Design Thinking with a Bot

Supporting the Design Thinking Process through a Conversational Agent

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Abstract

Motivation

Companies need to create innovation to stay competitive. One way to innovate is Design Thinking (DT), an analytical approach to create new solutions for a previously defined problem in a five to six step process with an interdisciplinary team. It focuses strongly on user centricity with a neutral facilitator having diverse tasks such as organizational tasks, coaching the DT team and providing technical support. DT can be conducted both in digital and analog way. Conducting DT can lead to cognitive load and, in case of digital facilitation, also to technostress. Cognitive load is the mental load resulting from extensively processing information in various ways such as facilitation and problem solving. Technostress is experiencing stress due to the use of collaboration systems such as Microsoft teams which results in lower satisfaction and productivity. One way to conquer these challenges is to use a conversational agent (CA). These are interactive software systems using natural language processing and understanding for various purposes such as acting as a co-facilitator, conduct research, support creative work and be able to affect group cohesion. Informational elicitation as well as providing recommendations is another advantage of CAs. However, current research focuses mostly on information elicitation and merely covers CA as DT co facilitator. This field lacks systematic and user-centered design knowledge on how a CA can support the DT process and, thus, relief the facilitator in the DT process.

Research Design

This research follows the Design Science Research (DSR) approach focusing on the iterative creation of an artifact to address business needs from the environment. The artifacts in this dissertation are constructs in the form of design guidelines (DG) derived from the application domain and a design artifact instantiated in the collaboration tool Microsoft Teams. To support this research approach, several additional research methods were applied across the publications in this dissertation. This includes a systematic literature review, semi-structured qualitative interviews, development of a research agenda as well as quantitative and qualitative data collection and content analysis.

Contribution

This dissertation contributes to the knowledge base covering the conceptualization of creative work and group facilitation with a CA, a deep analysis of business needs for CA supported DT facilitation as well as nascent design knowledge for an instantiated CA supporting DT facilitation. These were then applied to the DSR Knowledge Contribution Matrix focusing on Improvement and Exaptation. The conceptualization of creative work and group facilitation shows five main concepts: fostering creativity, showing emotional intelligence towards humans, support for facilitation and group dynamics as well as elicitating and processing information and giving recommendations. At last, users´ expectations and needs are derived. A thorough analysis of business needs in the application domain shows four main problem areas which are individial and group related challenges as well as difficulties in working in new work modes and workshop situations in general. Focusing on digital DT facilitation, two main problem areas arise which are lack of nonverbal communication and workshop conduction in a digital

environment. All problem areas were derived from both the facilitator´s and the participant´s perspective. Both contributions expand known solutions to new problems and, thus, lies in the Exaptation quadrant. Nascent design knowledge was then developed focusing on providing a neutral position, giving various kinds of input, conducting administrative tasks as well as providing network opportunities for participants. Besides concrete design guidelines (DGs), the CA can be assigned dual roles as in an assistant and the main provider of facilitation due to the fact that CAs are supposed to provide isolated tasks that are exactly the tasks of the facilitator. Thus, the main capability of a CA is derived as recognizing the respective challenge and need within a DT workshop and react respectively. Another main capability of a CA is its reciprocity of the CA´s benefits due to the fact that the facilitator is reactive towards the participants in its nature and, thus, beneficial to both parties. Besides these theoretical contributions, this dissertation contributes to two audiences in practice, namely the DT team and software developers. The DT team benefits from a consolidated overview of current literature showing possibilities and current state of the art research. Besides, a thorough analysis of business needs is provided which may help to conquer difficulties in both analog and digital DT workshops. Lastly, an instantiated CA for DT facilitation is provided for a first user testing. Software developers are provided with design knowledge which can be used to create a CA and further developed and tested.

Limitations

This dissertation faces limitations regarding the scope. In this dissertation, analog and digital conduction of DT were analyzed seperately. However, hybrid work is considered more and more in practice. Moreover, although a holistic approach was aimed in this research, not the whole DT process was considered but mainly general practices as well as the three phases Define, Ideate and Prototype. Furthermore, this research contains a small sample size which leads to restricted generalization and does not represent general DT workshop conduction. Considering the instantiated artifacts, they were built in a non functional way solely focusing on socio-technical aspects which may have an impact on the perception towards the artifact and its functionalities. Finally, mainly qualitative studies were conducted due to the novelty of the topic and lack of knowledge in existing literature.

Future Research

This dissertation gives implications for future research. First, further investigation of DT facilitation should be conducted in a cross industry approach as this research focuses on one specific domain in one industry. Besides, group facilitation as a whole should be considered in future research. Furthermore, hybrid conduction of DT should be examined. Role and task allocation between a CA and facilitators as well as the duality of a CA should be further analyzed. Lastly, the instantiated artifact should be further developed following the design knowledge derived in this research.

Kurzfassung

Motivation

Um wettbewerbsfähig zu bleiben, müssen Unternehmen Innovationen schaffen. Ein Weg zur Innovation ist Design Thinking (DT), ein analytischer Ansatz zur Entwicklung neuer Lösungen für ein zuvor definiertes Problem in einem fünf- bis sechsstufigen Prozess mit einem interdisziplinären Team. Es konzentriert sich stark auf die Nutzerzentrierung, wobei ein neutraler Moderator verschiedene Aufgaben hat, wie z. B. organisatorische Aufgaben, Coaching des DT-Teams und Bereitstellung technischer Unterstützung. DT kann sowohl auf digitale als auch auf analoge Weise durchgeführt werden. Die Durchführung von DT kann zu kognitiver Belastung und, im Falle der digitalen Moderation, auch zu Technostress führen. Kognitive Belastung ist die psychische Belastung, die sich aus der umfangreichen Verarbeitung von Informationen auf verschiedene Weise ergibt, z. B. durch Moderation und Problemlösung. Technostress ist das Erleben von Stress aufgrund der Nutzung von Kollaborationssystemen wie Microsoft Teams, was zu einer geringeren Zufriedenheit und Produktivität führt. Eine Möglichkeit, diese Herausforderungen zu bewältigen, ist der Einsatz eines Conversational Agent (CA). Dabei handelt es sich um interaktive Softwaresysteme, die natürliche Sprache verarbeiten und verstehen und zu verschiedenen Zwecken eingesetzt werden können, z. B. als Co-Moderator, zur Durchführung von Forschungsarbeiten, zur Unterstützung kreativer Arbeit und zur Beeinflussung des Gruppenzusammenhalts. Ein weiterer Vorteil von CAs ist die Gewinnung von Informationen und die Abgabe von Empfehlungen. Die derzeitige Forschung konzentriert sich jedoch hauptsächlich auf die Informationsbeschaffung und behandelt lediglich die Rolle der CA als DT-Co-Moderator. In diesem Bereich fehlt es an systematischem und nutzerzentriertem Designwissen darüber, wie eine CA den DT-Prozess unterstützen und somit den Moderator im DT-Prozess entlasten kann.

Forschungsdesign

Diese Forschung folgt dem Design Science Research (DSR)-Ansatz, der sich auf die iterative Erstellung eines Artefakts konzentriert, um Geschäftsanforderungen aus dem Umfeld zu erfüllen. Die Artefakte in dieser Dissertation sind Konstrukte in Form von Design Guidelines (DG), die aus der Anwendungsdomäne abgeleitet wurden, und ein Designartefakt, das im Kollaborationstool Microsoft Teams instanziiert wurde. Zur Unterstützung dieses Forschungsansatzes wurden in den Publikationen dieser Dissertation mehrere zusätzliche Forschungsmethoden angewandt. Dazu gehören eine systematische Literaturrecherche, halbstrukturierte qualitative Interviews, die Entwicklung einer Forschungsagenda sowie die quantitative und qualitative Datenerhebung und Inhaltsanalyse.

Beitrag

Diese Dissertation trägt zur Wissensbasis bei, die die Konzeptionalisierung von kreativer Arbeit und Gruppenmoderation mit einem CA, eine tiefgreifende Analyse der Geschäftsanforderungen für CA-unterstützte DT-Moderation sowie entstehendes Designwissen für einen instanziierten CA zur Unterstützung von DT-Moderation umfasst. Diese wurden dann auf die DSR-Wissensbeitragsmatrix angewandt, wobei der Schwerpunkt auf Verbesserung und Exaptation lag. Die Konzeptionalisierung der kreativen Arbeit und der Gruppenmoderation zeigt fünf Hauptkonzepte: Förderung der Kreativität,

emotionale Intelligenz gegenüber Menschen, Unterstützung der Moderation und Gruppendynamik sowie das Erfassen und Verarbeiten von Informationen und das Geben von Empfehlungen. Schließlich werden die Erwartungen und Bedürfnisse der Nutzer abgeleitet. Eine gründliche Analyse der geschäftlichen Anforderungen im Anwendungsbereich zeigt vier Hauptproblembereiche, nämlich individuelle und gruppenbezogene Herausforderungen sowie Schwierigkeiten bei der Arbeit in neuen Arbeitsmodi und Workshopsituationen im Allgemeinen. Mit Blick auf die digitale DT-Moderation ergeben sich zwei Hauptproblembereiche, nämlich der Mangel an nonverbaler Kommunikation und die Durchführung von Workshops in einer digitalen Umgebung. Alle Problembereiche wurden sowohl aus der Sicht des Moderators als auch aus der Sicht der Teilnehmer abgeleitet. Beide Beiträge erweitern bekannte Lösungen auf neue Probleme und liegen somit im Quadranten Exaptation. Das entstehende Design-Wissen wurde dann entwickelt, indem eine neutrale Position eingenommen wurde, verschiedene Arten von Input gegeben wurden, administrative Aufgaben durchgeführt wurden und den Teilnehmern Netzwerkmöglichkeiten geboten wurden. Neben konkreten DGs kann der CA eine Doppelrolle als Assistent und Hauptmoderator zugewiesen werden, da die CAs isolierte Aufgaben übernehmen sollen, die genau den Aufgaben des Moderators entsprechen. Die Hauptfähigkeit einer CA besteht also darin, die jeweiligen Herausforderungen und Bedürfnisse innerhalb eines DT-Workshops zu erkennen und entsprechend zu reagieren. Eine weitere Hauptfähigkeit einer CA ist die Reziprozität des Nutzens der CA aufgrund der Tatsache, dass der Facilitator in seinem Wesen reaktiv gegenüber den Teilnehmern ist und somit für beide Parteien von Nutzen ist. Neben diesen theoretischen Beiträgen leistet diese Dissertation auch einen Beitrag für zwei Zielgruppen in der Praxis, nämlich das DT-Team und die Softwareentwickler. Das DT-Team profitiert von einer konsolidierten Übersicht über die aktuelle Literatur, die Möglichkeiten und den aktuellen Stand der Forschung aufzeigt. Außerdem wird eine gründliche Analyse der geschäftlichen Anforderungen geliefert, die helfen kann, Schwierigkeiten in analogen und digitalen DT-Workshops zu überwinden. Schließlich wird eine instanziierte CA zur DT-Moderation für einen ersten Benutzertest bereitgestellt. Softwareentwicklern wird Designwissen zur Verfügung gestellt, das für die Erstellung einer CA verwendet, weiter entwickelt und getestet werden kann.

Beschränkungen

Diese Dissertation unterliegt Beschränkungen hinsichtlich des Umfangs. In dieser Arbeit wurden die analoge und die digitale Durchführung von DT getrennt voneinander analysiert. Die aktuellen Trends bei den Arbeitsmodi zeigen jedoch, dass in der Praxis immer häufiger hybride Arbeitsformen eingesetzt werden. Darüber hinaus wurde, obwohl ein ganzheitlicher Ansatz angestrebt wurde, nicht der gesamte DT-Prozess betrachtet, sondern hauptsächlich allgemeine Praktiken sowie die drei Phasen Define, Ideate und Prototype. Darüber hinaus enthält diese Untersuchung eine kleine Stichprobe, was zu einer eingeschränkten Verallgemeinerung führt und nicht die allgemeine Durchführung von DT-Workshops repräsentiert. Was die instanziierten Artefakte betrifft, so wurden diese auf eine nicht funktionale Art und Weise gebaut, die sich ausschließlich auf sozio-technische Aspekte konzentriert, was einen Einfluss auf die Wahrnehmung des Artefakts und seiner Funktionalitäten haben kann. Schließlich wurden aufgrund der Neuartigkeit des Themas und des Mangels an Wissen in der bestehenden Literatur hauptsächlich qualitative Studien durchgeführt.

Zukünftige Forschung

Diese Dissertation gibt Anhaltspunkte für die zukünftige Forschung. Erstens sollten weitere Untersuchungen zur DT-Moderation in einem branchenübergreifenden Ansatz durchgeführt werden, da sich diese Forschung auf einen spezifischen Bereich in einer Branche konzentriert. Außerdem sollte die Gruppenmoderation als Ganzes in der zukünftigen Forschung berücksichtigt werden. Darüber hinaus sollte die hybride Durchführung von DT untersucht werden. Die Rollen- und Aufgabenverteilung zwischen einer CA und den Moderatoren sowie die Dualität einer CA sollten weiter analysiert werden. Schließlich sollte das instanziierte Artefakt auf der Grundlage der in dieser Untersuchung gewonnenen Erkenntnisse weiterentwickelt werden.

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I. List of Figures

II. List of Tables

III. List of Abbreviations

Conversational Agent	CA
Design Thinking	DT
Artificial Intelligence	AI
Design Science Research	DSR
Information Systems	IS
Design Guidelines	DG
Publication	P
Research Question	RQ
Research Goal	RG
Virtual Collaborator	VC

1. Introduction

Companies need to create innovation, e.g. novel digital products and services, to stay competitive. One way to approach innovation is Design Thinking (DT). DT is an analytical approach to creatively create and experiment on new solutions based on a previously defined problem (Razzouk & Shute 2012). It specifies a five to six step process, at the same time leaves room for design in the implementation by providing various methods for different situations and steps (Plattner et al. 2009; Johansson-Sköldberg et al. 2013). Another speciality about DT is the interdisciplinary team, in which everyone contributes their competencies and benefits from different perspectives. Working together in a diverse team with different educational and experiential backgrounds is enormously important to ensure a broad perspective on the problem to be solved (Weinberg 2012, Brown 2008). There are various approaches and process structures (e.g. IDEO, Plattner et al., Liedtka and Ogilvie), but they all roughly follow the same path: first get to know and understand the problem or the current situation, get to know the target group, find potential solutions and then test them. Iterations over various phases are possible and are also an essential part of DT (Plattner et al. 2009). DT has become an established and widely used method, from industrial corporations to doctor´s office (Dorigkeit & de Paula 2019; Plattner et al. 2009). DT places a special focus on user-centricity. At the beginning of the process, the user group is examined in detail in the context of the problem to be solved. The content of this elaboration runs through the entire process; its findings are kept constantly present to the DT team, e.g. by means of a persona (Erbeldinger & Ramge 2015; Curedale 2013). The facilitator plays a special role in this approach. The tasks of the facilitator are very diverse: on the one hand, the facilitator performs organizational tasks, facilitating workshops using a wide variety of methods for different phases and situations in DT, and operating stakeholder management (Schallmo & Lang 2020). On the other hand, the facilitator has to provide technical support, e.g., by providing suitable suggestions, content and inspiration for the topics addressed, maintaining user centricity or documenting and clustering results in an appropriate way (Schallmo 2018; Schallmo & Lang 2020). Besides, the facilitator is responsible for the dynamics in the DT team by coaching and guiding the DT team to derive the relevant information for the problem at the right time, as well as explaining, describing, and teaching different methods and skills, e.g. low fidelity prototyping in a workshop (Plattner et al. 2009).

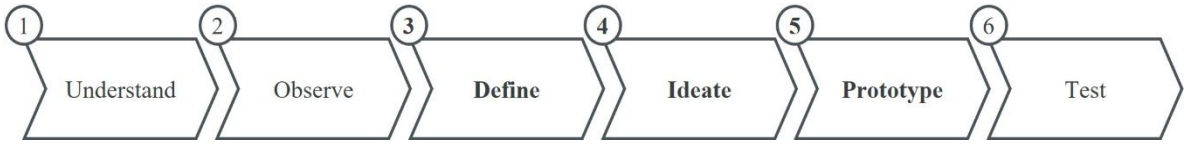

Figure 1: Six Step Design Thinking Process according to Schallmo & Lang (2020)

It is crucial that the facilitator maintains a neutral position to independently direct discussions and maintain constructive communication as well as productive collaboration throughout the team and the process (Schallmo & Lang 2020; Sonnenburg 2004, 2007). With current trends in work modes and the shift to more diversified locations, digital DT facilitation is more and more important (Bloom et al. 2022). However, above mentioned challenges are further exacerbated in the facilitation of digital DT sessions. In digital DT sessions, there are usually several communication streams (audio, chat, video)

that have to be viewed simultaneously by both the facilitator and the participants. The facilitator also has the task of using and moderating suitable communication streams (Besser et al. 2020). Besides, due to the digital facilitation, the facilitator faces less flexibility in the use of methods which leads to higher planning burden beforehand due to planning out alternatives in case the chosen method is not suitable during the virtual session (Thakur et al., 2020). Furthermore, a lack of body language can lead to misinterpretations in communication and be the cause of a lower social base for creative work. A lack of networking or active social breaks due to digital facilitation can also be a hindrance to the social base (Stockleben et al., 2017). The phases of idea generation and prototyping in virtual facilitation pose a particular problem. These two phases rely on active creativity and the use of multiple senses e.g. by "thinking with hands" or drawing (Schallmo, 2018). They require optimal tools for digital facilitation, some of which are already available in companies (e.g. PowerPoint, Miro). However, they require teaching on the facilitators´ side and learning on the participants´ side to use these tools effectively which can be complex, error-prone and time costly (Stockleben et al., 2017; Wenzel et al., 2016). Such activities and responsibilities of the facilitator can lead to cognitive load and, in the case of digital facilitation, also to technostress. Cognitive load is the mental load that results from processing information which can result from interactive elements (intrinsic cognitive load), inappropriate design (extranenous cognitive load) and extensive use of working memory (germane cognitive load). Especially in facilitating and problem-solving, germane cognitive load lies havily on facilitators due to extensive use of working memory (Sweller 2005). Technostress is the experience of stress due to use of collaboration systems such as MS Teams or Slack resulting in lower satisfaction and productivity (Ayyagari et al., 2011; Ragu-Nathan et al., 2008; Tarafdar et al., 2011). A study by Reinelt & Benlian (2022) shows that working remotely alone can cause positive eustress and negative distress. Eustress can be reached through the ease of system use and broad range of functionalities leading to better dealing with workloads, simplification and flexibility. Distress can be experienced through obstacles such as technical issues and overload such as too many tools, expectation of immediate availability, constant checking, notifications and irrelevant information (Benlian, 2020; Reinelt und Benlian, 2022).

To reduce cognitive load and technostress in digital DT facilitation, conversational agents (CA) might be a solution to consider. CAs are interactive systems based on software using natural language processing and understanding (Feine et al. 2019). Prior research shows that CAs can take over various roles in DT: Siemon & Strohmann (2020) show the concept of a virtual collaborator that acts as co-facilitator or team mate, and is supposed to provide assisting tasks, research, organization and evaluation in an independent, proactive and supporting way (Siemon & Strohmann 2020). Moreover, CAs show potential in supporting creative work (Chung & Adar 2021; Strohmann et al. 2018; Perrone & Edwards 2019), show emotional intelligence (Barrange et al. 2017; Ma et al. 2019; McDuff & Czerwinski, 2018; Medeiros & Bosse, 2017), facilitate working sessions and consider group effects (Bohus & Horvitz, 2010; Ceha et al. 2021; de Melo et al. 2017; Kimani et al. 2021). Besides, they are able to elicit information in various contexts and provide recommendations (Adikari et al. 2022; Ma et al. 2021; Petousi et al. 2021; Przybilla et al. 2019). However, current research only shows a small number of publications in CAs for potential use explicitly in DT facilitation which indicates necessary future work. Moreover, current research is more focused on information elicitation as well as decision making,

whereas for digital DT facilitation, research lacks a focus on supporting creative tasks. To tackle this research gap, this dissertation focuses on a specific application domain that uses DT in daily work life. This research consists of five research publications (P) that constitute individual research contributions. However, this dissertation follows – according to presented motivation and problem definition – an overarching research question (RQ) which is defined as follows:

RQ – How can a DT process be supported by a CA?

This RQ is followed by consecutive research goals (RGs) which focus on different aspects of the RQ. These are answered in one or more included publications. This thesis investigates how a socio-technical artifact can support DT facilitation. Due to its design-oriented nature, this thesis applies Design Science Research (DSR) following the approach of Hevner (2004). To pursue this goal, it is crucial to first get an understanding of the concrete business needs in the application domain (Hevner et al., 2004); therefore, RG1 is stated as follows:

RG1 – Gather insights from thorough analysis from business and literature

This RG will be answered in two steps focusing on a comparison of insights from the application domain. First, two studies are conducted to gather information about both analog (**P2**) and virtual (**P3**) DT facilitation which provide concrete needs and challenges from the application domain as well as design knowledge in the form of design guidelines for a CA conquering these, derived from qualitative interviews with both participants and facilitators of DT facilitation. Furthermore, **P1** focuses on current research on capabilities and possibilities of a CA as support for digital DT derived from relevant literature based on a systematic literature review. Besides, **P4** specifies commonalities and differences of virtual and analog DT facilitation as well as corresponding needs, challenges and design knowledge for developing a CA.

RG 2 – Specify design knowledge for a CA supporting DT in the application domain

Furthermore, to conquer derived needs and challenges, **P5** aims to provide a first click dummy as prototype for a CA supporting digital DT. A first artifact to create that was instantiated in the application domain by applying derived design knowledge. Through feedback derived from focus group discussions as well as from literature, further design knowledge was developed to deepen the knowledge base. **P6** provides an iteration of the artifact focusing specifically on the Define, Ideate and Prototype phase of DT. Its main result is an instantiated artifact. Table 1 shows the overall structure of this thesis. Following this introduction, the overarching research design and methods applied throught the thesis will be presented in Section 2. Section 3 gives an overview over important theoretical foundations as a base of this thesis. In Section 4, the publications included in this thesis are presented and briefly summarized. While each and every publication contains its own contributions, Section 5 and 6 focus on the overall theoretical and practical contributions of this thesis. In Section 7, limitations of this research project are presented and reflected while Section 8 shows implications for future research. Finally, the five individual publications included in this thesis are presented as well as P6 in Appx. A.

Wrapper	1.Introduction	2.Theoretical Foundations	3.Research Design	4.Publications
	5.Theoretical Contribution	6.Practical Contribution	7.Limitations	8.Implications for Future Research
Publications	9. Paper 1	Conversational Agents in Creative Work - A Systematic Literature Review and Research Agenda for Remote Design Thinking		
	10. Paper 2	Toward a Virtual Collaborator in Online Collaboration from an Organizations' Perspective		
	11. Paper 3	Problem Areas in Creativity Workshops and Resulting Design Principles for a Virtual Collaborator		
	12. Paper 4	Einsatz eines virtuellen Kollaborators in analogen & digitalen Workshops im organisationalen Kontext		
	13. Paper 5	Prototyping a Conversational Agent for AI-Supported Ideation in Organizational Creativity Processes		
	App. Paper 6	Evaluating the D!Think Bot: a Conversational Agent for the Creativity Process		

Table 1: Thesis Outline and Publications

2. Theoretical Foundations

This section introduces theoretical foundations regarding CAs as well as DT and its challenges in facilitation. CAs are automated dialoge systems that communicate with humans by using and processing natural language (Feine et al. 2019). Famous examples are Siri from Apple and Alexa from Amazon. CAs went from simple input- output design to technology based assistance with the ability of self learning from prior interactions (Laumer et al. 2019). They find more and more use in workplace due to higher reliability and less error prone e.g. as analysis tool, decision making tool, search engine or to increase productivity (Feng and Buxmann 2020). Various concepts and theories work towards CAs supporting facilitation. In this regard, three main paradigms are applicable in the context of CAs: the computers-as-social-actors (CASA) (Nass et al. 1994; Lang et al. 2013), computers as teammates (Nass et al. 1996) and social response theory (Nass & Moon 2000).

