to answer the following research question (RQ):

RQ: How can team cohesion be fostered by virtual leaders in virtual teams?

To address this RQ, we conducted 40 semi-structured interviews in 24 organizations. We examined team cohesion strengthening measures which can be implemented in virtual environments. Here, we took a closer look at measures which can be applied on the job (i.e., at work) and measures which can be applied off the job (i.e., in breaks or after work). Our research therefore complements existing literature on team cohesion by identifying practice-oriented measures, which can be applied by virtual team leaders. Our findings are beneficial to both, teams that work virtually due to the crisis and teams that were already working remotely before the pandemic. Therefore, we not only add value in the short term, but also in the long term, as many organizations increasingly plan to hybridize their work.

The paper is structured as follows: In the next section we present the theoretical background regarding virtual leadership and team cohesion. Subsequently, we present our methodology. We then present the findings of our semi-structured interviews and discuss our results. Finally, we conclude by reflecting on our findings, highlight the limitations of our research and provide fruitful avenues for future research.

14.2 Virtual Leadership and Team Cohesion

There is a general agreement on the relevance of leadership for virtual teams (Hertel et al. 2005), however, they gain additional importance in the pandemic. Leadership in the context of virtual teams is defined “as the leader’s incremental influence over and above general compliance with routine organizational directives” (Wakefield et al. 2008, p. 435). It is characterized as leading in an environment that is other than physical (Williams 2013). Hertel et al. (2005) describe virtual leadership as the management of distributed teams whose members predominantly communicate and coordinate their work via information systems.

Virtual leadership was already being researched intensively before the pandemic (Mehtab et al. 2017; Purvanova and Kenda 2018). However, research on virtual leadership takes on additional importance in times of the pandemic, as it has posed new challenges to leaders (Newman and Ford 2021; Torre and Sarti 2020). For example, Bekirogullari and Thambusamy (2020) investigated virtual leadership in particular for small businesses, since these organizations are less familiar with it. In a similar context, Bartsch et al. (2020) aim to investigate the effectiveness of leadership in relation to employee work performance in virtual environments caused by the COVID-19 pandemic.

Leading teams virtually is fundamentally changing the expectations imposed on leadership (Wakefield et al. 2008). Virtual leaders are confronted with highly complex and unique environments that are in a constant state of change (Roy 2012). Virtual leaders face the challenge of learning how to overcome barriers of time, space, and culture. Appropriate communication, being present, and building trust are essential in this context (Altschuller and Benbunan-Fich 2013; Jarvenpaa et al. 1998; Lepsinger and DeRosa 2015).

Acknowledging that team cohesion is one of the six key facets of "Teamwork Quality" (Hoegl and Gemuenden 2001), literature outlines fostering team cohesion as an important task of team leadership (Kakar and Kakar 2018; Lilian 2014; Malhotra et al. 2007). Bollen and Hoyle (1990) describe team cohesion as the team member's sense of belonging to a team and his or her feeling of morale associated with membership in that team. Carron et al. (1989, p. 3) define team cohesion as "the tendency for a group to stick together and remain united". Strengthening the feeling of "unity", "stick together" and "identity" in virtual teams is important because virtual work, especially in times of pandemic, provides only limited social interactions within the team and lacks informal or spontaneous opportunities to connect (Lepsinger and DeRosa 2015; Yang et al. 2015). Strong relationships within the virtual team and between team members can help to overcome the feelings of isolation (Roy 2012). It is the virtual leader's responsibility to create a culture of "belonging", "being there for one another", "caring", "listening", and "empathy" (Zeuge et al. 2020).

The literature suggests that cohesive teams achieve increased collective effectiveness and greater team success (e.g., Bajaj and Russel 2008; Beal et al. 2003; Keith et al. 2018). Team cohesion positively affects the level of objective commitment which in turn can improve team performance (Keith et al. 2018). At the same time, team members of cohesive teams feel more satisfied, have higher self-esteem, conform to group norms, make personal sacrifices for the

team, and share responsibility for the obtained results (Kakar and Kakar 2018). Team cohesion strengthens mutual positive feelings toward each other, thus allowing to resolve conflicts in a supportive and trusting environment (Keith et al. 2018).

14.3 Methodology

In our study we used an explorative approach to gain insights into factors that are important for fostering team cohesion in virtual teams from the perspective of both team members and leaders (Flick et al. 2004). Within 40 digital interviews (about 60 minutes in average) we have surveyed 19 team members and 21 team leaders from our research network in Germany in the period from 2021/01/18 – 2021/02/18. Of these, 70% are male and 30% female in an age range of 20 to 61. The average age is about 38 years, with an average age of 43.4 for team leaders and 33.1 for team members. We tried to interview as many couples (team leader and team member from the same team) as possible and surveyed various industries and company sizes (large corporations, small and medium-sized enterprises, as well as start-ups) and municipalities. In the results section, we have abbreviated the different organizations as follows: groups (G), small and medium-sized enterprises, as well as start-ups (SME), and municipalities (M). In the following, for reasons of better readability, we will only speak of organizations, which includes companies and municipalities together. The team size of the interviewed organizations ranges from 3 to 28 team members. Within their organization the interviewees have different professions and hierarchies. This distribution across hierarchical levels was random, but together with the different number of years of career experience, it can be ensured that individual biases are avoided and that different perspectives are considered (Miles and Huberman 1994).

To get a wider range of answers and to give the participants the chance to speak freely, we used a semi-structured guideline with open questions (Pumplun et al. 2019). We followed Sarker's guidelines for qualitative research to avoid the pitfalls of qualitative semi-structured interviews (Pumplun et al. 2019; Sarker et al. 2013). We improved our first version of the questionnaire after three pre-interviews. As a result, we only had to make minor changes to the questionnaire. After another five couples we evaluated again adding and omitting a few questions to get the best possible results, based on the Grounded Theory approach.

The questionnaire is divided into four categories. We started with the introduction of the interviewee and general questions about their career as well as attitude and concern regarding COVID-19. Afterwards we asked how virtual teamwork is put into practice before COVID-19,

during lockdowns, and the time in between. For example: “How extensively and for what reasons did virtual teamwork take place before COVID-19? How did this change through the lockdowns and in the time in between?”. Furthermore, we identified opportunities and threats within the virtual teamwork with questions such as “What technologies were used for virtual collaboration prior to COVID-19? How are these technologies being used? What are the technical challenges or limitations?” Finally, we asked questions about team cohesion and how the feeling of cohesion can be fostered virtually, for example: “What cohesion strengthening events took place before COVID-19?” “How can a feeling of belonging also be created virtually within your team?”. “How can personal relationships be virtually established with other team members?” We ended at the point at which all researchers agreed that the likelihood of gaining significant new insights through further interviews was low.

The recorded interviews were transcribed and analyzed with MAXQDA. We used Grounded Theory methods to analyze the interviews. Two researchers applied independently the open coding, i.e., the sentences and paragraphs were assigned code phrases that best represent the content (Corbin and Strauss 2014; Glaser and Strauss 2017). Afterwards, we compared and grouped the results (axial coding) so that we could specify superordinate measures and best practices (Corbin and Strauss 2014). In this coding paradigm, we looked for factors or challenges that affect the work in the team due to team cohesion. Different opinions were discussed with a third researcher and settled by agreement. For instance, for the subsequent citation: *“Or just as I said, just to say thank you to your employees, thank you for throwing yourself into the task or thank you for working so fast, I think that’s very important.”* (G_3_2), two independent codes (“respectful communication” and “communication patterns”) were found. Finally, “respectful communication” was used as the axial code. Subsequently, the axial codes were grouped by subject areas. We ended the analysis with saturation, e.g., when no new superordinate measures and best practices were found.

14.4 Findings

Our findings highlight the relevance for virtual leaders to foster cohesion in virtual teams. Building up on these results, we present measures, which we identified in the interviews, to empower team cohesion in virtual teams. First, we outline measures enhancing team cohesion on the job i.e., during working hours. Second, we delineate measures which can be conducted off the job, i.e., in break times or after work.

14.4.1 Relevance for Virtual Leaders to Foster Team Cohesion

Virtual teams collaborate and communicate primally via digital media e.g., e-mail, video- or audioconferences. Therefore, virtual teams enable collaboration across geographical, time, and organizational boundaries (Purvanova and Bono 2009). However, nearly all interviewees stress that virtual work reduces the feeling of team cohesion. The interviewees mention the lack of physical opportunities to interact with their co-workers and leadership as the main driver for this shortcoming.

> *"I think it's more difficult, to have this team cohesion than when you've seen each other every day. [...] If you now only work at home, then, I think it is more difficult to maintain team spirit." (G_3_2)*

> *"You can no longer see each other, you lose contact, which reduces team cohesion." (M_3_2)*

Team cohesion is an important factor for the success of virtual teams (Beal et al. 2003). Therefore, interviewees see it as the responsibility of the virtual leader to cope with the absence of face-to-face interactions. According to their point of view it is the leader's responsibility to establish virtual opportunities to strengthen team cohesion, to actively demand participation from all team members, and to ensure that all team members feel integrated.

> *"I think it is part of the leader's responsibility [...], to create opportunities to establish team spirit virtually as well." (G_1_1)*

> *"[...] and the leadership has to ensure that the individual feels involved." (G_3_1)*

When it comes to virtual teams, many leaders underestimate the importance of the interpersonal relationship and do not invest enough time in building a cohesive environment. For example, SME_4_2 states that digitization in the organization refers solely to the work context. Measures such as virtual events to foster the cohesion of virtual teams are not considered. Other interviewees state that they are not aware of any measures for empowering team cohesion in the virtual environment or are not able to bring them to action.

> *"So, digitization is really only there to [...] work off the tasks that existed before. That's why digitization was implemented. But not cohesion measures." (SME_4_2)*

> *"I also don't know [...] what you could do because during the pandemic you can't plan events that strengthen the team spirit" (SME_3_2)*

> *"We have not carried out any activities. We talk about it, but we can't implement them." (M_5_2)*

However, the lack of measures to enhance cohesion in virtual teams can have decisive disadvantages for the individual team members. Notably, it is underlined that team members feel isolated and abandoned. SME_2_2 emphasizes that cohesion plays a crucial role in how employees self-identify with the organization and that without a sense of community, employees may not feel committed to the organization. M_2_2 confirms that employees can be lost due to a lack of a sense of belonging and cohesiveness.

> *"What I' m missing more and more is personal contact, which makes me feel very lonely." (G_2_3)*

> *"Because in virtual times, employees can no longer be sufficiently emotionally tied to the organization. Because all this familial relationship (...) with colleagues simply become absent." (SME_2_2)*

> *"It was in the first lockdown when we hired a new employee who left at the end of the year. And the reason was that he didn't manage to build up a connection with his colleagues." (M_2_2)*

14.4.2 "On the Job" - Measures

14.4.2.1. Substantive and Personal Exchange

One of the most important challenges for virtual leaders is to motivate their teams to engage in continuous exchange, which increases team cohesion (Lilian 2014; Purvanova and Bono 2009). Here, it is up to the virtual leader to create virtual touch points. In doing so, virtual leaders should ensure that there is time for both substantive and personal exchange and provide opportunities for suggestions for improvement.

> *"What we introduced [for team cohesion] were more new virtual touchpoints." (G_2_5)*

> *"To have the time to not only talk about the job, but also to bring in private aspects [...] and to ask: What do you like right now? What works well? What doesn't? What can be improved?" (G_1_2)*

Virtual teamwork requires a frequent substantive exchange among all team members for example in form

of jour fixes, dailies, or weekly kick-offs respectively close-ups. The constant exchange ensures that all team members are always up to date. Everyone is informed about who is working on what, successes and failures can be evaluated, and next steps can be planned. According to M_3_2, this can strengthen cohesion.

> *"On Mondays we always have a Jour Fixe, where we discuss the week, and on Fridays we review the week and discuss the lessons learned." (SME_2_2)*

> *"I think if you meet regularly and not only when there is something to discuss, but that you perhaps exchange every morning. And then problems are also mentioned where you can help. So that you realize, even though you are in different places, you can help each other and be a team." (M_3_2)*

For a strong cohesiveness, there has to be time for personal exchange because without a personal level, team cohesion will not be achieved. To this end virtual leaders can deliberately schedule time for a personal exchange in meetings (e.g., jour fixes). The team can inform each other about personal news, share how they are feeling and doing, or discuss topics of general interest (e.g., the latest football results). However, there should not only be a personal exchange within the team, but also bilaterally. For this purpose, the virtual leader SME_2_2 conducts care calls to regularly obtain feedback on how his team is feeling. Furthermore, chat can be used to enable informal virtual communication also spontaneously and barrier-free.

> *"When we meet, we first talk in general. So not directly we meet and work hard on our points. That we first talk briefly with each other and everyone gives an update on how the situation is and how things are going [...]. That creates a feeling of closeness." (SME_1_1)*

> *"My leader, calls and asks me even beyond my calendar entries or whatever: How was your day? He also tries to find out how I'm doing personally. […] So that personal level, I think, is very much in demand for leaders in the current times." (SME_2_2)*

> *"So, since we [...] returned to the home office, we actually discovered the chat function for team [...] Yes, just a spontaneous "hi" or something, just so that you know that the others are still there, and you don't feel so lonely anymore." (M_2_1)*

14.4.2.2. Communication

The interviews highlight that communication patterns in a virtual team have a decisive effect on team cohesion. Overall, the interviewees prefer open, respectful, trustful, and friendly

communication within the team (e.g., G_3_2, SME_3_1, M_2_1). In addition, especially a sensitive communication is stressed for the virtual environment. M_1_2 further underlines that in virtual teams especially, unambiguous communication is important to avoid the possibility of miscommunication. Another way to maintain cohesion in a virtual team is to copy communication patterns from the physical to the virtual environment. For example, M_2_1 has translated his communication behavior into the virtual by sending a greeting by e-mail before the weekend instead of going from office to office.

> *"I have noticed that often when it comes to assigning tasks, people simply talk about "we" instead of naming a specific responsibility. And I believe that in a conventional team, it would come up more quickly that no one feels addressed exactly with 'we'." (M_1_2)*

> *"...then writing an e-mail and wishing the entire team a wonderful weekend, that is a way cohesion can be further maintained." (M_2_1)*

From a technical perspective a lot of interviewees recommend turning on the camera at meetings to increase the feeling of gathering. This allows one to better recognize who is speaking, which face is expressing concerns and who is perhaps waiting to finally be able to say something. In addition, it is suggested that digital backgrounds should be avoided. The insight into the personal "office" (or living room, kitchen) is more authentic and creates a feeling of closeness.

> *"And I think it's also very important to turn on the camera. […], it's important to see others, to have the feeling that you're not just talking to a picture, but instead a real person, who still has facial expressions and gestures, and yes, that this is also part of the team cohesion." (G_3_2)*

> *"So, a picture, for example, as a background I find distracting. So, you have the feeling that someone wants to hide something. [...] I think you have more insights into the privacy of the other person, which also makes working together a bit more pleasant." (SME_8_1)*

14.4.2.3. Interaction within the Team

The interviewees also mentioned several interpersonal principles to be important for cohesion in virtual teams. For virtual teams, just as for teams which do not work remotely, being punctual and keeping agreements is prerequisite (e.g., G_1_2, SME_2_2). Furthermore, the availability of team members and leaders plays a decisive role in virtual teams. At the same time, it is

emphasized that availability should be limited to defined time periods to ensure a healthy work-life balance.

> *"Exactly, and because I don't have fixed working hours, it is important that I can always reach my supervisor if I have any questions." (SME_4_2)*

> *"Always show that you are available. The availability, as I said, must be limited, but at least within these limits you must be available. And, to communicate when one is not available." (G_1_2)*

To maintain team cohesion in a virtual team, the leader can proactively initiate further measures: Some interviewed team members note that involving all team members in the decision-making process can strengthen team cohesion. Furthermore, interviewees stress that celebrating success and achievements jointly in a virtual format can also contribute positively to team cohesion. A further suggestion comes from the virtual leader G_2_1, who is very excited about little tokens of appreciation, e.g., sending presents such as merchandise to his team. He believes that this also contributes to the feeling of organizational loyalty.

> *"My boss is someone who likes to actively get the opinion of his employees, for example, when it comes to a pitch he asks […] And that also creates a feeling of team spirit […]by sharing your screen even in virtual times and everyone can contribute their ideas before he pitches." (SME_2_2)*

> *"I think something like that strengthens the team spirit when you somehow celebrate successes together […]. That also helps you in some way, in my opinion, to bring the team together". (G_4_1)*

> *"I sent it to everyone in my team; eleven small parcels. […] and they got a cup like this [showing a cup with corporate logo]. That was a big hit. These are gestures that one remembers." (G_2_1)*

14.4.3 "Off the Job" - Measures

14.4.3.1. Break Times

In addition, team cohesion should also be empowered "off the job" i.e., privately, and outside of work (Lepsinger and DeRosa 2015). This has become even more evident during the pandemic. The interviewees highlight to schedule "virtual breaks" to enable personal exchange. Here, it is not important that always all team members or leaders participate. More important is to regularly schedule virtual breaks within the team to exchange ideas, information, or

thoughts (e.g., M_1_2, SME_2_1, SME_4_2). The team of interviewee SME_6_1 for example, starts the week with a virtual breakfast.

> *"Now we have a big virtual breakfast meeting every Monday in this team, where we sit together. What did we do on the weekend?" (SME_6_1)*

Other organizations use for example lunch breaks for this purpose (e.g., G_1_1, SME_2_1, SME_6_1, SME_8_1, SME_10_2). This happens in most organizations on a voluntary basis, which is why usually a digital room is unlocked and anyone can dial in who likes as interviewee SME_8_1 explains.

> *"That's actually how it's organized now sometimes via Zoom, that we just have a short lunch break together, especially for the colleagues who are completely in the home office." (SME_8_1)*

> *"[We] emulated our lunches [...] to do something together outside of the official agenda." (SME_6_1)*

A new and creative measure to empower bilateral exchange was described by the interviewee G_3_2. In her organization, a "coffee roulette" has been introduced, where team members are randomly assigned to break-out sessions. As a result, a regular exchange takes place between all team members.

> *"Our leader has then [...] organized a virtual "coffee roulette". So, just doing something together that doesn't have to do with work, but still strengthens the team feeling a bit." (G_3_2)*

The interviews also revealed that some teams spend their breaks actively together, in the form of virtual sports sessions. In this way, the teams try to bring movement into the daily routines. G_5_1 remarks that in his organization it is important that sports sessions take place cross-departmental in order to promote the exchange between different teams even more.

> *"We have recently started office chair gymnastics, […] where a colleague of ours […] shows […] a few things, where you can take part." (SME_10_2)*

> *"This spring there was a small set with skipping rope, rubber bands for fitness at home sponsored by the organization. The last weeks there were also 1-2 times per week three slots each, where exercises were demonstrated [...] everyone could sign up for a session, but the was obligation that the sessions are interdepartmental." (G_5_1)*

14.4.3.2. After Work

There are also numerous measures to strengthen team cohesion after work. Linking to the last point of the previous subsection, some organizers have initiated sports events after work to strengthen the health and mobility of the team members as well as to empower team cohesion. Further measures are yoga classes, virtual walks, or the common team goal to cover the distance to Glasgow for the World Climate Summit through adding up the walked distance of each team member in a specific time frame.

> *"So, there were yoga courses etc. at the site before that were now streamed virtually." (G_5_1)*

> *"[…] we did the virtual sponsor run, where the team appeared as a team and spent the whole night on the treadmill, while it was broadcast live to colleagues." (G_2_3)*

> *"We also do challenges sometimes. We are currently trying out different things, such as walking together to Glasgow, where the World Climate Summit will take place. We use an app where we enter who has walked how many kilometers, and we hope that we will arrive there as a team." (SME_6_1)*

The interviews also showed that it is possible to celebrate special events virtually, for example Christmas celebrations. Here, some leaders got very creative by sending packages to their teams, which were then unpacked together in a virtual meeting (e.g., G_3_2). At the Christmas party of interviewee G_2_5 the package content served as the basis for the evening's activities.

> *"What came about around the Christmas party was actually that part of the team put extremely good thought into it and prepared something really great. Every employee got a package. There were various things in it that could be used for cooking […]. And so, all of them got together virtually that evening via Wonder. Everyone had cooked something for themselves and, yes, everyone saw each other virtually at dinner and with recipes that came out of the team. That was a very special action and who knows, maybe it will be repeated like that." (G_2_5)*

Many virtual teams also hosted virtual game nights. We were able to identify four virtual game types: a) virtual pub quiz (e.g., G_2_5, SME_4_2, M_1_1), b) virtual escape rooms (e.g., G_2_2, G_3_1, SME_6_1), c) Massively Multiplayer Online Games, (e.g., SME_1_2, SME_2_1, SME_2_2), and d) virtual board games such as ludo (e.g., SME_2_1, SME_2_2, or G_1_1). Interviewee SME_2_2 underlines that team cohesion can be fostered by having different teams or parts of the team compete against each other.

"Then this pub quiz, it is of course also an action, it takes place online. […]. You get snacks and stuff that are sent to the team members, so that so everyone feels like they're part of it." (SME_4_2)

"But there are other possibilities, like this digital escape room. […] And I have to say that the effects [on team cohesion] are relatively strong." (G_3_1)

"Or that you simply create an online game that you can play against each other. Or play Ludo or whatever and let the team compete against each other virtually. Maybe also to split his team inside again. We play three against three in some online games." (SME_2_2)

The events and virtual game nights are supplemented by virtual regulars' tables. For example, virtual wine, gin, or beer tastings can be organized. Here, there are no restrictions on creativity; some teams order food and arrange joint virtual dinners or organize cooking evenings. However, many of the interviewed teams just host the traditional "after-work-beer" virtually (e.g., SME_1_1, SME_2_2, SME_6_1_6).

"The [...] team in my department did a virtual wine tasting last year. This works quite well, as each employee received a little wine at home and then digitally tasted this wine together." (G_3_1)

"We baked cookies together virtually." (G_5_1)

"I just call it "beer call" where we spend time in the evening under a certain motto and have a beer or a glass wine or whatever together." (SME_6_1)

14.5 Discussion

Our results underline the importance of fostering team cohesion for both the team and the team leader. In line with literature, we have shown that empowering team cohesion is an important task of virtual leaders to ensure the team's success (e.g., Lepsinger and DeRosa 2015; Roy 2012; Yang et al. 2015). We examined different measures and best practices to maintain team cohesion in the daily business ("on the job") as well as in break times or after work ("off the job"). Here, we can conclude that one of the most important tasks of virtual leaders is to provide time for substantive as well as time for personal exchange within the team (Zeuge et al. 2020). Furthermore, we can conclude that many traditional measures to strengthen team cohesion are transferable to the virtual environment e.g., "happy weekend"-wishes can be sent per mail, or

the after-work beer sessions in a virtual meeting room. However, we also found that some organizations come up with new and creative ways to increase team cohesion, for example, introducing a virtual coffee-roulette or organizing remote sports competitions between virtual teams. In Table 14.2, we present the best practices found in the respective interviews as well as some exemplary measures to promote team cohesion.

	Measures		Examples	Quotes
„On the Job"	Exchange	Substantive exchange	Regular virtual meetings Bilateral exchange	G_7_1; M_5_1; SME_9_1
		Interpersonal exchange	Care calls Instant personal exchange	M_4_1; M_5_2; G_2_4
	Communication	Communication patterns	Unambiguous communication Transfer physical communication patterns to virtual	M_3_1; M_6_1; SME_7_1
		Technical communication	Turn camera on Avoidance of digital wallpaper	SME_1_3; SME_3_2; M_2_1
	Team interaction	Team-Team	Availability in core hours Keeping agreements	G_2_3; SME_1_1; SME_4_2
		Leadership-Team	Celebrating achievements Merchandise by post	SME_3_1; G_2_1; G_4_1
„Off the Job"	Break times	Socializing	Virtual coffee roulette Permanent virtual break room	G_3_2; G_6_1; M_1_2
		Sport	Virtual yoga class Virtual office gymnastic	G_5_1; SME_10_1; SME_10_2
	After-work	Sport event	Virtual run Virtual challenges	G_2_3; G_5_1; SME_6_1
		Virtual game night	Virtual escape rooms Virtual online games	M_1_1; SME_1_2; SME_2_1
		Virtual regulars table	Virtual drink tasting and cooking Virtual concerts	G_2_2; SME_4_1; G_3_1

Table 14.2: Overview of Selected Best Practices

As we explained in the section "Virtual Leadership and Team Cohesion", leadership from a distance i.e., virtual leadership, changes expectation imposed on leadership (Newman and Ford 2021; Torre and Sarti 2020; Wakefield et al. 2008). The interviews clearly demonstrate that both team members and leaders have embraced this change. The interviews revealed the changing expectations implicitly (e.g., being punctual) and explicitly (e.g., turning on the camera). The relevance of strengthening team cohesion in virtual teams (Lepsinger and DeRosa 2015; Roy 2012; Yang et al. 2015) was also confirmed by the interviews. Strategies and best practices were developed to address the limited social interactions in a virtual team. Often, the lead leaders themselves have the intrinsic motivation to increase this team cohesion through the identified strategies and best practices. It can be assumed that these best practices, which are perceived positively by all participants, will also increase the motivation of team members (Kwak et al. 2019). The results show that the best practices can be taken up and adapted by other virtual teams, for example. Thus, on the one hand, our research contributes to providing contemporary approaches to understanding virtual teams, especially considering the current situation. On the other hand, these approaches can be understood as a kind of a kit from which virtual leaders can take individual elements for their own management of virtual teams.

14.6 Conclusion and Outlook

We conducted a qualitative study to identify measures virtual leaders can implement to foster team cohesion in virtual teams. Since the success of organizations depends significantly on the extent of team members feeling of "belonging" and "unity" (Beal et al. 2003; Huang et al. 2004; Keith et al. 2018), our research contributes tremendously to practice. By interviewing 40 employees of 24 organizations, we provide a wide and comprehensible overview of practice-oriented measures and best practices for virtual leaders to strengthen team cohesion. Virtual leaders can build up on these and integrate suitable measures into their teams. Thus, our research not only helps to overcome the feeling of "loneliness" and "isolation" in the pandemic, but also beyond the pandemic, as virtual teamwork will further increase.

As with all research, our study has several limitations that provide promising avenues for future research. Since this research is based on a qualitative study, it comes with typical limitations of qualitative studies (e.g., weak internal validation). Apart from those, it is important to acknowledge further limitations: Despite the large number of interviewees, it should be acknowledged that all participants came from Germany. Consequently, the identified measures reflect the work and leisure culture of Germans. We encourage future research to supplement

these by measures and best practices of other cultures and nations. This would allow virtual team leaders to respond to the cross-national and cross-cultural nature of virtual teamwork. Furthermore, it should be mentioned that the results mainly provide a practical contribution. The theoretical contribution is limited to supporting the relevance of team cohesion and the role of the leader for team cohesion in virtual teams as demonstrated by literature. An initial idea for further theoretical work is an investigation of the characteristics and personality traits of virtual leaders for team cohesion. For instance, our work indicated the relevance of emotional intelligence. Here, further research can be conducted to determine how emotional intelligence can be learned and used to improve team cohesion.

14.7 Acknowledgements

We would like to acknowledge that this research is part of the inNOVATION research project. The project (HA-Projekt-Nr.: 977/20-134) was funded by the Hessisches Ministerium für Wirtschaft, Energie, Verkehr und Wohnen and the HOLM-Förderung.

We would like to acknowledge that this research is part of the aSTAR research project. The project was funded by the Federal Ministry of Education and Research of the Federal Republic of Germany (BMBF, funding code 02L18B010), the European Social Fund and the European Union.

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15 Bittersweet VR Collaboration

Title	**Bittersweet VR Collaboration: Necessary and Sufficient Conditions for Collaboration in VR**
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Publication Type	Conference Paper
Publication Outlet	Proceedings of the 42nd International Conference on Information Systems
Status	Published
Full Citation	Weigel, A., **Zeuge, A.**, Baumgart, T. L., & Niehaves, B. (2021). Bittersweet virtual reality collaboration: Necessary and sufficient conditions. *Proceedings of the 42nd International Conference on Information Systems*. (published)

Table 15.1: Fact Sheet Publication

Bittersweet Virtual Reality Collaboration: Necessary and Sufficient Conditions

Abstract. The spread of COVID-19 has led to new challenges on organizations of every size. This also affects collaboration, which since then has had to be more digital than ever. While traditional collaboration tools, such as video- and audioconferences have reached their limits in terms of interactive and flexible collaboration, the development of multi-user virtual reality (VR) technology is introducing new possibilities. We investigate which conditions have an impact on the intention to collaborate in VR environments. To this end, we conducted a multi-user VR experiment and then interviewed participants individually and in focus groups on their collaboration behaviors. We were able to identify technological-, task-, and user-related conditions, which could be distinguished in necessary and sufficient conditions. Our research has helped to create evaluation opportunities to determine what conditions should be met to foster collaboration in VR.

Keywords. Digital Collaboration · Virtual Reality · Multi-user · Exploratory Research.

15.1 Introduction

On March 11, 2020, the World Health Organization declared the coronavirus disease 2019 (COVID-19) as pandemic (WHO, 2020). COVID-19 and interrelated home office policies as well as contact restrictions pose new challenges for organizations, teams, leaders, and employees (Kohn, 2020; Zeuge et al., 2021). At the same time, the requisite flexibilization and digitalization of daily work act as a driver for digital transformation (Soto-Acosta, 2020). Before COVID-19, there was a significant upswing in digital collaboration technology that enabled location-independent collaboration (Hossain & Wigand, 2006). However, the pandemic has caused a more rapid increase in the use of collaboration technology due to the changing nature of day-to-day work (Soto-Acosta, 2020).

Collaboration is generally defined as the joint effort of two or more people to achieve a team goal (Briggs et al., 2003; Fan et al., 2012). Individuals in a team collaborate to create value that the members cannot create through individual effort (Briggs et al., 2009; Bruns, 2013). Collaboration is characterized by task-related and social interaction as well as communication to share resources and knowledge (Fleischmann et al., 2020). Thus, collaboration is a complex construct composed of different dimensions, e.g., communication, trust, and coordination (Brown et al., 2004; Deshpande et al., 2016; Russell et al., 2017).

Digital collaboration is a collaboration process in which team members primally interact and communicate digitally (Fan et al., 2012; Hossain & Wigand, 2006). Thereby, information and communication technology (ICT) represents a key component for the success of digital collaboration (Majchrzak et al., 2005; Smith & McKeen, 2011). Traditional digital collaboration tools (e.g., audio- or videoconferencing), however, reach their limits when it comes to interactive and flexible collaboration (Nor'a & Ismail, 2019). While for example, digital whiteboards or mind maps can support collaboration in two-dimensional space in an efficient way, the functions are not sufficient for three-dimensional space (e.g., prototyping). In addition, facial expressions and body language are lost to a great extent (Isaacs & Tang, 1994).

The development of virtual reality (VR) technology and content have attracted its use for everyday work (Muñoz-Saavedra et al., 2020) and introduced new opportunities for supporting digital collaboration (e.g., Hatzipanayioti et al., 2019; Mütterlein et al., 2018). Especially the development of multi-user VR solutions extends traditional tools by inviting multiple users to meet and interact in virtual spaces (Alghamdi et al., 2016; Heldal, 2007). With the use of VR for collaboration, participants collaborating can meet in a virtual space and interact with each other as well as objects regardless of their physical location. In addition, communication is enriched since, for example, gestures can be transmitted and thus perceived by the other participants. Currently, the benefits of a purpose-built VR environment likely do not exceed the resources required for development. The intention to use VR for collaboration may create areas for actual collaboration that otherwise would not be achieved.

While the benefits of using VR for collaboration have been widely studied, research encourages a more thorough examination of the conditions that drive users' intentions to collaborate in VR (Mütterlein et al., 2018). User intention to collaborate thereby means the willingness to commit to a collaborative process, since collaboration is, by its very nature, voluntary (Roberts & Bradley, 1991; San Martín-Rodríguez et al., 2005). First valuable efforts have been made to explore how certain conditions (e.g., immersion) influence the intention to collaborate with other users in VR (e.g., Hatzipanayioti et al., 2019; Mütterlein et al., 2018). However, to the best of our knowledge, no research has been conducted so far to determine overall which conditions influence user intention to collaborate in VR. Therefore, this research aims to investigate if there are other conditions and how these conditions influence the intention to collaborate. To this end, we conducted an exploratory research in a multi-user VR environment. Here, participants of two organizations connected by a value chain were interviewed. It is

important that participants are exposed to a process that is designed for real-world collaboration. However, collaboration across organizational boundaries does not currently occur in the simulated process, even though both organizations would benefit from collaboration. Consequently, conditions that influence the intention to collaborate in VR could be identified. These conditions could be differentiated into necessary and sufficient conditions in this research. For research purposes, our findings were linked to existing literature, and for practice purposes, recommendations could be derived on how collaboration occurs in VR. Thus, it has become clear which conditions that influence collaboration intention can support the creation of collaborative VR experiences.