In CASA, Nass et al. (1994) examine in five studies if social rules apply in a human-computer interaction. They found that users of a computer act politely towards computers and, thus, apply social norms not only to human but also to computers. Besides, even voices have the effect of a social actor which leads to an application of notions “self” and “other” to computers that may also have different cues such as gender or ethnicity. Moreover, the authors found that users act socially towards the computer in automatic and unconscious way (Nass et al. 1994). The Social Response Theory supports the results from the aforementioned studies. Thereby, Nass & Moon (2000) explore how users deal with the computer depending on individual, situational and technological aspects. While all users know that the computer is not human and does not require human interaction, the authors showed in their studies that users of computers do treat them humanely by applying categorization and mindless behavior through overlearning. First, users rely on social categories when interacting with computers. In their studies, results showed that gender stereotypes were applied by categorizing certain topics as “feminine” and “masculine” when hearing a male or female computer voice. Moreover, social category cues triggered specific expectations and assumption regardless of context when working with a computer agent. Also, being ingroup or outgroup, when assigned to a team with the computer, participants were more likely to cooperate with the computer and perceive it as more friendly and similar to themselves. (Nass & Moon 2000). Second, results show that users show mindless behavior from overlearning through deep habits and behaviors. In their studies, users gave polite response knowingly computers do not have feelings to hurt. Besides, users perceived computers as either helpful or not helpful and reacting reciprocally as well as gave reciprocal responses when asking about emotions: the more emotional information the computer told the user, the more emotional information the user gives back. At last, users perceived the computer more as a specialist than a generalist, and, thus, perceived content provided by specialist as better, and tend to lean more towards computers that are of their own personality, e.g. dominant or submissive personality traits. (Nass & Moon 2000). In 2013, Lang et al. (2013) examined if computers are still perceived as social actors and showed contradictory findings. In their research, they found that the users´ attitude towards computers changed due to more network-based and dislocated computers as nowadays, compared to CASA study in 2000 (Nass & Moon 2000), computers are connected to the Internet. Thus, there is no restriction to just one computer from the users´ point of view; the user´s data is available not only on one but on various computers which leads to a less well defined

physical partner (Lang et al. 2013). Furthermore, in Nass et al. (1996), the authors examine if humans are able to act in a team relationship with computers. They found that users of computers will likely form a team with a computer simply by being told to do so. This is due to the users´ dependency on a computer´s performance in task-oriented situations which leads to the humans perception of being a team with a computer. Users with this perception show the same behaviors as when working in a human team. (Nass et al. 1996).

Using these theories as grounding, several concepts were derived in the case of CAs in collaboration. Seeber et al. (2020a) considered CASA and provided an overview of possibilities of collaborating with technology-based autonomous agents stating that similarity in features – such as demographics, personality or decision-making strategies - between user and agent leads to higher trust and, thus, call for CAs going beyond a mere supporting tool to improve productivity and efficiency (Nass et al. 1994; Seeber et al. 2020a). Furthermore, CAs can support in decision making in certain situations (Davenport & Kirby 2015; Wilson & Daugherty 2018). This can also be done by providing humans with crucial information and research results in a timely manner and, thus, make lengthy manual research by humans redundant (Zumstein & Hundertmarkt 2017). Strohmann et al. (2018) considered CAs as virtual moderation assistance for onsite DT workshops (Strohmann et al. 2018). The authors thereby defined general guidelines for core characteristics and tasks of such virtual moderation, i.e. by giving a rather human than robot like appearance and support in aspects like provide knowledge about methodology and tools, collect information from previous workshops and ease of use as well as show authority and mannerism (Strohmann et al. 2018). Tavanapour et al. (2020) trained IBM Watson as CA to facilitate a group collaboration processes in Slack to find out where a CA is suitable as group facilitator. Their study was successful: the facilitation reached its collaboration goal. Further expert interviews furthermore state that the CA was accepted as facilitator and perceived as neutral and capable of supporting the group throught the collaboration process (Tavanapour et al. 2020). Siemon et al. (2021), furthermore, introduced the virtual collaborator (VC) and defined it as “a coequal virtual teammate in a collaboration setting” (Siemon et al. 2021). The VC – as stated by the participants in this study – should take over tasks in academia such as organizing appointments and provide meeting documentation and summaries of lectures as well as write scientific content such as papers or literature reviews. Participants primarily seek to reduce workload using the VC (Siemon et al. 2021). However, above mentioned literature shows research gaps. Although the pilot study was a success, Tavanapour et al. (2020) present weaknesses of the developed CA in the form of lacking capabilities to assist in creative tasks or by contributing value to the group discussion (Tavanapour et al. 2020). Siemon et al. (2021) present various tasks that should not be done by a VC as perceived by the study´s participants. These include not working as a team leader (leading to a conclusion of inequality between VC and teammates). The authors state several tasks that should be done by a VC as perceived by the participants. Though, this is not without limitations: participants stated that these tasks should only be conducted by the VC under strict rules and only for less complex tasks. Besides, studies consider various but separated aspects of collaboration and creative work (Siemon et al. 2021). This shows the ambiguity of current research and emphasizes the need for further research in this regard.

3. Research Design

This research is embedded in an overarching Design Science Research (DSR) project focusing on the iterative understanding of supporting DT facilitation through the use of a CA. Aiming to "understand[ing], execut[ing], and evaluat[ing] IS research" (Hevner et al. 2004), Hevner et al. (2004) describe the DSR framework that focuses on iteratively creating an artifact to address important tasks that are related to information within organizations (Hevner et al. 2004). The resulting artifact may range from constructs and models to instantiations (Hevner et al. 2004; Simon 1996). The artifacts in this dissertation are constructs in the form of design guidelines (DG) derived from business needs in the studied application domain as well as an iteratively created design artifact instantiated in an organization´s collaboration tool, i.e. Microsoft Teams, in the form of a CA.

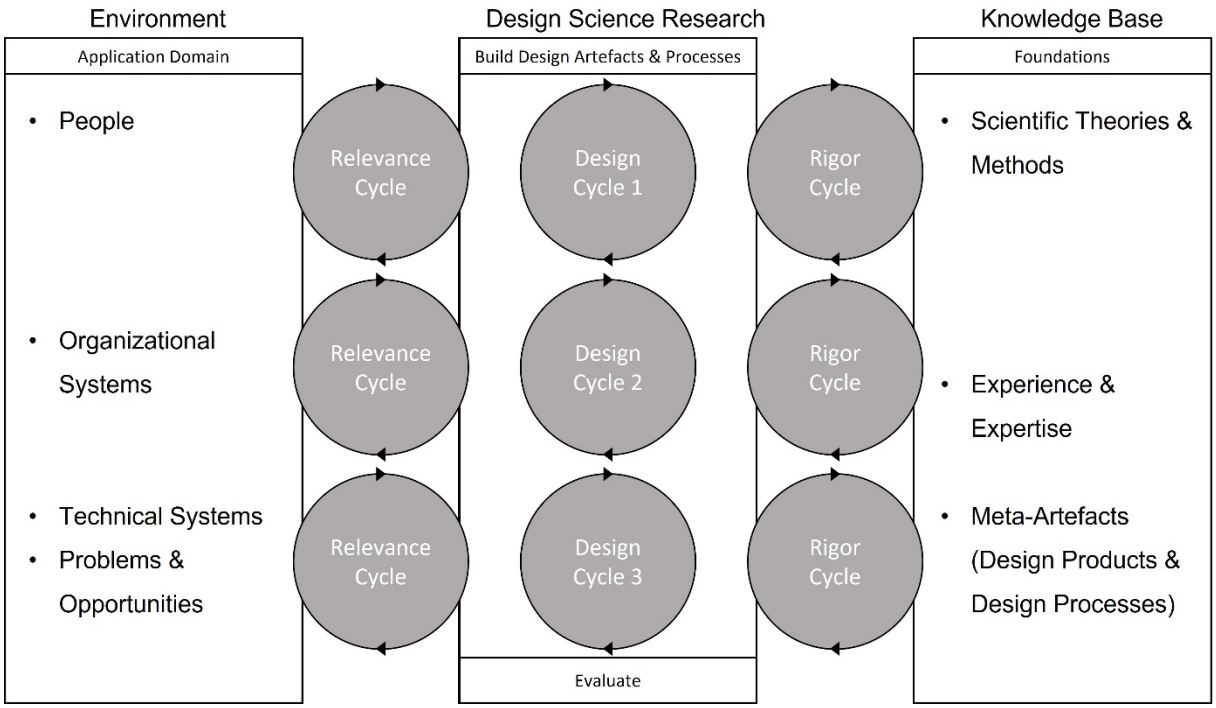

Figure 2: Three Cycle View according to Hevner (2007)

DGs are according to Nowack (1997) a "prescriptive recommendation for a context sensitive course of action to address a design issue" (Nowack, 1997). Greer et al. (2002) describe the suitability of the development of DGs for product development which are derived from observing the product itself (Greer et al. 2002; Möller et al. 2022) which is also the case for the present thesis. Thus, using DGs is suitable. DSR is especially relevant for design-oriented research focusing specific business needs which is applicable and, hence, DSR as overarching research paradigm suitable for this research. This dissertation follows along the three cycle view of Hevner (2007) that comprises the relevance, design and rigor cycle for iterative development of an artifact in a specific environment for the respective business needs (Hevner, 2007). Comprised in three design cycles, each and everyone was conducted in the application domain which functioned as research environment as described in the following.

3.1. Design Iterations – First Design Cycle

In the first design cycle, constructs in the form of DGs were developed to achieve a people-based artifact in the form of consensus building and justification for DT facilitation (see Hevner 2007). P1 starts the rigor cycle in the form of a systematic literature review according to vom Brocke et al. (2009) investigating what can be learned from prior research on CAs in creative work in digital DT. Five main concepts were identified: creative work, emotional intelligence, information retrieval and elicitation, recommendations and users´ preference. The main research gap results in creative work and a specific context, i.e. remote DT. This informs the design cycle by providing insights from literature as well as positioning the research in a purposeful way. Starting the relevance cycle, P2 and P3 extend the knowledge base by providing insights from the application domain: derived from a content analysis according to Mayring (2007), P2 provides needs and challenges of analog facilitation of DT workshops from the perspectives of facilitators and participants as well as respective DGs for a CA for DT facilitation. P3 provides respective knowledge from the same perspectives for digital DT facilitation. P4 comprises these insights in a reasoning for special focus for digital conduction in further research by building consensus in the studied sample. P1, P2, P3 and P4 then close the rigor cycle by contributing a research agenda (P1), problem definition (P2-P3) and design knowledge (P2-P4) to the knowledge base. The relevance cycle is then closed by all four publications through the display of evaluated design knowledge to identified business needs in the studied organization. The design knowledge derived from P4 is to highlight as it is significant for further development of the artifact.

3.2. Design Iterations – Second Design Cycle

The second design cycles contains an instantiated artifact in form of a CA supporting digital DT facilitation. The rigor cycle starts with P4 – thus, also P2 and P3 – that provides evaluated design knowledge to the knowledge base for the design cycle as well as literature review in P5. Respective DGs for digital DT facilitation were implemented in a design artifact using the platform Botsociety focusing on an Microsoft Teams interface as positioned relative to existing solutions in the studied application domain. The firstly designed CA supports the Ideate phase in the DT process by providing inspiration from different sources (P5). The relevance cycle starts with data collected previously in the application domain (P2-P4). P5 closes both the rigor and relevance cycle by providing evaluated design knowledge in forms of DGs to the knowledge base and by evaluating the presented artifact in the application domain through a SWOT analysis and focus group discussions.

3.3. Design Iterations – Third Design Cycle

The third design cycle presents the D!Think Bot as artifact which was expanded to contributing to the whole DT process while focusing on the Define, Ideate and Prototype phase. The relevance cycle starts with P5 which contributes insights from the application domain through focus group discussions and details the business needs for support through a CA digital DT facilitation. Besides, the third design cycle as well as the iterative development of purposeful DG is presented in P6 (s. Appx A). The rigor cycle starts with P5 by providing applicable knowledge through DGs and results from the SWOT

analysis. The D!Think Bot was designed using previously derived design knowledge implemented in Botsociety in an Microsoft Teams interface to ensure a relation to the application domain. P6 closes both the rigor and relevance cycle. The rigor cycle is closed through data collection and empirical evaluation and, thus, adding both qualtitatively and quantitatively evaluated design knowledge to the knowledge base. The relevance cycle is closed applying the artifact in the application domain and providing a solution on the identified business needs.

3.4. Research Methods

Besides DSR as the overarching research paradigm, other research methods were applied for different purposes. Furthermore, requirements were developed and evaluations carried out on a qualitative level. For the knowledge base, literature analyses were carried out in each study in order to create a basis for the research project. In addition, the knowledge base was expanded with each study by providing insights from the application domain as well as design knowledge for a CA in DT facilitation. In order to address the element environment in the three cycle view by Hevner (2007), particularly qualitative research methods such as interviews and focus group discussions, were used. This is especially useful when there is little knowledge about the research question to be investigated (Döring et al. 2016).

3.4.1. Systematic Literature Review and Research Agenda

Literature review is particularly relevant to achieve rigor and build the knowledge base (Gregor and Hevner 2013; vom Brocke et al. 2020). Thus, considering previous studies is key to create purposeful IS systems (Hevner, 2007). This dissertation contains both structured (P1) and unstructured (P2-P6) literature analyses as a contribution to the knowledge base as well as ensuring rigor in the individual publications. P1 follows the approach of vom Brocke et al. (2020) for conducting a systematic literature review. This considers investigating several academic databases with the help of keywords, backword/forward search und searching the results for important aspects considering the chosen topic (Webster and Watson, 2002). P1 aims to provide knowledge from prior research on CAs in creative work for DT facilitation as well as open up research avenues for further research. P2-P6 discuss relevant literature for the specific study to contextualize and ground the individually defined research goals and contributions.

3.4.2. Qualitative Data Collection and Content Analysis

DSR closely considers the application domain to create a meaningful socio-technical artifact. As per Hevner (2004), the environment with its people, organizations and technology need to be investigated to derive business needs and create relevance for IS research (Hevner et al. 2004). In this dissertation, several qualitative methods were used to derive respective business needs and, thus, create a purposeful IS artifact. Semi structured interviews are especially useful when there is a lack of fundamental information for a phenomenon (Döring et al. 2016). Aiming to gain first hand insights from the application domain was a prime goal to gather information about business needs and challenges in the research environment. P2, P3, P4 and P6 (Appx A) use semi structured interviews for data collection. P2 to P4 aim to obtain challenges and needs for supporting analog and digital DT facilitation. Focus

group discussions were conducted in P5. Focus groups are a facilitated discussion procedure consisting of a small group of participants that get information to discuss about. This method allows the researcher to collect data from group interaction and aims for the participants to discuss the topic presented critically to gather as many perspectives as possible (Schulz et al. 2012). In this dissertation, the focus group discussion was used for evaluation purposes. After data collection, a thorough analysis is needed. This dissertation used mainly the content analysis according to Mayring (2007) to analyze qualitatively collected data. The concept of Mayring´s qualitative content analysis is to systematically analyze collected material step by step in order to create a category system. In this dissertation, the model of inductive code construction as well as building categories as a summary of the collected data was applied. Afterwards, the results were interpreted based on the respective research questions of the studies (Mayring 2007). Besides the qualitative analysis, Mayring´s approach also offers a quantitative weighting to prioritize aspects in the analysis. Qualitatively collecting data ensured in this dissertation to acquire various insights into the application domain which is especially important and suitable when there is a lack of information in this field (Döring et al. 2016). In the retrospective, the chosen methods were very suitable for this research to gather information from both literature and the application domain.

3.4.3. Quantitative Data Collection

While this dissertation uses mostly qualitatively collected data, quantitatively collected data found its way in P6 for the third design cycle. In the third design cycle, evaluation following the 2-by-2 framework by Venable et al. (2016) was conducted. The framework considers four steps (1) why, (2) when, (3) how and (4) what to evaluate (Stufflebeam 2003). The goal of this formative evaluation was to improve the created artifact (1) in an ex ante evaluation approach where the artifact was created in studies before the evaluation (2) (Stefanou 2001). Besides, a user oriented evaluation considering real users in a real context was applied (Venable et al. 2016) aiming to evaluate the effectiveness of the artifact for improvement (4). This evaluation was conducted using two standardized questionnaires, System Usability Scale (SUS) for usability (Brooke 2013) and After Scenario Questionnaire (ASQ) focusing on evaluating a completed scenario (Revythi & Tselios 2019). By conducting descriptive statistics on the survey answers, the results were analyzed according to mean deviation. In the retrospective, this method was not completely suitable for this goal as SUS and ASQ are rather suitable for usability but not for usefulness evaluation. Besides, only a small number of people answered the survey. To counteract these, qualitative interviews were conducted in a subsequent data collection following the approaches of Döring et al. (2016) and Mayring (2007).

4. Publications

Table 2 shows all publications (P) resulting from the dissertation process.

No.	Publications (Ps)	Chapter
P1	Debowski, N., Tavanapour, N., & Bittner, E. A. (2022a). **Conversational Agents in Creative Work–A Systematic Literature Review and Research Agenda for Remote Design Thinking.** In Pacific Asia Conference on Information Systems (PACIS). Virtual Event.	9
P2	Debowski, N., Siemon, D., & Bittner, E. A. (2021a). **Problem Areas in Creativity Workshops and Resulting Design Principles for a Virtual Collaborator.** In Pacific Asia Conference on Information Systems (PACIS). Virtual Event.	10
P3	Debowski, N., Tavanapour, N., & Bittner, E. (2022b). **Towards a Virtual Collaborator in Online Collaboration from an Organizations' Perspective**. In Internationale Tagung Wirtschaftsinformatik (WI). Virtual Event.	11
P4	Debowski, N., Tavanapour, N., & Bittner, E. A. (2021b). **Einsatz eines virtuellen Kollaborators in analogen & digitalen Workshops im organisationalen Kontext**. Informatik Spektrum, 44(3), 170-177.	12
P5	Debowski, N., Tavanapour, N., & Bittner, E. A. (2022c). **Prototyping a Conversational Agent for AI-Supported Ideation in Organizational Creativity Processes**. In 55th Hawaii International Conference on Systems Sciences (HICSS). Virtual Event. Pp. 604-613.	13

Table 2: Included publications (P) with corresponding chapters

Citation	Debowski, N., Tavanapour, N., & Bittner, E. A. (2022a). Conversational Agents in Creative Work – A Systematic Literature Review and Research Agenda for Remote Design Thinking. In Pacific Asia Conference on Information Systems (PACIS). Virtual Event.
Ranking	WKWI-Ranking: B VHB-JOURQUAL 3: C CORE2018: A
Type	Completed Research Paper
Methodology	Systematic literature review and concept matrix
Research question	RQ1: What can be learned from prior research on CAs in creative work for supporting teams and facilitators in DT sessions? RQ2: Which research avenues and open research questions for CA support in DT can be identified?
Research contributions	This paper provides a systematic literature review, identifying five main concepts of CAs in creative work as well as deriving further research avenues and research questions for future research.
Co-authors´ contribution	Navid Tavanapour and Eva Bittner co-authored this publication. Eva Bittner provided overall feedback. Navid Tavanapour supported in writing the paper and specially contributed on the conceptual design of the paper.

Table 3: First publication of the cumulative dissertation

Citation	Debowski, N., Siemon, D., & Bittner, E. A. (2021a). Problem Areas in Creativity Workshops and Resulting Design Principles for a Virtual Collaborator. In Pacific Asia Conference on Information Systems (PACIS). Virtual Event.
Ranking	WKWI-Ranking: B VHB-JOURQUAL 3: C CORE2018: A
Type	Completed Research Paper
Methodology	DSR, semi-structured interviews, qualitative content analysis.
Research questions	RQ1: Which challenges occur in creative workshops for the facilitator and the participants? RQ2: How can a VC be designed to support facilitators and practitioners during the workshop and its execution?
Research contribution	This paper provides an analysis of problem areas in analog creativity workshops and derived design knowledge for a CA.
Co-authors´ contribution	Dominik Siemon and Eva Bittner co-authored this publication. Both provided overall feedback. Dominik Siemon supported in writing the paper and specially contributed on the conceptual design of the paper.

Table 4: Second publication of the cumulative dissertation

Citation	Debowski, N., Tavanapour, N., & Bittner, E. (2022b). Towards a Virtual Collaborator in Online Collaboration from an Organizations' Perspective. In Internationale Tagung Wirtschaftsinformatik (WI). Virtual Event.
Ranking	WKWI-Ranking: A VHB-JOURQUAL 3: C
Type	Completed Research Paper
Methodology	DSR, semi-structured interviews, qualitative content analysis.
Research questions	RQ1: Which challenges occur in virtual creative workshops for the facilitator and participants in comparison to onsite creative workshops? RQ2: How can a VC be designed to support the facilitator and practitioners during the workshop?
Research contribution	This paper provides an analysis of problem areas in digital creativity workshops and derived design knowledge for a CA.
Co-authors´ contribution	Navid Tavanapour and Eva Bittner co-authored this publication. Eva Bittner provided overall feedback. Navid Tavanapour supported in writing the paper and specially contributed on the conceptual design of the paper.

Table 5: Third publication of the cumulative dissertation

Citation	Debowski, N., Tavanapour, N., & Bittner, E. A. (2021b). Einsatz eines virtuellen Kollaborators in analogen & digitalen Workshops im organisationalen Kontext. Informatik Spektrum, 44(3), 170-177.
Ranking	WKWI-Ranking: B VHB-JOURQUAL 3: D
Type	Completed Research Paper
Methodology	DSR, two rounds of qualitative semi-structured interviews, comparison
Research questions	(de) F1: Wie unterscheiden sich die Designprinzipien eines VK für digitale Workshop-Situationen von denen für analoge Workshop-Situationen? F2: Welche Designprinzipien lassen sich aus organisationaler Perspektive für einen VK explizit für digitale Kreativworkshops definieren? (en) RQ1: How do the design principles of a VC for digital workshop situations differ from those for analog workshop situations? RQ2: From an organizational perspective, what design principles can be defined for a VC explicitly for digital creative workshops?
Research contributions	This paper contributes with a comparison of analog and digital DT workshops as well as its differences and similarities for a virtual collaborator. Besides, it provides specified design knowledge for a virtual collaborator for digital DT workshops.
Co-authors´ contribution	Navid Tavanapour and Eva Bittner co-authored this publication. Eva Bittner provided overall feedback. Navid Tavanapour supported in writing the paper and specially contributed on the conceptual design of the paper.

Table 6: Fourth publication of the cumulative dissertation

Citation	Debowski, N., Tavanapour, N., & Bittner, E. A. (2022c). Prototyping a Conversational Agent for AI-Supported Ideation in Organizational Creativity Processes. In 55th Hawaii International Conference on Systems Sciences (HICSS). Virtual Event. Pp. 604-613.
Ranking	WKWI-Ranking: B VHB-JOURQUAL 3: C CORE2018: A
Type	Completed Research Paper
Methodology	DSR, expert interviews, focus group discussions, development of non-functional design artifact according to derived design knowledge
Research questions	RQ1: Which strengths and weaknesses do potential users see in the presented prototype? RQ2: Which opportunities and threats do potential users see in the presented prototype? RQ3: What wishes and ideas do potential users have in order to improve the prototype´s usability?
Research contribution	This paper provides an evaluated design artifact in the form of a prototype as well as prescriptive design knowledge for further development.
Co-authors´ contribution	Navid Tavanapour and Eva Bittner co-authored this publication. Eva Bittner provided overall feedback. Navid Tavanapour supported in writing the paper and specially contributed on the conceptual design of the paper.

Table 7: Fifth publication of the cumulative dissertation

5. Theoretical Contributions

This dissertation contributes to the knowledge base in three aspects: the conceptualization of creative work and group facilitation with a CA (section 5.1.), a thorough analysis of business needs for DT facilitation using a CA (section 5.2.) and thorough design knowledge for an instatiated CA contributing to analog and digital DT facilitation (section 5.3.) consisting of a summary of derived design knowledge (section 5.3.1.), the duality of the CA differentiating the roles as support versus main provider of facilitation (section 5.3.2.) as well as the reciprocity of a CA towards participants and facilitators of DT facilitation (section 5.3.3.).

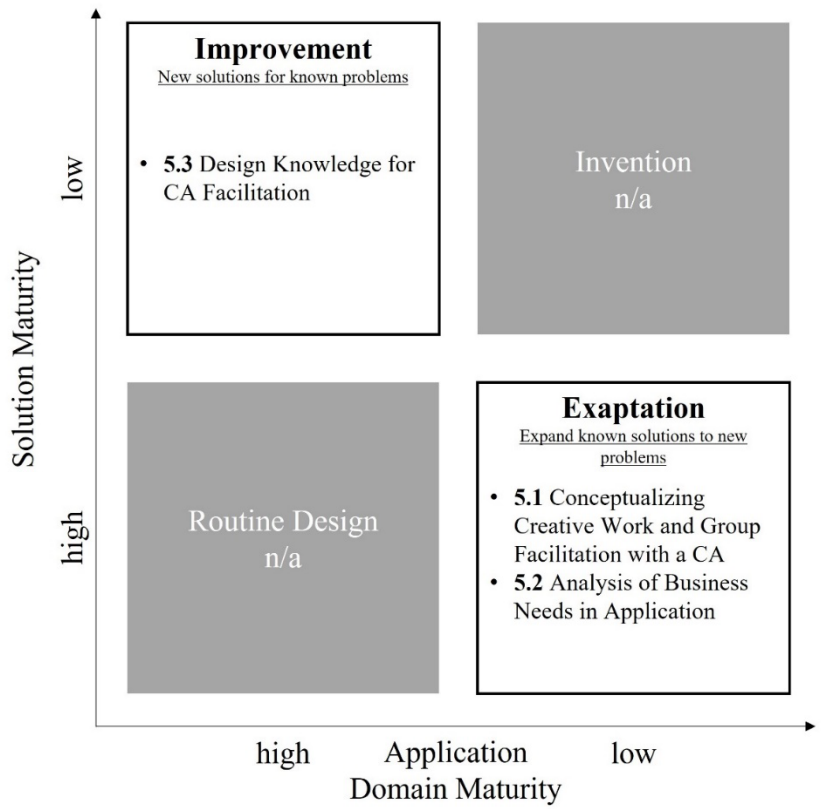

Figure 3: DSR Knowledge Contribution Matrix (Gregor & Hevner 2013)

These contributions are shown in the DSR Knowledge Contribution Matrix (Figure 3) according to Gregor & Hevner (2013) that discuss a DSR project´s contributions in the context of Solution Maturity and Application Domain Maturity relevant to the DSR project (Gregor & Hevner 2013). This dissertation´s main contribution lies in Improvement and Exaptation. Exaptation expands known solutions to new problems (here section 5.1 and 5.2). Improvement provides the development of new solutions for known problems aiming to create better solutions by providing more efficient and effective processes or ideas (here section 5.3). It contains a known application context with no solution determined to it (Gregor & Hevner 2013). The quadrants Invention and Routine Design are not applicable here. The dissertation´s contributions will be presented and discussed in the following.

5.1. Conceptualizing Creative Work and Group Facilitation with a CA

The conceptualization of creative work and group facilitation provides an extension of known solutions to new problems in the given application domain of DT facilitation. According to Gregor & Hevner (2013), in this quadrant, an artifact is not available in this specific field, but exists in a related area (Gregor & Hevner 2013). Thus, CAs were adopted from existing concepts (see section Related Work) to the field of DT facilitation by examining relevant needs and challenges of the application domain. The conceptualization of creative work and group facilitation was conducted through a systematic literature review following the approach of vom Brocke et al. (2020) (P1). Five main feature concepts were identified that are relevant to DT facilitation using a CA, which were then matched with respective DT phase and support type as presented below. It, thus, contributes with a "greater understanding of new artifacts" (Gregor & Hevner 2013), here of CAs for DT facilitation. The concept of Creative Work shows relevant features of the CA to foster creativity. Emotional Intelligence describes a CA´s ability to show empathy while Facilitation & Group Effects represents features of a CA to support facilitation and affect on group dynamics. Information Elicitation & Recommendations shows relevant features to gather information and process these in a specific context. The last concept User´s Preference presents potential users´ expectations and needs for DT facilitation. For the Understand phase, no research was provided through prior research that can be assigned directly to the Understand phase. However, the CAs support may consist of information elicitation for inspiration and decision support by providing background knowledge and process information, and, thus, provide a base for decision making (Athreya et al. 2018; Kaushik et al. 2020). For the Observe phase, the same case applies as for the Understand phase. This may arise due to the very practical and social components of these two phases. The information gathered for the mentioned phases are mainly from conversation with humans (Plattner et al. 2009).

Concept / Phase	Creative Work	Emotional Intelligence	Facilitation & Group Effects	Information Elicitation & Recommendations	User´s Preference
Understand		x		x	
Observe					
Define		x	x	x	
Ideate	x	x	x	x	
Prototype	x			x	
Test					
General	x	x	x	x	x

Table 8: Overview Concepts from Literature Mapped to DT Phases

For the Define phase, the main concept is emotional intelligence for understanding the target group through analyzing behavior (McDuff & Czerwinski 2018) and providing coping strategies e.g. for the target group (Medeiros & Bosse 2017; Vögel et al. 2018). Another way to support DT facilitators in the Define phase is by supporting decision making when facilitating a group (de Melo et al. 2017) as well

as through information elicitation and giving recommentdations for decision support (Athreya et al. 2018; Kaushik et al. 2020). For Ideate phase and to engage working creatively, a CA is able to provide decision support through giving recommendations (Strohmann et al. 2018) as well as providing inspiration in different types of forms (Perrone & Edwards 2019). For Prototype phase, main support to enable creative work is by providing suitable tools using a CA (Chung & Adar 2021) as well as providing inspiration and support with decision making (Kaushik et al. 2020) which is in line with the Ideate phase. As for the Test phase, there is again no prior research that may be assigned to this phase directly. This may be another hint for the rather practical and social component of this phase as seen on the Understand and Empathize phase, as the test phase requires interaction with potential users. All in all, providing inspiration, support in decision making and giving recommendations seem to be the most important steps to be taken by a CA besides increasing productivity, which is more of a result of the aforementioned capabilities of the CA.

5.2. Analysis of Business Needs in Application Domain

Another major contribution of this dissertation is a thorough analysis of the application domain and resulting business needs from a real industrial organization which is another contribution through exaptation. Here, the main contribution is the presentation of new challenges that can be solved through a CA which, however, was not present in a related field of this technology (Gregor & Hevner 2013). P2 to P4 show this strongly. These contribute with explicit problem orientation with regard to DT facilitation, its problems and needs of facilitators and participants. Although participants were interviewed and studied as well, the main focus relies on facilitators as these are the ones who support participants when problems occur (Plattner et al. 2009). The derived business needs can be defined as generalized class of problems due to its close consideration of a set process which is the well known DT process (Nunamaker et al. 2015). Although this research does not consider a cross-industry approach, DT practitioners lean onto the same or similar process and use the same or similar ressources to get to know the process. Therefore, the following contributions can be determined as generalizable knowledge in the application domain. Four main problem areas were derived for DT facilitation: individual challenges, group related challenges, difficulties in getting to know new concepts and approaches from a participants point of view, and workshop situations in general from facilitators point of view. From participants point of view, individual challenges arise e.g. due to self doubt and lack of knowledge or experience in a specific field and, thus, less engagement in a workshop. Group related challenges are consequently aspects such as very dominant participants that more quiet participants cannot work with or participants who tend to not working towards the workshop goal (Seeber et al. 2020). Besides, getting to know new concepts opens up the difficulty to break through known and comfortable thinking patterns and leaving the comfort zone of oneself. (Schelle et al. 2015). Lastly, for analog workshops from the facilitators point of view, mostly the organization of workshops but not the facilitation itself was the main challenge: taking minutes, organizing content, providing suitable content as inspiration for solution generation (Vreede & Briggs 2005). Also, trying out new methods for a workshop and having a “plan B” is a challenge for the DT facilitators causing a significant amount of cognitive load (Hjalmarsson et al. 2015). Focusing on a digital DT facilitation, two major problem spaces arise, lack of nonverbal

communication and workshop preparation and conduction in a digital environment. Especially when participants do not know each other in the beginning of the workshop, the environment is rather still and reserved than open and fruitful (Schelle et al. 2015). Networking in the beginning of a workshop as well as in breaks is either not given or conducted by only a few participants. This results from the lack of direct communication and body language as well as the digital environment as a communication barrier, i.e. participants can "hide" by turning off the camera and not saying anything. Besides, through "hiding" as quiet listener in a meeting, it is easier to jump from one workshop to another meeting which, thus, leads to less engagement in a workshop. This can make a workshop less fruitful generally and may lead to frustration and less productive conduction (Chikramane 2021). Moreover, communication may be more difficult due to the lack of body language: people tend to interrupt each other more often as they do not see when someone opens their mouth to start saying something. Handling several communication streams at once is another communication barrier which leads to distractions and, thus, less participation and engagement in the workshop. Participants tend to react distracted by notifications such as from email programs or other collaboration platforms (Bader et al. 2020). These aspects may result in less cohesive groups and, thus, higher cognitive load for facilitators of digital DT facilitation.

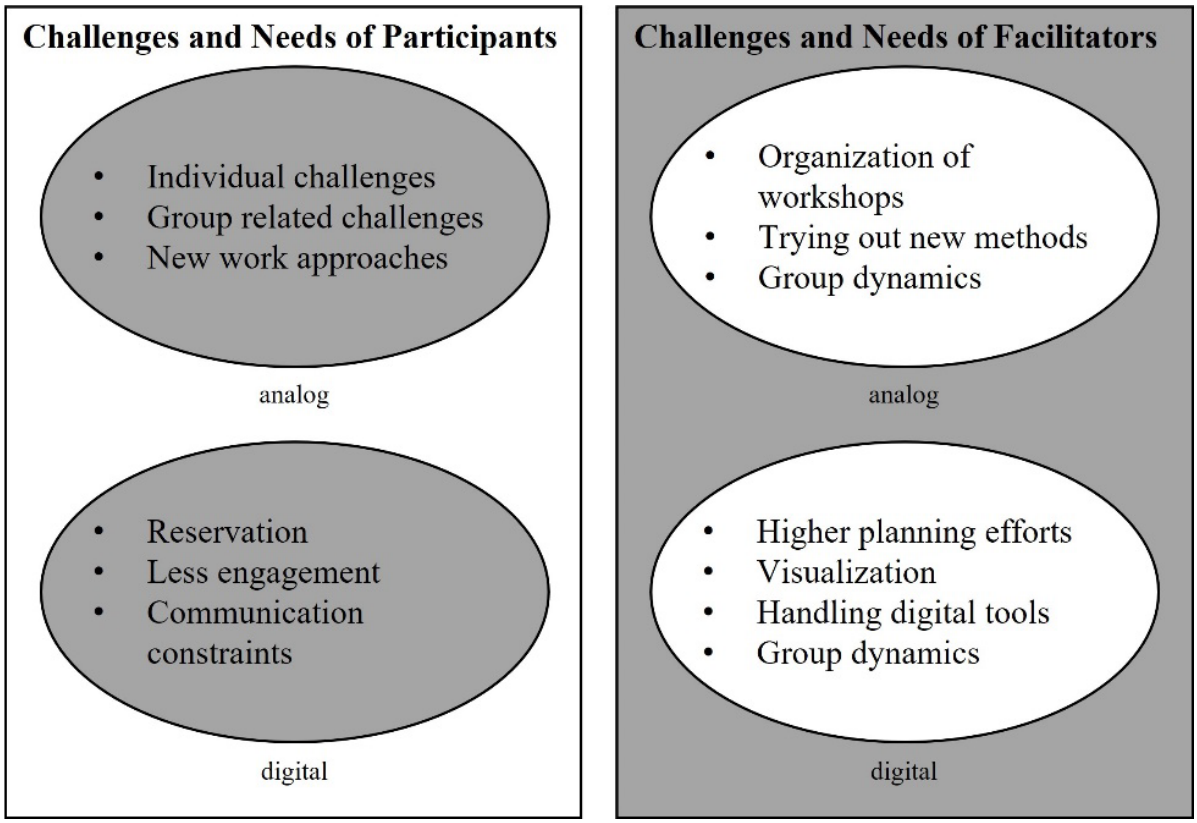

Figure 4: Overview Challenges and Needs of Participants and Facilitators in Analog and Digital DT

From a facilitators point of view, workshop preparations and dealing with digital functionalities are another main challenge (Bader et al. 2020). Especially when new in digital DT facilitation, facilitators tend to have a higher workload and, thus, higher cognitive load when preparing a digital DT workshop. This is the result of less spontaneity of the digital DT facilitation which leads to preparing more alternatives in case one method or tool does not work as intended, e.g. spontanouos visualizations

(Furmanek & Daurer 2019). Another major problem arises for DT phases that are heavy in visualization such as in Ideate and Prototype phases. In analog conduction, it is easy: participants just grab a pen and a piece of paper. In digital conduction, however, it requires firstly a suitable tool and secondly the ability to draw using digital tools which is less handy and requires some time to get comfortable than with a pen and paper (Stockleben et al. 2017). Not only for visualizations but also in general, handling digital tools requires explanations as well as a testing phase to get comfortable using it. This can counteract productivity in workshop situations. Thus, technical skills and handling digital tools and media is a general requirement for both participants and facilitators. In comparison to analog DT facilitation (Debowski et al. 2021b), the main burden of digital conduction lies in the lack of body language and direct communication which results in less networking and socializing between the participants (Chikramane 2021). In analog conduction, however, it is rather difficult to achieve a balanced group discussion with more dominant participants on the one hand side and more reserved participants on the other. A facilitator then works as a neutral position who does not judge any of the comments but rather takes care of achieving a good balance to ensure various perspectives. As of preparing a workshop, both analog and digital conduction require a high work load but is shown in different aspects. Analog conduction requires more documentation and digitizing documents as well as providing physical material such as post-its and pens (Meinel & von Thienen 2016). Digital conduction needs rather digital templates such as in PowerPoint or a prepared Miro board to work with. Additionally, not only one but several methods and, thus, several templates need to be prepared. Digital conduction, however, shows more advantages for documentation: as facilitator and participants already work in digital tools and digitally provided templates, no digitization is needed afterwards (Bader et al. 2020). But, a clear disadvantage is the digital conduction for the Ideate, Prototype and Test phase due to the lack of digital tools that can be used quickly and without any usage obstacles (Furmanek & Daurer 2019). In sum, analog conduction results in higher cognitive load regarding group facilitation in terms of equal discussions and postprocessing whereas digital conduction results in higher cognitive load regarding group facilitation in terms of engagement and workshop preparation. There are indeed similarities. Both types of DT facilitation and facilitation require a significant amount of the facilitator´s cognitive capabilities for providing inspiration in the Ideate and Prototype phase as well as providing input and information to support solution creation and decision making. Also, getting information of already existing solutions or products is another need for both types of conduction. Providing the possibility for an equal discussion was mainly a requirement for analog workshops, however, digital conduction will benefit from it as well through higher engagement of the participants. Thus, the neutral position of a facilitator needs to be maintained, whether as CA or as human facilitator.

5.3. Design Knowledge for CA Facilitation

Another major contribution of this research is nascent design knowledge as operational DGs derived from the business needs and is considered to the Improvement quadrant of the DSR Knowledge Contribution Framework. Contributions in the Improvement quadrant aim to create better solutions by i.e. developing nascent design knowledge to create more efficient and effective solutions in a known application context (Gregor & Hevner 2013). First, (meta)requirements were derived; afterwards, concrete DGs were derived to inform the knowledge base. Audience of this design knowledge are

primarily DSR researchers, software developers as well as DT practitioners that aim to provide support for DT facilitation. Main beneficiary of the CAs functionalities is the facilitator with the aim to decrease cognitive load and provide support for DT facilitation. However, participants benefit from these indirectly as the facilitator is mainly a servant leader to the participants aiming to provide the best possible environment to the workshop (Plattner et al. 2009). After deriving general design knowledge for both analog and digital DT facilitation, this research focuses on supporting digital DT facilitation through shifts in the researched environment and, thus, application domain. However, as main challenges and needs arise in providing information and inspiration through a CA for both analog and digital conduction, this is the main focus of the CAs functionalities (see. Section 5.3, P2 to P4).

5.3.1. Summary of Main Design Knowledge

General design knowledge was derived in P2 to P4. For analog DT facilitation, main DGs are in providing a neutral perspective through a CA. In detail, a CA should provide the ability to count and display speech shares by stating how many statements were given per participant in a workshop (Seidel & Berente 2020). Participants and facilitators stated that this information should be shown to either the participant itself for its own data, but not the data from other participants, or to solely the facilitator. This indicates that the main responsibility for ensuring a balanced discussion should further stand with the facilitator. However, with the use of the CA and mentioned DGs, the cognitive load of the facilitator could be descreased by providing an overview of speech shares. Thus, the CA can contribute to balancing out group discussions and providing a neutral position to the workshop (Waizenegger et al. 2020; Wilson & Daugherty 2018).

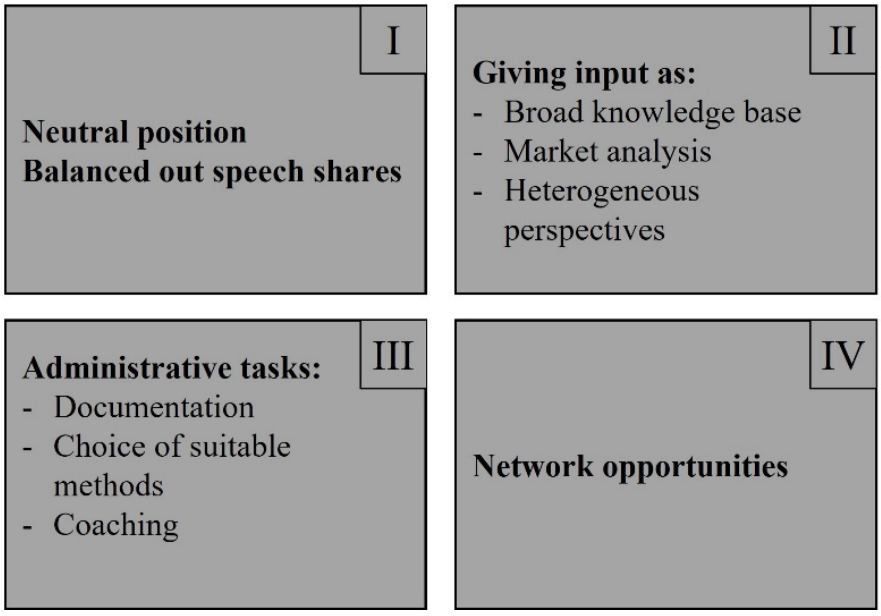

Figure 5: Overview of Main DGs

Another main DG is giving input. This shows various dimensions. First, contributing to the participants needs and challenges, the CA is supposed to provide a broad knowledge base for the participants to contribute with higher quality input during the workshop. This may happen in two aspects: first, as

knowledge base that increases from workshop to workshop that is available to the participants; second, by providing selectively in the suitable situation, e.g. providing inspirational information, statistics, pictures or sounds for a certain topic in the Ideate phase (Waizenegger et al. 2020; Seeber et al. 2019). Mostly, the aim of the Ideate phase is to develop and create a new and innovative solution for a previously stated problem (Plattner et al. 2009). Thus, the CA may provide a quick market analysis for existing products and solutions to then determine if the solution acquired in the Ideate phase is innovative and providing a competitive advantage for the organization (Dorigkeit & de Paula 2019). However, this DG can be determined as beneficiant to the facilitator as well as one of the facilitator´s task. The facilitator´s challenge is to provide inspirational content for every possible topic although not being a technical expert in all topics. Furthermore, the CA may function as providing different perspectives to ensure heterogenous and various different perspectives in the workshop. This can be done by giving the CA a specific role such as the persona, i.e. the target group, a contradictory perspective to challenge the built solution or thoughts or providing a perspective missing in the current team constellation (Gil et al. 2014; Ransbotham et al. 2017). Therefore, providing information and knowledge leads to benefits for all members of the DT team and, thus, to more productive and efficient DT workshops and decreased cognitive load for the facilitator.

The CA is supposed to provide support for administrative tasks which mainly focuses the facilitator´s perspective. Documentation is the facilitator´s main burden although digital conduction already provides a solution through digital templates. However, sensemaking, postprocessing and summarizing the workshop´s content as well as providing a well defined starting point for the following workshop is key for successful innovation work in DT (Gil et al. 2014; Ransbotham et al. 2017; Plattner et al. 2009). Moreover, choice of suitable methods for the respective workshop phase is key for successful DT, nevertheless, it also causes a significant amount of cognitive load for facilitators. A CA should suggest suitable methods based on workshop or phase goal, participants input and mood (Davenport & Kirby 2016; Zumstein & Hundertmarkt 2017)). As indicated for digital DT facilitation, it is also necessary to provide and prepare alternatives for given methods to quickly change in case a method is not suitable for the time being. Lastly, by coaching the participants, the CA can contribute to an open environment for the workshop as well as an open mindset among participants (Seeber et al. 2020; Wilson & Daugherty 2018). This is to aim for more engagement and more productivity during the DT workshop.

Specifically for digital DT facilitation (P3), a CA is supposed to provide network opportunities for the participants as this is one major difference and specific problem of digital DT facilitation. A CA´s main function, therefore, is to deliver non-personal information with respective privacy and data protection settings from business networks and intranet profiles in a subtle way. This aims to work as a starter for conversations among the participants. Furthermore, to influence group cohesion of the DT team positively, the CA may provide voice and conversational analyses to identify moods and counteract negative moods (Shamekhi et al. 2018; Dietvorst et al. 2015). All in all, this general design knowledge is derived from subjective interview answers from participants and facilitators. However, an instantiation of a design artifact based on these led to more specific design knowledge which will be presented in the following.

In a first instantiation in the application domain (P5), i.e. digital DT facilitation, the artifact was designed as intelligent chatbot within the collaboration tool Microsoft Teams as this is the prevailing tool for digital work in the studied research environment. Three main functionalities were instantiated for supporting the Ideate phase: knowledge generation through semantic analyses and providing background knowledge, providing analysis for existing solutions and products, and providing various different perspectives to the workshops. This generally fit the business needs, however, led to more concrete and specified design knowledge: set a certain focus and level of detail for acquired information (Kaushik & Jones 2021), combine general information provided with respective existing solutions (Gil et al. 2014; Ransbotham et al. 2017) as well as supporting empathic thinking by providing input characteristic for the previously defined persona instead of showing just statistics and information about it (Tseng et al. 2019). In a second instantiation in the application domain (P6, Appx A), the further developed artifact was evaluated for usability and ease of use, and further design knowledge derived. One DG specifically followed the first instantiation: optimize the CA´s output by applying natural language processing and understanding to achieve more precise information and knowledge. Furthermore, two new DGs were derived, visualization of the CA´s output (Siepermann & Lackes, 2019) as well as providing guidance through the DT process by the CA (Kaushik & Jones 2021). The results from the second instantiation show that design knowledge derived from mere subjective interview answers already give a great direction for a CA. However, as presented above, instantiations are especially important to derive further and more precise design knowledge for the CA.