The paper is structured as follows: In the following section we review the literature on collaboration and collaboration in VR. Subsequently, we present our methodological approach. We then present the findings of our exploratory research and discuss them. Finally, we conclude by reflecting on our findings, highlight some important limitations of our research, and provide fruitful avenues for future research.

15.2 Related Work

15.2.1 Collaboration

Teamwork is defined as "(a) two or more individuals who (b) socially interact (face-to-face or, increasingly, digitally); (c) possess one or more common goal(s); (d) are brought together to perform organizationally relevant tasks; (e) exhibit interdependencies with respect to workflow, goals, and outcomes; (f) have different roles and responsibilities; and (g) are embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment." (Kozlowski & Ilgen, 2006, p. 79). The effectiveness of a team is defined as the degree to which a team attains a goal while the efficiency of a team is defined as the degree to which a team preserves its resources during the accomplishment of this group goal (Cohen & Bailey, 1997).

Briggs (1994) observed three levels of teamwork: the individual, the coordination, and the collaboration level. Teamwork on an individual level describes uncoordinated effort from individuals toward a shared goal. It is characterized by individual processes from the beginning to the end (Nunamaker et al., 2001). The success of the team is the sum of the individuals' outputs (Briggs, 1994). On the coordination level, the individuals' efforts are coordinated to accomplish a shared goal (Nunamaker et al., 2001). Coordination is necessary to manage interdependencies within the task (Malone & Crowston, 1994). The team's success is the sum

of all the members' individual, ad hoc, and coordinated team performances (Briggs, 1994). On the collaboration level the individuals of a team collaborate to create value that their members cannot create through individual effort (Briggs et al., 2009; Bruns, 2013; Nunamaker et al., 2001). The team's success is the sum of all the members' individual and concerted group performances (Nunamaker et al., 2001).

We refer to Briggs et al. (2003) and define collaboration as a joint effort towards a team goal. Collaboration is a multi-dimensional construct composed of different dimensions (Kotlarsky & Oshri, 2005; Thomson et al., 2007). One central dimension of collaboration is trust (Brown et al., 2004; Jarvenpaa et al., 1998). Brown et al. (2004) describe trust as the "glue" that sticks people who collaborate by fostering confidence that all participants will contribute as agreed and not behave opportunistically. Trust reduces complexity and transaction costs (Jarvenpaa et al., 1998; Thomson et al., 2007) and includes the freedom to test assumptions, to experiment, and to make and talk about mistakes (Dixon, 2017). Since communication facilitates all forms of teamwork, it provides the basis for effective collaboration (Deshpande et al., 2016; Fleischmann et al., 2020). Jarvenpaa and Leidner (2006) indicate that certain communication behaviors can foster trust in early stages (e.g., social communication) as well as in later stages (e.g., substantial and timely responses). Another essential dimension of collaboration is coordination (Bruns, 2013; Jassawalla & Sashittal, 1998; Russell et al., 2017). Coordination, in the context of collaboration, is defined as "the act of managing interdependencies between activities performed to achieve a goal" (Malone & Crowston, 1994, p. 361). Coordination guarantees the efficiency of the collaboration (Raposo et al., 2001). Further dimensions of collaboration mentioned in literature are governance, administration, autonomy, and mutuality (Kotlarsky & Oshri, 2005; Thomson et al., 2007).

While physical collaboration is a collaborative process where team members work face-to-face, digital collaboration is a collaboration process in which team members primally interact and communicate digitally (Fan et al., 2012; Hossain & Wigand, 2006). Digital collaboration largely transcends time and space, connects people across disciplines, functions, and organizations, and combines the skills of all team members (Peters & Manz, 2007). Fan et al. (2012) suggest that collaboration efficiency and performance are significantly affected by the collaboration technology selected for collaboration.

Collaboration technology provides all team members who are dispersed across place and/or time with the same opportunity to participate (Majchrzak et al., 2005; Smith & McKeen, 2011).

Collaboration technology is the umbrella term for ICT supporting collaboration (Brown et al., 2010) and includes a wide range of asynchronous (e.g., e-mail, calendaring systems, or group discussion boards) and synchronous tools (e.g., chats, audio, or videoconferencing). Therefore, collaboration technology can be understood as the package of hardware and software supporting for communication, information-processing, knowledge sharing and the adoption and use of such technologies (Brown et al., 2010; Venkatesh & Windeler, 2012). They are designed to enable teams to work together regardless of time or physical location (DeSanctis & Gallupe, 1987; Venkatesh & Windeler, 2012).

15.2.2 Collaboration in Virtual Reality

With technological progress, the development of VR technology has opened new ways to experience virtual spaces, i.e., virtual environments or virtual worlds (Gleasure & Feller, 2016; Weigel et al., 2020; Wohlgenannt et al., 2020). A virtual environment consists of ‘‘software representations of real (or imagined) agents, objects, and processes; and a human–computer interface for displaying and interacting with these models” (Barfield et al., 1995, p. 476), while virtual worlds are ‘‘shared, simulated spaces which are inhabited and shaped by their inhabitants who are represented as avatars” (Girvan, 2018, p. 1099).

VR technology can be characterized by three properties: Telepresence, interactivity, and immersion (Walsh & Pawlowski, 2002; Wohlgenannt et al., 2020). Telepresence describes the extent to which VR can create a subjective feeling that one is in a virtual environment or world (Sanchez-Vives & Slater, 2005). Interactivity refers to “the degree to which users of a medium can influence the form or content of the mediated environment” (Steuer, 1992, p. 80). Immersion is the subjective experience of feeling completely absorbed or engaged with the activities conducted in the virtual environment or world (Dede et al., 2017, p. 3).

Suh and Lee (2005) distinguished two broader VR categories: non-immersive and immersive VR systems. According to Suh and Lee (2005), non-immersive VR refers to a virtual experience on a desktop or laptop computer that allows one to control characters or activities within a software. However, there is no direct interaction with the virtual environment. Immersive VR in contrast allows interaction with the virtual space (Schultze, 2014). Complex interface technologies, such as Head Mounted Displays (HMD) or cave automatic virtual environments (CAVEs), enable the user to be surrounded in an enclosed virtual space (Mills & Noyes, 1999). Controllers enable the user to interact with objectives in the virtual space.

Besides the technical improvements in VR hardware and software, multi-user VR solutions have developed significantly (Alghamdi et al., 2016; Jalo et al., 2020; Li et al., 2020) and invite multiple users to meet and interact in virtual spaces (Alghamdi et al., 2016). Here, users can simultaneously look, move around, and interact with virtual objects as well as with each other (Jalo et al., 2020).

Traditional collaboration tools (e.g., audio- or videoconferences) meet their limits especially when it comes to an interactive and flexible collaboration (e.g., prototyping). Multi-user VR technology extends these traditional tools and creates new opportunities for digital collaboration (Heldal, 2007; Li et al., 2020; Mütterlein et al., 2018). Therefore, it enables digital and interactive collaboration across departments and fields, independent of physical boundaries (Hatzipanayioti et al., 2019). Li et al. (2020) posit that multi-user VR is a promising new medium for digital collaboration, which better supports social presence (e.g., intimacy), rich non-verbal communications (e.g., mimic), and immersive realistic interactions.

Previous research has shown that collaboration in VR requires a different kind of investigation than the physical one. For example, Hatzipanayioti et al. (2019) investigate if collaborators who were physically in the same room and interacted with each other before the start of the task, collaborate more efficiently compared to collaborators who meet and interact only within the virtual space. Results show that sharing the same physical space and/or meeting each other before collaboration starts, creates a mental representation of the collaborating ones, builds trust, and therefore increases the collaboration efficiency. Mütterlein et al. (2018) study how immersion affects the users' intention to collaborate. To examine this effect the authors identified potential drivers of immersion in the individual domain (i.e., telepresence and interactivity) and the collaboration domain (i.e., social presence, media naturalness, and trust). They confirm that immersion is an important driver of the users' intention to collaborate and outline the importance of interactivity and immersion. However, telepresence, social presence, and media naturalness seem to be negligible.

Despite these valuable efforts to investigate how to foster collaboration, the conditions that drive intention to collaborate in VR are rarely investigated (Mütterlein et al., 2018). The new opportunities to collaborate digitally raise new questions about how people collaborate and how the intention to collaborate can be encouraged (Pouliquen-Lardy et al., 2016). Due to COVID-19, it has become increasingly clear that collaboration does not have to be limited to the same location (Waizenegger et al., 2020). This coincides with the ongoing digitalization

and the increasing requirements of organizations on how their employees collaborate (Orellana, 2017). VR technologies offer a promising tool for this purpose, especially to support previously unknown potentials (Weigel et al., 2021). It has not been comprehensively clarified if there are conditions that influence the intention to collaborate in VR. With their research, Hatzipanayioti et al. (2019) indicate that social interaction plays an important role in collaboration. But they also show that the investigation of conditions of collaboration has not been exhausted and future research may start here to identify additional ones. Mütterlein et al. (2018) also state that conditions need to be further investigated, since conditions of individual use cannot be straightforwardly adapted to a collaborative setting. They refer that future research should focus on a deeper comprehension and the diverse conditions by using quantitative research approaches to gain a better understanding of the intentions of collaborating in VR. This is where our research intervenes and examines the conditions for the VR context in light of the unexplored influences on collaboration. As an area that has not been extensively studied so far, our research contributes to a more comprehensive understanding on the intention to collaborate in a VR environment, providing an initial overview of the diversity of condition, and indicates implications for theory and practice. Therefore, we raise the following research question (RQ):

RQ: Which conditions do influence the intention to collaborate in VR?

15.3 Method

15.3.1 Method Selection

We follow an exploratory research design. For this purpose, we consider a group of organizations consisting of manufacturing and a service. These two organizations are organizationally separated, but together, they represent a value chain. We perform a real and holistic analysis of business processes by looking at a common process. The analysis of the process contains systematic data from the interview with individual employees. This research is part of a project that explores how VR can be used for collaboration between organizations. To this end, we interviewed the two organizations (one manufactures technical equipment, which is installed and maintained by the other). Barriers to collaboration were cited as physical separation, lack of time, and risks associated with the installation. The results of the manufacturer's construction processes have a significant impact on the service processes of the service provider. Therefore, both organizations were considered.

15.3.2 Case Design

In each experimental setup, two participants were confronted with the same scenario, namely that of the assembly process in VR. Physically, the participants were in two different locations. Participants were matched regardless of age and gender, but all participants were from a limited group of employees from the two organizations under research. During matching, care was taken to ensure that some participants knew each other prior to the experiment and other participants did not have such a familiar relationship because they each came from different organizations. In VR, each participant was represented as an avatar so that the participants could follow each other's movements and actions. In addition, Voice over IP communication was enabled between participants via the HMD.

The overall assembly process in VR can be performed by one person or by two people working collaboratively. However, some of the assembly tasks have been designed in such a way that the individual steps to complete this task can only be performed by one person (e.g., inserting the mortar) and some tasks can be performed both together and alone (e.g., carrying a ladder). This ensured that the collaboration between users could take place on a voluntary basis (Roberts & Bradley, 1991). Ten runs of the experiment were conducted resulting in twenty participants. Before the experiment, each participant was asked individually about their prior knowledge and experience. Exemplary questions here were: "How often have you used VR?" and "What do you expect from today's VR experience?". This was followed by the experiment, where the participants had to perform an assembly in multi-user VR mode. This was divided into eight process steps (site inspection and securing, assembly preparation, fastening plate assembly, column assembly, jib arm assembly, chain hoist assembly, functional test, and acceptance), with each step consisting of subtasks. As an example, process step 1 "Checking and securing the construction site" is described here, which consisted of the subtasks of measuring the construction site, comparing with construction plans, checking the floor thickness, and securing the assembly site. In the VR application, these tasks can be performed jointly by two participants, such as drilling holes (Figure 15.1 left). All tasks were processed in a VR industrial environment (Figure 15.1 right).

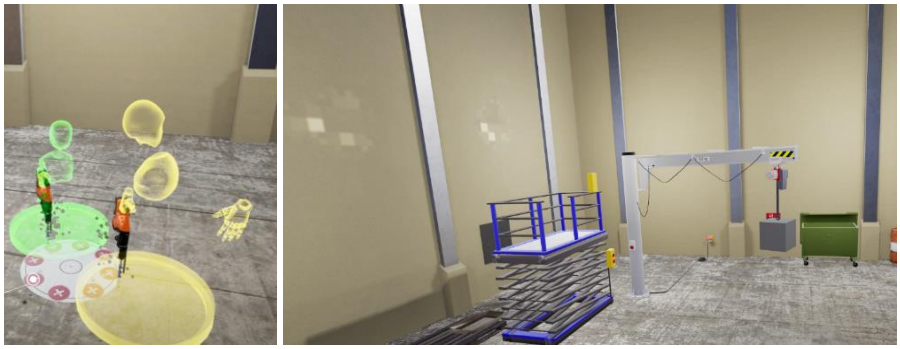

Figure 15.1: Screenshots of the Experiment

During the VR experiment, the two participants were supervised by two experimental supervisors. Here, for example, care was taken to ensure that the individuals did not collide with the physical walls of the room. They also subjectively observed if the participants collaborated with each other. Because each experimental supervisor has one participant at a time, they then compared their assessments and the situations in which they recognized collaboration among the participants.

After the VR experience, which took an average of 45 minutes, each participant was interviewed again individually. Questions were asked, such as “How well did you cope with the VR scenario ‘crane assembly’?” and “Did you feel supported by your colleague?”. These additional individual interviews were followed by a focus group interview with both participants together. Here, open-ended questions were asked, such as: “In what situations did the VR allow you to solve problems together with the second user?” and “Describe your interaction with each other in the VR. Why did you or did you not feel that you were interacting with each other as you would in real life?”. A total of twenty participants were interviewed; the exact composition of the data can be found in Table 15.2.

We used a semi-structured guide with open-ended questions (Pumplun et al., 2019) during the interviews to obtain the broadest possible range of responses and to allow participants to speak freely. In addition, we followed Sarker’s guide for qualitative research to avoid the pitfalls of qualitative semi-structured interviews (Pumplun et al., 2019; Sarker et al., 2013). Thus, we evaluated the first version of the questionnaire with one experiment, i.e., two interviews. This meant that we subsequently made only minor adjustments to the questionnaire based on the findings from the interviews. After a total of twenty interviews, we assessed that there was little chance for further new findings.

No.	Organization	Age	Gender	Position
1-1	Manufacturer	31	female	Marketing
1-2	Manufacturer	25	female	Technical draftswoman
2-1	Service provider	29	male	IT
2-2	Manufacturer	25	male	Technical draftsman
3-1	Manufacturer	27	male	Technical draftsman
3-2	Service provider	37	male	Electrician
4-1	Service provider	29	male	IT
4-2	Manufacturer	26	male	Controlling
5-1	Service provider	32	male	IT
5-2	Manufacturer	32	male	Technical draftsman
6-1	Manufacturer	29	female	Sales manager
6-2	Service provider	21	male	Trainee IT
7-1	Manufacturer	19	male	Trainee technical draftsman
7-2	Service provider	37	male	Service fitter
8-1	Service provider	25	male	Trainee IT
8-2	Service provider	27	male	Trainee IT
9-1	Service provider	27	male	IT
9-2	Service provider	27	female	IT
10-1	Manufacturer	44	male	Factory manager
10-2	Service provider	51	male	CEO

Table 15.2: Overview of the Participants

15.3.3 Data Analysis

The interviews were recorded and subsequently transcribed. The transcribed files were then analyzed using MAXQDA software. Grounded theory methods were used to analyze the qualitative data. Coding methods included open coding, axial coding, and selective coding. In the beginning, open coding was used. For this, conditions and situations of collaboration in VR were searched for (Glaser & Strauss, 2017). This step was performed independently by each of the authors to collect as many findings as possible. Axial coding followed, in which individual findings were compared and grouped to identify relevant aspects of the research (Corbin & Strauss, 2014). When it was expected that no more new insights would be found, the analysis was stopped at the so-called saturation point. The following example illustrates the process of data analysis: *"Communication is hugely important because it makes you feel like you are*

interacting and collaborating with the other user." (Interview 3-1). Two researchers independently of each other assigned the codes to this passage, which in their opinion represented best the contents. One of the codes was "communication" and the other code was "interacting and collaborating". They were combined to the code "communication enables collaboration" to be then used as the axial code. The axial codes were then grouped by topic. In the case of the present example, the text passage was assigned to the superordinate item "Communication". These parent items were later further grouped into technology, task, or user, and into necessary, or sufficient conditions. If there was disagreement between researchers on any issue, a researcher not involved in coding was brought in to discuss and determined an axial code.

In addition to this analysis, the observations were also evaluated. Here, the experimental supervisors assessed if and in which situation collaboration took place. These two assessments of a situation were evaluated for commonalities and then discussed.

15.4 Findings

We were able to classify our findings into technology, task, and user conditions. This corresponds to a widely used classification of factors influencing information technology in Information Systems (Goodhue, 1998; Serrano & Karahanna, 2016). Further, we were able to distinguish between sufficient and necessary conditions that influence the intention to collaborate in VR. Necessary conditions represent the basic conditions for collaboration in VR. However, if these conditions are fulfilled, this does not mean that collaboration will occur; for this, sufficient conditions are needed that foster collaboration in the multi-user setting. In the following, we show the conditions of technology, task, and user and how these are divided into necessary and sufficient conditions.

15.4.1 Technology

Technology plays a crucial role in the context of VR. As a basic prerequisite for the use of VR, technology is what makes the experience and the implementation of VR possible. It describes the intersection between the user and the virtually designed reality and offers the possibility of interaction. This includes both, the software for development and the hardware that enables users to enter the virtual world. Therefore, technology is a necessary condition for collaboration in VR that emerges with several underlying influences.

One technology-related condition of collaboration in VR is its **handling**. Since VR handling is necessarily dependent on hardware usage (i.e., HMD, controllers, sensors), collaboration is

also affected. If the way of handling the VR is not known or not yet internalized or if the technical restrictions (e.g., a certain defined area for VR use) are not observed, this has an influence on the collaboration, since the interaction with the partner and the VR itself is interrupted. For instance, exceeding the interaction radius of the VR has the consequence that the user can no longer be detected and thus no collaboration can take place. With regard to VR handling, the interviews revealed two different conditions that have an influence: first, the handling outside the VR environment, which includes technical, external conditions. These were caused, for example, by the handling of the controllers or positioning of the sensors, which resulted in problems for the users.

> *"Sometimes I had problems with the handling of the controllers. So that I got the buttons mixed up. Or that I was outside the detection space of the sensors." Interview 8-2*

> *"What was difficult? Well, the controls in general at the beginning. I would say that if it's completely unfamiliar, then it's not easy from the beginning. But I'd say the variety of keys is limited, so if you're a bit practiced, you'll be able to handle it." Interview 5-1*

Second, the handling within the VR environment. Elements of handling implemented within VR that allow a collaborative interaction were perceived to be necessary for collaboration. Interviewee 6-2 mentioned a specific task of the scenario, which was performed together with the collaboration partner.

> *"Yes, the [working] platform was good. I first got it in front of the crane and she stood on it and I raised it from below while she attached it to the top and then I lowered it again." Interview 6-2*

Another condition that influences the intention to collaborate is the **level of detail of the VR environment**. How a VR environment is perceived often depends on its details. This emerged as a result of collaboration and was stated in the interviews. The case depicted from the reality of crane assembly is a process characterized by collaboration. The difference to VR is the representation of details, which is clearly given in reality. The interviews showed that the level of detail is also a condition for the intention to collaborate in VR. On the one hand, due to the level of detail required by the case.

> *"I think it depends on the level of detail. I mean, in construction, of course, there are very detailed constructive things that you might not be able to represent in VR because that would be very time-consuming." Interview 2-2*

> *"I think that a proper cooperation, such as hooking the jib arm, was not necessary at all. [...] Normally the forklift driver lifts the jib arm in there, then the fitter has to look above to see how the bolt fits above [...]. Of course, this kind of cooperation does not occur here. However, this is probably also difficult to represent in VR, because the details are just so difficult." Interview 5-2*

On the other hand, the interviews showed that the level of detail of the environment contributed to an increase in collaboration, as it particularly created a sense of real proximity and presence of the collaboration partner.

> *"Well, if it is depicted very detailed, I would say so. [...] I felt very much in the role and was somehow close to the second user, although it wasn't like that at all. I think that depends on the level of detail." Interview 4-1*

Besides the VR environment and its level of detail **the avatars of the participants** collaborating with each other are necessary. The interviews indicate that the way the avatars are presented influences the intention to collaborate. The fact that the avatars were only represented in shadowy visualization (i.e., Figure 15.1 left) partially impaired collaboration. The participants had to search for each other because of the avatar's visualization and thus could not directly recognize where the other was located. Interviews showed that the representation would be better if the avatars would have been more adapted to the situation.

> *"The avatars could be a bit more present; they don't have to be like a real person, but sometimes I had to look for my teammate [to check] what she is doing." Interview 1-2*

> *"I had to search for him sometimes. I liked it visually, but I think I would find a classic outfit more suitable in the scenario." Interview 4-1*

When asking if the interviewees had the feeling of interacting with each other in VR as they would in the real world, for example, interviewee 2-2 replied: "Well, that would probably be something else because in VR you don't see each other, only schematically and only when you pay attention. In real life, you pay much more attention to each other." This supports the statement that the avatar design is a necessary condition of collaboration and the associated behavior of the participants.

However, that the level of detail does not have to be realistic on all levels was shown by the interviewees 7-1 and 7-2. While one lacked gestures and facial expressions and thus impaired the communication needed for collaboration, this aspect was seen by the other as support and a real reflection of collaboration.

> *"In real life, it would be different from my point of view because [...] you don't have any facial expressions or gestures when you talk. That means you tend to hold back here and there to say something because it would or could come across completely wrong on the other side because you simply have no gestures or facial expressions." Interview 7-2*

> *"But I don't think that's as dramatic as it sounds because if you do that in real life with a stranger who you've never seen before, a guy you get from the customer, then it's just the same. And that is the point. That is already mechanic-like." Interview 7-1*

Another technically necessary condition for collaboration in VR is related to design. **Immersion** is a common attribute of VR use (Mütterlein et al., 2018). It is not only necessary for the perception of the virtual environment and the fading out of the real world, but also influences collaboration. The feeling of collaboration arose primarily from the fact that the VR environment felt like real life to the participants, and they were able to completely fade out the real world. Whereby, for example, the possibility of communication reinforced the effect of immersion and thus supported the collaboration.

> *"You were sometimes so immersed that you actually thought you were standing next to each other [...]. We did two or three jokes and it felt like you were actually in the same room." Interview 4-1*

> *"It felt like he was in the room with me. So, the real rooms […] [were] completely blanked out for me, I really thought we were standing there together." Interview 6-1*

As mentioned, **communication** supports the intention to collaborate. It is a necessary, technology-related condition, since the technology acts as a prerequisite for communication between participants. Communication could be exchanged verbally and nonverbally by pointing or walking in the experiment. Unfortunately, recognition of facial expressions was not possible by the software. However, the verbal and rudimentary, nonverbal communication already led, among other things, to collaborating with each other.

> *"Communication is hugely important because it makes you feel like you are interacting and collaborating with the other person." Interview 3-1*

Furthermore, communication is significantly enriched by the fact that the participants could additionally perceive the mutual location through the representation by avatars. This resulted in occasions for communication, since participants put themselves in the role and position of the other and knew that the other was now closer to the tool or component. This initially led to the division of labor and cooperation. However, it also enabled collaboration among each other.

> *"Classic communication is also orientation work, so where do you and the other person stand? Am I taking this now or is the other person taking this now? We were able to reach these agreements very well." Interview 8-1*

> *"I found the collaboration particularly intense because of the communication, so we talked to each other and I also looked where the other person was and what the person was doing, at least what you could perceive." Interview 3-1*

15.4.2 Task

Another condition influencing the intention to collaborate in VR is the given task that participants are asked to perform. As collaboration requires a task to be performed together (Fleischmann et al., 2020), it seems to be a necessary condition of collaboration in VR. However, the interviews indicated that the task can be both necessary and sufficient, which could be distinguished taking on the identified conditions as a basis.

A necessary condition for collaboration is that the **formulation of the task** requires collaboration. Within the crane assembly process, participants were required to fulfill various tasks. The interviewees noted that some tasks (e.g., inserting the mortar) can only be performed by one user because, for example, only one tool was available. Few tasks in the VR environment did not explicitly ask for collaboration, so participants shared the tasks and worked on them individually, i.e., cooperated.

> *"We checked the tasks and then one of us did the first and the other prepared the next one. So, you knew you weren't alone, but you were doing something together. But when it comes to the task itself, you're working alone, because you can't do it together." Interview 2-2*

> *"We did not collaborate on these simple tasks because the tasks did not require collaboration. I found the tasks where it was desirable that we could do that." Interview 9-2*

Another necessary condition that influences the intention in VR collaboration is the exchange and intentional **transfer of information** between the participants. For crane assembly, this especially includes the exchange about the process. The interviews made clear that an understanding is nevertheless built up through the abstraction of the tasks. Another point is that the simplified but still recognizable progress in mastering the tasks initiates a learning process.

> *"The biggest information gain for me was the whole process. Before, I could only imagine how a crane is built, but now you really know how many steps are involved and how they interlock. I think it's because you've seen the different states as the crane "grows"." Interview 8-2*

> *"I think it's because it's just more descriptive than other learning environments. Because you can abstract well. I realize that I'm not using a screwdriver or really drilling a hole here in VR, but I can still link things well because I know from the real world how a drill works." Interview 8-1*

In this context, the interviewees emphasized that the intention to collaborate can be fostered by a more **realistic design of the tasks**. But different to the formulation of tasks and transfer of information the realistic design is a sufficient condition for collaboration in VR. Since even if the task is not mapped realistically, collaboration can be possible. Some tasks in the assembly process could be performed by one user in the VR environment but would require the collaboration of two service technicians in reality (e.g., carrying the ladder). Instead of working collaboratively as in reality, in the VR environment the participants split up these tasks. By designing the tasks more realistic (e.g., ladder has to be carried by two participants), the intention to collaborate can be promoted, as described by interviewee 2-2 and 5-2.

> *"But you could definitely collaborate more. For example, you could do a few tasks together. [...] You might carry a ladder together because it's heavy." Interview 2-2*

> *"Anyway, there was less collaboration necessary than in real life, starting with the plumb line, for example. In reality, I can't read the plumb line from the ground [...]. That means in real life I have to look at it from above and then have to tell the colleague who is on the ground which screw he should turn." Interview 5-2*

In addition, the interviews indicated that the intention to collaborate is increased if the tasks can be implemented more **efficiently through collaboration**. Interviewee 4-1 and 8-2 stated that even though they could have completed the tasks on their own, they collaborated to save time.

> *"It was also particularly useful to collaborate because it saved time. I don't think we had any tasks that we couldn't have done on our own, but it was a time saver." Interview 4-1*

> *"I think you could do the tasks alone but I think working together is more efficient because you work in a more coordinated way and you support each other in the tasks." Interview 8-2*

Another sufficient condition that influences the intention to collaborate is the **level of difficulty of the task**. Simple tasks were more likely to cause the interviewees to try to fulfill the task on their own, rather than collaborating with their partner. However, when the tasks became more difficult, they started to collaborate and helped each other. In addition, Interviewee 4-1 highlighted that at the beginning of the scenario he wanted to familiarize himself with the environment and started working independently. However, as he was confronted with more complex tasks later, he began to collaborate with his partner.

> *"At the beginning, I tried to familiarize myself with the scenario. First, I tried to solve everything on my own. But when it came to the more difficult tasks, I had to turn to my partner for support." Interview 4-1*

> *"For tasks that were a bit more complex, that were perhaps more challenging, we actually collaborated more closely in order to support each other, to ask each other questions, or to help each other." Interview 9-2*

15.4.3 User

Moreover, the interviews revealed that user attributes are sufficient conditions for collaboration in VR. As they are not necessary like technology as a kind of prerequisite for collaboration, they show an impact on the intention to collaborate that is important to consider, but in a more sufficient manner.

A condition related to the intention to collaborate depends on the **personal acquaintance** of the collaborating partners (Hatzipanayioti et al., 2019). The participants who collaborated in our setting already had known each other, which affected the way they work together.

According to the interviewees, the familiar basis compensated for the lack of facial expressions and gestures of the avatars and made it possible to derive non-verbal signals and emotions from the partner's voice and the avatar's body language. The interviewees emphasized that in this way a more personal level of collaboration was achieved.

> *"Well, because you knew who the other person was, it actually supported it. But I would say that if you didn't have any relationship at all, i.e., if anyone would be there, then it would be impersonal because you could not recognize his face." Interview 5-2*

> *"If we hadn't known each other, I don't know if it would have been so personal. Because you can't see the face or emotions, only hear the voice. But this way I found it personal, we could communicate quite normally." Interview 2-2*

The possibility of **perspective taking** in the crane assembly process allowed to help each other with their tasks and thus influenced the intention to collaborate. By taking on each other's tasks (e.g., extending the lifting platform) and giving hints on how to accomplish the task, partners could better understand the process and challenges of each subtask. Taking on another's perspective can thus improve the collaboration process by creating a shared understanding of challenges and allowing partners to work collaboratively on a solution. Additionally, information and knowledge were transferred from reality to VR, for example in the use of tools or in explaining processes and which tool is needed for which task. As a result, the participants collaborated and exchanged knowledge and information.

> *"The most collaborative thing we did was with the lifting platform. I could see a certain angle where it turned green, and he could not. So, I would say that's kind of work where you have to take on the other perspectives to solve a problem." Interview 8-1*

> *"The second participant gave me a lot of advice, both technical and in dealing with it, and without him it would have taken longer, that's for sure." Interview 4-2*

> *"So, I asked the second participant: Where does the screw have to go in now and where I have to attach the flexes? The second participant then gave me the instructions and told me that I have to do this here and there." Interview 1-1*

Additionally, we can add the **transfer of knowledge** between participants as a sufficient condition. Based on the interviews, we have determined that this is a "teacher–pupil" exchange. That is, the knowledge transfer or learning effect between participants occurs when one participant has less knowledge or less experience than the second one. Both participants work

on the same task and the experienced participant gives explanatory instructions, which are thus only presented abstractly in VR. Contexts are conveyed and special situations are discussed that have a particularly memorable effect on knowledge transfer. For example, it was explained which task follows the current task and for what reason and how this task can then be processed in collaboration.

> *"If someone tells you what to look for, then that's what you learn. Just like that, based on the information from a manual, I don't think it would have really had that success." Interview 2-1*

> *"I was able to learn a lot in different situations. For example, when the second participant explained to me which tools were used and why. Also, why certain tasks were done in between and where the connection is. The terminology for certain nuts, bolts... I was able to remember some of that." Interview 4-2*

Besides our findings and as described in the method section, the experimental supervisors rated collaboration. Whenever the two participants worked together on a task, this was rated as collaboration. If the collaboration consisted of parallel processing, for example, this was rated as no collaboration. For example, "You take the advice, I take the screw". However, when participants worked together on a task (e.g., both participants drilled the holes at the same time or content questions were discussed and answered among participants), this was scored as collaboration. Thus, it remains to be noted that situations of collaboration between participants occurred in all ten experiments.

15.5 Discussion

The findings allowed us to distinguish between technology, task, and user conditions that influence the intention to collaborate in VR, which were divided into necessary and sufficient condition. Using the example of the identified conditions – communication and perspective taking – we will distinguish them exemplarily into a necessary and a sufficient condition. Communication: In reality, the participants of the collaboration have all possibilities of communicative exchange. In the VR experiment, there is the peculiarity that no facial expressions can be transmitted. The participants in VR only have the possibility to communicate with each other via Voice over IP and with rough hand and head postures. However, this limited form of exchange is necessary to enable collaboration, as the interview excerpts show. Communication as a necessary condition for collaboration is probably also shared in general, but the peculiarity in this VR experiment is that already voice communication

with a rough transmission of gestures in VR is enough. Perspective taking: When the perspective of a third party is taken, it becomes clear that the view of the process changes. In reality, as an observer of the process depicted in the experiment, one remains at best an outsider, as there are environmental and injury hazards in carrying out the process, for example. In VR, these hazards do not exist; the participant is in the position of the service worker, without environmental or injury hazards. As the interviews show, perspective-taking worked several times. However, the interviews also show that this is a sufficient condition. There were experiments where objective collaboration was found but perspective taking was not observed in the interview. Since this is a qualitative research, this necessary and sufficient condition cannot be applied to collaboration in general but refer to the intention to collaborate in VR. Regarding our RQ (Which conditions do influence the intention to collaborate in VR?), we identified collaboration-relevant conditions for VR, based on the interviews conducted, and indicated that the intention to collaborate within VR depends on a variety of influences. Besides conditions that arise from the use of VR, such as immersion, there are additional ones that should be considered in theory and practice for future ventures. Table 15.3 shows a summary of the conditions and an example of each from our research.