5.3.2. Duality of CA – Assistant versus Main Provider

Another major contribution of this research is determining the duality of the CA in this application domain which can be further classified as nascent design knowledge (Gregor & Hevner 2013). Besides concrete design elements to determine the right and helpful functionalities of a CA in the studied application domain, it is necessary to determine the exact role of the CA in the application domain. Interestingly, all studies consolidated in this dissertation indicate, that the interviewees see the CA primarily as support for the facilitator, not as sole facilitator. However, all tasks mentioned to be taken over by the CA are exactly the tasks, a facilitator does routinely. This leads to the assumption that either participants do not feel comfortable with having a CA as sole facilitator, participants do not think that CAs are capable of doing all these tasks or they just do not want the CA do these tasks for other reasons. Nevertheless, this shows the duality of a CA in the application domain. A CA may be a great sole facilitator if accepted by the participants by taking over all described tasks: suggesting methods based on workshop goal or mood of participants (Wilson & Daugherty 2018; Shamekhi et al. 2018; Dietvorst et al., 2015), take over a specific role in a workshop to achieve balanced discussions when missing a perspective, determine the right timing for breaks (Seeber et al. 2019; Wilson & Daugherty 2018), strong research role, gather information, provide inspiration and give hints at the right timing (Gil et al. 2014; Ransbotham et al. 2017), encourage creativity and open mindset (Seeber et al. 2020; Wilson & Daugherty 2018), provide administrative support, e.g. through filling out templates, taking minutes (Shluzas & Pickham 2017) or interview transcriptions (Dolata et al. 2019), provide networking opportunities through information elicitation (Gil et al. 2014; Ransbotham et al. 2017). As prior research shows, CAs are capable to perform these tasks. This leads to the assumption that it is not important *if*

the CA takes over all these tasks but *when.* All studied objects provided their subjective opinion on the matter; this includes both their subjective challenges and needs in a workshop and subjective suggestions on what a CA could do. Therefore, it may be suitable to determine the right timing as *when a challenge or need occurs*. This may be a facilitator facing the challenge of unbalanced discussions and not being able to find a good solution to counteract these. This may also be a participant being constantly held down by a very dominant discussant in the workshop and not being able to find their right position in the discussion. A CA may certainly be a good help to solve these issues. However, it still shows a very subjective perspective and is very dependend on the situation. This may lead to the assumption that being able to *recognize* the respective challenge and need as well as the roles within the workshop is the main capability of a CA.

5.3.3. Reciprocity of a CA´s Benefit

As discussed above, the capabilities of a CA are derived from a number of subjective challenges and needs from the perspective of both participants and facilitators. However, it is not completely clear whom the CA benefits the most: the participants or the facilitators? This may lead to the assumption that a CAs role *is* not being assigned to one beneficiary. Observing the challenges and needs mentioned in the studied environment, it shows that these are reciproce to each other: it is the facilitator´s job to guide the participants and provide them with the tools and materials they need to solve their problem. This assumption is supported by the Theory of Affordances by Gibson (1977). This theory shows that certain user groups have different affordances and, thus, use artifacts differently and also for different needs (Gibson 1977). In the presented application domain, if a challenge or need arises from the participants, it is indirectly a challenge or need of the facilitator as this role is the one to support the participants throughout the whole process in a variety of ways. Thus, there is a valid determination that a CA in this application domain is also reciproce, namely, towards participants and facilitators. Its functionalities, therefore, are also beneficial to both parties and the affordances are dependent on each other.

6. Practical Contributions

This dissertation, furthermore, contributes to practice focusing two audiences, the DT team as well as software developers. The DT team – foremost the facilitators but due to its reciproce character also the participants – benefit from a consolidation of current literature (P1) giving an overview over five main concepts to counteract their cognitive load during workshops. This shows possibilities and current state of the art research on various applications of a CA. This can on the one hand serve as inspiration for quick wins by searching out individual solutions to conquer individual and subjective challenges. On the other hand, it may provide inspiration for a more systematic approach in optimizing the DT practice. Following this, DT practitioners benefit from understanding their user group better – participants. Providing a thorough analysis of business needs from both perspectives in both analog and digital conduction may help to conquer difficulties during the workshop and, thus, help to create better innovation. Furthermore, by comparing analog and digital DT facilitation, DT practitioners benefit from insights regarding the transition from sole work from the office to sole work from home to a more hybrid constellation. This can provide lessons learned from physical collaboration to the digital delivery of creativity workshops. Lastly, DT practitioners can benefit from a first instantiated CA for DT facilitation which allows the users to try out possible solutions as well as an individual setting of a CA supporting DT.

Software developers face the challenge to create such systems due to the lack of concrete business needs and requirements. This research contributes for this by providing design knowledge to create such system to start with. These are namely (1) providing objectivity and neutrality, (2) providing input and inspiration through information elicitation, (3) support administrative tasks such as documentation and (4) support coaching. Besides general requirements for such CA, the four main functionalities were presented in two versions of a socio technical artifact instantiated in the application domain which allows software developers to gather insights about such CA. Software developers can use these as well as the derived learnings from evaluations as inspiration and benchmark for a CA for DT facilitation. Initial approaches can already be tested in practice. Furthermore, practice can build on these functionalities and further work out DGs and requirements. Especially further evaluation with potential users may provide additional insights for deeper development. These can also be applied to other processes similar to DT that knowledge workers undergo, e.g. in the fields of Service Design activities. Lastly, general conceptions of collaboration with AI can be derived. First, considering the dualty and reciprocity of the CA provides practical insights on the audience and type of support and from insights on how to implement AI-enabled systems into current work practices.

7. Limitations

Although this dissertation provides major contributions, it has its limitations. First, this research focuses on supporting digital creativity workshops primarily. However, as shown in P3 and P4, facilitators of analog creativity workshops are also in need for support. Moreover, analog and digital conduction was examined separately. Under current development of new modes of work, many organizations consider a hybrid mode of work. Not considering hybrid modes of work may lead to false requirements for the CA as some functionalities may not be suitable for hybrid usage or only suitable for either digital or analog conduction. This may result into an artifact that did not fully consider business needs and challenges from the environment. Although a holistic approach was aimed to examine support for DT facilitators, not the whole DT process was considered but the three following phases Define, Ideate and Prototype as well as overarching factors. This provides a good overview on how to utilize the results from the previous phase for the upcoming phase. However, a high amount of cognitive results still results from the not examined phases Understand, Empathize and Testing. Besides, not only methods like Design Thinking cause a significant amount of cognitive load for facilitators. Many of the challenges and needs stated by facilitators are also applicable to other methods such as choosing the correct method for certain steps in a process, clustering content and providing inspiration through a CA. However, considering different approaches should still be represented in a holistic approach, not resulting in various single applications which might further increase technostress and cognitive load. Furthermore, this research contains a small sample size due to a low number of participants which leads to restricted representativeness and generalization. In this regard, P2 considers only two workshop scenarios in one company with limited number of interviewees. All interviewees also worked in the same department which can lead to homogenous statements among the interviewees. Besides, due to the fact that using CAs in this context is generally a new concept, expectations and understanding especially from people who are not proficient in this topic can still be very low. The instatiated artifact shows limitations as well. The artifact was built in a non functional way without training data and solely focusing on socio-technical aspects. This may have an impact on the perception towards the artifact by the sample. P6 (Appx. A) shows some hints for this: interviewees stated that they wanted to try out what the CA is capable of and firstly tried out intents that were not planned and, thus, not implemented. This, naturally, led to disappointment and lowered expectations towards the instantiated artifact and CAs in general. Moreover, mainly qualitative studies were conducted due to novelty of the topic and the lack of knowledge in literature. However, quantitative studies should be considered for evaluation pruposes as well as reaching a bigger sample size. Finally, interviews and observations were conducted in a short period of time so that consideration of changes overtime considering the covid situation as well as level of experience of the sample.

8. Implications for Future Research

This dissertation gives implications for future research by further investigating the phenomenon of DT facilitation (section 8.1), extend this research by the perspective of hybrid conduction (section 8.2) to investigate how future modes of work might influence DT facilitation as well as investigate deeper on role and task allocation between CA and facilitators (section 8.3) for optimal support and, thus, further develop the artifact (section 8.4) considering corresponding factors.

8.1. Further Investigation of DT Facilitation

This research contains one specific domain in one industry which was relatively homogenous. All interviewees and study participants were from one creative unit in an industrial organization. Future research should focus on doing cross industry studies on how other creative units and also none industrial organizations facilitate DT workshops to derive further needs and challenges. This aims to get a broader and more generalized perspective on DT facilitation as well as determining factors for supporting DT facilitation. Furthermore, future studies can be extended to supporting participants additionally to facilitators. Thus, needs and challenges from their perspective can be derived to further inform the knowledge base. Besides, a significant amount of cognitive load lies in group facilitation and counteracting group effects as indicated in P2 and P3. Research shows that CAs are able to support in group facilitation, e.g. by encouraging participants to contribute to structured discussions (Kim et al. 2021), show emotional intelligence, e.g. by finding suitable coping strategies for certain stress situations (Medeiros & Bosse 2017), as well as counteract negative group effects e.g. by enabling and encouraging even participation. Further research should examine these aspects and inform the knowledge base accordingly.

8.2. Extension to Hybrid Conduction

This dissertation considers DT facilitation for analog and digital conduction separately. However, current trends for new modes of work are ongoing, and hybrid work modes are more and more preferred in organizations to ensure maximum flexibility for employees (Kammler et al. 2022). Future research should consider analyzing and deriving needs and challenges change when facing hybrid conduction. Furthermore, a comparison can be drawn between hybrid, analog and digital DT facilitation to determine whether there are any differences from completely analog or completely digital conduction or if additional needs and challenges for facilitators or participants occur. Besides, different group effects may occur and, thus, group facilitation may be different than in completely analog or completely digital conduction. Additionally, future research should consider examining the effects of using a CA in hybrid DT facilitation as there is an additional communication stream that needs to be considered. This may have influence on technostress and cognitive load. Lastly, considering CASA on hybrid conduction may differ from completely analog or completely digital conduction. These aspects can further enrich the knowledge base on business need level and may result into deriving design knowledge for developing a CA.

8.3. Role and Task Allocation between CA and Facilitators

Future research should examine which role a CA should take over. Various possible roles were mentioned in P2 and P3: the CA could take over the role as facilitator, co-facilitator, participant or equal team member as well as providing the perspective in the method Six Thinking Hats or as a representation of a persona. However, it is not clear which role is suitable for DT facilitation. Moreover, not only role but also task allocation might be considered in future research. Studies could investigate which tasks a CA and which a facilitator should take over, and which might be shared to achieve optimal support for facilitators and participants.

8.4. Further Development of Artifact

Future research should consider using a functional prototype as artifact. This dissertation focused on design elements but not on technical feasibility. However, using a functional artifact may change the perspective when using or testing it as indicated in the results of P6 (Appx. A). As stated by interviewees in the interviews, users tested the capabilities of the artifact, however, not as indicated in the instructions but to test out if works beyond the instructions. Thus, this led to scepticism and less satisfaction with the CA. Using a functional prototype for evaluation in the respective environment might help to counteract prejudices towards using new technologies. Furthermore, the artifact should be further developed using the DG´s as derived in P6. Additionally, the artifact could be extended to the whole DT process by adding the Understand, Empathize and Test phases for consideration. Lastly, additional design knowledge may be derived according to 8.1. to 8.3. to follow a holistic approach and, thus, further develop the artifact according to business needs.

9. Conversational Agents in Creative Work – A Systematic Literature Review and Research Agenda for Remote Design Thinking

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Abstract

Companies rely heavily on the creation of innovation as digitization and globalization fasten competition. One approach is Design Thinking (DT) to create innovation which requires a tremendous range of competence and expertise in facilitation. With new styles of work approaching, DT is moved more and more into remote settings which brings new challenges such as difficult implementation of methods. One approach for supporting DT especially in remote settings is with the help of a conversational agent (CA). However, remote DT using a CA is barely covered in studies. We conduct a systematic literature review investigating what can be learned from prior research on CAs in creative work in remote DT. We identify 34 relevant papers and determined five concepts. We derive 19 research questions showing research opportunities in a research agenda. We, hence, call for further research on this underrepresented domain to benefit from the identified capabilities of CAs.

Keywords: conversational agents, design thinking, remote, literature review, concept matrix

9.1. Introduction

Companies are dependent on the drive of innovative key technologies, which also accelerate new styles of work such as working remotely (Belitz et al., 2020). While the demand for innovative and creative solutions is increasing, modern collaboration-driven innovation approaches face the challenge of designing their implementation for virtual execution. One particularly well-established approach to innovation development is Design Thinking (DT). DT is a problem-solving approach based on collaboration, user-centeredness, and creativity (Schallmo and Lang, 2020). It involves different stakeholders with different backgrounds in a multi-phase problem-solving process and is less a strict sequence of steps but more a collection of methods and tools that can be applied to find solutions (Johansson-Sköldberg et al., 2013).

Facilitating and leading DT processes requires a tremendous range of competence and expertise, with a very heterogeneous team composition and a variety of highly interactive methods (Meinel and Thienen, 2016). Facilitators have the challenging task of keeping an eye on and steering both the team and the process at the same time. The success of DT often depends centrally on good facilitation (Schallmo and Lang, 2020; Plattner et al., 2012). Qualities such as empathy, motivation, and flexibility with regard to new insights and skills such as fostering group dynamics, information absorption in unstructured discussions, and precise communication for instructions and recommendations make good facilitators. Last but not least, a deep understanding of the DT process and broad methodological knowledge is

required (Tschepe, 2017). Establishing an open and fear-free dynamic in the creative workshop is essential, and the challenge of designing an effective and efficient creative workshop with reserved and unfamiliar teams weighs heavily on the facilitator (Stockleben et al., 2017; Gumienny et al., 2012; Thakur et al., 2021). Factors such as team dynamics, problem orientation, and spatial circumstances must be considered when selecting appropriate methods (Dobrigkeit and Paula, 2019; Brown, 2008; Seeber et al., 2020). The suitability of methods for digital use further narrows the choices and leads to increased time for workshop planning due to the necessary application testing as well as less flexibility in conduction (Thakur et al., 2021; Stockleben et al., 2017). Missing information or perplexity due to a lack of overview can additionally be caused by the lack of screen space. DT needs plenty of space to freely design activities for the workshop conduction such as sketching and brainstorming in order to exploit the full potential of creativity (Sonnenburg, 2004, 2007; Stockleben et al., 2017).
As an approach to counteract the described multiple challenges, to relieve the facilitation of the DT process, and to make the facilitation role accessible to less experienced facilitators, the use of an on-demand conversational agent (CA) may be suitable and show promising results (e.g. Bittner et al., 2021; Bittner and Shoury, 2019; Winkler et al., 2019). A CA could present its functions to the participants through interactive training in advance of the DT process and provide assistance during the execution via voice dialog or chat (Debowski et al., 2021). In the role of an "ice breaker", a CA could offer opportunities for personal acquaintance at the beginning of the workshop by suggesting stimulating topics (Shamekhi et al., 2018). In addition, an intelligent method case or database would be useful for method selection (Bittner et al., 2021). However, only a few studies show explicit contributions for the use of CAs in the whole DT process or, in close proximity, creativity and collaboration processes. Remote DT sessions are barely covered in studies. Remote DT is becoming more and more important due to long-term changes of work styles and globalization, and is challenging to conduct compared to on-site DT. As intelligent search engines, CAs make information retrieval accessible in a structured way: for example, for problems within agriculture, "FarmChat" provides expertise with the help of a CA (Jain et al., 2018). As a "process keeper," an assistant could transparently guide the team and the moderator through the sequence of process steps, clearly present the agenda, and point out violations of the established rules of cooperation by recognizing certain keywords (Bittner et al., 2021). CAs are already successfully used in other fields which shows promise to implement for remote DT. However, there is little knowledge on how to support remote DT especially through CAs. Therefore, we conduct a systematic literature review (SLR) on CAs for creative collaboration and transfer insights from this for supporting remote DT. By identifying remaining gaps, we define a research agenda for the specific domain remote DT to close existing research questions raised by research agendas as well as further open up more detailed questions for the area of CAs in DT . Hence, we state the following research question (RQ) in this paper:

RQ: What can be learned from prior research on CAs in creative work for supporting teams and facilitators in DT sessions? Which research avenues and open research questions for CA support in DT can be identified?

To address this research question, we conduct a SLR following the approach of vom Brocke et al. (2009). Our paper is structured as follows. First, we introduce background and related work regarding remote

DT facilitation as well as possible CA applications with this regard. We then present the steps we have taken for our literature review. Afterwards, we discuss the main findings and concepts on how to relieve facilitators in remote DT sessions with the use of CAs, and show opportunities for future research. The last section summarizes theoretical and practical implications as well as limitations. We contribute to existing literature by providing a research agenda consisting of 19 research questions as well as a consolidated overview of concepts of CAs in DT.

9.2. Background

Challenges of DT Facilitation

Creativity research in communication science defines three types of communication: (1) face-to-face interaction, (2) technical communication, as well as (3) technical interaction (Sonnenburg, 2007). For the latter, the participants are in decentralized and synchronous communication, for example in a video conference (Sonnenburg, 2007), accordingly, a remote DT workshop can be defined as a technical interaction.

Creative problem solving approaches such as DT strive from an open mindset and an open collaboration in a team. They aim to structure creativity and collaboration, participation of various stakeholders as well as facilitating a result driven development process (Brown, 2009). In both directions, DT with its extensive landscape of methods demands a lot from both the facilitator and the team. The biggest challenges for teams are an inappropriate division of tasks, ineffective method selection and a destructive workshop dynamic (Seeber et al., 2020). Facilitators are responsible for the appropriate support of the teams and their mentioned challenges, as well as for the control and organization of the context before and after the DT process: Measures such as team composition and stakeholder management, process and method planning, provision of materials, rooms and catering, documentation and overview and transfer into the implementation of the developed ideas are tasks, which represent a high expenditure of time and organization (Hjalmarsson et al., 2015). The success of the innovation process depends heavily on these tasks and their implementation: the failure to involve key stakeholders, the composition of unproductive teams, the lack of important tools and utensils, and negligent documentation and use of results can lead to less fruitful workshops and ultimately to less effective developments (Hjalmarsson et al., 2015). A great influence on the quality of the workshop and its organization has the experience background of facilitators (Vreede and Briggs, 2005; Bostrom et al., 1993): The flexibility of the DT workshop and its context requires a high degree of openness and expertise (Bittner et al., 2021). The heterogeneous team composition also exposes DT facilitators from the outset to uncertainty, which, without experience, can lead to pressure to immature workshop results (Dobrigkeit and Paula, 2019).

The digital implementation of DT projects is typically avoided. A collaborative processing of methods and design of sketches and prototypes with haptic and simple tools such as paper, pen and whiteboard correspond to DT's understanding of offering members from all disciplines uncomplicated access to a creative way of working (Gumienny et al., 2012). Despite difficult conditions from the point of view of the facilitation and the team, changes in work styles and further globalization required the relocation of innovation workshops to new work modes such as remote work (Thakur et al., 2021).

The open and familiar exchange that is important for creativity (Sonnenburg, 2007), characterized here as a creative interaction, is often inhibited in digital workshops: The problematic communication of direct feedback to each other and the lack of body language can create a restrained atmosphere, in which a regulation of speaking parts and mutual understanding by the facilitators may be helpful: (Debowski et al., 2021). In physical collaboration, spaces can be used to stimulate the formation of ideas and to support creation processes (Stockleben et al., 2017). A remote workplace should depict appropriate meeting spaces and counteract problems of online interaction, otherwise the creativity of teams will not be fully exploited by process losses, such as retention of information and tendency to an inhibited exchange of views as a result of distanced cooperation (Sonnenburg, 2007).
The joint development of ideas and visualizations, here referred to as collaborative creativity, illustrates views, promotes reflection and creates a basis for discussions and resulting decisions (Cautela et al., 2019, p. 118). In particular, the methods of the phases Ideate and Prototype in the converging solution space of the DT process require more visualization possibilities than in the preceding research and analysis-heavy phases of the problem space (Debowski et al., 2021). For distributed teams, collaborative editing of methods for collecting ideas and modeling sketches and sculptural images is cumbersome: Generic online whiteboards, for example, are used to collect PDF-converted photographs of physical prototypes instead of using appropriate prototyping tools (Stockleben et al., 2017). The use of purposeful project tools is strongly favored by the supervision of experienced facilitators (Stockleben et al., 2017). Overall, in addition to the increased organizational and support complexity, the facilitation of decentralized DT workshops is burdened with the challenge of creating an effective digital environment to promote interaction, collaboration and creativity.
As an approach to counteract the diverse challenges described above, to relieve the facilitation of the DT process, and to make the facilitation role accessible to inexperienced participants, the use of a needs-based CA can be suitable (Bittner et al., 2021; Bittner and Shoury, 2019; Winkler et al., 2019; Debowski et al., 2021).

Conversational Agents as DT Support

A CA is an automated dialogue system that can communicate with humans by using and processing natural language (Laumer et al., 2019). This can be text-based, i.e., as a chatbot, speech-based, as with the assistance systems Siri (Apple) and Alexa (Amazon), and in hybrid form with voice and text output (Laumer et al., 2019). By further developing from a simple input-output design to the integration of artificial intelligence (AI) and the ability to learn from previous interactions, newer CA tools can adapt their functionality to the respective users in an AI-based self-learning manner and continuously optimize them for their specific tasks and activities (Laumer et al., 2019).
With the progress of reliability and decrease in errors, this type of assistance systems can also be used in environments with increased safety requirements: Workplace CAs find numerous applications in the workplace. They function as an analysis tool, search engine, routine assistance to increase productivity, decision-making tool, reflection and control support, for example to reduce distracting factors or to form a team with profile analysis (Feng and Buxmann, 2020).
CAs have experienced a strong increase in interest in the research community within the last two years: more than half of the contributions existing until 2019 have been published since 2017 (Diederich et al.,

2019). However, Diederich et al. (2019) revealed a lack of research around CAs as collaboration support and stimulated a more intensive discussion to exploit undiscovered potentials (Diederich et al., 2019). In the following years, the research deficit described above was taken into account and confronted in research agendas such as by Seeber et al. (2020).

9.3. Research Approach

We conducted a SLR in the research field of CAs and followed the approach of vom Brocke et al. (2009). Based on the taxonomy with its dimensions Focus, Goal, Organization, Perspective, Audience and Coverage proposed by Cooper (1998), we define the scope of our SLR. We focus on research outcomes and concepts regarding CA supported facilitation in remote DT sessions. Our goal is to identify and summarize concepts and issues on how to support facilitators in remote DT sessions using CAs. For organizing our literature review, we choose a conceptual structure. We conduct our SLR from a perspective of neutral representation of existing contributions and concepts. Our literature review is targeted at an audience with a background knowledge in IS research as well as practitioners and facilitators in remote DT. Lastly, our literature review is of exhaustive coverage with selective citation considering specific in- and exclusion criteria presented in Table 1. Besides, we rely on the definitions and terms introduced in the previous section Background.