		Condition	Example in the VR Experiment
Necessary	Technology	Handling	Intuitive use of VR hardware and VR environment
		Details of environment	Perception of crane assembly
		Design of avatars	Perceiving each other as human
		Immersion	Realistic representation of the assembly scenario
		Communication	Exchange-related tasks
Sufficient	Task	Formulation of tasks	Allow collaboration
		Transfer of information	Exchange about the assembly process
		Realistic design of tasks	Require collaboration
		Efficiency through collaboration	Division of tasks
		Difficulty of the task	Need for collaboration
	User	Personal acquaintance	The participants know each other before
		Perspective taking	Taking on the role of the service technician
		Transfer of knowledge	Exchange of experiences and knowledge

Table 15.3: Conditions Influencing the Intention to Collaborate in VR

Our research contributes to the current state of literature by addressing the demand of further investigation on conditions for collaboration in VR. As a field that has not received much attention so far, our research provides an initial overview of several conditions that influence the intention to collaborate in VR by expanding previous results (Hatzipanayioti et al., 2019; Mütterlein et al., 2018). Here, it should be noted that the technological conditions in their entirety are necessary conditions in VR. The person-related conditions can also be assigned to the sufficient conditions in their entirety. For the task-related conditions, the distinction is bipartite. While task formulation and transfer of information are considered as necessary conditions, realistic task design, efficient collaboration, and task difficulty are considered as sufficient ones.

This research is one of the first to examine what conditions influence collaboration in VR. The three properties (telepresence, interactivity, and immersion) of VR (Walsh & Pawlowski, 2002; Wohlgenannt et al., 2020) could be addressed in our research. For this, our guideline included questions about user experience with the scenario of a crane assembly. By doing this, we refer to Mütterlein and Hess (2017) and derived our questions from previous findings. For example, we used the question "To what extent could you hide the real environment in the VR scenario?" to ask about the occurrence of telepresence. Based on our findings, we decomposed telepresence (Sanchez-Vives & Slater, 2005) into two components. First, the perceived details of the environment and second, the design of the avatars, i.e., the extent to which the avatars are perceived as human and thus present. Interactivity (Steuer, 1992) can be found in the point handling. Here, it is listed as a necessary condition of the technology that the operation should be as close to reality as possible. So that the interaction is perceived as intuitive. Immersion (Dede et al., 2017; Suh & Lee, 2005) could be identified as such in the technology-related necessary conditions.

Based on the number of conditions, it can be said that VR collaboration is bittersweet. For the sufficient conditions, this is particularly appealing, since not all conditions need to be true at the same time. If one sufficient condition occurs it does not imply that another one must be true to the same degree. Therefore, sufficient conditions should be considered independently of each other. The necessary conditions, however, must be fulfilled for collaboration in a multi-user VR environment to take place at all.

15.5.1 Implications for Theory

Based on our findings, we were able to derive implications for both, theory and practice. For theory, our research extended existing research on multi-user VR solutions (Alghamdi et al.,

2016). Our VR scenario allowed both participants to look around and move independently. It also allowed participants to interact with virtual objects and with each other (Jalo et al., 2020). Additionally, we were able to confirm the findings of previous research that multi-user VR is a promising new medium for digital collaboration (Li et al., 2020). All users collaborated objectively and subjectively.

First of all, based on previous research, we were able to further investigate the intention to collaborate in the VR. Hatzipanayioti et al. (2019) looked at interactive collaboration across departments and fields, regardless of physical boundaries. Mütterlein et al. (2018) investigated how immersion influences the users' collaboration intentions by stating additional conditions to enrich current research. Basically, we were able to continue and extend these researches and add an application example. In particular, we addressed the question of how to foster collaboration in multi-user VR and answered it with necessary and sufficient conditions based on our data. Our findings enrich existing literature with an overview of conditions for collaboration in VR and thus complement previous findings (e.g., Hatzipanayioti et al., 2019; Mütterlein et al., 2018). These will enable future research to identify new entry points and further advance research in this field so far only slightly studied. In addition to the reasons already identified in the literature, such as social presence (e.g., intimacy) and immersive realistic interactions, we were able to derive necessary and sufficient conditions.

Apart from the VR literature, findings can provide implications in the field of knowledge transfer. The separation of information and knowledge transfer is consistent with the theory of the knowledge staircase (North et al., 2016). Here it is defined, among other things, that information only becomes knowledge through the addition of experience. We were able to confirm this in our research; we identified the fundamental possibility of information transfer as a necessary condition for VR collaboration. This means that the task must enable information transfer in order for collaboration to occur. However, knowledge transfer is a sufficient condition because user experience is a key contributor here. Only when a subject enriches the information with personal experience, aggregated knowledge could be shared. Thus, it can be concluded that classical approaches, such as the knowledge staircase (North et al., 2016), can also be used in innovative solutions like VR and provide the possibility of further adaptations for theoretical purposes.

15.5.2 Implications for Practice

Virtual collaboration will continue to influence our working world in the future. Our research therefore enables not only a short-term, but also a long-term contribution for practitioners.

First, we have shown where previous digital collaboration tools reach their limits (Heldal, 2007; Li et al., 2020; Mütterlein et al., 2018). To overcome these limitations, this and previous research propose the use of collaborative VR technology (e.g., Alghamdi et al., 2016; Heldal, 2007). VR enables more interactive and flexible collaboration than technologies, such as virtual flipcharts or virtual mind maps. Our research provides an overview of the conditions that must be considered when workers collaborate in VR and that the conditions are either necessary or sufficient to an intended collaboration. Technical requirements, such as the most realistic possible representation of the VR environment, enable abstraction from reality. Conditions, such as immersion, should therefore be considered from the outset when designing VR environments. For designers, the representation of the participants must be designed with care in such a way that participants are mutually perceived and verbal and non-verbal communication is enabled.

Task design also has a significant impact on the intention to collaborate in VR. There are simple tasks, such as cutting off screws, that do not invite collaboration, even though they are designed for collaboration. An exception is the situation when this task has to be performed simultaneously and multiple times (e.g., drilling holes). In contrast, more complicated tasks, such as correctly tightening the bolts on the crane, were directly tackled collaboratively by the subjects. For VR developers or VR designers, this means that task difficulty in complexity and temporal scope also plays an important role for VR collaboration.

However, necessary and sufficient conditions are required to foster the intention to collaborate in VR. For practitioners, such as VR developers, our research provides an indication of the minimum conditions that must be met to enable collaboration in VR. The sufficient conditions can then be additionally addressed to foster the intention to collaborate. However, the user conditions do not really depend on the developer, but on the participants. Depending on the goal of VR collaboration, the combination of participants can be influenced. For example, if the goal of VR collaboration is to achieve a formal learning outcome, then it makes sense to use a VR-experienced user as the instructor and an inexperienced user as the student. If problem solving is formulated as the goal, then users with similar levels of experience are advantageous, as they can discuss and try out different approaches together.

15.6 Limitations and Outlook

We conducted a qualitative research to investigate the conditions influencing the intention to collaborate in VR. Here, we were able to identify conditions regarding technology, task, and

user level, which could be divided into necessary and sufficient conditions. However, as with every research, this research comes with limitations, which invite future research to build on. This research comes with typical limitations of qualitative studies (e.g., weak internal validation). Apart from those, it is important to acknowledge further limitations: First, it should be emphasized that the findings are based on one exploratory research in which two participants always collaborated. Consequently, there may be other conditions (necessary and sufficient) that influence intent to collaborate, which could not be identified by our data. For example, it would be conceivable to examine the intimacy between the collaborating participants in more detail and, additionally, their baseline trust toward VR technology, which could have affected their collaboration performance. In terms of personal acquaintance, our research was able to order initial approaches, which, however, only partially reveal conclusions about the intimacy of the collaborating participants. We therefore encourage future research to build upon our findings and to validate our findings in further VR scenarios as well as with different amounts of people who collaborate. In addition, future research should focus on randomizing participants based on socio-demographic characteristics, such as age, gender, and professional status, which was not possible in this research due to the case design of the two organizations. This randomization would reduce theoretical bias of socio-demographic characteristics due to the selection of participants. Second, it should be emphasized that both collaborating participants were supported by an experimental supervisor. This became necessary because participants had only been in VR a few times before and the supervisors were objectively observing if collaboration took place. Some of the interviewees mentioned in the interview that this distracted them to some extent: “It was a bit difficult that I was in one room and (name of participant B1) in another; we could talk to each other, but I always talked a lot with you [supervisor 1] and [name of participant B1] a lot with you [supervisor 2] and that was of course a bit difficult. So, because of that, (name of participant B1) and I talked less with each other and rather with you [supervisor 1 and 2].” (Interview 2-2). Therefore, it should be noted that this may have adversely impaired the collaboration process. Future research should therefore ensure that there are no supervisors in their research settings or instruct their supervisors to remain passive during the collaboration process. Third, the conditions identified are based on the respondents’ perceptions and experiment leaders’ observations. The findings do not provide any information if these conditions also objectively increase the intention to collaborate. Future research can build up on the identified conditions and can investigate if these can also objectively foster collaboration. Researchers can build upon our findings and explore how specific conditions influence the intention to collaboration in detail. Furthermore, one could

examine if and how the different conditions influence each other. Finally, another interesting aspect could be a consideration of variously designed tasks. In our research, tasks in VR are predominantly physical tasks. The conditions for successful collaboration could be different when it comes to immaterial tasks. Future research could therefore investigate the extent to which the physicality of tasks is a decisive factor for the conditions for collaboration in VR.

15.7 Acknowledgements

We would like to acknowledge that this research is part of the aSTAR research project. The project was funded by the Federal Ministry of Education and Research of the Federal Republic of Germany (BMBF, funding code 02L18B010), the European Social Fund and the European Union. In addition, a subset of the dataset used here was used for another research paper within the project (Weigel et al., 2021).

We would like to acknowledge that this research is part of the inNOVATION research project. The project (HA-Projekt-Nr.: 977/20-134) was funded by the Hessisches Ministerium für Wirtschaft, Energie, Verkehr und Wohnen and the HOLM-Förderung.

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16 The "New Normal" of Virtual Team Cohesion

Title	**The "New Normal" of Virtual Team Cohesion – a Qualitative Study to Investigate the Impact of COVID-19**
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Publication Type	Conference Paper
Publication Outlet	Proceedings of the 28th Americas Conference on Information Systems
Status	Published
Full Citation	**Zeuge, A.**, Weigel, A., Schaefer, C., & Niehaves, B. (2022). The new normal of virtual team cohesion - A qualitative study to investigate the impact of COVID-19. *Proceedings of the 28th Americas Conference on Information Systems*. (published)

Table 16.1: Fact Sheet Publication

The "New Normal" of Virtual Team Cohesion – a Qualitative Study to Investigate the Impact of COVID-19

Abstract. A strong sense of virtual team cohesion can have a variety of positive effects, such as increased performance or self-esteem. For several decades information systems researchers have been studying both task and social cohesion and how to maintain such cohesion in the virtual. However, since one of the major challenges of the pandemic is dealing with feelings of social isolation, research outlines that COVID-19 had and still has a significant impact on virtual team cohesion. Our study examines the "new normal" of virtual team cohesion i.e., how virtual team cohesion strengthening measures have changed in times of the pandemic. To this end, our study presents the findings of a qualitative study with 26 individuals. We were able to shed light on how such measures changed on-the-job, in breaktimes, and after work. Therefore, we provide insights in the "new normal" of virtual team cohesion, which can inform research and practice.

Keywords. Virtual Team Cohesion · New Normal · Social Team Cohesion · Task Team Cohesion · COVID-19 · Qualitative Study.

16.1 Introduction

The World Health Organization declared COVID-19 a pandemic on March 1, 2020 (WHO 2020). The pandemic had and still has a lasting effect on our daily lives (AbuJarour et al. 2021). To contain further spread of the virus, multiple nations went into a lockdown and in-person contact was reduced to a minimum, colloquially known as "flattening the curve" (Anderson et al. 2020). These measures succeed in stemming the exponential spread of the virus, but at a horrendous cost to social coexistence (Tabish 2020).

The pandemic has led to a shift in teamwork from face-to-face interaction to virtual teamwork, often referred to in the literature as remote or distributed work/collaboration (Kohn 2020; Venkatesh 2020). The contact restrictions caused by the pandemic pose both temporary and permanent challenges (Hwang et al. 2020). To this end, work teams are forced to change the way they have been working (Carroll and Conboy 2020): physical meetings became virtual meetings and collaboration shifted from physical to virtual (Herath and Herath 2020).

Even though many teams already incorporated virtual collaboration to some extent, the pandemic changed and changes virtual team collaboration in a lasting way (Klonek et al. 2021; Waizenegger et al. 2020). The main reason why virtual collaboration is very different from pre-pandemic is that virtual collaboration is enforced (Richter and Richter 2020). In addition, the pandemic forced the collaboration of different types of employees, including those who

previously either did not want to collaborate virtually or were not permitted to do so, for example due to organizational policies (Chamakiotis et al. 2021). Since, the pandemic has changed virtual team collaboration in a lasting way, research highlights to investigate the influence of COVID-19 on virtual collaboration (e.g., Klonek et al. 2021; Waizenegger et al. 2020).

Team cohesion is one of the six key aspects of teamwork quality and therefore a prerequisite for successful team collaboration (Bajaj and Russel 2008; Paul et al. 2016; Yang et al. 2015). Team cohesion is generally understood as the tendency of a group to stick together and stay united (Carless and De Paola 2000; Carron et al. 1989; Paul et al. 2016). Thereby, team cohesion can be divided into social cohesion, which describes the interpersonal bonds within a team and between team members, and task cohesion, which describes the degree in which team members collaborate in an integrated manner to accomplish a team task (Mikalachki 1969). Strengthening the feeling of cohesion in the virtual is even more important because the physical distance can transform into a psychological distance, resulting in demotivation, frustration, and feeling of being left alone (Garro-Abarca et al. 2021; Lepsinger and DeRosa 2015; Paul et al. 2016).

As one of the major challenges of the pandemic is dealing with feelings of social isolation (AbuJarour et al. 2021), strengthening virtual team cohesion became and becomes even more important (Whillans et al. 2021). To this end, literature emphasizes to investigate the influence of COVID-19 on virtual team cohesion (Zeuge et al. 2021). This study addresses this promising research area and examines the "new normal" of virtual team cohesion. "New normal" refers to the changed working environment caused by COVID-19 and subsequent developments (Carroll and Conboy 2020). By shedding light on the "new normal" of team cohesion in virtual teams we explore how measures of maintaining team cohesion in virtual teams have changed in times of the pandemic. To this end we address the following research question:

RQ: How has COVID–19 impacted virtual team cohesion?

16.2 Virtual Team Cohesion

Team cohesion satisfies one of the most basic human motivations: the need to belong (Severt and Estrada 2015). Researchers have proposed many alternative definitions of team cohesion. For example, Festinger (1974, p. 274) defines team cohesion as "[…] the total field of forces which act on members to remain in the group. These forces may depend on the attractiveness or unattractiveness of either the prestige of the group, members of the group, or the activities

in which the group engages.". Bollen and Hoyle (1990) describe team cohesion as the team members' sense of belonging to a team and their feeling of morale associated with membership on that team. In this study we refer to Carron et al. (1989, p. 3) and define team cohesion as "[…] the tendency for a group to stick together and remain united.".

In 1969, Mikalachki divided team cohesion into social and task cohesion. Social cohesion describes the interpersonal bonds that exist between the team members (Mikalachki 1969). Task cohesion describes the members' shared commitment to the team task (Zaccaro 1991; Zaccaro and Lowe 1988). This distinction has received much attention, with much research efforts demonstrating support for the notion of separate dimensions (Grossman 2015). For example, a meta-analysis by Mullen and Copper (1994) showed that task cohesion is a stronger predictor of team performance than social cohesion. Other research found that social cohesion is more strongly related to team member satisfaction, while task cohesion is more strongly related to a reduction in absenteeism (Zaccaro 1991; Zaccaro and Lowe 1988).

Team cohesion relates to a variety of positive team collaboration outcomes in a significant way: for example, team cohesion has been linked to increased individual performance and therefore to greater team performance and success (e.g., Bajaj and Russel 2008; Beal et al. 2003; Keith et al. 2018). Cohesive teams are more satisfied with the team process, and are more cooperative and coordinative (Lu 2015; Paul et al. 2016). In addition, team cohesion positively influences team members attitudes, their level of engagement, and their motivation (Carron and Brawley 2012; Keith et al. 2018; Mathieu et al. 2015). Further, team cohesion can have a positive effect on loyalty of team members and their organizational commitment (Greer 2012).

Creating a culture of "belonging" is even more important for virtual team collaboration (Zeuge et al. 2020). The distance between virtual teams may turn into a psychological distance between them (Garro-Abarca et al. 2021) because the degree of team collaboration is lessened due to the limited transmission of rich information (Huang et al. 2009). Virtual collaboration offers limited social interactions within the team compared to physical collaboration and lacks informal or spontaneous exchange opportunities (Lepsinger and DeRosa 2015; Yang et al. 2015). Therefore, strengthening team cohesion is particularly important for collaboration in virtual teams (Lilian 2014; Purvanova and Bono 2009). Cohesive relationships within the virtual team can help to overcome the feelings of loneliness and social isolation (Roy 2012).

16.3 Methodology

In our study we investigated the influence of COVID-19 on virtual team cohesion (Flick et al. 2004). In digital interviews (60 minutes on average, over a span of two month, via Zoom/Microsoft Teams), we interviewed 26 employees from 14 different organizations in Germany. In the following we highlight the distinction between the organization types as follows: 7 large-scale corporations (C) with 14 interviews and 7 small and medium-sized enterprises (SME) with 12 interviews. All interviewees had already worked in virtual teams before the pandemic. We ended our research when all researchers agreed that theoretical maturity was achieved.

To get a wide range of answers and to give the interviewees the chance to speak freely, we used a semi-structured interview-guideline with open questions (Pumplun et al. 2019). We followed Sarker's guidelines for qualitative research to avoid the pitfalls of qualitative semi-structured interviews (Pumplun et al. 2019; Sarker et al. 2013). We revised our first version of the interview-guideline after three pre-interviews. As a result, we added and omitted some questions. After another five interviews we evaluated again and only had to make a few more changes to our guideline.

The interview guide is divided into four parts: We started with general questions about the interviewee (e.g., their age, their background). In the second part, we asked questions to understand how virtual collaboration has been put into practice before the pandemic and today (e.g., How extensive and for what reasons did virtual teamwork take place before COVID-19? How has this changed as a result of the pandemic?). The third part identified opportunities and risks of virtual collaboration (e.g., What technologies were used for virtual collaboration before COVID-19? How has this changed as a result of the pandemic?). In the fourth part, we asked questions about virtual team cohesion and how virtual team cohesion was maintained before the pandemic and today (e.g., What cohesion-building activities were implemented before COVID-19? How were personal relationships built with other team members? How has this changed during the pandemic?).

The interviews were analyzed using the MAXQDA software by means of bottom-up coding methods: in a first step, we read the transcribed interviews and applied the open coding method independently. The sentences and paragraphs were assigned code phrases that best represent the content (Corbin and Strauss 2014; Glaser and Strauss 2017). In a second step, we collected similar codes from the interviews and converted them into axial codes (Corbin and Strauss

2014). In a third step, different opinions were discussed and settled by agreement. In a fourth step, the axial codes were grouped by subject areas. We ended the analysis with saturation.

16.4 Findings

In the following, we outline how COVID-19 impacted virtual team cohesion. To structure our findings, we describe how measures to strengthen team cohesion changed on-the-job (i.e., during work), in breaktimes, and after work. We do this by first delineating what team cohesion measures took place before COVID-19 as well as how they took place, and then describing how those changed in times of the pandemic.

16.4.1 On-the-job

Pre-pandemic, nearly all virtual teams emphasized both starting and closing the week together. The goal of the joint start of the week was to communicate what was coming up in the week and to plan out the week. At the joint closing, the week was evaluated retrospectively, and a glance was taken at the next week.

> *"So, we always had a substantive exchange on Mondays. [...] We came together and discussed things that were planned for the week. At the end of the week, [...] we have discussed the week retrospectively and maybe also the next week's agenda." (SME_2_2)*

The joint start and closing of the week were maintained by all virtual teams during the pandemic. However, while the focus pre-pandemic was on exchanging work-related information, the virtual teams now also take time to talk about more personal matters. For example, leisure plans for the upcoming weekend are shared or the latest sports results are discussed.

> *"We start Monday morning at nine, we always start the week together, and then we simply talk about personal stuff for 20 minutes. We wouldn't have done that in the past, I would have pretty much said chop, chop, chop, that's what we're doing now. Now it's important for us to start and end together more personally." (C_2_4)*

Besides regular weekly kick-off and closing meetings, many virtual teams held regular jour fixes prior to the pandemic. The jour fixes had primarily an informative function. The focus was on presenting (partial) results achieved and communicating future strategies and goals. In addition, it was ensured that everybody was informed about who is working on what, next steps were determined, and tasks were assigned within the team.

> *"In our jour fix we had the freedom to discuss a task, to present the result and distribute tasks. This way we brought a structure into the daily work routine." (C_1_2)*

Due to the pandemic, the nature of the jour fixe has changed. As before, the informative character is maintained to further ensure that all team members are up to date. In addition to the informative aspects, however, social aspects are also taken into account. The jour fixe is used to share information about the individual well-being of the team members and to talk about non-work-related topics and interests.

> *"Now we try to address more social aspects. To have the time to not only talk about the job, but also to bring in private aspects." (C_1_2)*

> *"The jour fixe during the week is not so much about content. [...] We simply spend 20 minutes talking personally and sharing how we're doing. We didn't do that before." (C_2_4)*

Prior to the COVID-19-pandemic, many virtual teams used audio instead of video conferencing for collaboration. There were several reasons for this: many teams were previously not equipped with the appropriate hardware and/or software. In other teams, organizational guidelines prevented the use of cameras. Additionally, there were also teams that did not see the need for video conferencing.

> *"Before the pandemic, we never used our webcams. We only used audio conferences. I think we didn't need it." (C_1_1)*

Due to the pandemic and related curfews all interviewees stated that they turn on the camera. On the one hand, the interviewees feel that this can reduce the perceived distance. On the other hand, the video transmits the body language of the other team members. This enables one to better recognize, which face is expressing concerns and who is perhaps waiting to finally be able to say something.

> *"The availability of technologies has changed. [...] Before (the pandemic), web cams were not used. And now? [...] Web cams were bought, so video conferencing was also possible." (SME_1_2)*

> *"But with the start of the first lockdown, [...] we decided as a team that we had to turn on the camera so we could see each other. And that became a routine. [...] I think it's better if you can at least see a little bit how the other person reacts." (C_5_1)*

The virtual teams that used video conferencing for collaboration prior to COVID-19 reported that they used digital wallpapers (e.g., with an organization logo) to avoid giving team members insights into their physical surroundings. This prevented team members from gaining insight into private rooms or their whereabouts.

> *"We always used a digital wallpaper before." (SME_1_3)*

Most interviewees report that they no longer use digital wallpapers. For them, the insight into the personal "office" (e.g., living room, kitchen) allows team members to identify common interests or learn more about the private lives of their team members. From the perspectives of the interviewees this is more authentic and creates a feeling of closeness.

> *"So, a picture, for example, as a background I find distracting. So, you have the feeling that someone wants to hide something. [...] I think you have more insights into the privacy of the other person, which also makes working together a bit more pleasant. And I think this personal aspect is especially important […] in these times." (SME_5_1)*

Pre-pandemic, many interviewees indicated that they used chats primally to ask and answer questions at short notice in their virtual team. Thus, a substantive exchange was the main purpose for using chats. Moreover, the interviewees reported that there are clear rules on how to use chats in their teams.

> *"We used to handle chats in the team very responsibly. We had clear rules here." (SME_2_2)*

Since the pandemic, chats have been used more informally. Interviewees mentioned that they use chats for asynchronous social interactions such as birthday wishes or to send jokes, Graphics Interchange Formats (GIFs), or videos to their team members.

> *"We have been writing a lot more in the chat since the pandemic. And we also try to use the GIF function very extensively, [...] to make the work a bit more fun. […] So, more informal I would say." (SME_7_2).*

16.4.2 Breaktimes

Nearly all interviewees described that before the pandemic, it was common to turn off the computer and leave the workplace during breaks (e.g., to eat lunch or to go for a jog). In addition, team members flexibly scheduled breaks based on personal preferences and/or their work.

> *"We've always been able to be very flexible with our lunch breaks; for example, I sometimes jog for two hours on my lunch break." (C_3_1)*

The interviewees emphasized that the relevance of personal exchanges within breaks had increased during the pandemic. They reported that they had created opportunities for their teams to spend breaks together virtually. To that end, many virtual teams have set up virtual break rooms where anyone who wants to can dial in at any time. In this regard, interviewees emphasized that it was not important that all team members or leaders always participate. Rather, they reported that although use the break room was voluntary, the virtual break room was widely accepted and regularly used by their teams.

> *"We now have a Zoom-lunch break, which is voluntary. [...] During lunch, you can just join in and talk to your colleagues. Very informally. To create a spontaneous personal exchange." (SME_3_2)*

> *"That's actually how it's organized now sometimes via Zoom, that we just have a short lunch break together, especially for the colleagues who are completely in the home office." (SME_5_1)*

In addition, it became apparent that many virtual teams transfer the possibilities of physical collaboration to the virtual in order to promote informal and personal exchange ("office grapevine"). For example, the spontaneous coffee break at the coffee machine was virtualized by introducing a virtual "coffee roulette". Here, team members are randomly assigned to break-out sessions and can exchange ideas over coffee. In this way, a regular informal and personal exchange takes place between all team members.

> *"Our leader has then [...] organized a virtual "coffee roulette". So, just doing something together that doesn't have to do with work, but still strengthens the team feeling a bit." (C_3_2)*

The interviewees reported that not only opportunities for exchange were created. Rather, since the pandemic, virtual teams have also been actively spending their breaks with each other, for example in the form of virtual sports sessions (e.g., virtual yoga class, virtual office gymnastic). A few interviewees also mentioned that they organized virtual games in their breaks. Organizations have also organized these sessions across teams to strengthen inter-team cohesion.

"We have recently started office chair gymnastics, […] where a colleague of ours […] shows […] a few things, where you can take part." (SME_7_2)

"Or that you simply create an online game that you can play against each other. Or play Ludo or whatever […]. Just taking a break for half an hour in between and go for it. [...] And these are things you should do now in the pandemic." (SME_2_2)

16.4.3 After Work

Measures to strengthen team cohesion after work have also changed. Pre-pandemic, large-scale events such as Christmas parties or organization celebrations were mainly used to come together physically as a virtual team. In addition, internal team events such as visiting outdoor parks or participating in organization runs were also used to strengthen team cohesion. A few interviewees reported that they also hosted virtual team events prior to the pandemic, but they were less accepted and preferred. However, almost all interviewees confirmed that there were no spontaneous activities to strengthen team cohesion after work.

"Before COVID-19 there were Christmas parties. And then there were also a summer party and family parties [...] So it was more planned events and less spontaneous." (SME_1_2)

"My policy was always to have virtual events at least once a quarter to keep the mood high. [...] For example celebrating achievements. […] However, this was not as well accepted as physical events. Only a few people joined in." (SME_2_1)

In the pandemic, it became apparent that planned physical events such as Christmas parties or organization functions were virtualized to reduce the risk of infection. Here, some virtual teams got very creative by sending packages to their team members, which were then unpacked together in a virtual meeting. At the Christmas party of interviewee C_2_5, the package contents served as the basis for the evening's activities.

"What came about around the Christmas party was actually that […] every employee got a package. There were various things in it that could be used for cooking […]. And so, all of them got together virtually that evening via Wonder. Everyone had cooked something for themselves and, yes, everyone saw each other virtually at dinner and with recipes that came out of the team." (C_2_5)

Several interviewees reported that many additional events took place in their teams during the pandemic. These included wine, gin, or beer tastings or jointly organized cooking evenings.

Some interviewees mentioned that they participated in virtual sport events with their teams during the pandemic. These sporting and physical competitions have additionally fostered cohesion in the virtual teams.

> *"The [...] team in my department did a virtual wine tasting last year. This works quite well, as each employee received a little wine at home and then digitally tasted this wine together." (C_3_1)*

> *"[…] we did the virtual sponsor run, where the team appeared as a team and spent the whole night on the treadmill, while it was broadcast live to colleagues." (C_2_3)*

In addition, many virtual teams planned virtual game nights. The interviewees feel that games (such as virtual pub quizzes, virtual escape rooms, massively multiplayer online games, or virtual board games) within or between different virtual teams could strengthen the feeling of cohesion, because they can tackle challenges that have nothing to do with work in an informal and creative way.

> *"But there are other possibilities, like this digital escape room. […] And I have to say that the effects [on team cohesion] are relatively strong." (C_3_1)*

It is particularly interesting that in times of the pandemic, opportunities were created to meet spontaneously virtually after work, in addition to the planned events. Here, the opportunities that arise from teams working together in the same place were transferred to the virtual space. For example, video conferences were used to meet for an after-work drink or regulars' table.

> *"Now, in times of the pandemic, I ask my teammates if they feel like having a beer in front of the monitor after work and [...] chatting or whatever." (SME_2_1)*

16.5 Discussion

In this study we investigated how COVID-19 impacted team cohesion of virtual teams. By conducting 26 interviews, we were able to shed light on how team cohesion measures changed on-the-job, in breaktimes, and after work as a result of the pandemic (see Figure 16.1).

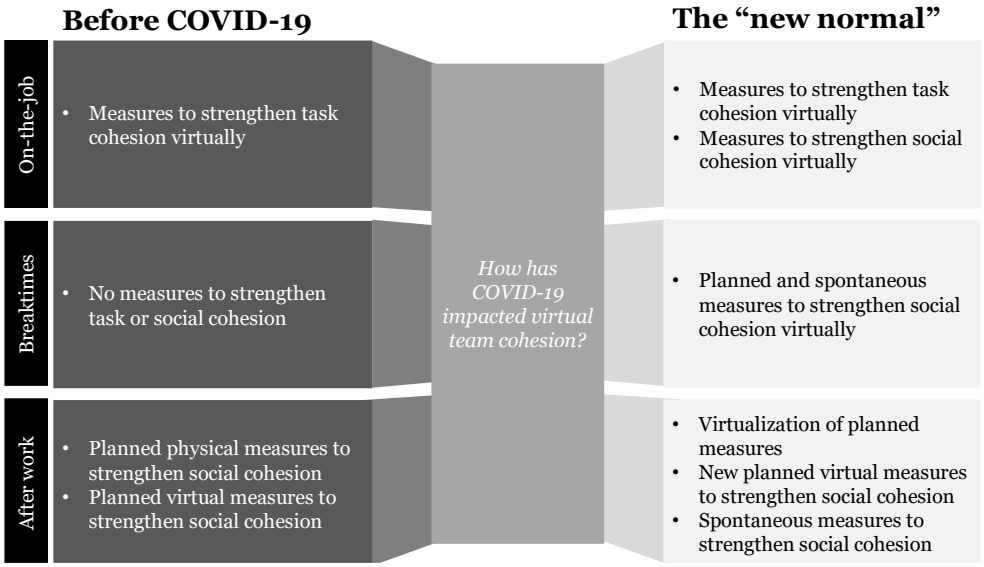

Figure 16.1: The Impact of COVID-19 on Virtual Team Cohesion in Virtual Teams

Pre-pandemic, measures to strengthen the cohesion of virtual teams **on-the-job** were mainly task oriented. The focus has been primarily on effective and efficient virtual team collaboration and hence on measures to enable planned (e.g., regular virtual meetings) and spontaneous substantive exchange (e.g., chats). Thus, the shared commitment to the team task could be strengthened (Zaccaro 1991; Zaccaro and Lowe 1988). These measures continued during the pandemic. However, due to the pandemic social cohesion in virtual teams has become more important to overcome feelings of isolation and loneliness (Whillans et al. 2021). Since continuous personal exchange increases the feeling of social cohesion in a team (Lilian 2014), many virtual teams deliberately scheduled time for personal exchange with the onset of the pandemic, even in meetings that were previously purely content-based (e.g., jour fixe). In addition, many virtual teams took measures to strengthen the feeling of being together in the virtual (e.g., camera on, avoid digital wallpapers) (Zeuge et al. 2021).

Before the pandemic, measures to strengthen social cohesion in virtual teams were mainly conducted after work. In other words, **breaktimes** were spent individually by team members. In our interviews, we could observe that breaks take on a new importance for social cohesion in the pandemic. We were able to identify measures to foster spontaneous personal exchange (e.g., virtual lunch breaks) as well as planned events (e.g., virtual sport sessions). Interestingly, both the spontaneous and planned measures were initiated as a grassroots movement by virtual teams. This may be explained by the fact that social interactions are very important for the well-being of employees (Kakar and Kakar 2018). At the same time, the feeling of being part of a team can reduce the risk of loneliness and the feeling of being left alone (Roy 2012).

Social cohesion in virtual teams was mainly maintained **after work** before the pandemic. To this end, team events or organizational events, such as Christmas parties or summer parties, were organized physically. There were also team events, which were already conducted virtually (e.g., celebrating achievements). However, due to the pandemic all planned events were virtualized (e.g., virtual Christmas parties) and were widely accepted. Indeed, with the outbreak of the pandemic, many virtual teams planned new and more regular events (e.g., virtual game nights) to strengthen social cohesion virtually. In addition, after-work events such as after-work beers were organized to get together spontaneously. This indicates that social cohesion has gained importance for many virtual teams even beyond work (Whillans et al. 2021). Working networks appear to be of greater importance in the pandemic (Marx et al. 2021).

Although virtual team cohesion has been studied for many years, the pandemic has fundamentally changed the nature and needs of virtual teams (Chamakiotis et al. 2021), making it necessary to reexamine virtual team cohesion. Our research contributes to the current state of knowledge by addressing the demand of further investigation on the "new normal" of virtual team cohesion (Waizenegger et al. 2020; Zeuge et al. 2021). Our study outlines to foster social cohesion as mandatory to overcome feelings of loneliness and social isolation. The primary cause is that people were isolated during the pandemic and craved social interaction and companionship. Social cohesion strengthening measures were brought to the forefront in virtual teams to address these needs. With our study we highlight that both planned as well as spontaneous cohesion strengthening measures, help to reduce psychological distance in times of social distancing. Future research can build up on these findings and investigate the influence of those measures on virtual collaboration outputs such as well-being, performance or organization commitment in times of the pandemic (Marx et al. 2021) in more deep. In addition, we outline that many measures for strengthening social team cohesion are translated from face-to-face collaboration to virtual collaboration. Examples include after-work drinks or virtual coffee breaks. Transferring proven measures from the real world to the virtual world to overcome the psychological distance offers a promising research area. Future research can build up on this finding and investigate if this transformation may apply to other areas of virtual collaboration, such as organization commitment.

Based on our findings, we also can derive implications for practice. For practitioners, this study is a clear indication that COVID-19 has caused a change in virtual team collaboration and virtual team cohesion. The advantages and disadvantages of the actual change are not the focus,

but rather the result as such; the “new normal” of virtual team collaboration is a fact that needs to be considered and respected. If leaders and organizations accept the “new normal”, then there are many ways to shape it. As an example, the coffee roulette is a practical measure. Adapting implicit exchanges from the real world to the virtual world created improved team cohesion that did not exist in virtual teams prior to COVID-19. In addition to these measures, other measures have been described in this study that can serve as best practices for leaders and organizations for the “new normal”. The “new normal" will become indispensable in professional practice. Virtual or at least hybrid working in organization work processes will also exist in a post-COVID-19 era. In this context, leaders, and organizations in particular are called upon to actively accompany this development and support it with suitable measures.

16.6 Outlook

Qualitative studies are able to generate deep insights into a subject that quantitative studies lack. This is what our qualitative study based on a total of 26 interviews about changes in virtual team cohesion through COVID-19 can provide. In compiling the sample, we took care to ensure the greatest possible diversity of interviewees to be able to represent a multitude of perspectives. This enables our qualitative study to still have good generalizability. Like any other empirical study, this study has typical limitations of qualitative research, but they also motivate further research. In a next step, our findings can be empirically supported by quantitative research, for example. Here, it seems particularly beneficial to distinguish the effectiveness on virtual team cohesion based on the identified measures. That there is a general effect could be explored through this study, but how large these effects are compared to the other identified measures could provide further exciting insights. In such cases, it might be helpful to explore interdependence through qualitative analysis.

It is likely that national factors, such as general societal attitudes towards COVID-19 and national COVID-19 prevention measures, could have an influence. However, these factors of internationality were neglected since the focus was on the general change in virtual team cohesion. To this end the consideration of these factors could broaden the perspective on virtual team cohesion. In addition, cultural aspects were neglected. Therefore, this study offers potential for further research. It could help to develop a more general theory about appropriate measures for virtual team cohesion. This would create the possibility of including external or personal factors in the analysis.

This study examined the "new normal" of team cohesion i.e., the change of team cohesion in times of the pandemic. Since this study is a snapshot of the current situation, it is likely that as the pandemic recedes, virtual team cohesion will be further impacted. This new "new normal" (i.e., the time after the pandemic) would then have to be reexamined and redescribed. However, the discussion participants agreed that the impacts of COVID-19 will remain in the future. Further research is recommended here, including to further challenge counterproductive behaviors, negative attitudes, or details about the technology.

16.7 Acknowledgements

We would like to acknowledge that this research is part of the inNOVATION research project. The project (HA-Projekt-Nr.: 977/20-134) was funded by the Hessisches Ministerium für Wirtschaft, Energie, Verkehr und Wohnen and the HOLM-Förderung.

We would like to acknowledge that this research is part of the aSTAR research project. The project was funded by the Federal Ministry of Education and Research of the Federal Republic of Germany (BMBF, funding code 02L18B010), the European Social Fund and the European Union.

In addition, we would like to acknowledge that subsets of the dataset used here have been used for other research within the projects (Zeuge et al. 2021).

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17 Leading Like a Rockstar

Title	**Leading Like a Rockstar – An Investigation of Virtual Team Leadership Behavior**
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Publication Type	Journal Paper
Publication Outlet	Information & Management
Status	Under review / 1st round
Full Citation	Weigel A., **Zeuge, A**., Schaefer, C., & Niehaves, B. Leading like a rockstar - An investigation of virtual team leadership behavior. *Information & Management*. (under review – 1st round)

Table 17.1: Fact Sheet Publication

Leading Like a Rockstar – An Investigation of Virtual Team Leadership Behavior

Abstract. The outbreak of COVID-19 placed extraordinary demands on leadership, as traditional team leaders became virtual team leaders at short notice. To lead digitally successfully, team leaders must adapt their leadership behaviors. Quinn's Model of Leadership Roles proposes leadership roles and competencies that team leaders should adopt to be effective. The barriers of virtual environments require adaptation of the roles and their competencies. This study adapts Quinn's Model to virtual team leadership by conducting 40 semi-structured interviews. The study highlights how the competencies characterizing the different leadership roles can be transferred to virtual team leadership, and identifies nine new competencies.

Keywords: Virtual team leaders · Virtual leadership behavior · Quinn's Model of Leadership Roles · Qualitative study.

17.1 Introduction

More than a century of leadership research has provided strong evidence that organizational success depends on effective leadership behavior [1]. Leadership behavior generally describes the behaviors and roles a leader performs in response to different circumstances [2–4]. This includes behaviors that relate to subordinates, teams, as well as to the organization itself [5]. Consequently, a considerable amount of leadership research is concerned with the question of what constitutes effective leadership behavior and which types of behaviors enhance the individual, team, and organizational performance [1,6–8].

The theory of behavioral complexity in leadership proposes a set of leadership roles that leaders should adopt for effective leadership behavior [9]. According to the theory of behavioral complexity in leadership, a behaviorally complex leader has the ability to "perform the multiple roles and behaviors that circumscribe the requisite variety implied by an organizational or environmental context" [9]. Denison, Hooijberg, and Quinn [9] used Quinn's Model of Leadership Roles (short: Quinn's Model) [10,11] as a method for classifying multiple (and sometimes competing) leadership roles. The model consists of eight roles: broker, innovator, mentor, facilitator, monitor, coordinator, director, and producer. Within each of the eight roles Quinn et al. [10–12] distinguish three competencies required to adequately perform the different roles (see Figure (Fig.) 17.1).

There is a general agreement that effective leadership behavior also plays a pivotal role in the success of virtual team work [13,14]. The rationale for this is that virtual teams are

characterized by highly complex and unique environments that are in a constant state of change [15–17]. Previous studies highlight leadership behavior as an important factor to maintain the effectiveness and performance of virtual teams, both directly and indirectly through the relationship between team characteristics and performance [15,18]. In addition, literature reveals that the behavior of virtual team leaders is crucial to minimize motivational and coordination losses [19,20].

However, research outlines that leadership behavior that is suitable for face-to-face teams cannot be readily transferred to the virtual environment and assumed to be successful [4,21,22]. While leadership behavior in virtual teams is likely to have the same performance-enhancing and relationship-building outcomes as in face-to-face teams, it may take a different form due to changes in the "availability of information", the "dispersion of the team", and the "permanence of the communications" [23]. Rather, virtual team leaders are forced to rethink and adapt their leadership behavior [19,24]. This gets even more important in times of COVID-19 since the pandemic has placed extraordinary demands on leadership behavior e.g., social isolation, battling a new set of distractions, or experiencing an unprecedented fusion of work and private life [4,25,26].

To successfully adapt leadership behavior to the virtual context, it is necessary for leaders to both expand and acquire new competencies [27]. To this end, we examine how the competencies of each leadership role identified by Quinn [10–12] can be transferred to the virtual environment. Further, we investigate whether the existing competencies in Quinn's Model are sufficient or whether virtual team leaders have to acquire new competencies to fulfill each role adequately in the virtual environment. We conducted 40 semi-structured interviews in 24 German organizations. Here, we interviewed both team leaders and team members to gain profound and comprehensive insights into the changing leadership roles.

Our study contributes to theory and practice alike: From a theoretical point of view, we adapted Quinn's Model to virtual team leadership and therefore provide a comprehensive investigation of virtual leadership behavior. The adapted model will enable future research to investigate virtual leadership behavior in more detail. For instance, our adapted model can be used to investigate the influence of leadership behavior on home office acceptance. From a practical point of view we provide an extensive and comprehensible understanding of virtual leadership behavior on which virtual leaders can build up in response to changing requirements. For

example, virtual team leaders can use our findings to expand or deepen their competencies in a targeted manner.

17.2 Leadership Behavior

17.2.1 Theory of Behavioral Complexity in Leadership

Leadership has been one of the most important concepts in management research [28]. Winston and Patterson [29] define a leader as „one or more people who selects, equips, trains, and influences one or more follower(s) who have diverse gifts, abilities, and skills and focuses the follower(s) to the organization's mission and objectives causing the follower(s) to willingly and enthusiastically expend spiritual, emotional, and physical energy in a concerted coordinated effort to achieve the organizational mission and objectives". Leadership refers to personality attributes, to characteristics of specific positions, or outcomes of specific behaviors [30].

Wakefield, Leidner, and Garrison [4] identified three research streams on leadership in organizations: First, the attribute-focused research stream which focuses on "who" the leader is. This research stream examines the leader's attributes and how these attributes influence individual, group, or organizational performance [e.g., 31,32]. Second, the relationship-focused research stream which focuses on "how" leaders interact i.e., how leaders foster relationships with subordinate [e.g., 33,34]. Third, the role-focused research stream which focuses on "what" leaders do [e.g., 2,9]. This research stream explores the roles and behaviors a leader performs to respond effectively to different circumstances. Since we aim to explore the leadership behavior of virtual leaders our study falls within the role-based research stream.

Leadership behavior is commonly defined in literature as the behaviors and roles a leader performs in response to different circumstances [2–4]. The behavior of leaders is critical for organizational success because, through their leadership behavior, they can influence and motivate their subordinates to fulfill organizational aims [35–37]. Several research studies emphasize that understanding the impact of leadership behavior is critical since leadership behavior is considered a pivotal driving force for the functioning and effectiveness as well as the motivation of individuals, teams, and organizations [38,39].

Research identified four dimensions of leadership behavior: The first dimension "*task-orientated behavior*" reflects the degree of task orientation of a leader's behavior [40]. This is the extent to which a leader defines and structures employees' work [41]. It is the leader's

responsibility to help the team to accomplish its task, for example by assigning and coordinating the team members' task or by setting clear individual as well as team goals [6]. The second dimension "*relation-oriented behavior*" reflects the degree to which a leader's behavior is employee-oriented [40]. This is the extent to which a leader cares about his or her team members and is concerned about their well-being, for example, by promoting team cohesion, managing conflicts, or making decisions in a participatory manner [41]. The third dimension on leadership behavior is "*change-oriented behavior*" [42]. Here it is the leader's responsibility to advocate and envision change, encourage innovation, and facilitate collective learning [7]. The fourth dimension of leadership behavior is "*external-orientated behavior*" [7]. This is the extent to which a leader is interacting with people outside the work unit (e.g., bosses, peers, and outsiders) [2,7]. It is the leader's responsibility to maintain networks outside the work unit, to represent the work unit, and to monitor externals [7].

In our study, we draw on the theory of behavioral complexity in leadership to investigate the leadership behavior of virtual team leaders [9]. Denison Hooijberg, and Quinn [9] describe behavioral complexity as "the ability to exhibit contrary or opposing behaviors (as appropriate or necessary) while still retaining some measure of integrity, credibility, and direction". The theory of behavioral complexity in leadership posits that effective leaders engage in a wide repertoire of roles and behaviors in response to unpredictable or complex situations [9]. Further, they avoid assuming other roles when a situation does not call for them [43]. The choice of theory of behavioral complexity in leadership as a theoretical lens is driven by particular challenges for leaders inherent in virtual teamwork i.e., "availability of information", the "dispersion of the team", and the "permanence of the communications" (Carte et al., 2006, p. 324). According to Wakefield, Leidner, and Garrison [4] it is appropriate to think of virtual leadership in terms of a repertoire of roles, as these challenges require the leader's role to change from direct supervision to that of an enabler.

The roles and behaviors, which are posited by theory of behavioral complexity in leadership, are derived from Quinn's Model [11]. Quinn [10,11] reviewed the literature on leadership behavior and summarized the leadership domain in terms of eight leadership roles (see Figure 17.1) which are represented in a circular pattern based on the two dimensions [10]: The first dimension (abscissa) displays roles to manage the internal (i.e., group-oriented) and the external environment (i.e., organization-oriented). The second dimension (ordinate) reflects organizational structure, from an emphasis on control to flexibility. Together the two dimensions form four quadrants which represent different leadership models that form the basis

of effective leadership behavior (Open System Model, Human Relations Model, Internal Process Model, and Rational Goal Model). Each quadrant contains two of the eight leadership roles, whereby each role complements the ones next to it and contrasts with the opposite [12]. Each role is characterized by three competencies, giving a total of 24. The roles are described below along their competencies [10–12]:

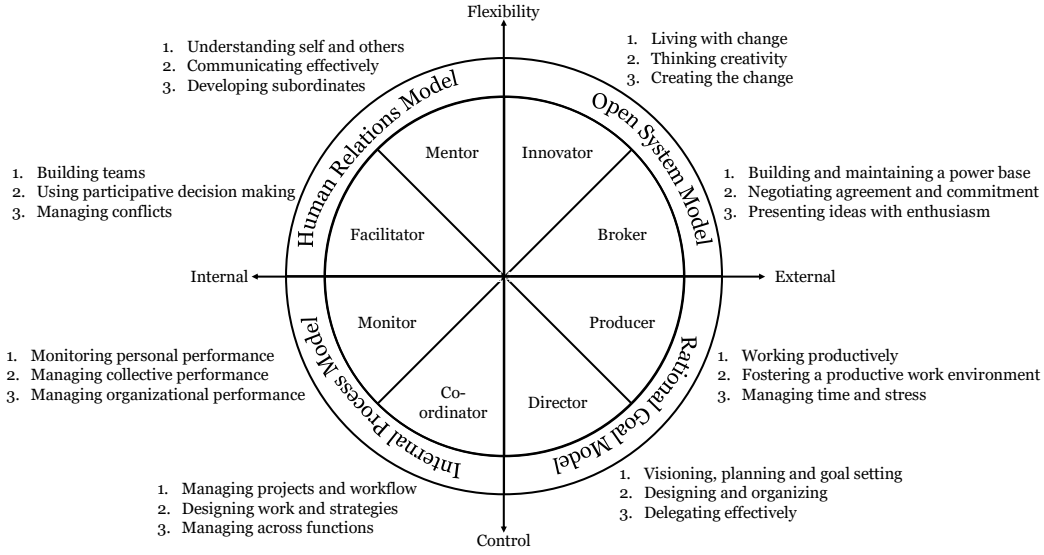

Figure 17.1: Quinn's Model

Broker role. As broker, the leader is expected to ensure external continuity. A broker has to acquire resources and maintain the unit's external legitimacy through developing and maintaining a network of external contacts. The broker is required to be politically astute, persuasive, influential, and powerful.

Innovator role. As innovator, the leader is expected to facilitate adaption and change. An innovator is a creative dreamer who sees the future and envisions and facilitates change in inviting ways. The innovator role requires the leader to conceptualize needed changes.

Mentor role. As mentor, the leader is expected to be aware of individual needs, to listen actively, to be fair, to support legitimate requests, and to attempt to facilitate the development of individuals. In this role the leader has to be helpful, considerate, sensitive, approachable, open, and fair.

Facilitator role. As facilitator, the leader is expected to encourage the expression of opinions, to seek consensus among divergent views, and to negotiate compromise. The facilitator role requires the leader to foster collective effort, build team cohesion, and manage interpersonal conflicts.

Monitor role. As monitor, the leader is responsible to collect and distribute information, check on performance progress, and provide a sense of continuity between discrete team tasks and the organization's plan. The monitor has to know what is going on in the unit and to see if the unit is meeting its goals.

Coordinator role. As coordinator, the leader is expected to maintain the structure and flow of the system. The coordinator administrates by scheduling, coordinating, as well as problem solving. This role is expected to be reliable. A coordinator involves a responsibility to set rules and standards.

Director role. As director, the leader is responsible to clarify expectations through planning, goal setting, and vision communication. The director is a decisive initiator who defines problems, selects alternatives, defines roles and tasks, sets rules and policies, evaluates performance, and gives instructions.

Producer role. As producer, the leader is expected to be task-oriented and work-focused, while striving to accomplish stated goals. The producer role requires the leader to optimize performance, foster a productive work environment, and manage time and stress.

17.2.2 Virtual Team Leadership

Globalization and digitization enable members of geographically and/or temporally dispersed teams to collaborate virtually [44]. While the term "virtual team" has been defined many times in literature [e.g., 45–47], the basic characteristics of a virtual team are consistent: geographic and/or temporal distribution of the team members, limited face-to-face communication, and interactions mediated by information and communication technologies (ICT) [48]. In other words, the key characteristics of virtual teams that distinguish them from face-to-face teams are (a) the spatial distance between team members that restricts face-to-face communication and (b) the resulting use of ICT for communication and collaboration team members [15].

In research there exist different definitions of "virtual leadership behavior". For example, Wakefield, Leidner, and Garrison [4] define virtual leadership behavior "as the leader's incremental influence over and above general compliance with routine organizational directives". Williams [49] characterized it as leading in an environment that is other than physical. In our study, we refer to Hertel, Geister, and Konradt [50] and describe virtual leadership behavior as the management of distributed work teams whose members predominantly communicate and coordinate their work via ICT.

Research acknowledges that effective leadership behavior plays a pivotal role in the success of virtual teams [15–17]. Therefore, virtual team leaders face the challenge of adapting their leadership behavior to overcome barriers of time, space, and culture. Research has made some valuable efforts to investigate virtual leadership behavior [51,52]. Appropriate communication, being present, building trust, and being empathic are essential in this context [47,53,54]. It is the virtual team leader's responsibility to create a culture of "belonging", "being there for one another", "caring", "listening", and "empathy" [55]. At the same time, since the team members look to the team leader for guidance, it is their responsibility lead by example [14].

Although virtual teamwork has been around for more than two decades [47], the pandemic has led to a widespread and long-lasting transition of virtual teams radically changing the underlying structures of virtual teams [27,56,57]: For example, virtual teams today also consist of employees who previously either did not want to work virtually or were not allowed to do so due to organizational politics. In addition, since the pandemic came at short notice, many organizations were not prepared for virtual teamwork, so employees often had to rely on personal ICT. Further, the pandemic has led to an unprecedented fusion of private and work life, for which the new virtual workers were neither technically nor substantively prepared.

Since virtual work has already increased over the past few years but was far from being the norm, the pandemic has placed extraordinary demands on leaders and their behavior [25,58]. At short notice and without any preparation team leaders transformed into virtual team leaders [55]. Given the new challenges facing leaders, research has begun to examine what effective virtual leadership looks like in times of pandemic [59]: For example, Chamakiotis, Panteli, and Davison [27] examine the extent to which existing knowledge from the literature on virtual teams can be used to inform leadership behavior in times of the pandemic. Bekirogullari and Thambusamy [25] investigated virtual leadership behavior for small businesses since these organizations are less familiar with virtual work. In a similar context, Bartsch, Weber, Büttgen and Huber [60] aim to investigate the effectiveness of leadership behavior in relation to employee work performance in the virtual caused by the COVID-19 pandemic. Harris [61] explores how school leaders are responding during COVID-19.

However, beyond these valuable research efforts, there is no research to date that addresses the competencies that virtual leaders need for effective virtual leadership behaviors. To ensure that virtual leaders can adequately fulfill the different roles [10–12] in virtual teams, it is necessary

to investigate how the different competencies can also be transferred in virtual settings and whether virtual team leaders have to acquire new competencies.

17.3 Method

17.3.1 Method Selection and Data Collection

In our study, we used a qualitative approach [62] to explore which different roles a virtual team leader has to possess vis-à-vis the organization and its team. We have followed a deductive, explanatory procedure of reasoning concluding from our interviews both from team leader and team member point of view, theoretically based in Quinn's Model [10–12].

As part of the study, we conducted 40 virtual interviews with an average length of 60 minutes. In order to assure the highest possible degree of contextual similarity, we conducted all 40 interviews within a brief period of one month (18 January and 18 February 2021). Among the 40 interviewees, 19 were team leaders and 21 were team members. The interviewees were between 20 to 61 years old, and the average age was 38 years, with an average age of 43 years for team leaders and 33 years for team members. Of the interviewees, 30% were female and 70% male. We interviewed enterprises of different industries (e.g., bank, telecommunication, mobility) and sizes (i.e., groups, small and medium-sized enterprises, start-ups) and municipalities. For better readability, we will use the umbrella term "organization" which encompasses enterprises and municipalities. Nevertheless, in the findings, we highlighted the distinction between the organization types as follows: groups (G), small and medium-sized enterprises, as well as start-ups (SME), and municipalities (M). In addition, for all citations, we have marked whether the interviewee is a team leader (TL) or a team member (TM).

To obtain a broader range of responses and for being able to elaborate on them by responding flexibly to the participants' answers, we used a semi-structured guideline with open-ended questions [63]. We followed Sarker's guide for qualitative research to avoid typical pitfalls of qualitative semi-structured interviews [63–65]. After the first three interviews, we improved our initial version of the questionnaire, requiring only minor changes. After another ten interviews, we evaluated again and had no changes.

The interview guide is divided into four categories. The first category encompasses questions about the interviewee (e.g., age, background, ICT competence). The second category deal with virtual teamwork. For example, "*How extensively and for what reasons did virtual teamwork exist before COVID-19? How has this changed through the pandemic?*". In this category, we

also seek to identify opportunities and risks within virtual teamwork with questions such as, "*What technologies were used for virtual teamwork prior to COVID-19? How are these technologies being used? Have there been changes in usage due to COVID-19? What are the technical challenges or limitations?*". The third category focuses on the role of the virtual team leader. In creating the questions, we adapted interview questions provided by Quinn [10] to guide qualitative studies of the eight roles and their competencies e.g., "*What are the most common formal communication problems in a virtual environment?". Here, we also added some new questions to investigate the responsibilities and the required competencies of a virtual team leader e.g., "What are the tasks of a virtual team leader? Are there any differences from a traditional team leader? What competencies does a virtual team leader need? Again, are there differences from a traditional team leader?*". In the fourth category, we asked questions about team cohesion and how the sense of belonging can be fostered virtually by the virtual team leader, for example, "*What cohesion-building events took place before and during COVID-19? How can a virtual team leader create a sense of unity and organizational identity? How can a virtual team leader build or maintain a personal relationship with his or her team members virtually?*".

17.3.2 Data Analysis

The interviews were recorded in German, transcribed non-verbatim, and translated into English for analysis. Subsequently, the interviews were analyzed using MAXQDA software, utilizing deductive and inductive content analysis methods by Mayring and Fenzl [66]. For this purpose, the eight roles of Quinn's Model [10–12] with the sub-competencies were used as a basis for the deductive content analysis. In the authoring team, we then independently analyzed the interviews according to Quinn's Model in a deductive manner, assigning the predefined Model components to the data. In case the authors noticed novel competencies during coding that the initial Model does not cover, these were noted. After ten interviews, the new competencies found in the coded interviews were discussed, grouped, and sorted into roles, forming an inductive loop based on the principle of axial coding and leading to a revised coding scheme [67]. We chose these discussion rounds to get closer to the final coding scheme in small steps. After agreeing on the extended coding scheme, the authors reviewed their already coded interviews and coded ten more. This process continued (four times in total) until all 40 interviews were coded. At the end of the 40 interviews, the authors independently re-coded all interviews again with the final coding scheme to have coded all inductively found aspects (see Figure 17.2). Differing opinions were discussed with another researcher and clarified by

consensus. Then, the axial codes were grouped by roles. We ended the analysis with saturation, i.e., when no new aspects of the existing or new competencies were found.

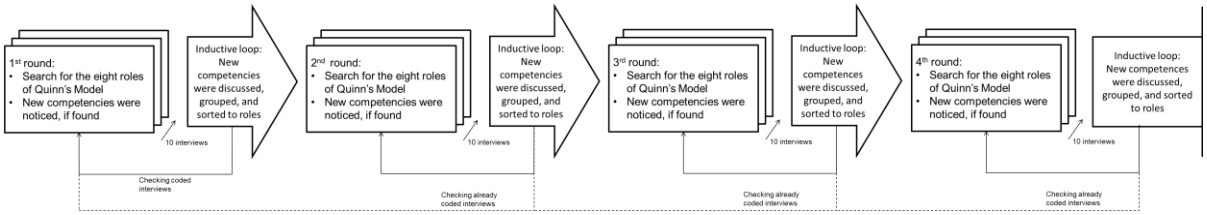

Figure 17.2: Process of data analysis

17.4 Findings

To present the findings in a structured way, we organized them along the eight roles of Quinn's Model [10–12]. We indicate how the competencies of each role can be transferred to the virtual environment. In addition, we identify new competencies that are necessary to adequately fulfill the leadership roles and were mentioned by both the team leaders and members.

17.4.1 Broker

Building and maintaining a power base. To build and maintain a power base, one responsibility of leaders is to continuously communicate successes and results to external audiences. In the context of virtual work, however, there is a lack of opportunities to spontaneously communicate successes or results (e.g., while having coffee with leaders of other departments). Therefore, it is the virtual team leader's responsibility to ensure that these results and successes are visible even virtually. To this end, the interviewees suggest introducing a regular interdepartmental exchange.

> *"On the department level, we also have an exchange meeting where everyone from each department briefly reports on what they achieved, so that we can also find out what the other departments are doing. Because this exchange in the office is missing." (SME_10_1_TM)*

Negotiating agreement and commitment. Since virtual negotiation takes place without direct eye contact and the perception of body language signals, it poses a special challenge for virtual team leaders. Thus, for successful virtual negotiations, virtual team leaders need different skills than in negotiations with a face-to-face counterpart. Here, the interviewees emphasized that it is necessary to build trust with the other party e.g., by turning on the camera. Further, the interviewees emphasized that it is important for virtual negotiations to continuously summarize interim results and explicitly designate responsibilities.

> *"You need to summarize more interim results or make the current status visible to all. Bring more transparency to the negotiations and decisions. So that all parties are on the same level. And I think it's important to show what part the other parties play in the overall decision." (SME_8_1_TM)*

Presenting ideas with enthusiasm. To present enthusiastically, not only a substantive and rhetorical presentation is required, rather, the use of facial expressions, gestures, or voice is essential. The challenge for virtual team leaders is that the use of ICT (e.g., video- or audioconferencing) prevents them from using appropriate gestures or body language. Therefore, they have to express their enthusiasm, especially through speech i.e., translating body language and verbalizing non-verbal signals. To this end, they have to place even more emphasis on content and formulation on the one hand, and the pitch of voice on the other.

> *"Speech is the decisive medium in the virtual environment [...]. Because you have to convince others through words and be able to engage other people. To be able to convince them of a project or an idea, and if necessary, to convince them to participate. Convince them of the situation and invite them to engage in the dialog. [...] And you have to do all that through words." (G_1_2_TL)*

Representing the organization. A new competency highlighted by the interviewees is that virtual team leaders have to represent their organizations virtually. Since negotiations no longer take place on the organizations' premises, the interviewees feel that the ties to the organization could be lost. Particularly in meetings with externals it has to be clearly recognizable which organization the leader represents. To ensure that virtual team leaders represent the organizational identity in virtual meetings, the interviewees suggest using virtual backgrounds with the organization's logo or merchandise such as coffee mugs.

> *"But we try to formulate a common vision because I think we need something we can unite behind. […] For example, by using the same logo in our Linked-In profiles. [...] To create an identity, we have a mug with our logo on it to strengthen identification." (G_2_1_TL)*

> *"However, when I think about this, I ask myself the question: How do you achieve identification with the corporate identity of the company and the corporate culture virtually? How do we create a representation here?" (SME_2_2_TM)*

17.4.2 Innovator

Living with change. Due to its complexity, virtual work underlies constant change from external. Virtual team leaders should be open to these changes and be prepared to adapt their competencies and mindsets accordingly. The interviewees emphasized that virtual team leaders should be both open and curious about change, starting with the adoption of new technologies. They should demonstrate a willingness to change as well as embrace change, which can help ease team members' fear of trying new ways.

> *"You have to be open to this constant change especially to new technologies and that's what I demand and expect to live. Because it's incredibly important so that we can move forward and by how the world is developing." (G_1_2_TL)*

Thinking creativity. One important competency that team leaders should possess to meet the challenges of constant change is being creative [68]. The interviewees emphasized that virtual team leaders need to be creative to deal with the special challenges of virtual work. Here, they highlighted that these challenges (e.g., lack of spontaneous personal exchange) can be overcome through creative approaches (e.g., interactive vote tools instead of face-to-face votes).

> *"In the past, we always held kick-off or debriefing meetings [...]. However, voting is more difficult in a virtual environment. [...] Now you must be more creative to find ways. For example, you can use interactive tools such as digital voting tools or digital whiteboards." (G_2_1_TL)*

Creating change. Leaders must not only be open to change but also actively initiate the change [69]. In the eyes of the interviewees, this is also true for virtual team leaders. In their eyes, it is important for virtual team leaders not to rest on the status quo, but to actively strive for change to continuously improve virtual work. A challenge for virtual team leaders is to perceive the need for change. Here, in the eyes of the interviewees, it is crucial to be attentive and to regularly request improvement opportunities.

> *"As a virtual leader, you have to change the way you think, because the idea of 'I've always done it this way, I'll leave it this way is not enough. You have to think about new things and look to the left and right to see what alternatives are available. Here, you have to request people to point out what improvement possibilities there are." (SME_9_1_TL)*

Living the change. In addition to these three competencies, the interviewees underlined a fourth competence of the innovator: living the change. The virtual team leader is required to actively live the change i.e., to lead by example. For both the team leaders as well as the team members, it is a necessary condition that the virtual team leader proactively drives changes e.g., by accepting new technologies or complying with communication rules. Therefore, the virtual team leader can ensure that changes are implemented sustainably and accepted in the long term.

> *"And that is another point I see: leading by example. It is incredibly important to set a good example and to exemplify the technical dimensions under such circumstances of virtual work [...] and I think it is very important in the environment of virtual work to set clear communication rules and to set a good example here as well." (G_1_2_TL)*

> *"That the leader simply takes you by the hand and ensures that everyone has someone to whom they can orient themselves. The leader sets the example [...] and says we're going to do things this way and that way. So, it's a common practice." (SME_1_1_TM)*

17.4.3 Mentor

Understanding self and others. Due to the lack of opportunities for face-to-face exchanges virtual team leaders have to be highly empathetic. Even more than traditional leaders, they need to listen carefully to compensate for important non-verbal signals that are sometimes lost using ICT. To this end, they need to be sensitive and mindful to recognize, understand, and empathize with the needs of their team members. Thereby, it is important to develop both a rational and emotional understanding of the team member's feelings. In this way, team leaders and members can strengthen their relationships virtually.

> *"This means what you don't notice in a face-to-face conversation with an employee i.e., what happens under the iceberg. Well, in terms of non-verbal reactions […] you don't get that in a virtual conversation, as you do in personal relationships. […] To be sensitive enough to see how an employee is doing via telephone or a camera, and to be able to manage that employee and not lose him or her. So, I think this is a new point that leaders now have to learn." (G_2_3_TM)*

Communicating effectively. Effective communication is also an important leadership tool for virtual team leaders. A challenge for virtual team leaders, however, is that informal conversations that used to happen in the hallway or coffee kitchen cannot take place.

Nevertheless, virtual team leaders have to be present i.e., they need to be reachable and approachable. To this end, they should be in regular and continuous contact with their team members (e.g., through care calls). Moreover, all communication should be clear and understandable. Especially in virtual settings, transparent communication is essential to build trustful relationships. Concise and unambiguous specifications help team members to orient themselves.