Selection of search string: The search term selection is crucial for the informative value of the research results (vom Brocke et al., 2009). We chose ("conversational agent*" OR “chatbot*” OR “virtual assistant*” OR "digital assistant*" OR “digital agent*” OR “virtual agent*” OR “virtual coach*” OR “digital facilitator*” OR “virtual facilitator*” OR “technology-based agent*” OR “virtual facilitation” OR “digital facilitation” OR “digital assistance” OR “virtual assistance”) AND (“creativity” OR “creative” OR “ideation” OR “design” OR "design thinking" OR "creative collaboration" OR “co-creation" OR “collaborative innovation” OR "innovation team*") as initial search string as a starting point for the literature search process. The concepts DT, creativity and collaboration are closely related to each other. However, they focus on different aspects: creativity is the “context-bound potential for meaningful novelty that unfolds in action” (Sonnenburg, 2007), whereas collaboration focuses on the interaction between two or more individuals (Sonnenburg 2007). DT, however, is an approach that combines collaboration and creative work in a certain process whereas creative work and collaboration can be seen by itself. Our initial search string shows a variety of synonyms as well as similar concepts in close proximity to each other. During the search process, we iteratively refined our search string taking into account the learnings from the search process by adapting keywords. After examining different keyword combinations, the final search string is ("conversational agent*" OR "chatbot*" OR "chat bot*" OR "virtual facilitator*" OR "digital facilitator*") AND ("design thinking" or "creativity" or "collaboration" or "facilitation"). Using fewer keywords allows to narrow down the results to the relevant domains DT and CA. The first phrase focuses on CAs and facilitation, the second on the DT process as well as on DT and facilitation.

Databases												
	EBSCO		ACM DL		AIS eLibrary		Science Direct		Web of Science		IEEE	
Search String	Hits	Relevant	Hits	Relevant	Hits	Relevant	Hits	Relevant	Hits	Relevant	Hits	Relevant
("conversational agent*" OR "chatbot*" OR "chat bot*" OR "virtual facilitator*" OR "digital facilitator*") AND ("design thinking" or "creativity" or "collaboration" or "facilitation")	10	2	1481	27	13	4	8	1	0	0	0	0
Inclusion criteria: creativity, communication, information elicitation, influencing teams or groups, give recommendations					Exclusion criteria: specific frameworks for software development, analysis of cultural aspects, assistance in life support							
Final number of papers selected for further analysis from 1512 screened papers = 34												

Table 6. Results of the Literature Search Process

Selection of databases: To ensure we consider the relevant databases, we considered those that contain a variety of IS journals as well as conference proceedings due to the fact that journals take significantly longer to be reviewed and conference proceedings usually show the latest results of current IS research. Consequently, we chose four databases that representatively cover the respective research field. We, thus, selected the databases of EBSCO (Business Premier), ScienceDirect, Association for Information Systems (AIS) and of the Association for Computing Machinery (ACM DL).

Selection of papers: In a first screening, we focused on screening the title, abstract and keywords. We only considered English language papers that were peer-reviewed to ensure quality. This process results in 82 papers which were further analyzed by screening the full-texts to determine a paper as finally considered for deeper analysis. A paper is considered as relevant for deeper analysis if it shows research with a central focus on using CAs for tasks that are relevant for any DT phase such as creativity, communication, information elicitation, influencing teams and groups or giving recommendations (see Background section). We remove papers that solely consider specific frameworks for software development, analyses of cultural aspects in using CAs as well as CAs in assistance for life support. This finally leads to 34 relevant hits as shown in Table 1 for reproducibility and transparency reasons.

Paper analysis and conceptualization: After identifying the relevant papers (see Table 2), we analyzed the papers from a concept-centric perspective. We, therefore, created a concept matrix according to Webster and Watson (2002) based on the results from the SLR (Webster and Watson, 2002). Accordingly, we analyzed all papers in full text focusing on the underlying concepts to investigate how

CAs can be used in remote DT sessions. Besides papers specifically dealing with DT, we consider concepts in close proximity to the respective challenges and factors in remote DT and CAs as described in the Background section due to the fact that there is not many publications considering remote DT as such. We then prioritized research with contributions to theory and practice. In an iterative process, we aggregate the results in more abstract meta-perspectives on the research field of CAs in remote DT.

9.4. Results

Figure 1 shows the number of papers – both journal and conference proceedings - that were published overtime and are relevant to our scope. The first published paper was in 2010 (n=1), the last in 2022 (n=1). There was a significant increase in publications in 2018 (n=7), which reached its peak in 2021 (n=11) until now. This shows increasing interest and significance in the research community for the research field of CAs in the direct and peripheral context of DT. We identified 30 papers as conference proceedings and 4 papers in a journal; 16 papers contributed mainly practical implications such as prototypes and frameworks evaluated in empirical user study, 18 contributed theoretical implications such as design guidelines, taxonomies and research agendas. In the following, we will present five concepts determined in our SLR, which will be described and analyzed.

Authors	Outlet	Theory/ Concept	Methodology	Contribution
Adikari et al. (2022)	Future Generation Computer Systems 2022	Patient-centered care through CAs	Prototype using a specific framework	Framework of empathic CA
Athreya et al. (2018)	WWW 2018	CAs	Prototype DBPedia Chatbot and user testing	Software
Barange et al. (2017)	AAMAS 2017	Virtual Environments	Prototype using specific architecture	Architecture of Pedagogical Collaborative CA
Bittner et al. (2021)	HICSS 2021	Collaborative and creative design processes, Design Thinking, Digital Agents	Expert interviews	Research Agenda
Bohus and Horvitz (2010)	ICMI-MLMI 2010	Turn taking in human-human interaction	Embodied prototype in shared task setting experiment	Situated spoken dialog system
Ceha et al. (2021)	CHI 2021	Humor in CAs	Prototyping a CA in a between-subjects experiment using a learning-by-teaching platform	Prototype of humorous CA
Chung and Adar (2021)	DIS 2021	Creativity support tools	Systematic Literature Review	Taxonomy
de Melo et al. (2017)	AAMAS 2017	Human-agent interaction, agents representatives	Experiment using a CA in two standard decision making games	Prototype of agents representatives
Debowski et al. (2021)	PACIS 2021	Collaboration and creativity with AI	Qualitative interviews with DT facilitators and participants	Design Guidelines
Debowski et al. (2022)	WI 2022	Collaboration with AI	Qualitative interviews with DT facilitators and participants	Design Guidelines
Følstad et al. (2021)	Computing 2021	Chatbots	Scientific Workshop	Research Agenda
Jain et al. (2018)	DIS 2018	Design and Evaluation of Cas	Empirical study with 16 first time users of CAs	Implications for Chatbot Design
Kaushik et al. (2020)	CHIIR 2020	Information Retrieval Systems	Presenting prototype	Prototype
Kim et al. (2020)	CHI 2020	Computer-supported cooperative work	Needfinding survey for a facilitating chatbot	Design Goals for Chatbot
Kim et al. (2021)	CSCW 2021	Chatbots in structured and unstructured discussions	Prototype DebateBot in two between-subjects experiments	Evaluated prototype
Kimani et al. (2021)	CHI 2021	Sharing the Load Online: Virtual Presentations with Virtual Co-Presenter Agents	Within-subjects experiment using virtual co-presenter agent	Evaluated prototype
Lee et al. (2017)	IMWUT 2017	Casual Group Conversations	Prototype using a mobile system tested in an observation experiment	Evaluated prototype
Ma et al. (2019)	WWW 2019	Emotional intelligence in interactions	Prototype using personality-driven virtual assistants and experiment	Evaluated prototype
Ma et al. (2021)	SIGIR 2021	Open-domain chatbots	Prototype as personalized chatbot and experiment	Model for dialogue history automatic and personalized responses
McDuff and Czerwinski (2018)	ACM Communication 2018	Emotionally sentinent systems	Literature Review	Research challenges
Medeiros and Bosse (2017)	AAMAS 2017	Computer generated peer support	Prototype using Python	Features of prototype
Mensio et al. (2018)	WWW 2018	Interaction types and threats of Cas	Literature Review	Summary of state of the art literature
Nguyen and Ricci (2017)	SAC 2017	Generation of group recommentdations	User study assessing usability of a recommender system	Evaluated group recoommentdation model
Oschinsky et al. (2021)	Government Information Quarterly 2021	Acceptance of and resistance to technology	Mixed methods study	Integrative theoretical model towards acceptance of and resistance to technology
Perrone and Edwards (2019)	CUI 2019	Unscripted and scripted comedy	Prototyping using a Podcast	Evaluated abilities of chatbot towards comedy

Petousi et al. (2021)	IDC 2021	Social bots	Mixed methods study	Design knowledge toward a social bot facilitating dialogue between students
Przybilla et al. (2019)	SIGMIS-CPR 2019	IS artifacts facilitating creative teamwork	Hypotheses testing in a 2x2 study design	Design knowledge toward a chatbot facilitating ideation
Reicherts and Rogers (2020)	CUI 2020	Guiding users´ thinking through a conversation user interface	User study assessing a chatbot´s ability to make users think in different perspectives	interface prototype for data analytics set up
Resch and Yankova (2019)	EASEAI 2021	Chatbots in education	Prototype tested in controlled environment	Evaluated concept of a digital assistant
Sowa et al. (2021)	Journal of Business Research	Collaboration and productivity	Three-stage study (desk research, empirical study, qualitative study with interviews and scenarios)	Knowledge about work with AI-based technologies
Strohmann et al. (2018)	PACIS 2018	Design Thinking with Virtual Assistants	Qualitative interviews	Design Guidelines for Virtual Assistants
Tabassum et al. (2019)	IMWUT 2019	Investigating Users' Preferences and Expectations for Always-Listening Voice Assistants	Online survey using conversation snippets from voice agents	Explorative user preferences and expectations
Vögel et al. (2018)	SEFAIS 2018	Emotion-aware cognitive systems	Scientific Workshop	Features of a Prototype
Weber and Ludwig (2020)	MuC 2020	Conversation design using Cas	Qualitative interview study with users of Cas	Framework with design spaces focusing interaction between user and CA

Table 2. Identified papers with outlets and used research methods

In a concept-centric analysis of the relevant papers, we identified five main research perspectives by inductively derive the concepts based on the respective results (e.g. prototype, framework) of the papers, which constitute the research field of CA features for DT sessions: Creative Work (CW) (5), Emotional Intelligence (EI) (5), Facilitation and Group Effects (FGE) (11), Information Elicitation and Recommendation (IER) (6) and User´s Preferences (UP) (6). We first identified the respective outcomes and contributions (see Table 2), and matched these with the support type and DT phases (see Table 3). We then derived overarching concepts. In the following, we discuss the different research streams using DT sessions as overarching domain. In this context, CW discusses relevant features of a CA that can be used in e.g. the Ideate or Prototype phase of DT. EI presents features of a CA that allows it to collaborate and communicate in an empathic manner with participants in DT sessions. FGE represents features that support the facilitator in guiding through a group discussion, decision-making and to respond to the group. IER addresses possible features to gather and process information for e.g., the Define or Ideate phase of DT. Finally, UP focuses on what potential users expect and need from a CA in DT sessions in order to use it accordingly. Table 3 shows a concept matrix with the identified concepts in the relevant papers in correspondence to the respective DT phase as well as the respective type of support that a CA takes over.

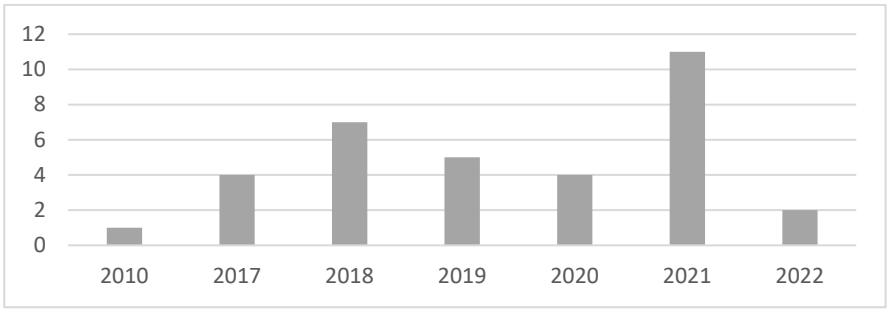

Figure 1. Number of Publications over Time

Creative Work

As for this concept, four relevant studies were identified concerning CW. Perrone and Edwards (2019) present a study in which they created unscripted comedy using two chatbots competing with one human host. The task was to answer playful questions to fool each other into thinking the bots were human

while all three participants tried to win the host for themselves. The chatbots are based on the Turing Test (Turing, 1950). In another round of testing, the authors tested abilities of chatbots with different personas in performing a scripted scene in another game. The chatbots´ responses sometimes fit the scene, sometimes transformed it into unexpected scenes. The study shows that chatbots with dialogue management gear are able to produce creative content even when not intended (Perrone and Edwards, 2019). Chung et al. (2021) analyzed existing creativity support tools such as fabricators or generative algorithms on how diverse aspects relate to each other. Creativity support tools took over the role of aiding ideation phases, implementation phases as well as supporting evaluation of created artifacts by critiquing (Perrone and Edwards, 2019).

Strohmann et al. (2018) investigated the potential of virtual assistants for DT sessions and derived design guidelines to inform the design of CAs in this domain. Main results are design guidelines for virtual assistants supporting creative processes with regard to characteristics of the virtual assistant (e.g. human-like behavior), moderation support as well as general conditions such as minding ethics, support the general process and time-keeping (Strohmann et al., 2018). Bittner et al. (2021) identified 16 capabilities of a digital assistant based on CAs for task, process and interaction facilitation in DT sessions based on expert interviews with experienced workshop facilitators from research and practice. The authors formulated a research agenda and call for further investigation on a digital assistants' capabilities, the combination of human and non-human facilitators, security and privacy topics, the impact on team collaboration as well as on the digital assistant's role and its appearance (Bittner et al., 2021). Debowski et al. (2021) derived problem areas and corresponding requirements for a CA as DT support raised by participants of DT sessions. The authors identified both individual and group related challenges as well as those related to creative work and working with new methods. A CA on the other hand can support by creating even and diverse discussions and working on participants´ open mindset (Debowski et al., 2021).

Emotional Intelligence

As for this concept, main results are that CAs increase engagement by reacting socially acceptable and emotionally intelligent (Barange et al., 2017; Ma et al., 2019; McDuff and Czerwinski, 2018). Other studies showed support in coping with stressful situations with the help of a CA (Medeiros and Bosse, 2017; Vögel et al., 2018).

For the latter, Medeiros and Bosse (2017) presented a chatbot simulating a friend to a person that needs support in coping with stressful situations. Technically speaking, the chatbot received messages sharing stressful situations, then identified the type of stress (e.g., work, relationship) that occurred and chose a fitting coping strategy (e.g., situation modification or cognitive change). The authors concluded that the chatbot correctly classified incoming messages in over 80%. Users perceived the chatbot´s responses as appropriate, and is, therefore, able to support in stressful situations (Medeiros and Bosse, 2017). Vögel et al. (2018) presented the Emotion-aware Vehicle Assistant (EVA) which is an intelligent assistant in autonomous cars based on gathering personalization information from user´s interaction with the system. With EVA, it is possible to make decisions and recommend as well as emotion sensing as feedback for learning even while driving (Vögel et al., 2018).

As second subsection, studies showed that CAs are able to increase engagement within a group. Barange et al. (2017) present a study with virtual assistants as team members and their effect on the user. They analyzed the effect of the agent´s behaviors on the user in procedures in virtual environments. Results are that users are more attentive with proactive agents which was perceived as helpful during procedures. Reactive agents on the other hand encouraged participants to interact with agents but using proactive agents led better results in learning were achieved than with a reactive agent. Proactive agent reduced overall learning time. In conclusion, proactive agents are anticipated as equivalent team members and tutors, useful for collaboration in virtual environment (Barange et al., 2017).
Ma et al. (2019) evaluated personality driven virtual agents as medical assistants with two different personalities (dominant and submissive) handling three challenges - verbal abuse, sexual harassment and avoidance. Here, participants perceived EI perceived as important factor for the virtual assistant. The agents´ expression of emotions shows higher level of EI and submissive personality in virtual assistant is perceived as more emotionally intelligent (Ma et al., 2019). McDuff and Czerwinski (2018) found in their study that responding to social and emotional cues allows systems to perform complex tasks in a more socially acceptable manner which leads to more engagement and trust from a user´s perspective (McDuff and Czerwinski, 2018).

Paper	**Concept**	**DT Phase**							**Support Type**									
		Understand	Observe	Define	Ideate	Prototype	Test	General	Provide tools	Provide inspiration	Coping stress	Behavior	Decision making	Shape group dynamics	Recommendations	Human-like	Increase productivity	Privacy
Chung and Adar (2021)	**Creative Work**					X			X									
Strohmann et al. (2018)					X			X					X		X		X	X
Bittner et al. (2021)								X						X	X		X	X
Debowski et al. (2021)								X		X	X			X				
Perrone and Edwards (2019)					X					X								
Barange et al. (2017)	**Emotional Intelligence**							X									X	
Ma et al. (2019)								X			X							
McDuff and Czerwinski (2018)				X	X			X				X						
Medeiros and Bosse (2017)		X		X				X			X							
Vögel et al. (2018)				X				X			X		X					
Bohus and Horvitz (2010)	**Facilitation & Group Effects**							X						X				
Ceha et al. (2021)								X									X	
de Melo et al. (2017)				X	X			X					X					
Kim et al. (2020)								X									X	
Kim et al. (2021)								X									X	
Kimani et al. (2021)								X									X	
Debowski et al. (2022)					X			X		X				X	X		X	
Lee et al. (2017)								X									X	

Reicherts and Rogers (2020)								X									X	
Petousi et al. (2021)								X						X			X	
Przybilla et al. (2019)					X					X								
Athreya et al. (2018)	Information Elicitation & Recommendations	X		X	X					X			X					
Kaushik et al. (2020)		X		X	X	X		X		X			X					
Adikari et al. (2022)								X					X		X			
Ma et al. (2021)								X		X								
Nguyen and Ricci (2017)								X					X		X			
Resch and Yankova (2019)				X	X			X		X								
Følstad et al. (2021)	User´s Preference							X								X		
Jain et al. (2018)								X								X		
Oschinsky et al. (2021)								X									X	
Sowa et al. (2021)								X									X	
Tabassum et al. (2019)								X										X
Weber and Ludwig (2020)								X										X

Table 3. Concept matrix showing identified concepts in papers with correspondence to DT phase and respective support type

Facilitation and Group Effects

As for this concept, main results are that a CA is able to facilitate group discussions (Kim et al., 2021; Bohus and Horvitz, 2010; Ceha et al., 2021; Kim et al., 2020; Kimani et al., 2021; Lee et al., 2017; Przybilla et al., 2019; Petousi et al., 2021; Reicherts and Rogers, 2019) and increase fairness in these by enabling even discussions in groups (de Melo et al., 2017; Kim et al., 2021).

For the latter, de Melo et al. (2017) investigate in their study how a digital representation of humans in form of an agent representative shapes decisions in social settings. Results show that people are less likely to accept unfair offers from others when represented by an agent representative compared to interaction with other humans (de Melo et al., 2017).

Kim et al. (2021) presents the DebateBot, a CA structuring discussions and encouraging participants to contribute. Results show that structured discussions through the bot led to higher discussion quality resulting in diverse opinions within the group. Facilitation by the DebateBot led to high level of opinion alignment within the group and more even contribution, higher level of task cohesion and communication fairness (Kim et al., 2021).

Bohus and Horvitz (2010) present an embodied CA in an empirical study in a shared task setting. They conclude that verbal and non-verbal cues of CA shape multiparty conversational dynamics (Bohus and Horvitz, 2010). Ceha et al. (2021) examine effects of a CA that uses affiliative and self-defeating humor on students in conducting a task on a learning-by-teaching platform. The CA showed curious and enthusiastic characteristics plus either affiliative humor, self-defeating humor or no humor at all. As a result, the authors conclude that affiliative humor increases motivation and effort significantly, while self-defeating humor leads to enhanced effort but to less enjoyment.

Kim et al. (2020) explore in their study the feasibility of a chatbot agent facilitating group chat discussions managing discussion time, encouraging even participation and organizing opinions. Using the chatbot, the group achieved more diverse opinions although no differences in output quality and message quantity was achieved. Participation and effective communication was enhanced to an even group discussion using the chatbot (Kim et al., 2020). Lee et al. (2017) used mobile devices to mediate group conversations in both passive and proactive manner and, thus, encouraged inactive participants to participate in the group discussions (Lee et al., 2017). Reicherts and Rogers (2020) indicate in their study that questioning users through conversation can be beneficial to enable deeper thinking (Reicherts and Rogers, 2020). Petousi et al. (2021) investigated a chatbot that facilitated a reflective discussion in a group of children about human history to promote historical empathy. The chatbot had a distinct personality that was at some points convincing as a person than a machine as stated by the authors. Pre-existing dynamics affected decision-making and cooperation between participants though, and preparation of discussion was key for successful results, e.g., open-ended and philosophical helped participants to rationalize thoughts and allowed to explore different perspectives (Petousi et al., 2021). Przybilla et al. (2019) investigated in their study how well a digital facilitator can support complex tasks of idea generation in teams compared to a human facilitator. They found no significant difference from each other: the digital facilitator successfully influenced the idea generation process. Nevertheless, the digital facilitator was perceived as less helpful (Przybilla et al., 2019). On the other hand, Kimani et al. (2021) investigate an embodied CA as co-presenter in oral presentations to reduce public speaking anxiety and increase presentation quality in video-conferences. As a result, the studied participants rate presentations with CAs as co-presenter as of higher quality and presenters felt less nervous (Kimani et al., 2021). Debowski et al. (2022) present in their study specifications and requirements for a virtual collaborator by combining insights from practice with literature for remote DT sessions. The authors specify main problems in virtual interaction such as lack of nonverbal communication and higher workload in preparing the sessions, and provide design guidelines for a virtual collaborator considering group cohesion, networking as well as providing inspiration to the remote DT session (Debowski et al., 2022).

Information Elicitation & Recommendations

As for this concept, main results are that a CA can elicit context-sensitive information and conduct respective searches (Resch and Yankova, 2019; Kaushik et al., 2020; Athreya et al., 2018; Ma et al., 2021), and to give recommendations for specific contexts (Ngyuen and Ricci, 2017; Adikari et al., 2022). For the former, several features of a CA were presented in the following studies. Resch and Yankova (2019) present a digital assistant that supports students in writing academic assignments. Tasks include project management, context-sensitive help in applying scientific methods and search in open access literature. As a result, the authors conclude that the digital assistant helps organizing the user´s time and workload (Resch and Yankova, 2019). Kaushik et al. (2020) present a multi-faceted interface for conversational search. It consists of a chat function between search agent and user, information box displaying retrieved key information and documents from search queries and query box to either enter own query or choose suggested query by chat agent (Kaushik et al., 2020). Athreya et al. (2018) introduce the DBpedia chatbot to optimize community interaction. It is able to understand user queries,

elicit relevant information based on queries, tailor responses for different platforms as well as develop and encourage subsequent user interactions (Athreya et al., 2018). Ma et al. (2021) presented a personalized chatbot based on implicit user profiles. They conducted that these led to more personalized responses as well as better performance in generating information (Ma et al., 2021).
Several features of a CA regarding giving recommendations were presented by two studies. Nguyen and Ricci (2017) present a group recommender system supporting groups in decision making by iteratively expressing and revising participant´s preferences during the decision making process and offering recommendations for facilitation such discussions to achieve an agreement. The presented approach shows high recommendation quality and choice satisfaction according to the authors (Nguyen and Ricci, 2017). Adikari et al. (2022) investigated a CA for real-time monitoring and co-facilitation of patient-centered healthcare. Tasks were detecting patient emotion transitions and group emotions, formulating patients behavioral metrics and giving resource recommendations based on the patient´s concerns. The authors concluded that this kind of CA contributes to effective patient-centered healthcare through facilitation features (Adikari et al., 2022).

User´s preference

As for this concept, general expectations mentioned by potential users are that working with a CA enhances human-machine collaboration and improves a user´s performance which is also investigated by various studies (Sowa et al., 2021; Følstad et al., 2021; Oschinsky et al., 2021). Potential users see privacy issues as main concern when working with CAs (Tabassum et al., 2019; Weber and Ludwig, 2020). Besides, potential users expect a CA to be able to communicate in human-like natural language (Weber and Ludwig, 2020; Jain et al., 2018).
For the former, Sowa et al. (2021) investigated synergies between human workers and AI in managerial tasks in a multi-staged study. Results show an increased productivity due to the enhanced human-AI collaboration, and authors call for collaborative approaches where humans and AI work closely together instead of full automation (Sowa et al., 2021). Oschinsky et al. (2021) investigated a potential user´s perception towards acceptance and resistance to technology in public administration. Their study shows that resistance or acceptance rely mainly on perceived value, sunk costs, switching benefits and value for citizens (Oschinsky et al., 2021). Følstad et al. (2021) provide a future research agenda on several research areas concerning CAs: for emerging chatbot user groups and behaviors, authors call to provide more studies on particular demographics, domains or contexts instead of general studies. Besides, they show that for social implications of chatbots, e.g. implications of AI for labor and business, and for chatbot user experience and design e.g. by improving existing designs, modelling and evaluating future designs, should be further investigated. The authors also call for further studies on chatbot frameworks and platforms to further interpret capabilities of a CA as well as context understanding and emerging techniques. Besides, chatbots for collaboration are to be studied by modelling human-chatbot collaboration and conducting empirical investigations. Lastly, scholars are needed to investigate the concept of democratizing chatbots e.g. chatbots for social good and inclusive design, and ethics and privacy in chatbots e.g. by understanding chatbot ethics and privacy, and conducting ethics by design (Følstad et al., 2021).

Tabassum et al. (2019) and Weber and Ludwig (2020) found in their studies that privacy issues are main concerns when handling CAs. Tabassum et al. (2019) explore in their study expectations on "always-listening voice assistants". They found out that participants are more likely to consent to a conversation with these when not sharing sensitive data. Overall, participants were satisfied with the services that stand-alone voice assistants such as Alexa and Siri provide, but privacy challenges occur and need to be considered for future design (Tabassum et al., 2019). Weber and Ludwig (2020) conducted an interview study focusing on daily positive and negative experiences with CAs and derive quality criteria for future design. These include: initial guidance, customizing commands, avoiding unrequested contact with user, precise recognition of user inputs, ability to respond to a broad range of questions and provide further information, ability to learn and improve from past conversations (Weber and Ludwig, 2020).
The latter also found in their studies the importance to users of communicating in natural language (Weber and Ludwig, 2020), as well as Jain et al. (2018) who investigated preferences of first-time users towards a CA in their studies. Preferences were "human-like" natural language conversation and an engaging experience exploiting benefits of turn-based messaging. Authors suggest implications for design of chatbots such as clarifying chatbot capabilities, sustain conversation context, handle dialog failures and end conversations gracefully (Jain et al., 2018).

9.5. Discussion and Development of a Research Agenda

In the following, we will discuss the main contributions of our SLR and propose a research agenda with research streams that deal as a starting point for future research on CAs in the context of remote DT. In sum, 19 research questions were derived from our SLR based on our theoretical background regarding CAs in DT processes (see Table 4).

Creative Work

We identified only four relevant studies for the context of creative work for peripheral use in DT which suggest first steps on how to use CAs for creative work e.g., as facilitator in DT. However, the low number of publications indicates necessary future work. We, hence, state the following research questions for further investigation:

1. How can a CA enhance creativity in remote DT sessions?
2. What features do users need for the Ideate and Prototype phase in remote DT sessions?

	Research Challenges & Opportunities	Corresponding Research Questions
I	- Only five relevant studies for the context of creative work for peripheral use in remote DT - Low number of publications indicates necessary future work	(1), (2)
II	- Working on group dynamics is key for virtual DT sessions - Dynamics need to be further investigated especially in remote DT sessions	(3) – (7)
III	- High impact of CAs on fair and even discussions - Lack of research on what role fairness plays in remote DT	(8), (9)
	- Human-like behavior of a CA enhances engagement and motivation in groups - No specific knowledge about DT in general or remote DT	(10)
	- Digital facilitator is seen as equally capable of facilitating but less helpful than a human facilitator - Not further indicated what led to this perception	(11), (12)
IV	- Information elicitation and recommendation tasks are well researched - Further research with regard to DT as specific context is needed	(13), (14)
V	- CAs were already researched for various application domains - No specific contexts, especially not for DT - Research agendas already call for focusing on specific contexts	(15), (16)
	- Increasing interest on how personal data is being used in various applications - Research remains in general scope	(17) – (19)

Table 4. Resulting Research Agenda

Emotional Intelligence

CAs show great potential in acting and reacting socially acceptable and emotionally intelligent. Working on group dynamics is key for remote DT sessions in order to be successful. However, these dynamics need to be further investigated to enhance and improve group dynamics in a positive way. We, therefore, state the following research questions in this regard for future research:

3. What group dynamics occur in remote DT sessions compared to on-site DT sessions?
4. What challenges in group dynamics does a facilitator in remote DT sessions need to face?
5. How can a CA minimize negative group dynamics and enhance positive group dynamics?
6. How does a CA need to be designed to be emotionally intelligent in the context of remote DT sessions?
7. How does a personality-driven CA affect group dynamics in remote DT sessions compared to a non-personality-driven CA?

Facilitation and Group Effects

Several studies have shown the impact of a CA on fair and even discussions. However, there is a lack on research on what role fairness plays in remote DT sessions. The following questions seem appropriate for further investigation:

8. What role does fairness play in remote DT sessions? What challenges occur?
9. How can a CA be designed to improve fairness and enhance even group discussions?

Scholars show that human-like behavior of a CA such as being curios, enthusiastic and humorous in some form enhances engagement and motivation in group work and discussions. However, there is no specific knowledge about DT in general or DT in a virtual environment. We, therefore, recommend investigating the following research question:

10. Which characteristics does a CA need to have to be perceived as “human-like” in remote DT sessions?

Studies show that a digital facilitator is seen as equally capable of facilitating but less helpful than a human facilitator. However, it is not further indicated what led to this perception. Other studies even suggest to not consider replacing a human facilitator but to achieve collaboration between human and digital facilitator. Hence, we propose the following research questions for future research activities:

11. How can roles be allocated between a digital and a human facilitator?
12. What strengths and weaknesses does a digital facilitator have compared to a human facilitator?

Information elicitation and recommendation

Information elicitation and recommendation tasks are well researched. CAs are able to perform various tasks in this regard, and Kaushik et al. (2020) already show one approach of a multi-faceted interface for conversational search. However, this needs to be further researched with regard to DT as specific context. Possible research streams are those for individual DT phases as well as those for the whole DT process. Consequently, we propose the following research questions to gain knowledge about both perspectives:

13. How can a CA interface be designed to support individual DT phases? What requirements and challenges occur with regard to information elicitation, search and recommendations for each DT phase?
14. How can a CA interface be designed to support the DT process as a whole? What requirements and challenges occur with regard to information elicitation, search and recommendations for the whole DT process?

User´s preferences

CAs were already researched for various application domains such as in public administration, health and in the university environment. However, no specific contexts, especially not for DT, was published. Research agendas already call for future research focusing on specific contexts e.g. supporting remote DT processes. For further research, we recommend focusing on the following two research questions in this regard:

15. How can a remote DT process be supported by a CA in general?
16. What specifications need to be considered when designing a CA to support a remote DT process?

User´s show increasing interest on how their personal data is being used in various applications. However, research in this field remains in general scope. The following research questions may shed light on this research stream:

17. What privacy issues can occur when using a CA in remote DT processes?
18. How can a CA enhance and support a user´s privacy preferences?
19. In what situations do users perceive an application as failing in privacy aspects?

9.6. Limitations

Nevertheless, our study shows some limitations. We identified few contributions focusing directly on DT, especially adopted in organizational structures. Furthermore, some publications consider a CA's adoption in general, which calls for further research to validate its contributions to specific domains such as health, public administration or DT in virtual environments. Finally, this SLR depend heavily on the authors decision on selecting and integrating literature as well as the judgement of the authors. We also restricted our keywords search to title, abstract and keywords to ensure close proximity to the searched topics, which may lead to a limited scope of the study. We recommend further research with empirical investigations to inform literature about specific factors of CAs in remote DT sessions.

9.7. Conclusion

CAs are becoming increasingly important in various contexts such as health or public administration, which results in new research streams and application areas. However, current research is mostly focused on general application areas with fragmented task overview such as information elicitation or facilitating group discussions. In most of the publications, no specific context is given for the application of CAs e.g., in health, public administration or remote DT sessions. Since there is little knowledge on remote DT so far, we conducted a SLR on the use of CAs in creative work. These findings will then be examined with regard to their contribution to remote DT, and corresponding research questions and research agendas for this underrepresented domain will be derived. We contribute to current literature by providing researchers and practitioners with a consolidated perspective of currently researched concepts of CAs in creative work. We identified five concepts, each dealing with specific features and characteristics that CAs can adopt. Based on that, we build a research agenda showing the need of a context-specific, holistic approach of designing and adopting CAs especially in the context of remote DT sessions. Although DT is an approach that has been around since 2008 (Brown, 2008) and is broadly used through different industries in innovation management (Belitz et al., 2020), we identified only a small number of publications explicitly dealing with CAs adoption in remote DT processes. As conducting DT virtually might be a quite new form as DT strives from collaborating with different participants in a physical room (Schallmo and Lang, 2020), we expected to at least identify some form of IT-supported on-site DT sessions. We, therefore, call for further research with empirical investigation in the field of adopting CAs in remote DT sessions to benefit from the various features that CAs are able to have with emerging technologies.

9.8. References

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10. Problem Areas in Creativity Workshops and Resulting Design Principles for a Virtual Collaborator

Debowski, N., Siemon, D., & Bittner, E. A. (2021a). Problem Areas in Creativity Workshops and Resulting Design Principles for a Virtual Collaborator. In Pacific Asia Conference on Information Systems (PACIS). Virtual Event.

Abstract
In this empirical study, we present requirements and design principles for a virtual collaborator – an AI that acts like a virtual teammate in a physical creative workshop situation to promote creative work. Therefore, we consider relevant literature as well as insights from creative workshops in the automotive industry by conducting interviews with participants of these workshops. We derive problem areas and corresponding requirements raised by the participants. Main problem areas are individual challenges and group interaction related challenges as well as creative work with new methods and general problems working in workshop sessions. To conquer those problems, the interviewees stated requirements to the virtual collaborator mainly to get a more objective perspective in a workshop, make workshops more participative and create an open mindset and atmosphere for creative work. Besides, the interviewees wish to solve problems like building clusters of content and taking the minutes.

Keywords: Virtual Collaborator, Human-Machine Collaboration, Creativity, Creativity Workshops

10.1. Introduction

Organizations are under constant pressure to retain their customers, acquire new ones, and secure their overall market share (Anning-Dorson 2018). Growing globalization and crises such as the COVID-19 pandemic present companies with further challenges. In this challenging environment, innovations play a crucial role in creating competitive advantages and thus ensuring sustainable success (Azoulay and Jones 2020). To address complex problems, collaborative teamwork is a proven approach that incorporates the strengths of all members and achieves better performance through synergistic effects than each one individually (Siemon et al. 2019b). In this context, teams are assembled with diverse members and their skills, and are now increasingly supported by intelligent systems that use artificial intelligence (AI) to assist the team in many different tasks (Bittner et al., 2019a; Bittner et al., 2019b; Wiethof et al. 2021). In this context, AI applications mostly still take over supporting tasks or automate tasks instead of acting proactively and equally in the team. Due to increased computing power and novel algorithms, artificial intelligence (AI) has developed in recent years leading to an enormous potential for the entire value chain of organizations (Russell and Norvig 2016). Besides early AI research that aimed at building a general human-like intelligence (Kurzweil 2005), there is a research stream focusing on a more specific definition, involving features such as problem solving, knowledge representation, reasoning and learning (Russell and Norvig 2016). Such applications are called AI-enabled systems and find considerable attention especially in IS research (Gregor and Benbasat 1999). Those AI-enabled systems are developed and implemented to interact with its users in a more human-like way. Examples such as Apple's Siri or Amazon's Alexa are changing the way we interact and coexist with technology

(Anderson et al. 2018; Maedche et al. 2016), resulting in a natural interaction, where computers are not perceived as mere tools, but as interaction and collaboration partners in a mutual value creation (Nass et al. 1994; Seeber et al. 2020). This is largely due to the fact that they interact and communicate in the most natural way possible, as they are not only becoming more intelligent, but also more human-like with characteristics such as personality, autonomy, empathy, emotion and anthropomorphic qualities (Nass et al. 1994). Many researchers argue that humans and computers have complementary skills that should be combined to complement each other (Dellermann et al. 2019). Concepts such as hybrid intelligence, human-machine symbiosis or human-in-the-loop argue that superior results can be achieved, if the capabilities of humans and AI-enabled systems are combined to generate mutual value (Dellermann et al. 2019; Epley et al. 2007; Gerber et al. 2020).

A key aspect of these concepts is that tasks are performed collectively and interdependent activities need to be coordinated (Siemon et al. 2019b). If these mutual activities are now used to achieve a common goal, AI-enabled systems become team members in a collaboration scenario (Seeber et al. 2020; Siemon et al. 2018). This results in collaboration between humans and AI-enabled systems, which leads to changes in work settings, shifts in team role identities and subsequently, the way a team works together. Thus, new workplace configurations emerge, in which so-called AI-based teammates, i.e. AI-enabled systems that act as teammates, work within a team of humans, fulfill certain roles and take on interdependent tasks (Seeber et al. 2020).

A variety of research articles and essays already exists that deal with collaboration between humans and AI-enabled systems and predict its enormous potential and influence for the future of work (Aleksander 2017; Anderson et al. 2018; Schwartz et al. 2019; Seeber et al. 2020). While specific aspects such as trust in AI in collaboration (Elson et al. 2020; Jessup et al. 2020) or design with regard to theories such as anthropomorphism (Araujo 2018; Epley et al. 2007; Watson 2019) have already been vastly researched, there is a lack of holistic approaches on AI-enabled systems in teamwork.

One possible scenario is the use of AI-based teammates in a creativity workshop setting in which certain creative tasks can be taken over to increase the creative potential of the team (Bittner et al., 2021; Bittner et al. 2019b; Strohmann et al. 2018). For continuous organizational success, it is important to be innovative, which is why creativity, where novel solutions are generated, is inevitable for sustainable and long-lasting business activities (Amabile and Pratt 2016; Runco 2004). An appropriate design, an appropriate distribution of tasks and their fulfillment by an AI-based teammate can lead to an increase in collective performance and thus to a long-term benefit (Bittner et al. 2019b; Seeber et al. 2020; Strohmann et al. 2018). Subsequently, an AI-enabled teammate can be implemented to further increase the overall creative potential of the team and thus the innovative capabilities of a company (Bittner et al. 2019b; Larson 2010; Maher and Fisher 2012).

However, most research focuses on specific single tasks of AI-based teammates, such as the idea evaluator (Maher and Fisher 2012) or the creativity workshop facilitator (Strohmann et al. 2018). It is still largely unexplored how an AI-based teammate should be designed not only for specific single tasks but in a holistic approach dealing with collaboration, group and individual challenges that occur in collaboration as well as creative work. Collaboration and creativity is a huge factor in organizations as these need to create new products or services to stay competitive. Thus, organizations require creative teams collaborating with different team members and using various methods and tools to stay creative

and innovative (Dulebohn & Hoch, 2017; Finkbeiner & Morner, 2015). Besides, these teams not only work on one single task but need to work on several tasks at the same time or in a defined structure or process with iterations or in workshop formats such as in Design Thinking (Schallmo et al., 2020). As a facilitator, it is necessary to conduct tasks such as facilitating a workshop, choose the right methods to enhance creativity in the group and work on the group's collaboration and mindset at the same time. On the other hand, participants need to get familiar with the chosen methods and engage with those as well as get the right information to create innovation in their organizations (Althuizen et al., 2014).
Such insights would benefit companies to better plan the implementation of AI-based teammates in various creativity-intensive processes such as creativity workshops. Furthermore, it would contribute to general theories of human-AI collaboration, such as the Social Response Theory (Nass et al. 1994), the Human-Agent and Human-Robot Interaction Theory (Krämer et al. 2012). Researchers are already calling for the exploration of such concepts with research agendas (Seeber et al. 2019; Siemon et al. 2018), panel discussions, concepts and theories (Krämer et al. 2012; Nass et al. 1996) to advance the phenomenon of human-AI collaboration.
In order to address these gaps and generate knowledge on specific requirements and design principles for AI-based teammates in collaboration scenarios, we aim to explore the perception, requirements and benefits of a so-called virtual collaborator (VC), an AI-enabled system that acts as a virtual teammate in a collaboration scenario (Siemon et al. 2018). Therefore, we aim to answer the following research questions: Q1: Which challenges occur in creative workshops for the facilitator and the participants? Q2: How can a VC be designed to support facilitators and practitioners during the workshop and its execution? We follow a qualitative and explorative approach by conducting interviews, implemented in an innovation and creativity department of an automotive company. Based on the results, we derive requirements for the implementation of AI-enabled systems in creativity-intensive processes.

10.2. Related Work

Artificial intelligence and collaboration

Argyle defines collaboration as "acting together, in a coordinated way at work, leisure or in social relationship, in the pursuit of shared goals, the enjoyment of the joint activity, or simply furthering the relationship" (Aleksander et al., 2017). Putting this definition into perspective, the will give an overview on how to collaborate with AI-enabled systems.
Today´s AI-enabled systems such as Apple´s Siri, Amazon´s Alexa, or Microsoft´s Cortana support in daily tasks, and are becoming more and more an important part of human lives. As these are developing and adapting to humans´ needs, collaboration with AI-enabled systems gets even more attractive (Tegos et al., 2014). They are able to understand natural human language and derive interactions and responses based on certain command in a social way (Spagnolli et al, 2017; Saeed et al., 2015). To focus on the cognitive capabilities of a system, Siemon et al. (2019a) defined the term virtual collaborator as a "coequal virtual teammate in a collaborating setting" (Siemon et al. 2019a) based on Seeber et al.´s statement of technology having the power and possibilities to be a human´s smart collaboration partner (Seeber et al., 2018). A study by Strohmann et al. (2018) investigated possible requirements for a virtual facilitator who physically conducted a design thinking workshop including supporting tasks,

calculations, looking up information, planning and monitoring tasks, and certain evaluations. What was explicitly excluded by the interviewees were managerial tasks, critical decision making, and creative work. The VC is supposed to be proactive, supporting and trustful (Kirchkamp et al., 2019; Strohmann et al., 2018; Siemon et al., 2015). This study sets a first direction for virtual collaboration for knowledge workers and, additionally, shows among others the need for further research in this field.

With this regard, VCs can take over various tasks such as a facilitator of an individual (Tavanapour et al., 2018; Tavanapour et al., 2019), as an administrator (Kumar et al., 2014), or even present a certain perspective such as the devil´s advocate (Waizenegger et al., 2020). Clawson et al. shows the influence of facilitator´s skills on group outcome as valuable dimension for designing VCs (Clawson et al., 1993). Furthermore, studies have shown that VCs have a positive impact on human capabilities in terms of improving and expanding these for example by supporting in decision making with the help of data processing (Maier et al., 2018). Besides, they can reduce time needed to solve problems, and, therefore, optimize goal reaching (Mourad et al., 2018). This, though, requires a clear setting and division of tasks conducted by both the participants and the VC, focusing on not only individual effectiveness but on the entire system´s (Boff et al., 2006).

Research has shown the importance of an adequate human-machine-relationship to get the best outcome in collaboration. The development of VCs nowadays allows supporting users to reach their goal (Tegos et al., 2014; Kumar et al., 2014; Luhamann et al., 1993; Louvet et al., 2017) which leads to an improved relationship between humans and machines and improved collaboration itself (Hale et al., 1989; De Creu et al., 2001; Nemeth et al., 2007). Furthermore, the VC´s role in the relationship should be regarded as partner in an equal position with balanced power and no superior control by either side (Jarrahi et al., 2018; Adelé et al., 2013). VCs as well as humans can reach their optimum when the VC is perceived as not only a mere tool but as a partner with an instinctive and natural relationship (Adelé et al., 2013; Boff et al., 2006). Thus, studies have shown that perception is an important factor for a positive team feeling. In a study from Nass et al., the individual´s perception was manipulated by simply being said that they are dependent on a computer´s performance. Therefore, being in a team with the machine is a necessity (Nass et al., 1996).

Studies show three requirements for a VC. The first is space awareness, considering the human-machine interaction taking place in virtual space while the human itself is in the physical world. This means, the VC must be aware of the human environment, and able to react on changes (Petriu et al., 2008; Sandini et al., 2018; Sato et al., 1996).

As a second requirement, the VC must have a clear understanding of the actors and the environment, requiring a profile of the whole system, including the human lives and the VC itself, and the possibility to collect data. This allows the system to function optimally and to gain new insights (Jacucci et al., 2014). In return though, constant transparency is necessary to guarantee this clear understanding (Spagnolli et al., 2017). With this regard, cyber security is a significant factor to be considered, especially in an organizational context as most of the time sensitive data is being discussed and processed (Saeed et al., 2015).

Communication in the human-machine relationship as a third requirement can make a significant difference in outcome quality. Giving input via mouse, keyboard or verbally is not sufficient for an adequate human-machine relationship as human communication is far more complex. Humans

communicate both verbally and rich in gesture which might be able to be recognized by the VC; but in order to maintain a sufficient and adequate communication between both actors, emotional as well as context-dependent capabilities must be met (Petriu et al., 2008, Sun, 2017).
Our literature review shows that requirements and roles of VCs are already an important research theme; though, we discovered the missing perspective from an organization that is dependent on various regulations and environmental factors. This study aims to give a first insight in possible requirements for a VC from an organization´s perspective.

Artificial intelligence and creativity

Creativity has recently been a significant and popular topic in business for it to be considered as a competitive advantage (Poctor, 2014). Although there is a lack of a consent definition of creativity amongst researchers, many of them agree to say that creativity is related to a new and useful idea (Sonnenburg, 2007). Though AI is considered as the automation of activities associated with human thinking such as problem-solving or decision-making, humans have a much more context- and emotion-dependent thinking that allows us to interpret and reinterpret artifacts. Machines are much more limited to interpreting artifacts based on the data sets given to them (Maier et al., 2018; Petriu et al., 2008, Sun, 2017) but can counteract obstacles humans have when working creatively, such as goal-fixedness (McCafrey et al., 2014). Abilities that could initially only be ascribed to living beings and above all to humans can now be carried out by AI (Besold et al., 2015). Although many researchers see creativity as something intangible (Boden 2004), others see creativity as something systematic and explainable, which means that "computers can- and do- exhibit the same kinds of behaviors that creative humans do" (Colton et al., 2009). As one of the leading researchers in computational creativity, Margarat Boden argues that research on computational creativity in-fact, helped towards a better understanding of creativity and that combinatorial and transformational exploration can be performed by computers (Boden 2009).
So called co-creative systems can build a link between human users and an AI-enabled system on a shared task. These systems serve as inspiration and augmentation of the user's creative process, and can increase and stimulate user engagement and creativity using factors such as music or drawing. Research shows that these systems are able to support creativity in the design process and the ideation phase (Karimi et al., 2020). However, most research on AI-enable systems performing creative tasks is usually limited to individual aspects (neglecting team scenarios) or consider isolated phenomena and tasks. Considering the outlined research, this study aims to give a first insight in problem areas and possible requirements for a VC in the context of an organization´s creative department.