> *"I think it's absolutely important to be reachable and to have a trusting relationship. [...] Since you are relatively far away from each other and don't see each other, sensibility is important. And to be able to assess the right note. [...] You have to be more communication-oriented than before, you have to be more sensitive than before." (G_4_1_TL)*

Developing subordinates. Employee development also describes an important competence for virtual team leaders. Like the traditional team leader, it is their responsibility to develop their team members and offer appropriate training opportunities. For virtual team leaders, the interviewees emphasized that imparting digital competencies is particularly important to meet the needs of virtual work. It was underlined that teaching the necessary digital competencies is valuable during the introduction of virtual work and the onboarding of new team members. This becomes important for team members with less technical affinity.

> *"The transfer of competencies is important. That the employees working virtually, especially those with less technical affinity do not feel left alone but instead can approach their leader with any problems. Or rather, that he ensures that the necessary digital competencies are imparted." (G_1_2_TL)*

Being a role model. A new competence highlighted by the interviewed team leaders as well as team members is that virtual team leaders should act as role models. It was emphasized that on the one hand, team leaders should set a good example in the integration and use of technology in everyday work (e.g., by sharing their experience). At the same time, it is also important to prove that asking questions and making mistakes are part of the process (see: Fostering error culture). The interviewees emphasized that in this way, virtual team leaders can strengthen the basis of trust between leader and team member.

> *"And I think it's even more important in the virtual environment to really attend every appointment consistently in order to be a good role model for the team." (SME_2_1_TL)*

> *"Virtual leaders have a role model function. If my leader gives me the feeling that he trusts me 100%, then I will pass this on. So, the leaders have a very strong influence on how such things as trust are practiced. For example, I can say with a lot of luck that my leader gives me this trust. And that makes it all the easier for me to pass on that trust." (G_3_1_TM)*

17.4.4 Facilitator

Building Teams. Strengthening the feeling of team cohesion is important because virtual work, not only in the pandemic, lacks informal or spontaneous opportunities to connect. The interviewees underlined that it is the virtual team leader's responsibility to establish virtual opportunities to strengthen team cohesion on the job (i.e., during working hours) as well as off the job (i.e., after work). On the job, virtual leaders need to create virtual touch points to enable substantive as well as personal exchange. After work, team cohesion can be fostered through virtual socializing events.

> *"I think it is part of the leader's responsibility [...], to create opportunities to establish team spirit virtually as well. That doesn't mean just work-related, but instead joint lunch or coffee meetings." (G_1_1_TM)*

Use participative decision making. Participative decision making aims to reach an agreement under equal participation of all participants [70]. The challenge for virtual team leaders is to perceive and involve all participants equally. For example, under the conditions of virtual meetings, more self-confident team members may express themselves faster and easier than those who are more reserved. In addition, individuals with less technical affinity could stay out of the discussion due to insecurity. Virtual team leaders, therefore, need to listen carefully, be sensitive and proactively involve passive participants.

> *"So being able to listen even more carefully and be quiet and involve people who are more reserved, because the chance of losing those individuals in the virtual environment is higher." (G_2_1_TL)*

Managing conflicts. The nature of virtual teamwork (i.e., distance and communication via ICT) causes more diverse conflicts [4]. An important competence for virtual team leaders, as well as for traditional leaders, is to manage these conflicts. The challenge for virtual leaders is to recognize conflicts in their teams since ICT (e.g., audio- or videoconference) makes it more difficult to perceive non-verbal signals such as facial expressions and gestures. To identify

conflicts early, virtual team leaders need to communicate continuously with all team members and be particularly sensitive to nonverbal signals.

> *"When you see colleagues […], you can tell how they are by their gestures, their behavior, or their expressions. [...] And that's even more difficult virtually, because facial expressions, gestures, and the emotional world, doesn't come across to the same extent." (G_7_1_TL)*

Embracing diversity. In addition to the existing competencies of the facilitator, both the team leaders and team members highlighted that embracing diversity gets more important for virtual leaders. Virtual teams often consist of individuals with different experiences, interests, or functions. This is further amplified by differences in time, geography, and culture. Therefore, the interviewed leaders and team members felt that it is important for virtual team leaders to be aware of diversity and to embrace diversity by establishing tolerance and flexibility towards different working styles and communication patterns.

> *"COVID-19 has therefore completely revolutionized the future workday. Which is completely in my favor. I would prefer to work virtually with a lot of flexibility, and then maybe half a year here, half a year somewhere else over the winter days or something." (SME_9_1_TL)*

> *"So, for example, with the homeschooling, it can be that I am sometimes not available. Because maybe I'm explaining something to my daughter. And my colleagues know about that and consider it. That is important." (SME_8_1_TM)*

Creating emotional bond. From the perspective of both team leaders and team members, another new competence of the facilitator could be identified: to create an emotional bond of the team members. The physical distance and the corresponding lack of interpersonal contact can cause members to feel abandoned and may not feel committed to the team or organization. Therefore, one important responsibility of virtual team leaders is to emotionally involve team members in all processes to motivate them and retain their loyalty to the team as well the organization in the long term.

> *"It is my responsibility to create a feeling of emotional bond. […] It was in the first lockdown when we hired a new employee who left at the end of the year. And the reason was that he didn't manage to build up a connection with his colleagues." (SME_2_1_TL)*

> *"Because in virtual times, employees can no longer be sufficiently emotionally tied to the organization. Because all this familial relationship […] with colleagues simply become absent. As a virtual leader, I have to ensure this emotional bond." (SME_2_2_TM)*

17.4.5 Monitor

Managing personal performance. The respondents emphasize that virtual work requires more communication between the virtual team leader and the team member. Instead of a brief spontaneous exchange in the office or the coffee kitchen, an exchange must be actively requested. Here, it is the virtual team leader's responsibility to enable exchange for both issuing work assignments and discussing the results.

> *"The leader has to actively seek communication every time. What, I think, was also not so important before this intensive virtual work, that you present the results because you don't see the results anymore. Now you have to actively always talk about what came out of it." (SME_1_3_TM)*

Managing collective performance. To manage the performance of a team, there should be a continuous exchange within the team: Who is working on what? Who is the knowledge holder? What has been achieved? The interviewees highlight the relevance of coordination and communication within the virtual team to bridge the distance and avoid knowledge silos. Therefore, virtual team leaders should create opportunities for continuous substantive exchange within the team.

> *"Basically, my job is to keep the team together. That means really making sure that people come together as a team and exchange ideas. So that the knowledge is not distributed among individuals, but that the exchange is encouraged. That people in the team somehow coordinate with each other and know where each other stands at the moment." (G_3_2_TM)*

Managing organizational performance. To manage the performance of the organization, the interviewees emphasize that the virtual team leader should engage in communication and regular exchange with other team leaders and executives. The fact that collaboration is purely virtual makes it even more important that all leaders are always informed about who is responsible for which assignments. This ensures that no team or employment is working on the same tasks at the same time and that there is no redundancy or overlap.

> *"In order not to lose the overview in the organization, that everyone somehow knows what the other is responsible for. What is the status-quo? How close are we to the goal? And is everyone kept up to date and picked up in between? But that's a big challenge." (G_3_2_TM)*

Managing work without boundaries. Since individuals no longer work together in the same physical workplace, work inevitably becomes spatially and temporally delimited. Both team leaders and members, therefore, emphasize that virtual team leaders should deal with work without boundaries. It is no longer the time of presence that counts, but the work performance at the end of the process. To this end, they emphasize that virtual team leaders should lead with a focus on outcomes and results.

> *"I am results-oriented. I don't care how the employee achieves the result. Whether he does it at the weekend or on a workday, in the evening, or in the morning, it is basically legal for me. And our employees also appreciate that very much." (SME_5_1_TL)*

> *"Virtual leaders need a certain understanding of the personal situation in which employees find themselves. Part of that is allowing freedom in when and where I do my work." (M_5_1_TM)*

17.4.6 Coordinator

Managing projects and workflow. The interviewees suggested that virtual work requires more management of projects and workflows compared to centralized work. They emphasized that organizing schedules, coordinating collaboration, and aligning tasks in a virtual team are more important due to the complexity of virtual work. Here, the virtual team leader has to be a management talent because many different tasks have to be coordinated across many virtual meetings. A structured approach can help here.

> *"You should have certain skills to manage projects, to plan, i.e., organizational skills. In the virtual it is important that the leader is well structured to be able to manage everything." (SME_2_1_TL)*

Designing work and strategies. The interviewees point out that to design work and strategies, virtual team leaders should adopt an agile mindset. It is about actively steering the organization. Being anticipative and proactive is required to initiate necessary changes. This can range from day-to-day work to strategic work. Agile approaches can reduce the communication,

coordination, and control risks inherent in virtual work since they focus on interaction and communication.

> *"I would say that a virtual leader has to be able to think in a very agile way, especially at this time. The processes really have to be kept lean on the one hand and agile on the other." (SME_10_1_TM)*

Managing across functions. The interviewees highlighted that one challenge for virtual team leaders to manage across functions is to set clear priorities and divide the functions and inherent tasks into important and (currently) unimportant ones. This division makes it possible to manage the many functions (e.g., project manager, controller) virtually which are to be performed one after the other in different meetings.

> *"I'm definitely working on separating the important from the unimportant functions. And that has been totally important in this virtual environment." (G_2_1_TL)*

Fostering error culture. Both the team leaders and members emphasized the importance of virtual work to establish a constructive and positive error culture, as they feel an increasing risk of misunderstandings when individuals do not physically meet. According to the interviewees, an open error culture allows them to correct mistakes without losing trust. Especially since virtual work lacks opportunities for spontaneous exchange, it is important to be able to openly ask for help. In addition, it allows team members to offer their help and pass on knowledge, but also to learn from each other's mistakes.

> *"Yes, and I think that learning from mistakes will become more and more important in the future. […] We have to get used to leaving our comfort zone and have the courage to make mistakes. That's where I pay attention as a leader." (G_6_1_TL)*

> *"In other words, an open culture of error, so that people can learn more from each other […]. So, 'Let me show you this' or 'Here, I don't know what to do'." (SME_4_2_TM)*

17.4.7 Director

Vision, planning, and goal setting. It is the responsibility of both the traditional and the virtual team leader to set a vision, a plan, and goals. However, the interviewees mentioned that communication of the vision and the goals get even more important for virtual team leaders. It is the responsibility of the virtual team leader to bridge the virtual distance and ensure that the

team can identify with the vision and goals. The team member should know what is one' s contribution and that of the others to achieve the goals.

> *"When a team leader sets a vision or goal while giving employees what they need to do their job perfectly, that's exactly the kind of leadership. I think this is needed in virtual teams with some management." (SME_2_2_TM)*

Designing and organizing. The interviewees highlight that transparency is a prerequisite for designing and organizing virtual work. Virtual team leaders have to provide this transparency. Here, it is not only necessary to communicate transparently who is working on what and what deadlines need to be met, but also to be able to preview the next steps. The interviewees recommend daily stand-ups and the use of project management tools to create this transparency. Moreover, they expected the virtual team leader to create transparency, analogous to traditional work, about which team members are on vacation or have called in sick.

> *"So, it was definitely a big challenge to maintain transparency about the results. And then you realize that that has become incredibly important in virtual work." (G_2_5_TM)*

Delegating effectively. Team leaders should be able to delegate effectively. The challenge for virtual team leaders is not only to delegate tasks, but it becomes even more important to communicate expectations (e.g., What deadline? What quality? What tools should be used?). Such information can often be inquired and communicated spontaneously in centralized work. However, due to the lack of opportunities for spontaneous exchange, this must be communicated by the virtual team leader. In addition, due to the virtual distance, it is important that the virtual team leader not only knows whether the person has the skills to perform the tasks, but also whether it fits the person's current workload.

> *"Delegating tasks is still one of the most important tasks for leadership and in virtual it becomes important to clearly state expectations here. When people work virtually, there is less spontaneous communication and then things tend to go wrong quite easily. Moreover, it has become more important [...] to listen to the employees and find out how busy they are." (M_1_2_TM)*

Guiding through structures. Both the virtual team leaders and members underlined that virtual team leaders should guide by clear structures. From the interviewees' perspective, a

lack of structures in virtual work makes them feel overwhelmed and abandoned. By setting clear structures for virtual work, the virtual team leader can avoid productivity losses. Therefore, it is the responsibility of virtual team leaders to specify guidelines and structures e.g., by defining which tools are used, which meetings take place regularly, and how work outcomes are shared.

> *"I feel more like a captain on a ship who is the last to leave. That gives the employees structure and keeps discipline high." (SME_2_1_TL)*

> *"We have a guiding figure, someone who not only initiated the whole thing but also somehow leads the group and provides clear structures." (G_1_1_TM)*

17.4.8 Producer

Working productively. One challenge for virtual team leaders is balancing reachability and productivity. In contrast to centralized work, it is more difficult for team members or externals to determine whether the virtual team leader is currently working or available for questions and arrangements. This contrasts with the time slots for meetings, and preparation for and follow-up on appointments. It was emphasized by the interviewees that virtual team leaders need to actively create and communicate time slots to avoid productivity losses due to frequent interruptions.

> *"You have so many virtual meetings every day that it has become very, very difficult as a leader to create free space for content-related work. [...] In the meantime, it is simply super difficult to create free space to have these phases of concentration." (G_3_1_TM)*

Fostering a productive work environment. To foster a productive virtual work environment the interviewees stress that it is the virtual team leader's responsibility to set clear reachability policies. Virtual work blurs the lines between work and the private sphere and increasingly conveys the feeling of having to be reachable, which can increase the level of stress. To avoid negative health consequences, the interviewees recommend that virtual team leaders should define time slots for reachability and non-reachability as well as policies for recovery times (e.g., breaks) for both team leaders and members.

> *"I think it is very important for virtual work to set clear reachability policies. Because of this constant demand for reachability. As a virtual leader, you have to define with your team when you are actually reachable, in what form, and for which aspects? [...]*

I assume that you are often in a field of stress where you could easily become overloaded." (G_1_2_TL)

Managing time and stress. The interviewees mentioned that in contrast to centralized work, many short-term arrangements now take up space in their schedules which were previously done in the hallway in between. The large increase in meetings is perceived as negative by both team leaders and members. They describe the situation as stressful, hectic, and sometimes frustrating. They, therefore, suggest that virtual team leaders should always have a comprehensive overview of the work and manage time effectively, e.g., by setting time slots for meetings and independent work.

"My schedule is now filled to every square inch, including by my team members. If there is a gap, then it has to be filled somehow. That leaves you with little room to breathe." (SME_6_1_TL)

Reducing complexity. The degree of complexity in virtual work is characterized by time differences, the use of foreign languages, different ways of dealing with conflicts, group-specific communication styles, or simply technical unpredictability. Both the team leaders and members highlighted that it is the virtual leader's responsibility to reduce complexity. This can be achieved by creating transparency especially in terms of who is working on what. In addition, complexity can be reduced by clearly defining responsibilities.

"Complexity reduction I think is also important, because especially when you, always do such half-hour meetings, to every little thing, it is even more important to abstract once in a while and takes complexity out. It is even more important in virtual than in presence." (G_2_1_TL)

"So also keeping this transparency of the results there. In any case, it was a great challenge. And then you realize that it has taken on a tremendous significance." (G_2_5_TM)

17.5 Discussion

Our study shows that awareness of virtual team leadership is becoming increasingly important. 14 of the 40 respondents were not working virtually at all until the outbreak of the COVID-pandemic. Conversely, 26 of the interviewees, or more than half, were already working virtually to some extent. However, virtual teamwork now had to be fully implemented for all interviewees. It can be assumed that the advantages of virtual environments will continue to be

indispensable in the future [27,71]. Employees and team leaders, as well as organizations and processes, have adapted to this virtual way of working in a disruptive way [72]. For example, the pandemic left a noticeable and, at least in parts, long-lasting virtualization of our work and thus also of virtual team leadership [27].

In this study we examined how the different competencies of each of the eight leadership roles from Quinn's Model [10–12] can be transferred to the virtual environment. In addition, we were able to identify nine new competencies necessary to fulfill the various leadership roles in the virtual environment. From the perspective of both team leaders and team members, some competencies, such as team building, become even more important for virtual team leaders. Other competencies, such as delegating effectively, could be transferred to the virtual environment with little efforts. In addition, we were able to identify new competencies to fulfill each role adequately for virtual team leadership. In the role of mentor, for example, the role model function becomes a new competence. Only if virtual team leaders rise to the challenge of being role models for their team members, even at a distance, they will be able to fulfill the role of mentor in virtual teamwork in the future.

Figure 17.3 shows the adapted Quinn's Model in detail. Drawing on these findings, we describe the adapted roles for the virtual team leader below.

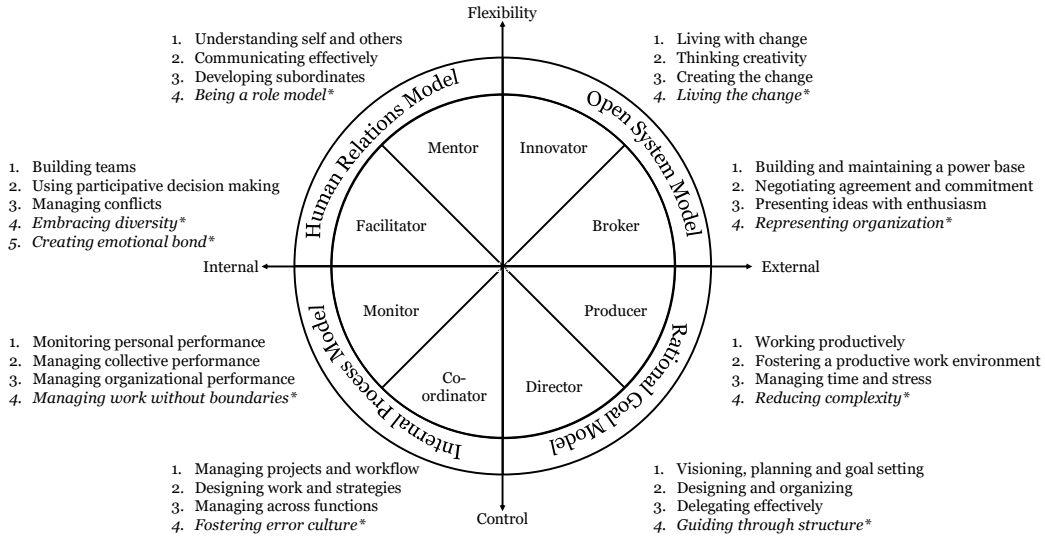

Figure 17.3: Adapted Quinn's Model for virtual leadership

Broker. As broker, the virtual team leader needs to provide external continuity. Here the team leader needs to adapt to the virtual environment to fulfill this role adequately. It is the virtual team leader's responsibility to make results and successes virtually visible. This includes continuously summarizing interim results and explicitly naming responsibilities. To this end,

the virtual team leader needs to adapt one's communication to the virtual environment by paying attention to the transport of content and formulations on the one hand and the tone of voice on the other. In addition, it is the virtual team leader's responsibility to represent the organization and one's team in the virtual environment.

Innovator. As innovator, the virtual team leader should both demonstrate a willingness to change and create the change. This can help ease team members' fear of breaking new ground. Virtual team leaders are also expected to be virtually creative to deal with the challenges of virtual work. This includes recognizing the need for change even virtually and regularly looking for ways to improve. Furthermore, it is the responsibility of the virtual team leader to ensure that change is implemented sustainably and accepted in the long term by living the change oneself.

Mentor. As mentor, the virtual team leader must be even more approachable, emphatic, and motivating. The mentor has to be able to virtually perceive the need for support on the one hand and support the team members on the other. To this end, regular personal, as well as substantive exchange, is essential to develop the team members. Transparent communication is essential, especially in the virtual environment, to build a trusting relationship. In addition, the virtual team leader should act as a role model.

Facilitator. As facilitator, the virtual team leader is responsible to actively soliciting participation from all team members to ensure that all team members feel integrated. This can also strengthen team cohesion virtually. Particularly the virtual team leader is responsible to pay intention to the integration of passive team members. Here, the team leader is required to be sensitive to nonverbal signals and to listen carefully. This enables the virtual team leader to identify conflicts at an early stage. Tolerance and flexibility towards different working styles and communication patterns are also important in this context. Furthermore, it is the responsibility of the virtual team leader to involve the team members emotionally in all processes to motivate them and emotionally bond them to the team and the organization in the long term.

Monitor. As monitor, it is the virtual team leader's responsibility to collect information and distribute it to the right places. Information can be, for example, performance progress or tasks. By performing this role, the virtual team leader ensures continuity between the competencies of individual team members and the overall structure of their teams. With centralized work conditions, it was possible to read the workload status of team members, for example, by

gestures and facial expressions. However, virtual work completely removes these possibilities of implicitly perceiving the workload. It is therefore necessary that verbal communication be given a new status, which then makes it possible to measure work performance virtually.

Coordinator. As coordinator, the virtual team leader is responsible to coordinate various tasks across many virtual meetings. Agile approaches are particularly advantageous in the virtual environment because they reduce the communication, coordination, and control risks as the focus are more on interaction and communication. Furthermore, different functions (e.g., project manager, controller) must be performed by the same person, often in close succession. Dealing with this change in function has therefore become more important than in the past. Fostering a positive and constructive error culture is an important responsibility of the virtual team leader.

Director. As director, it is the virtual team leader's responsibility to communicate the vision and goals. Team members need to be made aware of their role and what each team member can contribute. At the operational level i.e., in the design and organization of the virtual work, the virtual team leader is expected to create transparency. The virtual team leader is responsible to be sensitive to the workload and the skills of the team members to delegate effectively. In addition, virtual team leaders should provide clear structures to guide their team members.

Producer. As producers, the virtual team leaders are responsible for actively create and communicate time slots to avoid productivity losses due to frequent interruptions and task changes. Policies for reachability and non-reachability as well as policies for recovery times (e.g., breaks) should be established for both the team leader and the members. The virtual team leader should always have an overview of the current work and its progress because it is his or her responsibility to reduce the complexity of the virtual work. This can be achieved by creating transparency, especially about who is working on what.

17.5.1 Implications for Theory

In this study, we provide a comprehensive overview of the roles a virtual team leader performs to effectively respond to various circumstances and challenges in the virtual. Thereby, we contribute to the role-focused research stream identified by Wakefield, Leidner, and Garrison [4]. Here, we were able to confirm leadership behaviors already highlighted by literature such as appropriate communication, presence, trust-building, and empathy [47,53,54]. These behaviors also form a basis for virtual team leadership and have lost none of their importance [15–17]. New additions are virtual behaviors that are fulfilled in the real world by implicitly

focusing on a location (e.g., Building Teams). In the virtual world, these behaviors must now be explicitly addressed and fulfilled. Therefore, our findings underline the importance of the sense of belonging and organizational identity in the virtual environment [44,55,73].

The four dimensions of leadership behavior established in research [40] can also be addressed by the virtual leadership roles we have identified. In this way, we transfer leadership behavior to a virtual level. This then influences the research in terms of the dimensions of leadership behavior. An example can be the formulation of individual and collective goals [6], which must now also be virtual, addressing here in the virtual the role of the director and the monitor. In transfer, this also allows conclusions to be drawn about the change in leadership style [6] and team performance [74]. The virtual leadership model we have adapted can be of particular importance when it comes to the influence of leadership behavior on the introduction of home office [75].

Fundamental for this research is the adaptation of the model of Quinn's Model [10–12]. Therefore, we based our research on the theory of behavioral complexity in leadership (Denison et al., 1995). Researchers such as Wakefield, Leidner, and Garrison [4], or Kayworth and Leidner [18] have introduced Quinn's Model to investigate virtual teamwork. To the best of our knowledge, however, no research has been conducted to determine whether Quinn's Model needs to be adapted for virtual leadership. Therefore, we contribute to research in different ways: First, we were able to confirm the different roles with their competencies for virtual leadership and highlight different measures of how the competencies can be transferred to the virtual environment. Second, we highlight nine new competencies which are needed to adequately fulfill the different roles in a virtual environment. In this way, we contribute to the research by describing the eight roles and their competencies adapted to virtual team leadership.

As many organizations plan to continue working in at least a hybrid form in the post-pandemic period, this study may provide a valuable foundation for future research on the potential of virtual leadership behaviors [26,76]. For example, the finding could be used to examine the role of leadership behavior for technology adoption during and after the pandemic, since literature demonstrates that leadership behavior plays a critical role for technology adoption [13,77]. In addition, research can build on our findings and explore how technology should be integrated by virtual team leaders to foster a sense of team cohesion or organizational commitment.

17.5.2 Implications for Practice

“How do you lead teams that work virtually and not on-site?” This is a question many leaders have been asking themselves since the outbreak of COVID-19. For very few of them, virtual work has been the norm. With our study, we show how team leadership behavior has to change to meet the special requirements of virtual teamwork. Special requirements for virtual work can be, for example, that one must be aware that team members can get lost in the multitude of virtual possibilities. Here, the virtual team leader must “live the change”. It is not enough to use a tool or virtual method because others are doing it, but the virtual team leader must live the meaningful integration of change into his or her work processes in the role of innovator so that team members can then establish it in a meaningful way. In perspective, organizations can build on our findings and implement appropriate measures to raise awareness of these competencies or ensure that these competencies emerge in the first place. Here, we were not only able to show that leadership behavior is changing for virtual teams and that all interviewees are aware of this change but also that many are already actively implementing this change. None of our interviewees could imagine a complete return to the way of working before the pandemic. According to our interviewees, virtual work will become the working method of the future, probably not exclusively, but to a large extent.

To successfully lead virtual teams not only during the pandemic but also in the long term virtual team leaders have to adapt their leadership behavior [19]. This study was able to show, on the one hand, how the different roles and their competencies change for virtual team leaders. Many best practices of different organizations were shown as examples, which are the representative totality of the findings. On the other hand, we were able to identify nine new competencies that are important for virtual leaders and map them to the existing roles of Quinn’s Model. A particular challenge for team leaders is to maintain team relationships and motivate employees, even when they work from home. This study highlights the need to expand the role of the facilitator to be competitive in this space. It is not a given that these working relationships will work well in the virtual space without further action. However, the competencies of “Embracing Diversity” and “Creating Emotional Bond” demonstrate an initial approach to how virtual team leaders can address these employee needs.

Virtual team leaders can build up-on our findings and integrate suitable measures into their teams as well as expand and deepen their competencies accordingly. This is important for both current virtual team leaders and virtual team leaders in the future. Of course, these

competencies are expected to change even more as new technologies and opportunities are developed. In these times, virtual teams need a compass through the many possibilities. Therefore, this study helps team leaders evaluate their current behaviors and adapt them to the virtual. In this way, ongoing virtual work can be further expanded and strengthened.

17.6 Limitations and Outlook

We conducted a qualitative study to investigate the leadership behavior of virtual team leaders. In this study, we were able to discover how the competencies of Quinn's Model can be transferred to the virtual environment and, in addition, discover new competencies for virtual team leaders. Even though we tried to design our study approach as carefully as possible, this study comes with some limitations, motivating for further research.

Since this study is based on a qualitative study, we cannot confirm (yet) our findings with quantitative data. Future quantitative studies would allow validating the new competencies to Quinn's Model. Moreover, our study focuses on the virtual team leader, so we cannot draw any conclusions on whether the findings can be generalized to the Chief Executive Officer (CEO). Here, we encourage future research to investigate virtual leadership behavior with a special focus on the CEO. In this context, it should be further noted that external stakeholders (e.g., suppliers, distributors) were not considered in this study. However, since external stakeholders particularly influence the leadership roles of the right side of Quinn's model (external dimension), future research should take them into account as well. Another limitation regarding the interviewees, which should be mentioned, is that all interviewed team leaders and team members work in Germany. Therefore, one possibility for future research is to apply virtual team leadership to the context of transnational virtual team leadership. This would allow a more profound investigation of the leadership behavior of virtual team leaders and allow to identify competencies that are necessary to deal with challenges such as cultural or time-related differences. In addition, we conducted our study in times of the pandemic. As a result, the answers of the interviewees may be particularly focused on the current challenges. Conducting the interviews after the pandemic may result in some need for further competencies that could not be captured within this research.

17.7 References

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III Organizational Perspective

18 Influencers of Digital Transformation

Title	**Influencers of Digital Transformation: A New Concept of User Participation in IS Projects**
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Publication Type	Conference Paper
Publication Outlet	Proceedings of the 29th European Conference on Information Systems
Status	Published
Full Citation	Weigel, A., **Zeuge, A.**, & Sauter, L. (2021). Influencers of digital transformation: A new concept of user participation in IS projects. *Proceedings of the 29th European Conference on Information Systems*. (published).

Table 18.1: Fact Sheet Publication

Influencers of Digital Transformation: A New Concept of User Participation in IS Projects

Abstract. Influencers are very common in online marketing. Our study claims that the influencer concept can also be applied to digital transformation projects. Influencers of digital transformation projects may contribute to visualize the benefits of these projects and convince the end users of these projects. Therefore, we introduce the "influencer" as a new concept for user participation and investigate how it enhances the conversational key-user concept. We conducted an explorative study in small and medium-sized enterprises (SMEs), which implemented either the key-user or the influencer concept as participation concepts for digital transformation projects. We explored the relevance of influencers, by highlighting the differences of both concepts (i.e., influencer and key-user concept) in terms of focus, role, motivation, communication, function, direction and objective. Finally, we investigated the success factors of digital transformation in this influencer concept. Based on our results, we formalize the influencer concept, enabling the further implementation within organizations.

Keywords: Influencer · Exploratory Research · Project Participation · Project Management · IS Project · Digital Transformation Project · SME.

18.1 Introduction

On the internet, influencers play an important role. Whether it is on Instagram, YouTube or Facebook – they inspire or influence other people in their purchasing decisions for products (Brown & Hayes, 2008). Regardless of whether the consumer's decision concerns the next holiday trip, the new cosmetic product or the latest computer game, influencers have become one of the decisive factors in online marketing. The metaphor of a fisherman is often used to explain the effect of influencers (Brown & Hayes, 2008). The fisherman casts a big net to catch more fish. In terms of influencers, this means identifying those who have a large network and thus reach social communities so that as many people as possible can be influenced.

User participation is commonly defined as activities performed by users during system development (Barki & Hartwick, 1994a). Thereby user participation can have a positive impact on the success of an information system (IS). For example, it was shown that there is a positive link between user participation and user satisfaction (Kujala, 2003; Mckeen & Guimaraes, 1997), system quality (Lin & Shao, 2000; Melchor & Chaparro, 2008), as well as user acceptance (Bachore & Zhou, 2009). Two main types of user groups can be distinguished: end-users and key-users (Wu & Wang, 2007). End-users are the ultimate users of an IS (Wu & Wang, 2007). Key-users are users of the IS who are assigned to support other end-users in the

immediate work environment and who, for this purpose, participate during system development and cooperate with organizational as well as external specialists (Maas et al., 2016). Key-users are typically software experts (Maas et al., 2016) and act as educators, trainers, advisors and change agents (Wu and Wang, 2007). The participation of key-users in the development process can significantly affect the success of an IS (Pan & Mao, 2013).

We claim that the concept of influencers can also be applied to IS projects. Subtypes of IS projects are information technology (IT)-enabled organizational transformation and digital transformation projects (Wessel et al., 2021). According to Wessel et. al (2021) IT-enabled organizational transformation projects leverage digital technology in supporting the value proposition and enhance an existing organizational identity. However, digital transformation projects in contrast leverage digital technology in (re)defining an organization's value proposition and involve a new organizational identity.

In our study we are proposing a new concept for user participation, the "influencer", and investigate how it enhances the conversational key-user concept in digital transformation projects. To this end, we look at small and medium-sized enterprises (SMEs) and their efforts to successfully address digital transformation. Since SMEs have more limited resources compared to large companies, the challenges of digital transformation are more difficult to meet (Li et al., 2018; Weigel et al., 2020). Therefore, SMEs are dependent on finding a compatible path of digital transformation. We argue that influencers of digital transformation projects can help to make the benefits of these projects directly visible in the daily work and can convince end-users of the project and its goals. This might lead to a better acceptance of IS projects in SMEs and can thus maintain the competitiveness of SMEs.

Therefore, we raise the following research question (RQ):

RQ: What are concepts of user participation in digital transformation and how do they differ?

Our study follows an explorative research approach. First, we use the existing literature on user participation and key-users to gain a deeper understanding of the topic. Subsequently we briefly introduce the concept of champions, which seems to be similar to the identified influencer concept. Then we interviewed a total of 11 people with a semi-structured guide. Our results show that the influencer concept has the potential to revolutionize SMEs' approach to digital transformation. We discuss our results by deriving practical and theoretical implications. Furthermore, we show the limitations of our study and identify avenues for future research.

18.2 Related Work

18.2.1 User Participation

User participation can be defined as "participation in the development process by a member or members of the target user group" (Olson & Ives, 1981, p. 2). User participation enables users of an IS to interact with system designers and aid in many aspects of the system development process: planning, analysis, design, testing, and implementation (Lin & Shao, 2000). While some scholars use the term "participation" interchangeably with "user involvement", others differentiate between these two terms (Harris & Weistroffer, 2009): For example (Lin & Shao, 2000, p. 285) define user participation as "a behavioral construct (the degree of participative behaviors of users during the development process)" and user involvement as "a psychological state reflecting the importance and personal relevance that a user attaches to a given system". Harris and Weistroffer (2009) suggest that user involvement encompasses user participation, including both hands-on and psychological contact during system development. We refer to (Barki & Hartwick, 1994a, p. 60) and use "user participation" when referring to "the assignments, activities, and behaviors that users or their representatives perform during the system development process" and the term "user involvement" when referring to "a subjective psychological state reflecting the importance and personal relevance that a user attaches to a given system".