10.3. Research approach

We conducted twelve interviews with facilitators and participants of creativity workshop in an organization. The workshop is usually conducted in a specific room with utensils for creative work such as whiteboards, pens, different types of paper and other accessories for visualizing and designing (Schallmo et al., 2020). At the beginning of the workshop, the facilitators give an introduction and present a specific goal for the upcoming phase and steps to achieve this goal. For these, different methods and tools such as interviews, personas and silent brainstorming using sticky notes are being

used. Once the team is familiar with the elaborated content, various visualization techniques can be used (Stickdorn et al., 2014; Freiling et al., 2019). For these purposes, templates with the corresponding fields are created, which can be filled in using a whiteboard. The team members discuss together the contents for the corresponding fields and fill them in by hand. During the entire process, the facilitator, as a neutral party, primarily pays attention to supporting the discussions, for example by asking questions or providing his or her own impulses. After all individual tasks have been discussed, the next steps are discussed (Schallmo et al., 2020). Once the workshop is over, the facilitation team must follow up with the workshop and prepare a complete documentation of the workshop.

The semi-structured interviews were prepared, conducted and analyzed (Döring et al., 2016) with the help of guidelines to ensure comparability of the gathered information. These guidelines were separated into three sections covering questions regarding first impressions as well as individual and group related challenges during the workshop and handling potential input from the VC. The interviews took about thirty to forty minutes.

Table 1: Criteria & characteristics of interviewed individuals

Interviewee	Workshop experience	Training background
F1-F3	High	Design Thinking Expert
F4	High	Agile Coach
F5	Average	None, self-taught
P1	Average	In training for Design Thinking facilitator
P2	Average	None
P4-P9	Average	None

The interviewees were selected according to their role as facilitator (F) or participant (P) as well as according to their respective workshop experience, which was previously defined as a criterion. Workshop experience for facilitators was measured by the number of workshop facilitations conducted (high > 200; average < 200 workshops), for participants by the number of workshops attended (high > 50 workshops; average < 50 workshops). Having experienced a creativity workshop both as participant and facilitator, these interviewees were able to show a deeper understanding of possible requirements and problem areas when working with a VC. In the mentioned workshops, the participants focused on generating innovations in the field of new products and services based on the Design Thinking principles.

Each interview was recorded and fully transcribed in order to paraphrase them following the qualitative content analysis by Mayring (2007). The codes were built inductively by one researcher in three cycles of manual coding resulting in 465 codes. Paraphrases from the interviews were first attributed to each code, then categorized in turn. Fifteen requirements emerged from code mapping eventually (Mayring, 2007). Design principles (DPs) were derived from the challenges and requirements following the design science research approach of Hevner et al. (2000) and Gregor et al. (2020) (Hevner et al., 2000; Gregor et al., 2020).

10.4. Findings and resulting design principles for the VC

In the following, the requirements and design principles for a VC as main artefacts of this study are elaborated based on four problem areas mentioned by the interviewed participants. These include individual challenges, such as self-doubt, lack of knowledge or experience. The second area refers to group related challenges such as the handling of more dominant and active workshop participants that do not have the group objective in mind but their own interests. The third problem area is the difficulty in getting involved in new approaches and processes and in breaking away from old patterns of thinking. Finally, working in workshop situations generally was mentioned as a fourth problem area. Figure 1 shows an overview of requirements and design principles derived from the participant´s statements.

Regarding the first problem field, individual challenge, it was mentioned that the own opinion was held back during a workshop situation due to a perceived lack of appropriate knowledge or experience to make valuable contributions: “I only speak when I am halfway convinced of my thoughts” – P4 Besides, assertions had been made during a workshop that turned out to be false. In order to prevent or counteract these two challenges, the VC is expected to gather and process information quickly and reliably (Waizenegger et al., 2020; Seeber et al., 2019). Above all, facts and information with a deposited source should be provided to validate statements (R8, DP2) and to build up a knowledge database that can be developed from workshop to workshop. In addition, this ability should be used to find existing solutions, e.g., from other companies or social media, as a further impulse or stimulus: “It can give a clue by referring to social media or other sources and drawing inspiration from them” – F3. Studies show that AI-based agents are expected to collect, analyze, synthesize, and identify patterns, which can directly be used in the presented workshop situations (Gil et al., 2014; Ransbotham et al., 2017).

Speaking in front of more dominant participants was problematic as not only individual participants but the whole group is influenced by the opinion of the dominant person which can lead to a one-sided workshop structure. For this reason, the VC is expected to monitor speech shares (R2, DP1): "That everyone is connected via a gadget, that he then notices 'ok here are two or three people not so active in the conversation'" – P5. This is to measure the speech contributions and make them transparent either to the entire group or only to the moderator in order to take necessary measures to restore the balance. This will also allow the equal treatment of each participant's input. In addition, this balance is also beneficial to the overall structure, and thus also to the achievement of the workshop objective. Since AI-powered systems perform various tasks but are not directed and controlled by a human, traditional hierarchies of power and control can thus be challenged. This can have a direct impact on both the outcomes of a workshop and the behavior of the more dominant participants (Seidel & Berente, 2020).

The second problem area consists of group related challenges and the handling of these. A frequently mentioned problem is when individual participants in a workshop do not work towards the common goal, but primarily pursue their own interests, noticeable both in terms of their own input and in how they deal with the input of others. For this reason, the objectivity of the VC is assumed to create a neutral instance within the group and to ensure that input is treated equally by each participant (R1, DP1): "Not 100% neutral, but I think the perception would be that at least based on the data it is taking in, it is treating everything equally and not treating anything else as subordinate" – P7. In this way, criticism expressed by the virtual collaborator is welcome and considered as helpful and not as a personal attack.

Numerous studies have already investigated that AI-enabled systems can play the role of an empathic team member, providing feedback to the team and also addressing critical issues (Seeber et al., 2019; Waizenegger et al., 2020; Wilson & Daugherty, 2018; Benke, 2019; Xiao et al., 2019).

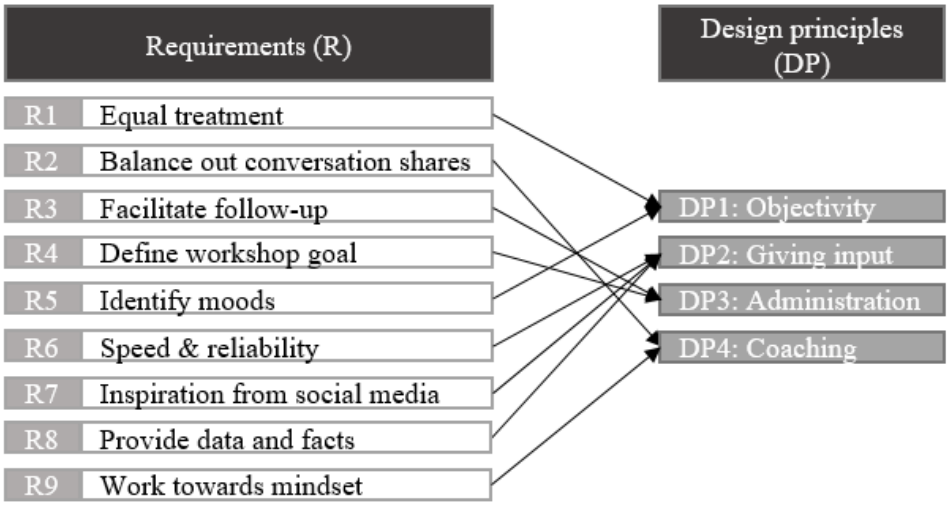

Figure 1. Requirements and Design Principles for a VC

F1, F2 and F4 mentioned that it can sometimes be difficult to choose appropriate methods, to switch to other methods, or to try new methods. In this regard, the VC could suggest methods based on the workshop goal (R4, DP3) or the mood of the participants (R5, DP1) to better respond to the needs of the group: "Also methods on how to approach such a topic, so that just the person doing it has an objective of what to actually do." – P5 . This could also further promote creativity. Studies show that AI-based agents can boost human intelligence by providing information or deliver explanations to the users (Davenport & Kirby, 2016; Zumstein & Hundertmark, 2017). It has been found in several studies that AI-enabled systems are able to influence group decision-making processes as well as team outcomes to achieve the goals of their users (Wilson & Daugherty, 2018; Shamekhi et al., 2018; Dietvorst et al., 2015).

Although this is also the facilitator´s task, the VC could support the facilitator in this respect or take over this task completely, so that the facilitator can take care of the workshop participants individually: “I´m thinking of the 6 Thinking Hats method, and that an AI takes one of the roles” – P7. This could also be achieved by the virtual collaborator analyzing the group with regard to its roles and other aspects, for example, to achieve a balanced group and then possibly to present a missing perspective or recognize based on voices, if breaks or changes are needed (Seeber et al., 2019; Wilson & Daugherty, 2018). The VC should be used to find existing solutions, such as from social media (R7, DP2), as a further impetus or inspiration: "It can give a hint by referring to social media or other sources and getting inspiration from them" - F3. Studies show that AI-enabled systems are expected to collect, analyze, synthesize, and identify patterns that can be used directly in the workshop situations presented (Gil et al., 2014; Ransbotham et al., 2017).

As a third problem area, getting involved with new methods and approaches, and breaking away from old patterns of thinking was a frequently mentioned challenge. As a requirement, the virtual collaborator

could function as a coach (R9, DP4) to open the participants' mindset and, therefore, enable and encourage a creative approach to a project (Seeber et al., 2020; Wilson & Daugherty, 2018). The virtual collaborator can thereby respond individually to the participants' needs or use inspiring images or videos to get the whole group involved in the creative work: "You always have your own method kit that you use, but it just doesn't work for every person" – P7. Creating a mood board was another way to give new impulses as an external perspective, being not directly involved. For this matter, it was suggested that the virtual collaborator could make use of social media. In this way, the virtual collaborator could be used to permanently present views or personae during the workshop, thus improving user-centricity. In this way, user´s needs could be developed more quickly by the AI-based agent taking over different positions and perspectives (Malone, 2018; Wilson & Daugherty, 2018). This could improve the user-centered approach in creative workshops.

As a fourth problem area, administrative preparation such as organizing and designing the workshop was frequently cited as a challenge. Taking minutes and showing connections between different results were described as very time-consuming, as well as taking minutes and filling out templates (Shluzas & Pickham, 2017). Same applies to the creation of protocols and filling out templates. This is expected to be done by the VC: "I would now expect that I get a transcript of the interview and the staff member does the follow-up or something." - F2 (R3, DP1). A study by Dolata et al. (2019), for example, showed that AI-enabled systems can help with administrative tasks such as capturing, transcribing, and archiving documents and meeting minutes during the workshop, or to communicate through various channels such as email or messenger (Dolata et al., 2019).

10.5. Discussion & Conclusion

In this paper, requirements for as well as the potential benefits of a VC in a creative workshop situation were worked out. Based on qualitative interviews with participants in creative workshops, the views of potential users were derived. The analysis resulted in nine requirements and four design principles, in which the interviewees stated their opinion on the individual and group-related challenges as well as requirements and benefits of a VC. The requirements and design principles refer to and address four problem areas. The first problem area is based on individual challenges such as self-doubt or introversion. The second problem area considers group-related challenges such as dealing with very dominant participants. The third problem field is about working with creative methods according to which the interviewees first had to get involved with the new methods. The last problem area is about general difficulties in workshop work as this is usually very efficient for the participants but involves a lot of effort.

The requirements obtained are consistent with findings from other studies that primarily focus on virtual collaboration between humans and AI-based team members (Bittner et al. 2019b; Strohmann et al. 2018). It should be particularly emphasized that the view of an AI-based team member and the associated tasks are still strongly attached to an assisting role. Subjects tend to view AI-based team members as assistants and assign them corresponding tasks, such as monitoring the process or providing information. However, it also appears that for certain tasks, AI-based team members are also seen as more autonomous and hybrid value creation systems can emerge. Such approaches, so far very theoretical, are for example the machines as teammates or the hybrid intelligence approach (Dellermann

et al. 2019; Seeber et al. 2020). In these approaches, AI-based team members are seen as equal partners and actively contribute to the collaboration. For example, our participants mentioned that an AI-based team member can bring own perspectives and contribute inspirations.

Even though our research provides valuable insights, the study includes a variety of limitations. First, the consideration of only two workshop scenarios in a company and the limited number of interviewees does not allow an unrestricted generalization of the results. Even though our scenario certainly provides a number of transferable implications, the context of the automotive industry is still a limiting factor, as it is very much characterized by its focus on engineering and technology. Second, since AI and in particular the VC are still new and very unknown concepts, experiences, expectations and the associated requirements are still very limited. The requirements and wishes of workshop participants could therefore still be strongly influenced by existing, immature and faulty AI-enabled systems. Furthermore, a general uncertainty about the role and impact of the use of AI could be a strong limiting factor in the exploratory design of a VC.

Consistent with that, the results of the qualitative investigation clearly show the skepticism of the interviewees about the technology of artificial intelligence. According to the interviewees, this skepticism would increase, if the quality of the VC's work was low. Nevertheless, the interviewees see great advantages in use, especially in terms of efficiency, objectivity, and fast data processing by the VC. For this reason, the opinions of potential users should always be sought in the conceptual design and the VC should be built iteratively. Here, a special focus should be placed on transparency throughout the entire process to gain the trust of potential users and counteract skepticism. The fears and concerns of potential users should always be addressed. Recent studies show that the acceptance of AI-based technology can be low as those technologies evolve to “black boxes” due to the lack of understanding on how results are produced, who owns data and what happens with this data, leading to information asymmetry (Seeber et al., 2019, Gregor & Benbasat, 1999; Szollosy, 2017). This may lead to problems in identifying with the elaborated results due to the lack of control. Participants might feel threatened, if AI-enabled systems challenge their roles and identities by taking over certain tasks, but might also support and encourage these roles (Seeber et al., 2019). Also, users might not identify with the outcomes due to (un)conscious biases programmed willingly or unwillingly, or resulting from prejudices in the society, leading to poor decision-making (Kirs et al., 2001; Tegos et al., 2014).

In summary, our research contributed to emerging theories and concepts on collaboration with AI and machines becoming teammates (Seeber et al., 2020; Bittner et al., 2019b) by incorporating a qualitative study with frequent collaborators in creativity workshops. We contribute with specific requirements, that can serve as a foundation for further developing design knowledge or as future aspects for collaboration engineering (de Vreede et al., 2019). Practice benefits from insights into the general conceptions of collaboration with AI and from insights on how to implement AI-enabled systems into current work practices. However, future research needs to be conducted to better understand the needs, fears and perceptions of individuals that will work with AI in future collaboration scenarios. Specifically, aspects such as transparency and trust need to be investigated by opening up the “black box” of AI in order to insure an effective future collaboration with AI.

10.6. References

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11. Toward a Virtual Collaborator in Online Collaboration from an Organizations' Perspective

Debowski, N., Tavanapour, N., & Bittner, E. (2022b). Towards a Virtual Collaborator in Online Collaboration from an Organizations' Perspective. In Internationale Tagung Wirtschaftsinformatik (WI). Virtual Event.

Abstract
In this empirical study, we present the specifications of virtual collaboration in times of the Covid-19 pandemic in an organization that worked mostly co-located beforehand, and requirements for a virtual collaborator (VC) resulting from those specifications. Related work shows that a VC can support virtual teams in achieving their goals and promote creative work. We extend this with insights from practice by observing creative collaborative workshops in the automotive industry and conducting interviews with facilitators and participants of these workshops. We identify challenges that participants face in virtual collaboration, and derive design guidelines for a VC to address them. Main problems arise due to the virtual interaction lacking nonverbal communication and the preparation phase requiring more planning and effort. A VC could help by influencing group cohesion, networks between participants, and the virtual working environment as well as by contributing content.

Keywords: virtual collaboration, artificial intelligence, technology-based agents, virtual creativity, virtual workshops

11.1. Introduction

Due to the Covid-19 pandemic and the shutdown situation, the working world has been forced to shift quickly from a presence-oriented co-located to a completely virtual work experience in no time. Employees have been confronted with virtual tools to collaborate with each other to accomplish their tasks [1]. One scenario for such a collaboration are virtual workshops in organizations, which were - before the pandemic situation - often conducted onsite. Besides the advantages, virtual collaboration comes with new challenges for facilitators and participants of the workshops. The virtual setting lacks non-verbal communication and interaction, which causes a different team atmosphere and a variety of challenges and counteracting behavior [2, 3]. Furthermore, the facilitator and the participants need to manage different communication and information streams over speech and text at the same time virtually [4]. Additionally, small interactions such as showing, highlighting or organizing demand a tool functionality and effort, which is less complicated in onsite workshops [5]. These might result in cognitive overload which can have a negative impact on attention and creativity [6], and calls for automated support of virtual workshops based on artificial intelligence (AI). Many research articles already deal with the cooperation between humans and AI [7-8] and show a great potential of AI for the future of work [9-14]. Specific factors such as trust and skepticism in AI regarding collaboration with humans [15-18] are already being researched. However, there is a lack of a holistic field research approach and especially of AI-supported virtual collaboration in the creativity process [19-20]. Further research is demanded by scholars via research agendas [21-22] and panel discussions [23]. A so-called

virtual collaborator (VC) goes further in this respect: it is not limited to assistance functions, but should be considered as an equal virtual teammate in a collaborative work environment, acting with the user [24].

At this point, we position our research and investigate from an internal organizational view the challenges that facilitators and practitioners face in creative virtual workshops compared to onsite workshops, and how a VCs can be designed to address these challenges. For this purpose, we ask the research questions Q1: Which challenges occur in virtual creative workshops for the facilitator and participants in comparison to onsite creative workshops? Q2: How can a VC be designed to support the facilitator and practitioners during the workshop? To answer the research questions, we follow a qualitative and explorative approach by Döring et al. [25] and Mayring et al. [26] by conducting semi-structured interviews with participants and facilitators of creativity workshops in an innovation and creativity unit of an automotive company. The aim of this study is to identify the challenges of virtual collaboration in creativity workshops, and to develop design guidelines (DGs) for a VC following the approaches of Hevner et al. [27] and Gregor et al. [28]. This paper continues with related work on VCs and virtual collaboration before presenting our research approach. We delineate our findings with the identified challenges as well as the DGs for the VC. We discuss our results in connection to existing literature and outline limitations of our research. Finally, we provide a conclusion and highlight our contribution.

11.2. Related Work

Collaboration is defined as acting together pursing a common goal in a coordinated way [29]. With the help of computer technologies, a new type of collaboration has emerged in which people can work together regardless of time and place. This includes communication and certain types of interaction [30], which has led to more and more research into how to use technology to support collaboration processes. These include shared data storage, shared workspaces and editors, but also increasingly technologies that address group processes and seek to steer behavior in teams [31]. Furthermore, the collaboration research is extending its scope towards artificial collaboration partners such as conversational agents [3, 22, 23]. While the concept conversational interface [32-33] reduces interaction between system and user to conversation, the terms artificial collaborator [34] or artificial companion [35] focus on physical instantiations.

However, to focus on the cognitive capabilities of a system, Siemon et al. [24] defined a VC as a technology-based agent that is able to perceive its environment, process information, make and learn decisions, act on them, and interact with humans and other machines to achieve a common task goal with more or less autonomy [24]. In other studies, a VC was assigned the role of the organizer [36] or the representation of other views and perspectives [37]. VCs can also support the collaboration process and expand their capabilities, for example in decision-making [38-39] or in reducing complexity and time expenditure. This is how the achievement of objectives can be optimized [40]. However, the VC must consider the entire system of collaboration, not just individual effectiveness. To achieve this, the goals and distribution of tasks between participants and VC must be clearly defined [41]. To achieve optimal results in collaboration, an adequate human-machine relationship is important. If the collaboration goals are achieved [42-43, 36, 12], not only the relationship between participant and VC

improves, but also the collaboration itself [44-46]. To this end, the VC should be seen as an equal partner in the collaborative relationship in terms of power and control [47-48]. This leads to an optimal performance of both participants and the VC [47, 49, 41]. However, according to Nass et al. [42] perception of the VC as a machine team partner also plays an important role. Furthermore, Nass et al. [49] found that individuals in groups apply social rules and have similar expectations towards computers and just accept being in a group when asked to be [16, 50-55].

Research has shown three essential requirements for VCs, space awareness [56-59], role allocation [59-61] and the human-machine relationship [57, 43, 62]. Space awareness needs to be considered, since the interaction between humans and machines is virtual, whereas humans usually interact in a physical environment when working co-located [56]. This results in the second requirement, role allocation, as the VC must have a clear picture of the participating roles and environment. This leads to the VC being able to collect data by profiling the entire system of VC, participants and their communication streams such as text, speech and video functions, as well as the working environment to gain insights and function optimally [60]. However, this requires continuous transparency in the entire process to provide this clear picture [61]. The human-machine relationship as the third important prerequisite requires communication, which can make an important contribution to the quality of results. Giving input via mouse, keyboard or only verbally is not sufficient for an adequate human-machine relationship. As humans communicate both verbally and via body language, these modalities must also be recognizable by the VC to allow emotional and contextual communication [57, 53, 62].

Although research has already shown some important prerequisites for collaboration with a VC, the organizational view especially real-world cases within organizations rather than organizational or management research has not been sufficiently explored [19-20]. Aspects [63] such as data security, current systems used in the organization and reducing redundancies in tool landscape [18-21] need to be considered. Also, organizations deal with different challenges in collaboration and especially in creativity sessions such as hierarchies in groups and group effects like social loafing [17].

11.3. Research Environment – Creative Unit in the Industry

In the following, the working method of the investigated creative unit (CU) in the industry in the analog as well as digital context is explained. The first author is a frequent facilitator of DT workshops in this CU. The CU bases its work strongly on the design thinking approach in the 6-phase model according to Schallmo & Lang [64]. Design Thinking (DT) is a method for solving existing problems and involves various stakeholders with different backgrounds at an early stage. The focus is consistently on the needs of the users, who are involved at every stage. Depending on the phase in the DT process, a thematically appropriate workshop is designed [64], which is explained below as an example in both analog and digital implementation using the third phase "Defining the point of view". This phase allows the team to evaluate, interpret and weigh the insights, and create a common basis on the contents, summarized in a typical, fictional persona [64]. The “Defining the point of view” phase is a good example to analyze due to its various tasks to be solved regarding both team and individual work, which is why it has been chosen for this particular study.

The analog workshop is conducted in a room with utensils for creative work such as whiteboards, pens, different types of paper and other accessories for visualization purposes [64]. No technical aids or technical utensils are used in analog workshops. At the beginning of the workshop, an introduction to the workshop and the participants as well as the agenda with contents and breaks is presented [65-66]. Following the goal of the "define point of view" phase to scan, synthesize, and analyze the previously conducted interviews, the participants talk about the content: What were the insights? What was mentioned particularly frequently? What was not mentioned?
Subsequently, the information obtained is visualized e.g. in a user journey. The user journey represents the path of using a solution with the respective experience and contact points of the users [67]. A template with the corresponding fields is provided using a whiteboard. The team members discuss the contents for the fields and fill them in by hand. During the entire process, the facilitator, as a neutral party, primarily pays attention to supporting the discussions, for example by asking questions or providing their own impulses. After all individual tasks have been discussed, the next steps are discussed. It may happen that, due to the iterative nature of the DT process, the team takes a step back, for instance realizing that more information on the potential users is still needed [64]. After the workshop, the facilitation team prepares and provides the documentation. Digital workshops at the CU also follow the DT principles and process described above, but differ in their implementation. While a physical room is provided for analog workshops, digital workshops take place in a virtual room. The CU presented here uses Microsoft (MS) Teams as a collaboration tool, primarily the conference function. The workshop is prepared by appropriate explanations and templates using PowerPoint slides, which are presented in the conference. Specifically, each step is explained verbally and in writing on the slide. In the next step, participants are divided into groups of maximum six people. Each group has a facilitation team consisting of two people. The groups can be formed automatically in a randomized manner using the "Break out rooms" function in MS Teams [68]. The content-related work phase then starts with the prepared templates. The facilitation team can choose between two options: Either participants write directly into the templates, for example, during the loud brainstorming [69-70] or the participants first write down their thoughts for themselves using the MS Teams chat function [71]. Once the time has expired, the facilitation team gives a signal for all participants to simultaneously send their thoughts to the group chat. Then, each team member presents, and the facilitation team transfers the presented content from the group chat to the prepared template for documentation purposes. This is particularly suitable, if participants have not worked frequently with the program used. All work phases are carried out according to this principle. Here, too, the next steps are discussed, and a feedback round is held. Digital editing in the templates during the workshop usually eliminates the need for follow-up work, or at least greatly reduces it.