Barki and Hartwick (1994b) identified two research streams on user participation: The first research stream investigates the impact of user participation on system development outcomes e.g., system quality, use, and satisfaction (e.g., Hartwick and Barki 1994; Ives and Olson 1984). The second research stream investigates interpersonal processes, i.e., intervening and mediating the relationship between user participation and system outcome (e.g., Bostrom 1989; Robey et al. 1989). More recently, Schermann and Merz (2018) highlighted the role of user participation in a variety of project tasks including engineering, user training, and system adoption, as the predominant research stream (e.g., Hsu et al. 2008; Coughlan and Macredie 2002). Furthermore, research identified the relationship of user participation and adoption of IS (e.g., Hartwick and Barki 1994) as well as the role of user participation in the context of information security risk management as important research streams (e.g., Spears and Barki 2010).

Literature confirmed that user participation is expected to have a positive impact on the implementation and ultimate success of an IS (Cushing, 1990; Hunton & Beeler, 1997). It was shown that there is a positive link between user participation and user satisfaction in IS

development (Kujala, 2003; Mckeen & Guimaraes, 1997). Markus & Mao (2004, p. 535) propose that the quality of engagement by business professionals is important because "participation richness is related to [both] solution development and solution implementation success". Moreover, it was pointed out that user participation can increase system quality (Boland, 1978; Lin & Shao, 2000; Melchor & Chaparro, 2008). It is confirmed that user participation can increase user acceptance of the system (Bachore & Zhou, 2009; Kujala, 2003) and that IS developed with user participation better match requirements and specification than systems designed solely by IS professionals (Barki & Hartwick, 1989). Moreover, literature demonstrated that user participation creates a feeling of ownership to the IS, whereby user resistance will decrease and user commitment will increase (Lynne, 1983).

18.2.2 Key-User

There are two main types of user groups: key-users and end-users (Wu & Wang, 2007). Key-user groups are "the main groups of direct users of the IS – those users who access the system directly, or who use its direct outputs" (Gable et al., 2008, p. 387). They are selected from the operating department (Mahdavian & Mostajeran, 2013). As part of an IS project team (Wu & Wang, 2007), key-users represent the involved business units, have domain knowledge, and have extensive software knowledge (Pan & Mao, 2013; Maas et al., 2016). In contrast, end-users are the ultimate users of the IS. Their knowledge is limited to the part of the IS which they need for their work (Wu & Wang, 2007).

Key-users are involved in almost all stages of IS implementation projects (Mahdavian & Mostajeran, 2013): In the development phase, key-users are the developers of the requirements of the IS (Mahdavian & Mostajeran, 2013). In the implementation phase, they are involved in the tests needed for implementing the system (Rizoto-Vidala-Pesoa & Kuzņecova, 2017). In the roll-out and hand over phase, key-users function as specialists in parts of the IS and act as trainers, help-desk resources, advisors, and change agents for end-users (Rizoto-Vidala-Pesoa & Kuzņecova, 2017; Wu & Wang, 2007). However, most of the key-users still fulfill their on-going business functions (Maas et al., 2016).

The relevance of key-users was highlighted by Pan and Mao (2013). The authors mentioned four reasons, why key-users are critically important for system success: First, as representatives of the involved business units, their acceptance of the IS is a precondition for the system's success. Second, one of the key-user responsibilities is to provide business knowledge that is required for system configuration to ensure the fit between the IS and the respective business. Third, key-users, as representatives of their business units, support business units' managers in

important system decisions. Fourth, key-users are a prerequisite for effective knowledge sharing among multiple stakeholders, e.g., vendors, consultants, and end-users from different business functions.

18.2.3 Champions

The role of champions was identified by (Schon, 1963) in a seminal article on radical military innovation. Schon (1963) claims that a champion who identifies the innovation as his or her own, promotes the innovation actively and vigorously through informal communication channels. He or she risks his or her position and prestige to ensure the innovation's success is the key to overcome indifference and resistance that major technological change provokes.

Champions in terms of organizations are defined as individuals who informally emerge in an organization (Howell & Higgins, 1990) and “who made a decisive contribution to the innovation by actively and enthusiastically promoting its progress through critical stages in order to obtain resources and/ or active support from top management.” (Roure, 1999, p. 4). Their primary focus is to "make a decisive contribution to the innovation process by actively and enthusiastically promoting the innovation, building support, overcoming resistance and ensuring that the innovation is implemented" (Howell & Higgins, 1990, p. 40).

Champions are often proposed as a means to promote the adoption of IS (van Laere & Aggestam, 2016). To accurately reflect the nature of IS, to accurately capture the non-technical aspects that are seminal to successful IS innovation and to precise “critical stages” and “top management”, the definition of Roure (1999) was refined by Renken and Heeks (2019, p. 835) for the IS discipline: They defined champions as “any individual who makes a decisive contribution to the socio-technical innovation by actively and enthusiastically promoting its progress through critical innovation and diffusion stages in order to obtain resources and active support from all stakeholders.” Their primary focus therefore is to circumvent or push the innovation beyond approval and implementation barriers (Beath, 1991). By promoting their personal vision actively and vigorously, champions express confidence in the innovation, involving and motivating others to support the innovation and persisting under adversity (Beath, 1991; Howell & Sheabb, 2001). Renken and Heeks (2019) derive three characteristics to refine who IS champions are and what they do: First, IS champions focus on long-term results rather than short-term obstacles and therefore have a strategic vision about successful project outcomes and even beyond. Second, IS champions focus on relationships to promote ideas, rally support, and build consensus. Third, IS champions focus on resources by actively identifying and mobilizing resources needed to advance the project.

18.3 Methodological Approach

18.3.1 Research Design

This research is based on 8 interviews (5 individual interviews and 3 focus group interviews) with a total of 11 participants, conducted between January and March 2020. The interviews lasted between 40 and 60 minutes. Focus group interviews were sought whenever a participant had only been employed in an organisation for a few years (<=5). It could be assumed that these participants had not yet fully experienced the participation opportunities due to their low organisational affiliation and thus the evaluation might be limited. When making the appointment, we asked if there was a supervisor or colleague who could also take time for the interview. In the case of K-1, the response to our interview request was the organisation's IT expert. In response to our question about the supervisor, he additionally invited the managing director. In the case of K-3, the Chief Financial Officer (CFO) agreed to conduct the interview with us, who additionally invited the IT expert. Participant K-4 felt able to answer all the questions himself and independently, which was true. In interview I-2, participant 1 had only been in the organisation for 2 years, whereupon he invited a colleague with more years of organisational affiliation. The interviews follow an explorative approach to find out how concepts of user participation are used in the organization to successfully implement the digital transformation. Originally, we wanted to better understand the concepts of user participation in SMEs. However, we came across a new type of user participation, the "influencer". In our interviews, it became clear that 4 respondents followed this very exciting and innovative approach.

We used a two-step approach to scientifically investigate user participation. In a first step, we asked open questions, such as "What is your management structure in the organization?" or "How did you organize the responsibilities in the organization, especially the IT-related decisions?” In this process, we discovered the role of the organizational influencer. Based on this, we were able to further develop our semi-structured interview guide in the second step. The interview guide was supplemented by specific questions, e.g., " To what extent are you involved in the projects??" and, "Explain how the position of the influencer came about?”. This gave us insights from different perspectives, of user participation, namely from the organizations that use a key-user concept and those that use an influencer concept. The explorative character of this study is based on instruments of the Grounded Theory coding methodology (Gioia et al., 2013; Glaser & Strauss, 1967; Urquhart et al., 2010).

18.3.2 Data Collection and Analysis

All interviewed organizations have in common that they are active in the German industrial sector and are to be classified as SMEs. This combination enabled us to obtain different perspectives on the implemented participation concept. Table 18.2 gives an overview of the conducted interviews.

Interview		Used Concept	Age	Position	Work Experience in Years
K-1	**-1**	Keyuser	45	CEO	20
K-1	**-2**	Keyuser	40	IT	5
K-2	**-**	Keyuser	49	CEO	23
K-3	**-1**	Keyuser	51	CFO	2
K-3	**-2**	Keyuser	64	IT	30
K-4	**-**	Keyuser	50	CEO	5
K-5	**-**	Keyuser	37	CEO	10
I-1	**-**	Influencer	42	CEO	12
I-2	**-1**	Influencer	37	Sales	2
I-2	**-2**	Influencer	22	Sales	6
I-3	**-**	Influencer	46	Sales	6

Table 18.2: Overview of the Respondents

We started with the open coding method using the software MAXQDA (Corbin & Strauss, 1990; Glaser & Strauss, 1967). Two researchers read the transcribed interviews and applied independently the open coding method. The sentences and paragraphs were assigned code phrases that best represent the content. Next, similar codes were collected from the interviews and converted into the axial code. In this coding paradigm, the experiences and characteristics of the influencer concept could be captured and mapped. For instance, for the subsequent citation: "*I always think from the customer's point of view, because in the private customer sector it is almost normal for the customer to configure something like this digitally.*" (Interview I-1), two independent codes ("customer orientation", and "customer as digital native") were found. Finally, "customer orientation" was used as the axial code. Subsequently, the axial codes were grouped by subject areas. Different opinions were discussed with a third researcher and settled by agreement. We ended the data collection phase after all researchers agreed that there was a low probability that significant new insights could be generated by additional interviews.

When analysing the user participation concepts in the interviews, some text passages could be clearly assigned to the key-user concept. In other text passages we found significant deviations from this known concept. Whenever we found deviations from the key-user concept known from the literature, we noted them. One interview partner (I-1) called his approach the influencer concept. After reviewing the commonalities of the interviews (I-1 to I-3), it became clear that we had found a new form of user participation. However, interviews I-1 to I-3 all describe a similar conceptual approach, so we combined them into a new unified concept, the *influencer concept*.

18.4 Findings

First, we present the results of the interviews on the key-user concept (K1-K5) and then the findings on the influencer concept (I1-I3). The researchers found that the self-image of the influencers and their attitude towards digital transformation issues played an immense role in the organization. We examine both the top management perspective, which looks at organizational conditions, and the employee perspective, which looks more at operational conditions. Subsequently, the differences between the two concepts are presented and discussed.

18.4.1 Interviews about the Key-user Concept

Organizations that apply the key-user concept are characterized by the fact that key-users are responsible for a specific purpose. For example, one of the interviewed CEOs limits the area of responsibility of the key-users to a specific software. Furthermore, different key-users are responsible for the different departments of the Enterprise-Resource-Planning (ERP) system. Thus, the responsibilities of the key-users are limited to the process steps in a software.

> *"Our key-users are always responsible for a specific system. We have key-users for our ERP system and others for the CRM system. For our ERP system, we then have different key-users for the different perspectives. For example, one person is key-user for purchasing, another person is key-user for the sales process in the software."- Interview K3-1*

This quote makes clear that key-users are always limited to their task and the software they use. The scope is deliberately limited, all alternative solutions or process steps that are not covered by the software are not intended. The key-users are selected by the CEO and e.g. by the IT manager based on their previous knowledge. In the event the key-users have new tasks

to perform, they are sent for training to acquire skills that they will pass on to other employees in the organization.

> *"A key-user is a person who is already well acquainted with the software used. Depending on the area, you take the person who has worked most with the software so far. If nobody really knows the software, a young colleague, for example, is assigned to look after the software as a key-user. This person is also trained."- Interview K3-2*

> *"In the end we usually make one of them an expert and he passes this on to the others. This is definitely the case when using a 3D scanner and the corresponding software. The training was so expensive that we could only send one person for training. That was the key-user, who then trained the other colleagues internally."- Interview K-2*

It is interesting that a key-user often does not select the task, but is appointed to it or selected due to his or her qualifications. In the project context, a managing director sees the key-user's task to provide impulses for the new IS and to gain an overview of the software's areas of application. The key-user is invited to identify further possible applications of the software. However, the key-user is always limited to the software. It is in his or her responsibility to ensure a smooth operation of an existing IS.

> *"I see the demands on the key-users as being to provide impulses for software use, to give an overview of the main topics, and since the existing business operation is in the foreground, the business operation must simply run optimally with the software."- Interview K-2*

For the purpose of process optimization along a software development, the key-user acts as an intermediary between management, IT and end-users. During the development process, he or she should pass on the requirements of the end-users to the Information Technology (IT)-department so that the IT-department can implement these requirements. Afterwards, the implemented requirements are communicated to the key-users, who in turn pass the information back to the end-users. The information exchange from key-user to end-user often takes the form of small training sessions. In this way, the key-user becomes a multiplier for the new functions available in the software.

> *"The key-users define the requirements for further system development. The IT-department then implements them and returns this information to the key-user. The key-user in turn then informs the department"- Interview K-1-1*

Key-users have the possibility to report problems and suggestions for improvement. These are forwarded to the IT-department as change requests. In contrast to the IT-department, the key-user has a very good overview of the individual processes in the organization, as he or she represents the interests of the department he is working for. This facilitates mediation between management, IT-department and end-users.

> *"Key-users know how to present the problem or suggestions for improvement verbally, but they also have a good overview of the individual processes within the department, the individual interfaces to other departments and can keep track of thing."- Interview K-1-2*

The CEOs in our sample avoid making instructions or decisions without discussing them with the key-user, since the key-user has knowledge and experience in the project as well as the daily business and has an overview of the suggestions of other employees. Key-users pursue the objective of finding a solution that takes into account the suggestions of the end-users and represents an optimal solution for the organization. In addition, the expertise of the key-user is taken into account and – since the key-user knows the software – the technical possibilities of the IT solution are also considered.

> *"I do all this only in cooperation with the key-user. I don't make decisions or give instructions at this, let me say, I like it when employees make alternative suggestions so that we can discuss them and find the best solution for the organization."- Interview K-4*

18.4.2 Interviews about the Influencer Concept

The interviewed CEO is organizationally responsible for the influencer concept in his organization and has introduced the concept in the organization. He laid the foundation for the digital transformation and the influencer concept by taking his customers' perspective. Since the organization mainly produces for private customers, this customer group is already used to using digital tools for product configuration. The CEO enables his organization to digitally map a customer order from inquiry to delivery.

> *"I always think from the customer's point of view, because in the private customer sector it is almost normal for the customer to configure something like this digitally." - Interview I-1*

From this strategic perspective, the CEO has created a feasible roadmap for the digital transformation. He analyzed the current situation of the organization and determined that there is not enough internal IT expertise available for this transformation. The CEO therefore recruited an IT specialist as a freelancer to accompany the organization on the transformation-journey. However, it was important to the CEO that the organization built up its own digitalization competencies. Hence, he selected employees in whom he saw the potential to help shaping this digital change. These employees were to learn from the freelance IT expert and translate his expertise into practical applications for the organization.

> *"You have to imagine it this way: We don't have any IT professionals, we have a freelancer who supports us a little bit, but my ability is that I can develop people well. Then I chose this colleague because he was interested and wanted to continue his education."- Interview I-1*

For the CEO, an employee's motivation to drive the digital transformation is the most important factor, i.e., the intrinsic motivation of employees to improve their work with digital tools. For each of the digital transformation projects there is a one-hour meeting every week and the influencers have become the driving force in these meetings. The CEO even observed that the actual progress of these projects has accelerated compared to previous projects. In addition, the influencers are more capable than the CEO of convincing the end-users of the need for change. The CEO concludes that the process knowledge of the influencers significantly reduces the resistance of other colleagues to possible changes. He reasons that the influencers have really understood why these changes are necessary for operational processes. The influencers are involved in the entire process from idea to implementation. This involvement the dissemination of information from the projects much more efficient, as the influencers inform the other colleagues almost casually about the project steps.

> *"The organization consists of three product areas, and I looked at who had an intrinsic interest in digital transformation and I pulled these people from each area together. These influencers are part of the project groups, which means they are present at the weekly one-hour meetings. My experience is that the influencers understood that things change and that you have to change. Also, everything is getting faster and faster. It's a good idea to involve these influencers in the project from the beginning and then give them positive feedback to each department. That goes down much better than someone who implements it as a manager. If someone doesn't want to implement something, he*

always finds reasons why something doesn't work. This method works quite well."- Interview I-1

After the introduction of the influencer concept, the CEO's role in the projects also changed. From being a driving force of digital transformation in the beginning, he increasingly became a mentor for the influencers. Initially, he actively supported the project. As the development progressed, the CEO was able to withdraw more and more, since the influencers as digital transformation drivers were much more involved in the projects than the CEO could have been. The involvement of influencers goes as far as that the digital transformation only works because the influencers are involved.

"What the influencers lacked was structure. I had to create a structure, purely organizational. For example, the influencers had to learn how to approach projects once a week, organize it and follow it up. That took about two years, but now it's working very well and I just sit down at the Jour Fixe and they report. Sometimes they ask me, but that works quite autonomously. (...) You can see that the influencers have become independent in the meantime, because they enjoy it. (...) I have a feeling that the digital transformation will only work if the influencers participate."- Interview I-1

The interviewed influencers are commercial employees who spend only part of their working time in the digital transformation projects. They are still involved in the operational tasks of the organization in their departments and the task as influencers takes a second place. One of the interviewed influencers can also draw on experience in IS projects from his previous job. The other influencer, however, was recruited solely on the basis of personal motivation. Both influencers state that they can only successfully manage the digital transformation in cooperation with external IT experts.

"I've just already managed a few IT projects in my life. Of course, the CEO found this fact interesting and included me. In the future it will be about the development of a new configurator, I'm not writing the software but I'm the manager who creates the concept and supervises the implementation. For the actual implementation we have external people."- Interview I-2-1

"The CEO addressed me: "Here's the situation, IT-wise, how fit are you?" I said at the time that I was relatively inexperienced. But I'm interested in it. And then he gave me the chance. The good thing is that we work with an external IT company. When they

finish various tasks for us, I look at the results and then the next time I can do it myself." - Interview I-2-2

The two influencers work very closely together in their secondary activities. The interesting thing about their main tasks is that there is hardly any overlapping of expertise. Therefore, the influencers jointly examine possible projects and then jointly decide who will take over which project. Of course, digital projects concerning the main tasks are also supervised by the influencers, but projects that cannot be clearly assigned to a specific department are then "tackled together". Thus, with the involvement of external IT experts, this clearly shows that nobody feels left alone with the projects at any point in time.

"We also divide the projects up a bit, depending on what we know. We come from two different departments, so he makes the configurator for one product group and I make the configurator for the other product group. The big projects, the projects where nobody is operationally specialized, we tackle together."- Interview I-2-1

In addition to this self-organized division of tasks, the handling of the digital transformation projects is also an interesting aspect. Here it can be observed that the influencers apply the usual methods and procedures of project management. For example, a specification sheet is created that serves as a basis for external offers. On this basis, an offer is selected that appears to best meet the requirements. As the project progresses, it is remarkable that change management seems conventional at first glance. Only the persistence of the influencers should be mentioned. Since the influencers do not insist on a specific software, but always have the optimal handling of the process in mind, they always question the project result itself very critically. For the influencers, a successful project is first and foremost a project that improves the previous process.

"We had defined an artificial intelligence that could automatically classify documents. For example, an algorithm that can distinguish between internal and external invoices. When the IT expert we hired told us that it didn't work fully automatically (...), we wondered if another competitor could do it better. During the project we weighed up the pros and cons again. (...) In our projects we pay more attention to the process to be improved than just the software."- Interview I-2-1

At the end of a project the process must convince the influencers. This internal conviction is very important to convince the end-users of the success of the projects. Here, the influencers highlighted that they still feel responsible for their project results and the associated process

even after a project has ended. For example, the influencers do not force these new processes on any of their colleagues but concentrate on showing the improvements. This convinces the end-users after a certain training phase.

> *"My colleagues can always contact me if they have any questions. Usually it's like this, then I don't really get any feedback on the new projects. After one or two weeks, I talk to my colleagues to get feedback (...) I then show the end-users what benefits they have from the solution or what time can be saved."- Interview I-2-2*

The level of communication between influencers and their colleagues is very informal. Information is passed on to colleagues almost casually, for example in short meetings or during coffee breaks. In this way, the influencers can inform about the progress of the projects at very short intervals. For more formal content, which is not intended to convince but to explain, the influencers use presentations sent by e-mail. According to the influencers, all this is done via "small channels". More rarely, however, meetings in the presence of all colleagues and, for example also with the management, are possible to discuss project topics.

> *"We have a channel. On one project, I wrote a PowerPoint presentation and sent it around: "Look, it is super fast, super easy..."" - Interview I-2-1*

> *"We communicate on a buddy basis. (...) I would say you could just get everyone together and talk to them."- Interview I-2-2*

Besides communicating and influencing internal colleagues, the influencers also serve to translate the digital requirements. Through their entire experience in digital transformation projects, they know how to draw up their own problems and the problems of their colleagues for IT experts and the CEO. Thus, a problem description first becomes a process analysis and then, depending on the urgency, a requirement for the software. In the opposite direction, the influencers are able to communicate the answers and solutions of the IT experts to their colleagues in an understandable way. In this way, possible misunderstandings and dissatisfaction are largely avoided.

> *"I am called in because of my experience to get to the heart of the projects, because I have often dealt with IT people and businesspeople who don't necessarily speak the same "language"."- Interview I-2-2*

It is interesting to observe that the influencers do not see themselves directly as such. They identify themselves essentially through their main activity in the organization. Although the

activity as influencers is not primarily in the foreground, this function is nevertheless omnipresent when the influencers casually talk about their projects and project progress. It goes without saying that the influencers consider current digital topics such as artificial intelligence and its implementation in one of their projects. The influencers also take responsibility for these projects and serve as contact persons for the CEO, end-users and external parties. Here, they often provide unsolicited and casual information about the current status.

The end-users are well informed about the projects of the influencer and organization. This is particularly interesting because the respondent states that he is not primarily affected by one of these projects, but nevertheless knows what the status of the project is and what possible consequences it will have for him or her.

> *"The influencers have told me this before, but I have not actively asked them about it because it does not directly concern me. It is then casually explained that it is a separate project to make our organization as paperless as possible and that colleagues are familiar with its implementation."- Interview I-3*

It is also interesting that the end-users want to become influencers for a solution as soon as this solution is available. Even more restrained, but then in all clarity, the remaining end-user are aware that as soon as a project is in the introduction phase, it should be supported. Due to a strong "feeling of unity", every end-user feels very identified with the organization and projects of the influencer. This suggests that the influencer concept probably works because end-users do not feel negatively manipulated, as it may be the case with external interventions such as management policies or objectives (Green & Pawlak, 1983). The end-users themselves feel much more infected by the project and its positive effects on their work.

> *"And when that happens, yes, then of course I have to become more of an influencer. Then I also have to inspire people that this is a great project and that they have a positive value for their daily business."- Interview I-3*

The end-user has a very positive attitude towards the influencer concept. Furthermore, the end-user understands the sense and value of the projects. Finally, it is easier for him or her to accept possible changes at an early stage. He or she feels involved in the projects, even if he or she is not an original member of the projects. The end-user is passively and casually provided with information about the projects. This means that he or she is also aware of the effects of the projects on his or her future working environment and can adapt to those early on.

18.4.3 Overview of Key-user Concept vs. Influencer Concept

The influencer concept can be seen as an enhancement to the key-user concept that has been widespread and established in other organizations. The influencers have become the decisive factor for digital transformation projects. In Table 18.3 we compare the main points of the influencer concept with those of the key-user concept. In the following section we go into these points in more detail.

Concepts	Key-user	Influencer
		
Focus	Software implementation	Process transformation
Role	In the project and the daily business	Mainly in the daily business
Motivation	Extrinsic	Intrinsic
Communication	Request / Response	Publish
Function	Represents professional interests	Promotion of the transformation
Direction	Top-down	Bottom-up
Objective	Sustainability of the software	Sustainability of the process

Table 18.3: Comparison of Key-User Concept vs. Influencer Concept

Focus: The focus of the respective concepts seems to be different, although both concepts pursue user participation. While key-users focus on a specific software implementation (Maas et al., 2016), influencers take a more holistic view of process change. Influencers, as we found out in this research, are experts in the business processes and always focus on the best possible change for the respective process. In case of doubt, influencers use different software solutions for the optimal process. Key-users acquire specific knowledge about a single software solution and therefore have a more narrow focus because they are more involved with the software than with the process.

Role: Key-users in the project team are often only involved in certain phases of a project (Mahdavian & Mostajeran, 2013). For example, they are involved in the project for the collection, evaluation and training of requirements (Wu & Wang, 2007). This involvement of key-users in the projects is a necessary, but not sufficient, condition for the success of many projects. On the contrary, influencers are both, a necessary and a sufficient factor for digital transformation projects. Influencers are therefore an elementary component of the project. However, influencers are still active in their actual roles in the organization. Influencers

continue to carry out their previous tasks and manage to fulfil both tasks well through synergies between the digital transformation project and their main task. Key-users are also divided into two roles as described (Maas et al., 2016). However, they often have one main role in an organizational process and the other role in a development project.

Motivation: The combination of main tasks and project tasks often motivates influencers intrinsically, as they can see the possible improvements in the processes they work on every day. In addition, when influencers are chosen, care is taken to ensure that they have an interest in the framework of the digital transformation. Since key-users are selected, e.g., by the project manager, they consider this task independently from the overall project (Mahdavian & Mostajeran, 2013). They are also used to the process, but their focus is on adapting the process to the project or software. Usually this key-user task is another task for which key-users are paid or otherwise rewarded.

Communication: Key-users often communicate in a request and response process. This means that key-users receive a request, e.g., from the project manager (Pan & Mao, 2013). This request is answered with a software test or processing (Wu & Wang, 2007). This communication usually takes place internally, i.e., with the project team or with the end-users. The project team plays an important role for the key-users and their task in the project. Influencers, however, see themselves as independent and serve as the central point of communication within the project. They communicate in a kind of publication process. This means that influencers communicate regularly and unsolicited with end-users as well as other people involved in the project. This does not require a request but rather happens randomly.

Function: Influencers pursue the function of promoting the change that the project aims to bring about. They are responsible for the projects and acceptance of these projects. It is therefore in the influencers' interest to convince end-users early on of the changes brought about by their project. However, they do not understand this task as a work instruction, but rather implicitly promote the changes by letting the possible improvements speak for themselves. This refers not only to their own process, but also to the organization´s processes. The function of key-users, on the other hand, is to represent the interests of the respective departments from which they were appointed (Maas et al., 2016; Pan & Mao, 2013). This can mean that only those process steps that affect the respective department are taken into account by the key-user (Mahdavian & Mostajeran, 2013). For example, downstream and upstream processes must be considered by other key-users. This can lead to tensions between

departments, if a positive change in one department leads to negative changes on other departments.

Direction: The way how a concept is introduced has a significant influence on how the concept is lived afterwards. This difference becomes particularly clear when considering the two concepts. When key-users are formally named by the CEO, they also see their task as a formal task. Here there is a clear top-down system. Although the influencers themselves are called to this task by their responsibility for a process, it is more a passion than a task. Here, a bottom-up development is obvious.

Objective: In summary, key-users are responsible for the software. Moreover, they train end-users and are experts in the respective software. Key-users are interested in further developing and adapting the software. They are involved in the expansion and sustainability of the software (Pan & Mao, 2013). In contrast, influencers are responsible for the business process. The software solution used is not as important to them as the expected improvement through it. When influencers notice that the changes do not achieve the desired effects, they question the decisions that have already been made. This leads to an enormously high sustainability of the processes, but it also creates risks regarding project continuity.

18.5 Discussion

To address our RQ, we surveyed SMEs that have implemented user participation concepts. We conducted explorative interviews with CEOs, IT managers and end-users to understand the different perspectives on the used concepts. Our research question aims to investigate the differentiation of the key-user concept and the influencer concept. We were able to identify seven key aspects in which these concepts differ: First, the focus with which the employees pursue their respective tasks differs. Second, the roles of key-users and influencers in the organization differ. Third and fourth, we found differences in motivation and the communication process. Fifth, key-users and influencers fulfill different tasks in a project. Sixth, the goals pursued by the two concepts differ and finally, the direction from which the user participation was initiated.

The discovered influencer concept for digital transformation projects allows a transfer of the findings to the social media influencer. The influencer of digital transformation processes has the focus on the process transformation with the objective of a sustainable process. Also, for the social media influencer it is important to keep an eye on the development (and thus a process) of their own content. To remain sustainably credible and trustworthy, social media

influencers should be aware of their external impact and actions at all times. To this end, it is important to stand up for one's own views, to regularly reflect on one's external impact and, above all, to rethink one's communication (Enke & Borchers 2019).

It turned out that the concept of influence was introduced by the organizations themselves. In the absence of IT specialists, external IT support was purchased, and this support was always accompanied by an influencer. Since these influencers had a personal interest in the success of the IS projects, the concept was made more stable. The influencer concept does not only allow for user participation, but user participation is a fundamental part of the concept. Since the influencer can be project manager and user at the same time, he or she has a very strong opinion and expressiveness. This will certainly not work for every type of employee. Therefore, choosing the right influencer is an important task. In the case of the interviewed influencers, they are characterized by a high level of enthusiasm for digital transformation. Additionally, they have a high level of commitment and good communication skills.

18.5.1 Implications for Theory

The concept of champions (Schon, 1963) is in some respects similar to influencers. However, champions are primarily strategically oriented and aim for successful implementation of their projects. In this paper, we investigate user participation and propose a concept that extends the conventional key-user concept. Since champions do not take over the role of a user in the system development, champions can be unambiguously distinguished from the influencer concept. This research proposes another new concept of user participation.

User participation should not only lead to a better understanding of the developed IT solution, but also be beneficial in the continuous improvement of processes (Barki & Hartwick, 1994a). Therefore, the introduction of a new role leads to a broader view of user participation in IS projects, as user participation should not only comprise software implementation but rather process change. The influencer role serves to bundle important aspects in an IS project and beyond. By introducing the influencer concept for IS projects, our research provides a new perspective on user participation and enhances the understanding of user participation in IS projects.

Since this is the first study exploring the concept and relevance of influencers in IS projects, our research provides initial knowledge about influencers in IS. We described in detail how influencers were introduced and implemented in an SME. From this, we were able to deduce and create knowledge about the relevance of influencers for both management level and end-

users. Moreover, our research provides a detailed differentiation of key-user and influencer in IS projects by means of identified dimensions, i.e., focus, role, motivation, communication, function, objective and direction. On the one hand, this differentiation expands existing literature on key-users by providing a structured overview of the concept and its key characteristics. On the other hand, the differentiation of the two concepts contributes to a deeper understanding of the influencers. This enabled us to conceptualize the influencer in IS projects. Overall, research can benefit from this study as a point of departure for further research on influencer as a new user participation concept in IS projects.

18.5.2 Implications for Practice

From the researched influencer concept we can derive implications for the practical application in organizations. It should be noted that the influencer concept can be an exciting enhancement of user participation in IS projects. The proposed influencer concept was presented and explained in this study and contrasted to conventional key-user concepts. In order to implement this influencer concept successfully within the organization, it should be noted that pure IS knowledge of an influencer is not necessarily decisive for the success of IS projects. Rather, it is important that influencers are motivated intrinsically to drive these projects forward. Therefore, this research will help organizations to take up the influencer concept and to implement it fully or partially in their organization. When selecting personnel, motivation for the project topic is a crucial factor.

The results of this study lead to the conclusion that digital transformation projects are better accepted in SMEs if these benefits are directly visible in the daily work – this is where influencers can help. Overall, these expected benefits played a major role in the interviews used to communicate about the projects. In this way the influencers can convince the other end-users of the projects and the projects' goals. This makes it all the more important that the influencers have access to informal channels of communication. These channels of communication enable the end-users to informally exchange information about the projects and the expected changes. In any case, it is important that the CEO supports the influencers in changing their own way of working and that of the organization. The influencer concept, as outlined in the results, can help CEOs and organizations to reorganize themselves and there are projects to achieve greater acceptance of the change. Even though the influencer concept relates to the context of SME, there is no argument against its application in larger organizations. Especially in larger organizations, where communication is less dynamic than in SMEs, the influencer concept can help to communicate projects and their goals and generate a wider reach.

18.6 Limitations and Future Work

We conducted a qualitative study to conceptualize influencers and highlight the main differences between influencer concepts and key-user concepts. Moreover, this study demonstrates the relevance of introducing influencers for IS projects, by highlighting the shortcomings of key-users. However, as with every study, this research comes with limitations, which invites future research to build on our research. Since this research is based on a qualitative study, it comes with typical limitations of qualitative studies (e.g., weak internal validation). Apart from those, it is important to acknowledge further limitations, which may create opportunities for future research: 64 German SMEs were contacted. These SMEs were selected because they have gone public with their IS projects, e.g. in the form of an article on the company homepage or in newsletters from industry associations. Of these, 20 organizations were willing to be interviewed. An initial review revealed that only eight of the organizations had involved users in their development process. The interview partners of the eight organizations were all male. In addition, more respondents commented on the key-user concept than on the influencer concept. The assumptions for the influencer concept are therefore based on four different views on the topic. In our opinion, however, this is sufficient to understand and conceptualize the influence and implementation of the concept in the organization. Therefore, the proposed influencer concept should be considered as a blueprint for digital transformation projects. We encourage future research to further investigate this concept in more detail. For example we are convinced, that the influencer concept is also suitable for and applicable to IT-enabled organizational transformation projects (Wessel et al., 2021). Moreover, future research could investigate the influencer concept for organizations of other size e.g., start-ups or corporate groups.We encourage future research to explore the applicability of our findings to different industries. For example, it could be examined whether the concept needs to be adapted to organization size or whether the organization industry impacts the implementation of the influencer concept. These findings could be used to further develop the proposed concept and its implementation. For example, this could lead to a better understanding of whether the implementation of the influencer and key-user as two disjoint concepts is useful or whether the combination of the two concept is more practicable. In addition, we encourage future research to evaluate the success of introducing influencers for IS projects (i.e., change acceptance, employee-satisfaction, process improvement), since our research is focused on the conceptualization. Furthermore, the influencer itself could become

the object of research. For example, it could be investigated which personality traits positively effect participation in IS projects.

18.7 Acknowledgements

We would like to acknowledge that this research is part of the aSTAR research project. The project was funded by the Federal Ministry of Education and Research of the Federal Republic of Germany (BMBF, funding code 02L18B010), the European Social Fund and the European Union

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19 Competence Transfer in Virtual Realities

Title	**Competence Transfer in Virtual Realities (VR): Can VR Bring Products and Services Together?**
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Publication Type	Journal Paper
Publication Outlet	WORK: A Journal of Prevention, Assessment & Rehabilitation
Status	Published
Full Citation	Weigel, A., Baumgart, T. L., **Zeuge, A.**, Sauter, L. M., Niehaves, B., Huchler, N., Heinlein, M., Wittal, R., & Staiger, B. (2022). Competence transfer in virtual realities: Can virtual reality bring products and services together? *WORK: A Journal of Prevention, Assessment & Rehabilitation*, 72(4), 1727–1743. (published)WORK - A Journal of Prevention, Assessment & Rehabilitation, 72(4), 1727–1743.

Table 19.1: Fact Sheet Publication

Competence transfer in virtual realities (VR): Can VR bring products and services together?

Abstract.

Background

The virtual and real worlds of work are increasingly merging through digital transformation. This also applies to products and services. Virtual Reality (VR) with all its learning opportunities is a promising technology to improve workflows and enable transparency between different departments and organizations. This transparency is particularly important when it comes to preventing potentially dangerous work situations.

Objective

We investigate weaknesses in competence transfer processes between computer-aided designers and service employees connected in a hybrid value chain. On the one hand, designers receive only little feedback, hence are missing necessary evaluation to adjust their designs to empirical specifications. On the other hand, service employees, therefore, work with sometimes impractical machine designs which makes their work on-site unergonomic, dangerous, and more difficult.

Methods

We present a design science-driven, empirical approach to provide enhanced competence transfer with the help of VR. Thereby, we evaluate a self-developed VR demonstrator with an iterative approach consisting of 60 qualitative interviews.

Results

The developed VR demonstrator supports interorganizational sharing of (tacit) knowledge by enabling designers to take the service perspective and ensuring collaboration across organizational boundaries. By intentionally using VR technology as an interruption to the work, the design can be viewed from a service perspective and evaluated for occupational safety and health issues.

Conclusions

The work process improvements achieved by the VR demonstrator enable early consideration of design issues that are particularly relevant to safety, thus ensuring greater occupational safety and health protection in the processes for service employees.

Keywords. Design Science Research · Perspective Taking · Tacit Knowledge Transfer · Interruption · Collaboration.

19.1 Introduction

Prevention, avoiding a dangerous situation in the first place, is often better than aftercare when a dangerous situation has already occurred. This applies to back pain, stress, and also the risk of injury [1,2]. Digital transformation can also contribute to this, often not at first glance, but all the more so when you look at the connections. For example, in the course of the digital transformation, the virtual and real worlds of work increasingly merge [3,4]. Products and services are equally subject to this process. The contribution, especially of highly specialized technical products, can be significantly increased by combining them with accompanying services [5]. Accordingly, it is necessary for products and services (such as design and maintenance processes) to blend seamlessly. To this end, the necessary competencies on the part of both manufacturers and service providers should be identified and jointly expanded. A common understanding of the respective competencies and tasks enables the entire value chain to be viewed from the perspective of safety for each individual.

Nowadays, value chains are usually modified to hybrid value chains [7]. Hybrid value chains do not refer exclusively to the manufactured product but include associated services into the value chain in order to provide a better service offering for the product [8]. This research examines the development process of an interactive Virtual Reality (VR) demonstrator; its main function being the mediation of competencies across hybrid value chains (i.e., design processes and workflows related to maintenance) [9]. The developed VR demonstrator is intended to enhance the crane design process and is being evaluated with a total of 60 employees. Due to the local separation of the organizations and the resulting lack of situational exchange opportunities between individual employees, there is less continuous exchange of knowledge and competencies. This means that avoiding potentially hazardous conditions can only be considered to a very limited extent. In addition to the conception of virtual space for experience-based and subject-related competence transfer, the exchange of knowledge between maintenance personnel and other relevant employees (designers, management, etc.) within organizations should be supported. This is particularly important for a sustainable alignment of construction and service work which is crucial for making products easier to maintain. In addition, the transfer of knowledge and the associated improved alignment also play a central role in the area of workplace safety and the prevention of occupational accidents [10,11].

For our research process, we illustrate both theoretical and practical elements in the VR demonstrator to promote the transfer of competencies across hybrid value chains. Therefore,

relevant requirements and practices of the employees are first empirically determined to better define the demonstrator. Subsequently, the competence transfer is conceptualized in organizational terms [12]. The research aims to provide employees with the best possible support in their competence development and to transfer this support into operational practice on a pilot basis. In this way, we contribute to shaping future work practice. The mapping of overarching processes in VR enables mutual understanding and competence transfer between organizations. This allows future development of better products customized to subsequent services. The knowledge imparted serves, in particular, to raise awareness of the topic of work safety and, thus, contributes to the prevention of dangerous situations in the workplace.

VR has already been studied in product development and ergonomics of products in terms of speed, quality, flexibility, and others [13]. VR has also been researched as support for assembling work [14], but there is a lack of consistent linkage between these topics across the value chain which this work identifies as a gap and explores below. As previous literature shows, VR is highly integrated into the learning context and shows a supportive function for learning processes [15]. Additionally, the significant development of multi-user VR solutions enables an interactive and simultaneous experience across different departments and organizational boundaries [16]. To fully benefit from the (learning) potentials of VR [17] in a practice-oriented context, we apply a design science research (DSR) approach strongly related to Peffers et al. [18]. According to Gregor and Hevner [19], we extend design science literature by providing further contributions. Relying on our artifacts, we address the following research question (RQ):

RQ: How can the potentials of VR technologies be used to ensure the transfer of competencies across organizational boundaries?

To answer the RQ, we structured our research as follows: First, we provide an overview of the related work on hybrid value chains, technology-supported perspective taking, VR in the context of tacit knowledge transfer, VR usage as an interruption to the design process, and the possibilities of digital collaboration through VR. Second, the research methodology is described based on the research framework of design science. Third, the results are discussed based on interview extracts and the contribution is highlighted. In summary, a table is presented that breaks down the findings. The limitations of the present research are addressed and further recommendations for future research are made.

19.2 Theoretical Background

In hybrid value chains, machines and services are offered in combination and often represented by multiple organizations [20]. Aligning the organizations with each other becomes particularly important as the different organizations often have divergent aims [21]. Although the organizations' operations are linked to the same product via a value chain, they differ fundamentally in their work processes [22,23]. Competence transfer between organizations can support a better understanding of each other and coalescence [24]. Thus, the consideration of hybrid value chains between organizations is becoming increasingly important [9,25] because optimal competence transfer can only be achieved if the different organizations are well aligned [26]. In the course of digital transformation, digital competencies have been developed that enable employees to cope with technological progress and the associated changes in the workplace [27]. In this context flexible and digital technologies are of particular importance, enabling constant assessment and redesign of work. Digital competence is a dynamic capability that can be primarily supported by technologies that enable evaluation. This can provide insights into what is potentially possible [28]. The possibilities for evaluation through technologies (in our case VR) represent a core component of digital competence.

As technology has evolved in recent years, new ways to enter and experience VR are emerging [29]. Current trends, as well as solutions, are highlighting the possibilities created by VR. Issues related to possible difficulties in the use of VR, including side effects and the transfer of competencies to the real world, have been explored in prior literature [4]. Particularly noteworthy are immersive VR solutions that provide users with a three-dimensional experience in a closed virtual space shown on a head-mounted display [30]. Furthermore, a closed VR space enables a focused interactive experience [17]. Thus, we argue that VR technologies offer great potential to combine perspective taking and further competence transfer aspects (in this case, previously tacit knowledge transfer and digital collaboration) along the value chain and to make them usable for work contexts. Optimal process design is considered, as research addresses aspects of interruption.

19.2.1 Perspective Taking

Originated from psychological research, perspective taking is an attempt to enable one person to take the perspective of another person [31]. While literature often describes this process as a reflection of our own point of view [32], perspective taking is researched in different contexts. For instance, customer and user orientation can be understood as a form of adopting a perspective that has a positive effect on the development of new products [33]. In the context

of services, the ability to adopt the perspective of the client has a positive effect on the ability to help [34]. Classically, perspective taking can be triggered by the explicit request to put oneself in the perspective of another person [31]. However, digital technological developments increasingly show that perspective taking can also be influenced by technical measures [35,36]. To this end, perspective taking has been, for instance, used as a de-escalation tactic to reduce the product managers' commitment to an original product launch date when they were confronted with serious software deficiencies in the product [35].

In the context of perspective taking, VR can be a key technology. The user can be virtually put "in the shoes of another person" and be confronted with this person's views or challenges. However, research on the use of VR about technology-supported perspective taking is limited [9]. Only a few articles deal with use cases in an organizational context. For example, researchers argue that the combination of avatar manipulation and role-playing in a virtual space can lead to the development of empathy [37]. In terms of hybrid value chains as a decisive factor in the avoidance of occupational hazards in today's economy, the integration of VR might be beneficial in this context. The better the hybrid value chains function, the better the objectives of the various organizations are aligned. This can be fostered by technology-supported perspective taking; one form might be VR. One way to strengthen competence transfer is the technology-supported perspective taking [9].

19.2.2 Tacit Knowledge Transfer

Tacit knowledge describes knowledge that accumulates over a period of time in form of experience in organizations [38]. Due to its characteristics, the transfer of tacit knowledge constantly remains a challenge for organizations [39]. In contrast to explicit knowledge, tacit knowledge is characterized by the fact that it is difficult to capture or document, and particularly deeply anchored in individual employees [40]. In the organizational context, tacit knowledge includes, for example, experiential and expert knowledge as well as competencies of employees [41].

The focus of this research is on the tacit knowledge that is created during assembling and maintenance processes and is embedded in the minds and work steps of service employees. Tacit knowledge comes from managing the daily work and is the result of technical exposure to regular challenges in maintenance and assembling situations [42]. For instance, Hejduk et al. [11] recognized a significant correlation between the employees' management of tacit knowledge regarding safety and hazard prevention at work. Nevertheless, to date, there has

been little literature that addresses the use of IT for interorganizational tacit knowledge transfer in hybrid value chains.

A classification of tacit knowledge according to its degree of tacitness is made by Chennamaneni and Teng [39]. Thereby, they developed and assigned appropriate knowledge transfer mechanisms and communication media types. For capabilities of rather low tacitness, asynchronous, and lean media such as e-mails or asynchronous groupware are sufficient. In turn, the transfer of knowledge with a particularly high degree of tacitness requires the observation and imitation of expert behavior which depends on a communication technology that enables synchronous face-to-face communication [39]. Haase et al. [42] emphasize that technology-enhanced tacit knowledge transfer requires a learning environment that can map work processes while maintaining a narrative character. They justify that storytelling methods are required for the extraction of tacit knowledge. The mapped stories consist of facts as well as tacit knowledge. VR technologies meet these requirements and provide a suitable learning environment [42].

19.2.3 VR Interruption of CAD Processes

Interruptions are a common occurrence in modern work practices and can affect work performance. Particularly due to digital transformation, workers increasingly rely on the usage of technology to accomplish their working tasks [43]. Work interruptions are defined as "incidents or occurrences that impede or delay organizational members as they attempt to make progress on work tasks" [44]. When interruptions are caused by, or attributable to the use of technology (e.g., e-mail notifications), research refers to them as interruptions that are induced by technology [45]. While common technologies, such as phone calls or e-mails, can interrupt office workers up to 70 times a day [46,47], they lose a third of their workday as a result [48,49]. Therefore, interruptions are mostly considered as negative events which can impair the performance of work activities [50] by reducing productivity, adding load due to additional tasks, or disrupting ongoing work processes [51].

Besides the negative nature, research from a technological perspective indicates different types of interruptions that show different effects on performance [e.g., 46,50]. How interruptions appear is critical to assessing their impact on worker performance [52]. According to Trafton and Monk [53] from an ergonomic perspective, the occurrence of an interruption initiates a process that directs attention from a primary task to be performed to a secondary task initiated by the interruption. Regarding the common use of a multitude of technologies to perform work tasks, Addas and Pinsonneault [46] identified three different stages of the influence of

technology-induced interruptions on the process of primary task performance. First, interventions as secondary tasks provide relevant information for primary task performance. Second, intrusions provide irrelevant information. And third, hybrid interruptions as a mix of both. By directing workers' attention to a secondary task, they are partially irrelevant to the primary task, however, relevant information is generated through interaction with the secondary task. This makes hybrid interruptions a special type of interruption that contradicts the very definition by combining both positive and negative influences on the primary task performance [46].

Using VR within the Computer-Aided Design (CAD) could be considered as a hybrid interruption for construction processes. Since CAD is a common standard, the way of construction can be supported with the usage of modern technology like VR [54] and results in influences on conditions (i.e., technology switch) of task execution regarding the job context [55]. While considering the involvement of VR in the construction process as a hybrid interruption, we refer to the technologies used within the design process (i.e., CAD and VR) which can be adapted to the constant sequence of the interruption process [53]. Therefore, we consider the crane design process as an overall task, while considering CAD as the primary task of the process in terms of the technology commonly used and VR as a secondary one as an innovative technology in terms of digital transformation for CAD-model consideration. For the process, first, the primary task is performed. Regarding the interruption process, the secondary task occurs which initiates the interruption and interrupts the initial primary task process. Conceivable approaches for VR usage could be either fixed verification points anchored in the design process or an interim check by the designers themselves (e.g., at a certain design progress, it is necessary to use the VR for detecting interfering edges). By doing this, the attention and work processing shifts from using CAD to using VR which represents an interruption of a design process that has been standard so far. Meanwhile, the designer can collect valuable information and impressions (e.g., identification of interfering edges or consideration of the components in their original size), supporting and positively influencing current and future CAD constructions as the primary task in crane design. After using VR, CAD construction is continued. The switches between the tasks are called interruption lag and resumption lag [53] and refer to the technology switch between a computer workstation for CAD construction and VR.

Considering the implementation of VR and the adaptation of the interruption process indicates the characteristics of a hybrid interruption within the construction process. On the one hand,

the CAD work on a computer workstation is interrupted due to the change to VR and its usage. This implies a negative impact on the process in the sense of an intrusion since no relevant information for the construction is provided [46] and the CAD process is stopped. On the other hand, VR as the secondary task within the construction process allows considering the construction in new angles and environments as well as different types of interaction than on CAD workstations [56]. Thereby, in the sense of an intervention, relevant information for the construction can be created [46] which does not influence the current construction as the primary task in an only positive manner but can sustainably enrich future constructions with increased knowledge and can accelerate processes, as errors are eliminated during the construction.

19.2.4 Digital Collaboration

Collaboration is generally understood as a process in which two or more people share knowledge and resources to jointly achieve a common goal [57–59]. While the terms cooperation and collaboration are often used interchangeably, literature delineates these two terms [58,60]. Cooperation is a process in which individuals work on different subtasks of the intended result [60,61]. Collaboration, however, is a process in which individuals work together to create value that members cannot create through individual efforts [62,63]. Therefore, collaboration is characterized by task-related and social interactions as well as communication to share resources and knowledge [64].

Digital collaboration is a collaboration process in which collaborators primarily use IT to interact and communicate [65–67]. To make digital collaboration particularly effective, it is important that the user's focus is not on the functions of the application [68]. Collaboration software and tools enable collaboration that transcends spatial and temporal boundaries [69]. However, traditional collaboration tools, such as video conferences, meet their limits when it comes to interactive collaboration (e.g., prototyping), since the functions are not sufficient for three-dimensional space and facial expressions, and the body language is lost to a great extent [70].

Literature suggests that multi-user VR is a promising new technology for digital collaboration [71–73]. Multi-user VR technology makes it possible for multiple users to meet and interact with each other as well as with virtual objects in virtual spaces [74–76]. Multi-user VR enables interactive collaboration by supporting social presence, rich non-verbal communication, and immersive realistic interaction [74]. In addition, the concurrent use of images and speech supports decision-making and improves communication among collaborators [71]. So far there

is only limited research on how VR solutions can be designed in such a way that they can be used effectively in collaboration with multiple stakeholders [77]. Our research aims at supporting employees in their competence development by including a VR scenario into operational practice for assembling and maintenance. Various factors have to be considered for using VR in the operational context. In addition to adopting a different perspective and transferring knowledge, also the integration of innovative technologies (i.e., VR) into previously common design processes (i.e., CAD) and collaboration in such virtual environments are important.

19.3 Methodology

DSR has become increasingly important in the research field of information systems (IS) since the 1990s [78]. The importance of DSR remains undiminished [18,79]. Two research streams of design science are distinguished: one deals with the creation of a new IT artifact, the other deals with the manipulation of an existing IT artifact. We use an inductive strategy [80] to develop an artifact for a specific problem that has occurred in practice, and then generalize it to address a class of problems. We expect that theoretical approaches to the influence and effects of, e.g., IT artifacts only emerge after their use and research [81]. In doing so, this research follows the six phases of the DSR methodology for IS research [18], including: problem identification, the definition of the objectives of a solution, design and development, demonstration, evaluation, and communication.

First, the existing processes were analyzed to determine the exact procedures. An important part at this point was the understanding of the process knowledge. At the same time, existing best practices were examined. Moreover, the technical possibilities for implementing a VR environment were explored. After an overview of the initial situation and the feasibility of the VR environment had become available, the requirements for the demonstrator were determined. Furthermore, we developed a concept to specify how the VR environment should represent and address the researched approaches as well as the collected data. Afterward, the actual development of the VR demonstrator started. We regularly evaluated if the demonstrator met the requirements and the concept, and the results were included in the further development. As a final step, the development of this prototype and its further application was discussed.

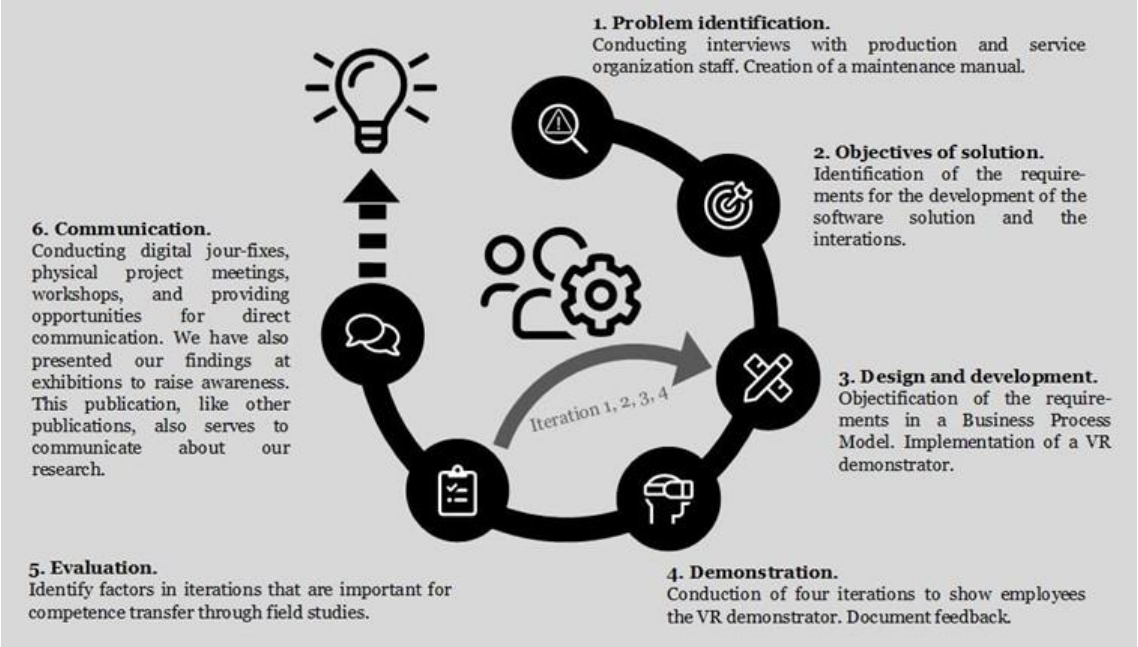

Figure 19.1: Overview and Application of the Design Science Phases

We completed our DSR with a total of four iterations. An overview of the single phases is given in Figure 19.1, followed by a detailed explanation below. Each of these iterations consisted of developing or refining the VR demonstrator. This demonstrator was then tested with a total of 60 participants in an experimental setting. The interviewees were employees from two German small and medium-sized enterprises (SMEs) – both, employees and managers. A total of 11 women and 49 men were interviewed. This approximately corresponds to the ratio of men and women in the mechanical engineering sector in Germany. The participants had an average age of 34 years and an average work experience of 12 years. After the tests, qualitative interviews with the participants were conducted. For a table of the four iteration steps, see below (Table 19.2).

Iteration	**Production participants**	**Service participants**	**Method**
1	6	5	Qualitative content analysis
2	9	5	Grounded theory
3	7	8	Qualitative content analysis
4	9	11	Grounded theory
∑	**31**	**29**	

Table 19.2: Overview of Interviewees

The interviews were recorded and subsequently transcribed. Qualitative content analysis methods were used to analyze the qualitative data in Iteration 1 and 3 [82]. These analyses aimed to identify patterns in the interviews that deal with the objects of research. We wanted to learn more about how perspective taking on the one hand, and interruptions, on the other hand, are experienced and how this experience affects the transfer of competencies. To this end, we used an open coding approach in the interviews. The data was coded independently by two researchers. Afterward, these codes were discussed together. For example, it happened that the same text passage was coded differently. These conflicts were resolved by identifying one of the existing codes as the best or by merging the two codes into a new code. This process was repeated until all text passages were successfully coded and both researchers agreed on the outcome.

Grounded theory methods were used for iterations 2 and 4 [83]. The coding methods used include open coding, axial coding, and selective coding. Initially, open coding was used, i.e., in iteration 2 and in iteration 4, factors and situations of tacit knowledge transfer were searched for once, and conditions of collaboration were searched for once [83,84]. This process was conducted independently by two researchers to gather as many findings as possible. The findings were then compared and grouped (axial coding) to identify relevant aspects of the research [84]. Different perspectives of the researchers were discussed, and a common solution was sought in the interest of all researchers. The analysis was stopped at the saturation point, i.e., when no new higher-level measures were found. If there was disagreement between the two researchers on any point, a third researcher was brought in to discuss and establish an axial code.

19.4 DSR Steps

19.4.1 Problem Identification

In this research, we consider two organizations that are interconnected via a hybrid value chain; first, a producing organization and second, an organization that offers accompanying services for the products. In order to analyze the deficits in the competence transfer process, we conducted pre-interviews and observed the processes. The interviews and the observations presented several insights valuable for the development process. For example, maintenance work on a technical machine requires a head for heights as well as a defined skill set. This skill set includes the assembling of complex components, fault detection, and repairing machines in case of failure. However, the person maintaining a machine is usually not the person designing the machine. This means that there are knowledge gaps in the value chain between the services

of assembling, maintaining, repairing, and developing a product. The difficulty is that important aspects of maintenance are not considered in the design process. (e.g., accident risk, accessibility of components, and ergonomics). The designers often only know the details of their products from the CAD program (Figure 19.2).

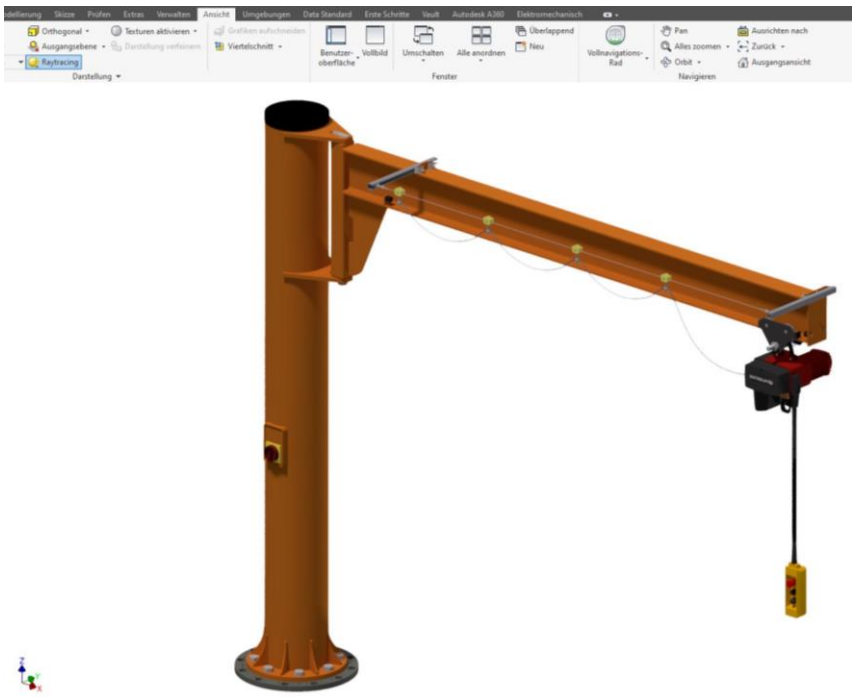

Figure 19.2: Screenshot of the CAD Environment

As a solution, a new, cooperative, and employee-centered approach is planned. To this end, we use the concept of influencers to apply digital transformation projects in the organization [85]. The concept states that influencers can help by demonstrating the benefits of digital transformation projects and convincing the end users of these projects. This concept is characterized by the fact that the focus of influencers is on the transformation process as such. Influencers are still primarily concerned with day-to-day work, but they have an intrinsic motivation to make a positive difference in their workday and that of the organization.

To incorporate this, we accompanied a service employee for two days. During this time, we observed and documented maintenance work on two different machines. For this purpose, we documented the individual steps with photos. Due to the industrial environment and the applicable regulations, it was not possible to video. However, based on the documentation and photos, we created a maintenance manual which was later discussed with the service personnel to ensure validity. By accompanying the product development process, we were furthermore able to trace the steps of the integration of the standard parts to the static calculation of the

designed product. This workflow offers the potential for improvements through digital transformation, more precisely through the VR demonstrator.

19.4.2 Objective of Solutions

Based on the interviews and documentations, we were able to identify requirements that provided a basis for the design and development of the software solution. To enable an improvement of the products, a simulation environment should be created to enable designers to evaluate their design during the design process.

Therefore, the interactive VR demonstrator aims at visualizing the maintenance work to make work processes and conditions tangible and to improve interdisciplinary skills. This is intended to digitize and facilitate the cross-organizational exchange of knowledge between maintenance employees and designers. From the combination of these arguments, the problem definition can be derived as follows. The two areas of design and maintenance are not yet sufficiently aligned. Consequently, machines are designed that do not meet the optimal requirements for service processes to the extent as they could. This leads to problems during assembling, maintenance, and repair which can also have an impact on safety aspects (e.g., accessibility of components and ergonomics). The goal of the VR demonstrator is to address this area of tension by enabling an optimal transfer of know-how between the two areas. To this end, various approaches are being explored in the iterations of the VR demonstrator which address the prevention of hazards at work.

19.4.3 Design and Development

After the findings of the interviews and the definition of the objectives, the VR demonstrator was designed in iterative steps. The requirements were objectified using the Business Process Model and Notation (BPMN). This enabled the software developers to develop the VR demonstrator in a structured and comprehensible manner. The VR demonstrator is based on well-known technologies, such as the HTC VIVE Pro Eye and the Unreal Engine. The objective of the demonstrator is to provide a solution that can be used in a variety of situations and different scenarios.

It emerged from the interviews that the level of detail is important because on the one hand it is presented as detailed as necessary, but on the other hand, it is also presented as generally as possible. This resulted in the fact that not every specific detail had to be simulated and interactively designed in VR. Therefore, a reduction of complexity was realized to enable a simplified implementation of different product types.

The development was executed in an agile way to provide for flexibility when taking up the findings of the evaluation running in parallel. The VR demonstrator comprehensively presents the technical solution and focuses on user immersion and experience in the VR environment (Figure 19.3). To support user participation, the concept of influencers was used [85].

Figure 19.3: Screenshot of the VR Demonstrator

19.4.4 Demonstration

We conducted four iterations, where participants from the production organization (e.g., designers, IT staff, sales staff), as well as service employees (e.g., service technicians, service engineers, and commercial staff), were able to try out and evaluate the features of the VR demonstrator. In each experimental setup, the participants were randomly selected from the aforementioned organizations and confronted with the same scenario, namely the assembling process of a crane in VR. The scenario was divided into eight process steps (site inspection and safety, assembling preparation, assembly plate assembling, prop assembling, boom assembling, chain hoist assembling, functional test, and acceptance), with each process step itself consisting of subtasks. Depending on the iteration, only single process steps or the entire process were carried out. As an example, process step 1 "Checking and securing the construction site" is described here which consists of the subtasks surveying the construction site, comparison with construction plans, checking the soil thickness, and securing the assembling site. The participants were continuously observed and any comments or feedback during the experiment were documented. In the next phase, the interviews were conducted. Regarding the experiment, it should also be noted that the participants were always supervised by experimental supervisors, who, for example, made sure that the participants did not collide with the physical walls of the room.

In the future, implementation strategies will be developed to anchor the VR demonstrators in the organizations. These implementation strategies determine how the processes are designed, how the target groups are integrated for productive use, and how accompanying organizational measures (e.g., guidelines and workshops) are implemented. Based on these strategies, the VR demonstrator will be implemented in the organizations in the form of a pilot project. The experience gained will be analyzed and used to further develop VR demonstrators.

19.4.5 Evaluation

The VR demonstrator was continuously evaluated in terms of usability and competence transfer capabilities. Insights can be used for competence transfer and for teaching work processes along the hybrid value chain. In addition, it was examined whether the solution offers significant added value for collaborative working. Several field evaluations were conducted with users and the demonstrator. Prior to the demonstrator, individual aspects (e.g., perception of VR simulation environments, learning/supportability, or applicability) were evaluated in laboratory studies.

In the context of the VR demonstrator's quality assurance, we aim for a formative evaluation that continuously checks technological (i.e., usability tests) and technical aspects (i.e., process step integration). Furthermore, the development was discussed and reflected in workshops with all project participants. The objective was an iterative enhancement of the VR demonstrator based on the evaluation findings. The starting point of the evaluation was research on perspective taking; tacit knowledge transfer was then added as another research area in this iteration. In addition to technical changes based on the findings from Iteration 1, the next evaluation iteration focused on tacit knowledge transfer. We repeated this approach in the following iterations and next discovered the interruption of CAD work processes as an issue to be investigated. In the following Iteration 3, VR collaboration was discovered as a topic to be investigated. In Iteration 4, the technical development was completed, and no further points were raised in this context in the interviews.

Below we present the findings of the four iterations of the DSR process. These relate to technology-enabled perspective taking, tacit knowledge transfer, interruption, and collaboration through the VR demonstrator. In this context, the technology-supported perspective-taking, the transfer of tacit knowledge, and the assurance of collaboration through the VR demonstrator have a direct impact on the transfer of competencies between organizations. By allowing both organizations to interact with the simulated processes in the VR space and gain an understanding of each other's processes, competence transfer is

enhanced. The consideration of interruptions represents an indirect effect on competence transfer. Designers will only use the VR demonstrator consistently if they do not feel negatively influenced by the VR solution in the future, e.g., in their work efficiency.

19.4.5.1. Technology-supported Perspective Taking

Immersive VR technologies allow users to view a wide variety of situations from many perspectives. VR can give the user the feeling of being in the perspective of another person (employee) and experiencing the situation from their point of view in a particularly realistic way [86]. The problem becomes clear in the spatial, temporal, and social separation of the organizations' activities. This separation makes it impossible to align one's actions with the intentions and actions of others throughout the process.

The analysis of the interviews shows that there were mostly alignment conflicts between design and assembling/maintenance. Often these were not gross errors, but the fact that the products were designed to be difficult to assemble or maintain. For example, service technicians would assemble parts in a different order or change components/assembling steps at certain points to simplify the process. Some products later turn out to be not easy to maintain if repairs require disassembly of the entire product or components are difficult to access. In the case of custom products, the design idea often does not match the assembling conditions. In addition, the designers are often unaware of the manufacturing conditions. Why assembling and maintenance procedures are not considered in the design seems to be due to both the designers' lack of experience in real assembling and the lack of exchange. What the manufacturing and service organization needs is an (IT) concept that focuses on the process of interaction. Therefore, designers need to experience not exclusively the pure assembling of a product but also the existing working conditions. The lack of consideration of the assembling situation in the design often led to problems later on. One designer describes that if he had been able to assemble a product, he could have made assembling improvements that the assemblers could not even imagine.

> *Iteration 1 – Participant 2: "It may be that I can greatly improve the product with simple changes and save my colleagues' time, the mechanic may not even know these possibilities. [...] But of course, one could try out such assembling virtually, as it is best because I don't think that every colleague always thinks about maintenance."*

> *Iteration 3- Participant 2: "But of course I've always thought about how, for example, if you lift the things in there now, the boom or something, how would that work in reality, how would others do it."*

At that moment, the designer understands this interaction situation as the result of a previous situation for which s/he may be responsible. Without the interaction in VR, s/he would not interrupt the designs and would not realign them in the future. By taking the perspective, s/he is in an exchange process with the (virtual) environment of his/her colleagues, in which s/he can adapt actions reflectively and, thus, contribute to a change of the environment. The VR simulation of an assembling situation is not only suitable for the designers, but also the assemblers themselves, especially if the assembling of new products or new components is to be tested or trained. The training would make the assembler feel better prepared.

19.4.5.2. Tacit Knowledge Transfer

In the course of the evaluations, the transfer of tacit knowledge in a multi-user VR application was investigated. The participants had to perform individual assembling steps in a defined sequence until assembling was successful. They had the option of dividing up the various assembling steps among themselves and of supporting each other in completing the individual steps. The interviews revealed that the mutual perception of the users and the parallel communication significantly influence the social interaction with each other. Social interaction, in general, is decisive for a successful transfer of tacit knowledge in VR environments. Participants could perceive when the second user was having trouble processing the next steps. Without having to communicate the difficulties explicitly, they could be detected by pure observation and, thus, encouraged exchange.

During the VR simulation, questions arose among the participants about the assembling process. They thought about more complicated situations and wondered how individual assembling steps could be carried out by a service technician alone. The VR encouraged them to rethink the processes by experiencing them first-hand. At this point, the aforementioned process of rethinking reflects the generation of tacit knowledge. Rethinking would not have taken place in this effort if the participant had not experienced the situation him-/herself.

> *Iteration 2 – Participant 1: "In VR, I thought about how, for example, some tasks would be in reality. For example, when you work with heavy things, it's very easy in VR, but how would that work in reality and how would the real service mechanics do it?"*

Even if the assembling process depicted in VR did not correspond to reality in terms of time, the degree of abstraction was sufficient for a participant to become aware that the time previously calculated for assembling is too short for a sole service worker. The knowledge gained encouraged them to rethink their time calculation and change it for the future. Overall, it was found that experiencing the VR situation contributed to cross-organizational tacit knowledge sharing in the form of experiences and made employees more aware of the service process.

> *Iteration 2 – Participant 5: "I'd say that I understand the rationale for often doing assembling in pairs, namely because of the activities that can only be done in pairs. I also understand the problem with our assembling time calculation. We would have to set up the calculation differently because I would say that these idle times, when only one colleague can assemble something, are not considered in a meaningful way. And yes, that makes you think about this."*

19.4.5.3. VR Interruption of CAD Processes

Evaluations also included incorporating assessment of VR usage into the design workflow. Here, especially in the context of hybrid interruptions, we investigated how the additional use of VR within the CAD process is perceived by the workers. The assumed adverse effect on work performance which often comes from the definition of interruptions, could not be identified exclusively. Instead, in terms of the hybrid form, a positive view of the additional workload due to VR usage was identified for the overall construction process. However, the additional effort within the process was perceived as a disruption, as the hardware to be used (i.e., CAD workstation or VR) and the way the crane is viewed in the virtual space had to be changed. This change away from the usual office environment generates new knowledge about the crane parts and their position. It also supports for instance the assumption that additional effort has a positive impact when a clear added value is recognized.

> *Iteration 3 – Participant 13: "Well, that's a media break for sure because, before, you sit there with the keyboard and the mouse and then you sit there with the glasses and you're really in the tunnel, but that's not negative. It's more positive that you get a new perspective and have a haptic experience. But I don't see it as an interruption in the sense that it would distract me from my work."*

> *Iteration 3 – Participant 6: "I would say, totally out of it in no case. Maybe a little more distracted for a moment, but that's because you're really in a different environment.*

But I find it much more complementary than that it interrupts anything, i.e., the workflow."

Interrupting the design process by using VR generated valuable information that also positively influenced assembling and maintenance afterward. CAD design represents objects in three dimensions, but this only takes place on a screen in a design program. VR, however, creates a three-dimensional environment that can be experienced, allowing the construction of the CAD program to be viewed in an environment that mimics reality. Although this leads to additional work for the designer and interrupts the common process of designing, the resulting experience outweighs this. The VR usage leads to a transfer of competence for the current and especially for future projects and crane designs by generating additional information (e.g., accessibility). With representation in VR, gained knowledge can be used to avoid any trouble spots and, thus, support assembling and maintenance and, consequently, additional steps within the value chain.

Iteration 3 – Participant 7: "If you say okay, for example, you have a type of crane and now you have to construct something and then check the accessibility for the fitter, […] then you can, of course, reproduce this directly in such an environment and then see directly where you have faults or collisions or perhaps areas not readily accessible and you can see that very quickly, you don't have that if you don't have that possibility."

Iteration 3 – Participant 1: "I could actually imagine the representation in VR being helpful because you don't have that form of experience now. The CAD models lack the reference to the environment. Of course, it becomes a bit more complicated, but I think that would be more pleasant in virtual space."

19.4.5.4. VR Collaboration

Collaboration between organizations, i.e., manufacturers and service providers, is essential in the real world to ensure the design of products easy to maintain and sustainable alignment across organizational boundaries. The new opportunities to collaborate in a VR environment raise new questions about how people collaborate and how the intention to collaborate can be encouraged [87]. Thus, during the evaluations, it was investigated which conditions influence the co-workers' intention to collaborate in the VR environment. Here, the technology (i.e., hard- and software), the user (i.e., the collaborators), and the task (i.e., different steps of the assembling process) were considered. We were able to identify necessary and sufficient conditions, influencing the intention to collaborate in VR.

A prerequisite for the use of VR for collaboration is the technology used which makes the experience and the implementation of VR possible. One technology-related condition is the handling of the hardware (e.g., controller) as well as the handling of elements in the VR environment (e.g., objects). If the way of handling is not known or not yet internalized, this affects the collaboration, since the interaction with the partner, the VR environment as well as the VR itself is interrupted. Another technically necessary condition for collaboration in VR is immersion. The feeling of collaboration arose primarily from the fact that the VR environment felt like real life to the participants, and they were able to completely block out the real world.

> *Iteration 4 – Participant 7: "What was difficult? Well, the controls in general at the beginning. I would say that if it's completely unfamiliar, then it's not easy from the beginning. But I'd say the variety of keys is limited, so if you're a bit practiced, you'll be able to handle it."*

> *Iteration 4 – Participant 9: "It felt like he was in the room with me. So, the real rooms […] [were] completely blanked out for me, I really thought we were standing there together."*

On the task-level, it turned out that there are necessary and sufficient conditions influencing the intention to collaborate in VR. A necessary condition for collaboration is that the task allows the participants to collaborate. This means that the tasks should be designed in such a way that the users have to work together instead of sharing the tasks and working on them individually (i.e., cooperating). A sufficient condition that fosters the intention to collaborate in VR is a realistic design of the task. Some tasks in the assembling process could be performed by one user in the VR environment but would require the collaboration of two in reality (e.g., reading the plumb line). Instead of working collaboratively, the participants split up these tasks. By designing the tasks more realistic, the intention to collaborate can be fostered.

> *Iteration 4 – Participant 4: "We checked the tasks and then one of us did the first and the other prepared the next one. So, you knew you weren't alone, but you were doing something together. But when it comes to the task itself, you're working alone because you can't do it together."*

> *Iteration 4 – Participant 10: "Anyway, there was less collaboration necessary than in real life, starting with the plumb line, for example. In reality, I can't read the plumb line from the ground [...]. That means in real life I have to look at it from above and then have to tell the colleague who is on the ground which screw he should turn."*

On the user level, it revealed that the user attributes influence the intention to collaborate in VR adequately. One sufficient condition that influenced the intention to collaborate is the familiarity of the collaborating partners. If the collaborating partners already had known each other before, this positively influenced the intention to collaborate in VR, since a more personal level of collaboration was achieved. The familiar basis compensated for the lack of facial expressions and gestures of the avatars and made it possible to derive non-verbal signals from the partner's voice and the avatar's body language. Another sufficient condition that positively influences the intention to collaborate in VR is knowledge transfer between the collaborating partners. The knowledge transfer occurs when one partner has less knowledge or less experience than the other one ("teacher-pupil" exchange). By conveying contexts and discussing special situations the intention to collaborate can be fostered.

> *Iteration 4 – Participant 10: "Well, because you knew who the other person was, it actually supported it. But I would say that if you didn't have any relationship at all, i.e., if anyone would be there, then it would be impersonal because you could not recognize his face."*

> *Iteration 4 – Participant 3: "If someone tells you what to look for, then that's what you learn. Just like that, based on the information from a manual, I don't think it would really have that success."*

19.4.5.5. Summary of Findings

Iteration	Research object	Key finding
1	Perspective taking	VR can help designers add a service perspective to their general understanding of how their designs work. Environmental conditions or specific designs can be simulated and tested virtually. The lack of understanding of these specific conditions is reinforced by VR and perspective taking across organizational boundaries.
2	Tacit knowledge transfer	VR offers potentials to support the transfer of tacit knowledge in organizations. While in the past the transfer of tacit knowledge was often considered at the level of individual employees in an organization, these research results now enable the consideration of interrelated value creation processes across organizational boundaries.
3	Interruptions	To fully exploit the potential of VR use, one must also address the threatening side effects. Only if VR use is seen as beneficial, it will be used in reality. The research shows that work processes (in our case CAD processes) can be intentionally interrupted by VR use to gain an advantage, provided that the use of VR adds value.
4	Collaboration	Collaboration in VR is a promising method to share experiences between designers and service technicians. This could be defined in terms of technology, task, and user-related aspects.

Table 19.3: Summary of the Most Significant Findings from the Four Iterations

19.4.6 Communication

Project communication was carried out continuously during the duration of the project. Due to the agile nature of the project organization, it was possible to incorporate feedback promptly into the development of the demonstrator. The immediate communication ensures that the defined goals are achieved on time and according to plan. Problems can be detected early due to the continuous exchange of information. Moreover, a continuous exchange between the project partners helps to ensure the consolidation of the project findings. This exchange will form the basis for future project-related communication. We also presented our interim findings in the form of the demonstrator on exhibitions to raise awareness for the issue. Any feedback or comments were collected and shared among project partners to further improve the demonstrator.

19.5 Discussion and Future Work

This research deals with the development of a VR demonstrator for the simulation of partly dangerous maintenance procedures. The work process improvements provided by the VR demonstrator enable early consideration of particularly safety-relevant design issues and, as a result, provide increased occupational safety and health in service processes for service employees. Inspired by a developmental research method, a problem-oriented research design was presented [18]. The requirements were then derived based on the problems identified. On this basis, qualitative interviews were conducted with the organizations' practitioners. Afterward, the resulting findings were evaluated by all participants in a workshop, and learning scenarios were developed to solve the original problem of the lack of competence transfer along the hybrid value chain.

To answer our research question "How can the potentials of VR technologies be used to ensure the transfer of competencies across organizational boundaries?" we used the demonstration phase of the DSR approach. In this demonstration phase, the VR demonstrator is presented and explained to the employees of the organizations in four iterations. Special attention is paid to the applicability, to the respective configuration, and the simulation of workflows. Subsequently, feedback and evaluation phases were conducted in the form of further qualitative interviews. The findings obtained show that the unique simulation properties of VR lead to an improvement in product and service quality across organizational boundaries. To this end, the aspects of technology-supported perspective taking, tacit knowledge transfer, interruption, and collaboration in VR were investigated.

As a contribution to practice, we have created a VR demonstrator that can be used for the development and training of various products. The VR demonstrator helps workers become aware of the maintenance and assembling conditions and imparts knowledge about circumstances that represent common hurdles in maintenance and assembling processes. It can additionally contribute to workplace safety by imparting knowledge about the mentioned circumstances and, thus, sensitizing for potential risks at work [10]. Along with this research and along the VR demonstrator, it is possible to further develop the future of work. This concerns both, the working conditions for the maintenance personnel determined by the products and the alignment of organizations with each other. The findings to date highlight the unique simulation opportunities of VR that can lead to improvements in product and service quality in the environment studied. Recommendations and guidelines could also be developed

that can be extended to other use cases through extension, application, and evaluation. The collected knowledge can help to understand how VR can be integrated into the industrial context. Future research could also quantitatively assess how VR can be better designed to support employees in their work process and skill development.

As a contribution to theory, we applied methods from design science literature to provide level one and level two contributions [19]. The level one contribution has been provided by the design, implementation, and instantiation of the VR demonstrator. On level two, we provide our version of a design science application in an organization characterized by a hybrid value chain. Thus, we established a connection between an immersive VR design and the development process. Likewise, previous VR research in the area of product development [13] and also in the area of supporting assembling [14] could be consistently thought of further and extended in the area of hybrid value chains. Future research steps could include the creation of additional constructs, methods, design principles, and calculation rules.

As with any practice-oriented research, there are some limitations: First, the empirical basis for the developed VR demonstrator is based exclusively on the design and service scenario. In order to overcome this limitation, we intend to transfer the VR demonstrator to other use cases, such as management and purchasing departments. Our research has verified the benefit of the VR demonstrator in a design and service scenario in two organizations. According to the interviews, it is helpful to transfer at least the service scenario to other organizations. Thereby, the employees of external service organizations, who also maintain the machines of the organization, could be addressed. Second, the findings to date include results from a total of four iterations. In the future, additional influence constructs can be identified, and further development can be sought based on them. Third, the participants of the evaluations could only test the VR demonstrator for a short period of time in the experiment. Future research should also carry out more long-term evaluations to gain more detailed insights into the effects of VR on the work of the employees. Last, we have to limit the results of the tacit knowledge transfer within VR to experience knowledge transfer which is done by taking the perspective of the service worker. We were able to identify this in the analyses of the interviews, but at the same time, we know that especially the documentation of tacit knowledge is a challenge. Therefore, our results are limited to the transfer of experience knowledge through the VR application, as the designers experience difficult situations during assembling and are confronted with the need to find a design solution to avoid these problems beforehand. Future work could develop design science guidelines for the implementation of software projects within organizations

connected by a hybrid value chain. The collected knowledge can further help to understand how VR can be integrated into the industrial context. In the course of that, it could be determined which concrete artifacts a VR environment needs to improve the design and support employees in their work processes.

19.6 Acknowledgments

We would like to acknowledge that this research is part of the aSTAR research project. The project was funded by the Federal Ministry of Education and Research of the Federal Republic of Germany (BMBF, funding code 02L18B010 - 2L18B013), the European Social Fund and the European Union. In addition, we would like to acknowledge that subsets of the dataset used here have been used for other research within the project.

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20 Stay Committed - On the Role of Organizational Commitment for Virtual Collaboration in SMEs

Title	**Stay Committed - On the Role of Organizational Commitment for Virtual Collaboration in SMEs**
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Publication Type	Conference Paper
Publication Outlet	Proceedings of the 13th International Conference on Advanced Collaborative Networks, Systems and Applications
Status	Under review / 1st round
Full Citation	Mohos, J., **Zeuge, A.**, Reßing, C., Niehaves, B., & Moog, P. Stay committed - On the role of organizational commitment for virtual collaboration in SMEs. *Proceedings of the 13th International Conference on Advanced Collaborative Networks, Systems and Applications*. (under review – 1st round)

Table 20.1: Fact Sheet Publication

Stay Committed - On the Role of Organizational Commitment for Virtual Collaboration in SMEs

Abstract. The COVID-19 pandemic intensified virtual collaboration, which is equally crucial and challenging for SMEs. Our paper investigates the role organizational commitment plays for virtual collaboration and identifies how organizational commitment can be sustained in virtual collaboration in the unique context of small and medium-sized enterprises (SMEs). Participants in the research included 15 members of virtual teams within SMEs, employed in knowledge work. We found that organizational commitment is of great importance in virtual collaboration in SMEs. Our findings suggest that organizational commitment is only established in physical collaboration, but it can be maintained in virtual collaboration. Our initial findings serve as a starting point for further research on organizational commitment in virtual collaboration. Implications for practitioners as well as the research community are discussed.

Keywords. Virtual Collaboration · Organizational Commitment · SMEs · Qualitative Research.

20.1 Introduction

The crisis-driven digital transformation of work i.e., the enforced digital transformation induced by the COVID-19 pandemic [1, 2], has led to the fact that location-independent collaboration became a standard practice [3, 4]. Although working from home is no longer enforced, many organizations are discussing whether and to what extent virtual collaboration should be continued in the future [5]. While many advantages of virtual collaboration for employees (e.g., improved work-life-balance), teams (e.g., spontaneous collaboration possibilities) and organizations (e.g., greater productivity and shorter development times) occurred [e.g., 6, 7], the pandemic highlighted also many challenges of virtual collaboration starting with poor internet connectivity and ending with decreasing organizational commitment of employees [8, 9].

The crisis-driven digital transformation offers unique opportunities, especially for small and medium-sized enterprises (SMEs). For example, through virtual collaboration, SMEs can draw on qualified specialists regardless of where they live, which addresses the problem of the shortage of skilled workers [10, 11]. Since SMEs are basically facing a shortage of resources, they can reduce transfer time and costs as well as travel expenses through virtual collaboration [12, 13].

Research on virtual collaboration indicates that it requires formalized structures and coordination to moderate unavoidable turbulences and unpredictability occurring in virtual collaboration [14, 15]. Pierce and Hansen [16] argue that adherence to structures and scheduled

videoconferences are also important to increase trust within the team and strengthen virtual collaboration. Furthermore, communication and the exchange of personal information are essential and have to be fostered in virtual collaboration [14, 15].

SMEs tend to be informal structured and rather lack development of internal communication instruments [17]. Rather than formal structures, personal collaboration is characteristic of SMEs – resulting in greater involvement and visibility. For this reason, employees of SMEs have a higher organizational commitment than employees of larger companies [18], not least because informal and personal communication is a regular part of their daily work. However, SMEs also depend on the organizational commitment of their employees, as this ensures that employees are not poached because of resources that SMEs cannot offer [18].

This brings up the interesting conundrum of how meaningful organizational commitment is in virtual collaboration and how organizational commitment is affected by the tension between physical and virtual collaboration in SMEs. Therefore, our research aims to answer the following research question (RQ):

RQ: Which role does organizational commitment play for virtual collaboration in SMEs and how can it be sustained?

Our paper is structured as follows: Firstly, the theoretical background on virtual collaboration and organizational commitment in SMEs is briefly examined. Secondly, the methodological approach is described, and the findings of our research are presented. Finally, we conclude with discussing potential implications to theory and practice and identify the limitations of our work as well as further research outlook.

20.2 Theoretical Background

20.2.1 Virtual Collaboration

Collaboration, according to Briggs et al. [19], describes one level of teamwork. Collaboration refers to the interaction of individuals within a team to create value that individual members could not achieve through individual effort [19, 20]. Thus, the sum of the performance of all individuals and of the team as a whole are essential for the success of the team [20]. Collaboration can be understood as a collective effort to achieve a team goal [21, 22]. Collaboration consists of a number of dimensions, such as trust [23], communication [24] and coordination [25].

With physical collaboration being a process where team members collaborate face-to-face, virtual collaboration is a collaboration process in which team members primally work together virtually [26]. According to Peters & Manz [27] virtual collaboration transcends time and space, connects people from various organizations, functions and disciplines, and connects all team members' abilities.

20.2.2 Organizational Commitment

According to Mowday et al. [28], organizational commitment can be defined as "1) a strong belief in and acceptance of the organization's goals and values; (2) a willingness to exert considerable effort on behalf of the organization; and (3) a strong desire to maintain membership in the organization". Organizational commitment refers to the relative emotional intensity of employees' identification with their organization [29] and the decision of an employee to continue working with their organization [30]. The concept is closely associated with employee turnover, absenteeism and performance [28, 31]. Levels of commitment can also affect employees' effort, attitudes and behaviors, levels of job satisfaction, and eventually firm performance [e.g., 32–35]. Compared to job satisfaction, commitment is considered to be more ingrained, robust, and long-term than job satisfaction [36].

Particularly to SMEs organizational commitment challenges are pertinent, since their performance depends on their ability to use the discretion of a relatively limited number of employees [18, 37]. This can be of special importance considering the limited resources they can offer their employees compared to larger organizations [18].

20.3 Methodological Approach

To achieve a comprehensive and in-depth insight into the influences of organizational commitment on virtual collaboration, we applied an inductive, qualitative approach [38]. Therefore, unstructured interviews with open-ended questions with 15 interviewees took place over a period of 4 months.

The interviewees were between 26 and 56 years old at the time of data collection, with an average age of 35 years. 8 of the interviewees stated that they were female and 7 defined themselves as male. All interviewees worked predominantly remotely and were employed in the field of knowledge work. The organizations to which the interviewees belonged were located in Germany and employed less than 250 employees and can therefore be defined as SMEs [39].

We used an open-ended, semi-structured guideline [40], which conformed to Sarker's guidelines for qualitative research [40, 41]. We conducted three preliminary interviews before the first version of the questionnaire was refined. Only minor changes had to be made to the interview guide. We then recorded the interviews and afterwards transcribed them verbatim and anonymized. We analyzed the transcribed files using MAXQDA software. First, we independently applied open coding [42, 43]. Subsequently, axial codes were formed by comparing and grouping the open codes [42]. In a final step, the axial codes were grouped by subject (i.e., selective coding). The analysis ended with saturation.

20.4 Findings

We were able to identify three main grounding findings. Firstly, organizational commitment is still and even more of high relevance for employees when working remotely. Remote work has different requirements than continuous work in the office, which makes committing to the organization even more necessary. Secondly, organizational commitment only appears to be established in direct contact, i.e., when the employees are onsite in the office. However, we also found factors that enhance organizational commitment, which are sustained in remote work using formal and informal practices and routines. Our third finding is thus that organizational commitment can be maintained to a certain degree in virtual collaboration.

20.4.1 Organizational Commitment is Still and Even More Relevant in Remote Work

Organizational commitment is generated by a variety of (ultimately very individual) factors. These range, for example, from adequate communication and trust to participation and the feeling of being heard. The factors mentioned are often associated with attitudes and self-perception of managers, which are first of all location- independent. Thus, it is clear that organizational commitment has relevance in the remote work setting and that it is of great importance to foster communication among the employees.

> *The personal fit is definitely crucial, meaning that you somehow have the feeling that you can identify with the values and goals of the organization [...], you feel like you belong. You have certain points that you would like to address: Push forward, change. And you are given the opportunity to do so [...] That certainly contributes to the feeling of belonging. I don't really see a difference [remotely in contrast to onsite] (O2-I4).*

> *In my opinion, the fact that people stay in the company depends mainly on [...] whether they are appreciated. [...] How can you appreciate remotely? Through communication and by telling employees that they have done a great job. (O1-I2)*

Beyond location-independent factors, there are situations where organizational commitment plays an even more important role remotely than onsite. When employees are not physically working in the company, for instance, there are modified control mechanisms that are subconsciously and implicitly in place when they are working in the office - for example, from supervisors to employees or even between employees. In addition, the range of potential jobs is greater in remote work. In this context, interviewees name organizational commitment as an important instrument for employee bonding in virtual collaboration.

> *You never know [...] what the person is really doing at home. Theoretically, they could also make a call with a potential employer, with a headhunter [...], and simply ask for a new offer [...]. That's why I think it's important to make sure that such a scenario simply doesn't happen, but that you feel like you belong to a club so strongly that you have no interest in being poached (O1-I1).*

> *Here in my current work […] for example it is working well, because we have this constant contact and there are real people I am working with. But when it is remote work with people I only have contact with via email, I don't have the feeling that I let anyone down and […] I would not feel guilty if I just cut off the cooperation (O6-I2)*

20.4.2 Organizational Commitment only Establishes in Onsite Work

The majority of interviewees express a very positive attitude towards remote work. However, planned onsite days for team events or to meet colleagues are considered important. Interviewees often critically reflect that it is difficult to maintain their commitment to the organization virtually and that the development of organizational commitment requires direct interaction within the organization.

> *In order to really strengthen this bond 100%, I think […] that you have to see each other physically […]. This is only possible up to a certain degree [remotely]. (O1-I1)*

The interviews show that the factors to which interviewees ascribe the development of organizational commitment can only be established through personal contact. Communication between colleagues is highlighted as central and small talk and private conversations in particular are considered elementary for the sense of belonging.

> *The lack of face-to-face communication, this is missing. It's a different feeling and people don't have that bonding, that brotherhood. [...] in between or during lunch break, we talk about other things and so on. When we work from home or remotely, that doesn't happen. (...) The identification with the company does not exist. (O1-I3)*

Face-to-face communication is perceived as more natural than virtual meetings could represent. In this context, one issue lies in the currently prevailing work culture, which does not intend room for small talk in remote work. This makes it difficult to establish private dialogue in virtual collaboration that does not seem forced.

> *When I come into the office daily and see someone, I have a quick chat and ask them: "Hey, how's life and how's the travel planning going?" or "How's the house-building going?" or whatever. It's easy because you see each other and just make small talk. But small talk remotely is very difficult, because it is always seen as a waste, always seen as not efficient. I don't call my colleague and say, "Hi, I have to ask, how's your house-building going?" That would actually seem a bit bizarre if I were to do that. How do I get this small talk into it [remote work] without it seeming so forced? (O2-I1)*

> *Communication is not as fluent as when you are in the office in person and have your colleagues sitting right next to you [...]. In my opinion, you will never achieve the same level of interaction between employees. In other words, you will never achieve the same quality (O3-I1).*

Various routines lay the foundations for the onsite organizational commitment. These are informally found between employees and include private small talk and shared humor, coffee, or office grapevine.

> *Small talk is missing remotely. Making a little joke, going to the coffee machine together. I'm a non-smoker, but going out for a smoke together, for example. [...] It's just not possible remotely. (O1-I2)*

On the organizational side, there are formal routines enhancing organizational commitment. In this context, interviewees mention workshops in person, team events, joint participation in sporting events and annual 'workations'.

> *What we also like to do is participating in sport events as a team, as an entire company. And then it's also part of it that we always design our t-shirts ourselves in advance and we don't hand it over to an agency, but we really do it together as a team, think of cool*

things and then apply them. That's part of it. [...] And of course that also helps people to identify with the company in some way. (O2-I4).

20.4.3 Organizational Commitment can be Maintained in Virtual Collaboration

The interviews show that organizational commitment is formed in presence. However, if employees are equipped with a certain amount of organizational commitment (from onsite work), this can be maintained in virtual collaboration. This requires more explicit routines and structures than in work onsite.

I think you need more structures remotely. Well, you need structures, you need processes, and if those are there and if they are clear and everyone can stick to them, then I believe that on the one hand you have a certain freedom, a certain flexibility that you can offer your employees, and on the other hand they also know exactly what they have to do and how in order to fulfill or meet the requirements. And I do believe that the employees are then particularly loyal because they can combine freedom and work wonderfully with each other (O4-I3).

In addition, the availability of remote work can lead to the strengthening of organizational commitment due to the improved work-life balance and the associated feeling of "being understood by the organization". Interviewees see the advantages of virtual collaboration and value the freedom it offers.

This freedom of working hybrid helps them to feel more fulfilled in their personal lifes because they are able to maintain that balance and that directly contributes to the engagement to the company, because they feel like "my company understands me and provides me the flexibility". (O5-I2)

In order to maintain organizational commitment in virtual collaboration, organizations strive for various routines that are intended to maintain organizational commitment. Interviewees mention, among others, participation in the form of holistic task responsibility or tools that enable transparency about company internals remotely.

I am part of the company and not just an employee. Yes, we do remote work but what I say in the company has an impact. I am not just the employee doing my tasks. I own a part, maybe not financially, but [...] in the direction of technology, for example. There are my tasks and if I say that something doesn't work that is also listened to. (O1-I3)

> *There is a 'virtual deal bell' where everyone gets an email from HubSpot. It's automated with confetti when you open it, "the customer has now signed the project here, we've just made €150,000 in sales". (O1-O1)*

Further routines identified from the interviews are related to communication and trust among employees. For instance, team meetings are planned on a regular basis or a periodical 1:1 appointment with the supervisor is set up in order to have the opportunity to directly address any problems that would disappear unseen in virtual collaboration. Other routines included the scheduling of specific times for private small talk or inviting employees at weekly cross-company meetings to share moments of their private life.

> *At the jour fixe [...] we always have five minutes to arrive. Where we just chat privately. [...] It doesn't feel forced anymore if you keep it really simple like that. (O2-I1)*

> *So every Monday morning, the CEO or me, we talk a little bit about the company, what was happening, funding and then two or three people […] can talk about their hobbies, their wedding, whatever they want to, anything from their personal life they are comfortable sharing with. I had also given the chance to people who are shy, that they can write a blog post. […] You get to see so much about the people. […] It gives you points to talk to that person, you build a connection. (O5-I2)*

However, it becomes apparent that maintaining organizational commitment virtually requires much more effort and consciousness than onsite. Whereas in the office, managers or employees can notice directly in personal contact when problems, dissatisfaction or demotivation arise, this aspect requires more time and effort in virtual collaboration.

> *That's challenging, really understanding where the needs are, where the problems are. Are they suffering, is their mental health fine? Are they stressed? You can ask these questions, but you have to spend time to build a relationship for that person to open up and really talk about it. Otherwise, I can go and ask but people assume nothing is wrong. You can see and sense something is wrong. That building, that takes a lot of effort and time in remote work versus when you are in the office. You can go for lunch or have a smoke and they can discuss these things far more easily. Making it work remotely I would say this effort is a lot more. So, people have to put conscious effort in this. This itself is a challenge. (O5-I2)*

20.5 Discussion

We conducted a qualitative study to shed light on the context of organizational commitment and virtual collaboration in SMEs. To answer our proposed RQ we can say that organizational commitment appears to be highly relevant in the virtual collaboration context. We found the development of organizational commitment has to take place onsite, as it depends on face-to-face communication, trust among employees and team cohesion. However, organizational commitment can though be maintained in virtual collaboration. Our findings suggest that more effort and mindfulness are necessary to sustain organizational commitment in virtual collaboration, but is still possible, when planned and executed in a structured manner.

While organizational commitment is a widely studied field, it has not yet received much attention in the context of virtual collaboration in SMEs. By interviewing 15 employees, we were able to provide initial insights and derive implications for both, theory, and practice.

Our findings are important to theory, as we contribute to the organizational commitment literature by looking at organizational commitment in virtual teams. The fact that organizational commitment is created onsite and can be maintained in virtual collaboration provide important indications of the origins of organizational commitment. We were thus able to transfer established findings to a modern working context. This will enable future research to discover new entry points and advance research in this so far little-studied field. Beside the organizational commitment literature, our initial findings may be starting points in the field of virtual collaboration. The understanding that organizational commitment can be maintained virtually provides insight into how virtual collaboration in SMEs should be designed to strengthen the attachment of employees to the organization.

In addition, we were able to derive implications for practice. We underlined the importance of organizational commitment for virtual collaboration in SMEs. Practitioners should therefore initially focus on creating awareness in the organization. For SMEs virtual collaboration provides a competitive advantage to recruit skilled workers. Here they should take action to support the maintenance of organizational commitment in virtual collaboration e.g., allocating financial or personnel resources.

Our research supports SMEs with measures to successfully build and maintain organizational commitment (virtually). SMEs should focus on giving employees sufficient opportunity and reason to build organizational commitment onsite and establish structured opportunities to maintain organizational commitment in virtual collaboration.

As with every research, our research comes with limitations, which invite future research to build on. Firstly, we conducted qualitative research where the typical limitations of qualitative studies are included (e.g., weak internal validation). Future research could use quantitative research, where concrete measures of organizational commitment could be applied and quantitatively tested. Further, the size of our sample gives cause to limitation. In addition to a larger sample size, it would also be interesting to conduct further research using a case study design between different SMEs and thus taking different employee groups into account. A comparison with larger companies could also yield interesting findings. Ultimately, our research can only serve as an initial starting point for linking organizational commitment and virtual collaboration. Further research should explore in more depth which factors of virtual collaboration (e.g., communication, trust, coordination) influence organizational commitment in SMEs and how.

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