Table 1: Differences between analog and digital DT workshops

Criteria	Analog	Digital
Material	Whiteboard, pens, paper, and utensils for handcrafting	Laptop, digital whiteboard and chat in MS Teams, PowerPoint Slides
Work Style	Stand up, in groups, discussions, work in silence	Individuals in dispersed locations, break-out-rooms in MS Teams for group work, or in presenting mode
Environment	Physically in workshop room	Individually in private spaces, other locations, in front of the computer

11.4. Research Approach

We collected data from the perspective of potential users of a VC by conducting semi-structured interviews (see Appendix A at https://bit.ly/3yvnu4q) lasting thirty to forty minutes. We chose interviews as an appropriate approach when lacking fundamental information for a phenomenon [25]. The interviews first addressed challenges of analog and digital workshops as well as requirements for a VC related to them. We aimed to gain insights about an organization´s perspective with regard to handling virtual creativity and collaboration workshops [72]. Interviewees are employees of the CU and were selected according to their role as facilitator (F) or participants (P) as well their workshop experience. We chose to consider both perspectives as different roles result in different challenges and needs. Besides, participants are an important main user of the VC whereas facilitators give us broad insights as they have worked with many different teams. Workshop experience (WE) for facilitators was measured by the number of digital workshops conducted (High > 60; Average < 60 workshops) and for participants (High > 10 workshops; Average < 10 workshops). Separation criterion was the average of the highest and lowest facilitation experience (100 and 20) as well as highest and lowest participation level (20 and 1). The criteria gender, age and job background were added for the sake of achieving a heterogeneous sample; for the topic itself, criteria workshop experience as well as relevant training are expected to be significant. After conducting nine interviews, results began to reach their plateau; therefore, twelve interviews seemed sufficient. The interviews were partially transcribed and analyzed using the qualitative content analysis by Mayring [26]. In a bottom-up approach, categories were built inductively, resulting in two sections, “Lack of nonverbal communication and human-like atmosphere” and “Workshop preparations and digital functions”.

Table 2. Criteria & characteristics of interviewed facilitators (F) and participants (P)

No.	WE	Relevant Training	Gender	Age	Job Background
P1	High	Participate frequently	Female	29	Compliance Manager
P2	High	Participate frequently	Male	31	Risk Manager
P3	Average	Participate by demand	Male	36	Legal Expert
P4	Average	Participate by demand	Female	32	Service Designer
P5	Average	Participate by demand	Male	35	UX Designer
F1	Average	None, by practice	Female	36	IT Consultant
F2	Average	None, by practice	Male	29	Innovation Manager
F3	Average	None, by practice	Male	39	IT Consultant
F4	High	In training to DT Expert	Female	32	Communication Manager
F5	High	In training to DT Expert	Male	35	IT Consultant
F6	High	Certified DT Expert	Female	29	Innovation Manager
F7	High	Certified DT Expert	Male	29	Innovation Manager

11.5. Findings

Challenges (C) of virtual workshop implementation

Lack of nonverbal communication and human-like atmosphere: The biggest and most frequently mentioned difference is the lack of body language and direct feedback (**C1**). The chance to get a first impression of a situation and its participants is eliminated. Often, the atmosphere at the beginning of a workshop is very reserved and participants do not talk to each other until the facilitator has officially opened the workshop. But even during the workshop, direct feedback is often not possible. If the participants are tired and need a break, they show a lack of concentration or yawning. In addition, participants very often interrupt each other due to a lack of body language, as they cannot see when others take a breath and start speaking. All interviewees also mentioned that participation was generally lower, holding back to avoid interrupting others (**C2**). The mute function, which always came into effect in large groups when a person did not speak, was also a hindrance to speaking. Especially for facilitators, it is difficult to focus participants' attention on themselves to guide and moderate. It is difficult to assess, whether participants are fully dedicated to the workshop or doing other activities on the side, such as answering emails or dealing with other topics: "You can see they're part of the meeting, but are they fully engaged?" (F7). It was also mentioned several times that in a virtual working environment, it was easier to intentionally leave a discussion or work phase (**C3**). About their own involvement, P1, P2 and P3 mentioned that they were more often distracted by other things on the screen or even the mobile phone and did several things at once. This led to an information overload and required discipline. During breaks and interruptions in the work phase, the opportunity to talk informally with each other is limited as well as networking while having lunch together. Yet, the virtual working environment made it possible to read documents or collect facts on a topic to contribute more adequate arguments to a discussion. Furthermore, it was easier to structure one's thoughts and take notes. The participants were sometimes very motivated due to the current exceptional situation. Since everyone is affected by the Covid-19 pandemic and has empathy for the other participants and facilitators, participants were particularly ambitious. In addition, P1 and P2 indicated that they felt more confident because they felt

protected by being separated from the presence of other people. Also, participants stated, that they felt more pressure to prove that they are fully engaged in the workshop, because it was not easily seen due to the virtual situation (**C4**). Therefore, they felt especially motivated to engage in the workshop. This applies especially when the participants did not know each other beforehand. If participants only got to know each other during the workshop, they were initially more reserved and tense, than if they had known each other before (**C5**). Thus, the desired cohesion in the group did not exist as in a co-located setting. The participants mentioned that moods and other interpersonal subtleties do not come across as well as in co-located situations. There was also more discussion and dispute. One assumption behind this is the protection that results from the virtual, more anonymous working environment. On the other hand, participants and facilitators who knew each other before reported that they met on a different, more personal level. This was mainly since participants also got to know each other's private environment in the videos. Since everyone was subject to the regulations on mobile working, everyone could understand, if by chance a child or partner was visible in the picture. This strengthened the group cohesion: "Through online collaboration one got to know the colleagues differently. It welds them together, you get a glimpse into their home, into their private lives." (F1).

Workshop preparations and digital functions: A fundamental view of the interviewees was that in virtual workshops, dedicated planning and preparation was essential and took more time and effort than in the co-located way (**C6**). It was necessary to go through all the possibilities that could occur during the workshop and at the same time prepare alternatives in case something did not go well. In addition, the objectives of the workshop had to be defined more precisely to align the methods and process with them: "You have to go through the whole workshop more often, what are the possibilities in the interactive sessions, and what alternatives do we have." (F4). A clear advantage of virtual workshops is that workshop materials such as pens, whiteboards and paper no longer need to be prepared, as everything is processed on digital whiteboards and PowerPoint slides. However, this need for planning also means that e.g. spontaneous visualizations or a change of methods is harder to conduct (**C7**). Decisive planning and digital processing make follow-up work much easier. After the implementation, a lot of content and material is preserved, which is often not the case in a co-located workshop, because different media is used. Chat messages can also be retained, in which important spontaneous ideas and comments may be found.

Regarding the choice of methods, participants and facilitators had different opinions. While participants thought that all methods can be digitally reproduced, facilitators saw this rather less (**C8**). Especially the Understand, Observe and Define phases from the DT process are easier to conduct digitally than the phases Ideation, Prototyping and Testing. This is since the last three phases need more visualization possibilities, which are rather difficult in the digital implementation (**C9**). The interviewees, especially the facilitators, stated that the method selection is more decisive for virtual than for co-located implementation. There is a lack of movement in the setting and spontaneity in the change of methods, because tools need to be prepared: "The first three phases of the Design Thinking process are well digitally feasible, after that it becomes more difficult." (F7).

Another important factor is working with digital tools. The participants are often not used to working with them and need more time for discussion and reflection (**C10**). This makes the facilitator's work even more difficult, since in addition to the facilitation, they must also explain digital tools. Both

facilitators and participants cited technical skills and the handling of digital media as important factors for successful implementation. The virtual implementation has the clear advantage that there are no geographical borders to hinder, so that participants can take part in the workshop regardless of location and do not have to travel to the event: "Every meeting is only one click away" (P2).

11.6. Resulting Design Guidelines for the VC

We derive the following DGs for the VC according to Gregor et al. [28] in a virtual creativity workshop from the interviews based on the mentioned Cs above and stay in line with Hevner et al. [27] and Gregor et al. [28].

Networking and influence on group cohesion: To bring together participants with similar interests and skills, the VC should be able to collect information from databases and networks from the intra- and internet (F2). This should be a stimulus for networking and exchange. In advance, a workshop-specific profile could also be created. However, networking should not be too active, but rather in a subliminal, subtle way (F2): “Something like ‘Do you know XY? She is also an agile coach.’, based on what is stated in my LinkedIn or intranet profile.” (F2). This results in **DG 1: Networking Opportunities**: *Allow networking of participants by automatically delivering non-personal information from networks in intra- and internet and creating a workshop-specific profile, because the virtual environment is a barrier for informal exchange between participants, who meet virtually for the first time.*

The VC could also identify moods based on voice and conversation analyses and give corresponding tips to the facilitator or have a direct steering effect on the participants (P1, F6). At the same time, an opening and inspiring mindset could also be conveyed to stimulate the creative process in the workshops: “When people are open-minded to get a kind of coaching from the VC, this could help” (F6). The VC could guide the participants into an open mindset through one-on-one written or verbal conversation (F6), utilizing the data from the previous voice and conversation analyses, which results into **DG 2: Influencing Group Cohesion**: *Create an open and inspired mindset for participants by identifying moods based on voice and conversation analyses and giving tips to the facilitator, because an open and inspiring mindset stimulates the creativity process, which leads to innovation creation.*

Influence on the virtual environment: The VC should accompany the participants and facilitators during the entire workshop (P1). In doing so, the VC should have an organizational and supporting effect on the immediate virtual environment.

On the one hand, the VC should take over time keeping, if necessary and on the other hand, it should also include a reminder function that gives a hint about the upcoming agenda item and introduces the next phase (P1). In addition, the VC should provide different virtual rooms for different situations and make something appealing with a welcoming text and a round of introductions (P1, F4). This is intended to replace the role of the host, who welcomes the participants (P1, F4): "The VC could walk through the rooms, he could say, 'Here's what's on the agenda,'" (P1), which results into **DG 3: Support during whole virtual workshop**: *Support both facilitators and participants by taking over tasks like time keeping, reminder function, introduction to the next phase in virtual rooms and provide support for handling digital tools, because explanations and support of participants for handling the virtual environment is time consuming and takes away the facilitator´s focus from guiding the participants content-wise.*

To achieve a balanced discussion, tracking the share of a conversation of the participants is of great importance. The speech proportions of the participants should be monitored in order to balance the contributions. This might encourage silent people to speak and very dominant personalities to take a step back (F7). Therefore, the VC should be capable to balance the speech proportion with social badges by actively encouraging passive participants to contribute to the team discussion (F7), which results in **DG 4: Tracking conversation shares**: *Track the share of a conversation of all participants and provide hints if imbalanced to both facilitators and participants, because dominant personalities might take over the conversation and, therefore, leading to imbalanced workshop results.*

Contributing content: Furthermore, the VC should be able to support the process by providing information and background knowledge (P2). Semantic analyses and keyword searches will be used to retrieve knowledge to support the research phases. Creative sessions should also be enhanced by input, for example by showing examples or inspiring images or sounds. Here, the VC should take on the role of participant and fact provider, and at the same time visualize the generated knowledge (P2): "The VC could offer broad knowledge on certain keywords in a visualized form." (P2), which results in **DG 5: Provide information and inspiration**: *Support knowledge generation and exchange by providing visualized information and background knowledge using automated semantic analyses, and keyword searches, and showing examples, and images or sounds, because searching for information regarding a specific topic might take up a lot of time during a workshop that might be needed for other phases in the DT process.* In contrast, the VC should also be able to contribute directly to broadening perspectives, e.g. as sparring partner for exchanging views (F2, P2). For example, P2 stated that opposite views would be useful to obtain and build on another perspective, while F2 rather said that similar ways of thinking would foster the joint building of ideas. F2 tended to focus on harmonization and cooperation, while P2 focused on the complementation of the ideas. In addition, the VC is supposed to recognize, when a discussion becomes monotonous and then bring in new perspectives and contributions to enhance the discussion and make it run in a new direction. In this way, new connections could also be pointed out to obtain the broadest possible picture, which results into **DG 6: Provide perspectives of different user groups**: *Support idea generation and provide inspiration for participants by providing new perspectives from different points of view, e.g. from a specific user group´s perspective, because user centricity is a key for successful innovation resulting from DT.*

Using the analytical power of AI, it was frequently stated that the VC should be capable to analyze and evaluate the idea of a user regarding potential and fields of application (P2). In addition, the internet should be screened for existing similar ideas (P2), resulting in **DG 7: Evaluate generated ideas or solutions**: *Support idea generation and evaluation by providing information and potential use cases for similar products/services/ideas from the internet, because research about existing products/services/ideas might be time consuming*.

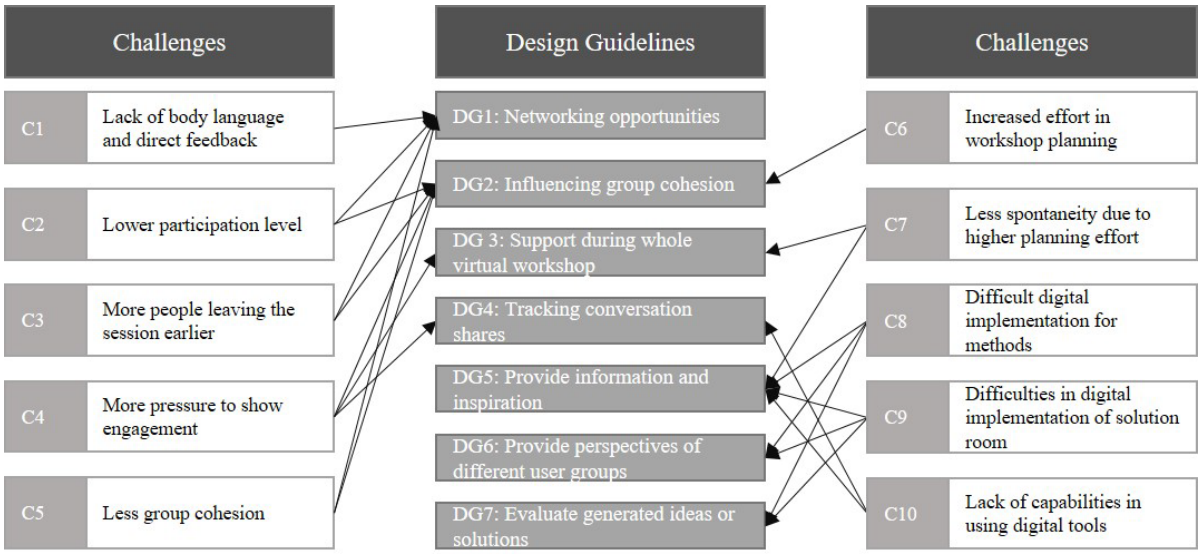

Figure 1. Challenges and respective design guidelines

11.7. Discussion and Limitations

The interviews especially show that nonverbal communication and the lack of it is the most challenging part of virtual collaboration. Nonverbal communication needs to be compensated or replaced by virtual interaction. This substantially reduces the familiar clues for the first impression, since less non-verbal communication is possible (F5). Moreover, at the beginning of a workshop the participants are very reserved until the facilitator opens the workshop. Even during this time there is no direct feedback, and the video function is rarely switched on - whether for reasons of network load or lack of will. The literature also shows the overriding role of face-to-face encounters and non-verbal communication: the success of virtual collaboration lies in penetrating such physical differences that requires building up a common understanding and trust [73]. This was also mentioned by F6 in the interview: "More time must be reinvested digitally to build trust, but it is also possible" (F6). The lack of nonverbal communication may also lead to misinterpretations. Communication in virtual collaboration is more difficult due to the lack of nonverbal cues and concurrent feedback [74]. It increases cognitive load and concentration effort on the participants, because they need to do two things at the same time: listen and process the received information and reply digitally by typing or turning on the microphone or video [75]. Virtual rooms also make several concurrent conversations about different topics more likely, which can lead to more misinterpretations due to the lack of supporting information [74-75]. These aspects were also reported by P1 and P3: "You accidently interrupt more often, and then you're afraid to say anything. By the time you unmute, the moment to speak is gone" (P3). For example, P3 reported that the mute was an obstacle to speaking. If you wanted to start speaking, someone else had already interrupted you. The moment to contribute to the discussion is very short, and often passes by when the mute is lifted. As a result, participation decreased: "It was just generally quieter, all the microphones were muted, there was no consenting 'hmm' in between." (P1).

Motivation is another huge factor that was frequently mentioned by scholars. While virtual collaboration might get frustrating due to technological glitches (“I worried about the internet connection, especially as facilitator as I´m responsible for the workshop” (P2)), the overall motivation helps to overcome these

as well as communication and collaboration barriers due to the use of collaboration technologies [76]. The overall increased motivation and pressure [77] was also mentioned with regard to the Covid-19 pandemic since everyone is affected and has empathy for other participants as well as for the facilitators ("I mean, we´re all affected by it, we just tried our best to participate" (P1)). It is also helpful for the general improvement of collaboration, if the participants knew each other beforehand. This has been mentioned in other studies as well as in the interviews (F3-4, F4, F6-9). Studies have shown that team members should know each other in terms of their (cultural) background [78] and their knowledge and skills [79]. The more familiar people are with each other, the less cultural differences there are, which can greatly help the success of virtual collaboration [80]. This is also reflected in the interviews. The interviewees stated that trust and the right mindset are of great importance for the success of digital collaboration. Trust is harder to build digitally than in co-located settings, but it is still possible (F7).
Scholars found the virtual implementation of workshops requires technological skills and knowledge of the possibilities of the collaboration tools, even more so when technical issues occur [80-81]. Accordingly, F1 and F6 stated that rules of play for the handling of the collaboration medium used had to be established and enforced by means of the facilitator, such as muting to minimize background noise. They also mentioned that much more had been invested in planning the workshop beforehand to be able to convert co-located formats into digital ones. Therefore, the facilitators had to deal with the media to get to know all the functionalities (P1, F6). These challenges address research question Q1. It is also assumed that a VC could suggest suitable methods based on the goal of the workshop or the mood of the participants to better respond to the needs of the group. This could also further encourage creativity. Scholars have shown that technology-based agents can enhance human intelligence by providing information or explanations to users [82-83]. AI-based agents can influence group decision making and team performance to achieve user goals [84-86, 37]. Although this is another task of the facilitator, the VC could support the facilitator in this respect or take over this task completely, so that the facilitator can individually supervise the workshop participants. This could be achieved by the VC analyzing the group in terms of its roles and other aspects, e.g. to achieve a balanced group or present a missing perspective or identify through voice analyses whether breaks or changes are necessary [37, 87].
While our research provides valuable insights, it is also subject to some limitations. First, our findings and their generalization are limited to the conducted interviews and our observations in the short period of a few months. Therefore, in further research it would be interesting to investigate, if and how the level of experience of participants and facilitators in the digital execution of workshops changes by time. Considering the current state of the art AI applications, some DGs might be easier to implement than others, which is to be considered in this study. Also, we only considered the Define-phase in this study. Future research should investigate further DT phases and consider several DT phases combined, such as the Define, Ideation and Prototype phases. Furthermore, a general uncertainty about the role and impact of the use of AI [88] could be a strong limiting factor in the exploratory design of a virtual collaborator.

11.8. Conclusion and Contribution

In this paper, we derived the challenges of virtual collaboration as well as DGs for a VC for virtual creative workshops. Based on qualitative interviews with facilitators and participants, the views of

potential users were developed and matched to their experienced challenges and differences between virtual and co-located implementation of workshops. The analysis resulted in two major challenges of virtual implementation and seven DGs.

In summary, our research contributes to theories and concepts on collaboration with AI and virtual collaboration itself [3, 23, 80] as well as on specific requirements such as space awareness [56-59], human-machine relationship [57, 54, 62] and role allocation [59-61]. In conclusion, as for (work) space awareness [56-59], we contributed DGs 3, 5, 6 and 7. These can make up for the lack of the usual physical environment and inspiration by providing specific information, inspiration, additional perspectives as well as evaluate generated ideas or solutions to get to the right direction of results. For human-machine relationship [57, 53, 62], we provided DGs 1, 2, and 4 to enhance communication between participants, facilitators and VC in order to match human communication and balance out the lack of body language and gestures. Also, empathy can be increased here to further improve human-machine relationship as well as quality of results in the workshop [57, 49, 62]. For role allocation [59-61], we contributed DGs 2, and 4, which can support the VC to define each participant´s role by improving group cohesion through increasing participation, planning and analyzing in different situations as well as working on balanced conversation shares and supporting throughout the whole workshop.

We contribute specific DGs regarding an organizational environment, that can serve as a foundation for further research in virtual collaboration and supporting collaboration with the help of AI in an organizational environment that worked mostly co-located beforehand. We specify challenges and phenomena resulting from ad-hoc virtual collaboration of participants that worked from home and tried to adopt learnings from co-located work to the virtual implementation of creativity workshops.

11.9. References

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12. Einsatz eines virtuellen Kollaborators in analogen & digitalen Workshops im organisationalen Kontext

Debowski, N., Tavanapour, N., & Bittner, E. A. (2021b). Einsatz eines virtuellen Kollaborators in analogen & digitalen Workshops im organisationalen Kontext. Informatik Spektrum, 44(3), 170-177.

Abstract

In dieser Studie stellen wir Unterschiede und Gemeinsamkeiten in der analogen sowie digitalen Zusammenarbeit hinsichtlich eines virtuellen Kollaborators (VK) dar. Konkret beobachten wir eine Kreativeinheit in einem Industrieunternehmen sowohl in der analogen als auch in der digitalen Durchführung kollaborativer Workshops. Aus den daraus resultierenden Herausforderungen und Anforderungen, die wir anhand von Interviews erheben, leiten wir Designprinzipien an einen VK ab und ziehen einen Vergleich. Gemeinsamkeiten bestehen darin, den Teilnehmenden zusätzliche Informationen und kreativen Input aus internetbasierten Quellen zu liefern. Unterschiede bestehen in der administrativen Vor- und Nachbereitung der jeweiligen Workshops sowie in der Art der Beeinflussung kollaborativer Arbeit. Während bei der digitalen Durchführung eher die Perspektiverweiterung im Vordergrund steht, ist es bei der analogen Durchführung die Ausbalancierung der Redebeiträge. Spezifika stellen sich darüber hinaus für die digitale Durchführung bei der Vernetzung der Teilnehmenden sowie beim Umgang mit digitalen Werkzeugen.

12.1. Einleitung

Aufgrund der Covid-19-Pandemie und der seit März 2020 wiederkehrenden Lockdown-Situationen ist die Arbeitswelt gezwungen, innerhalb kürzester Zeit von einer präsenzorientierten und analogen zu einer vollständig virtuellen Umgebung überzugehen. Beschäftigte sind daher mit virtuellen Werkzeugen konfrontiert worden, mithilfe derer sie zur Erfüllung ihrer beruflichen Tätigkeiten zusammenarbeiten [1]. Ein Szenario für eine solche Zusammenarbeit sind digitale Workshops innerhalb von Organisationen, die vor der Pandemiesituation vor Ort durchgeführt wurden. Neben Vorteilen bringt virtuelle Zusammenarbeit auch neue Herausforderungen für Moderierende und Teilnehmende der Workshops mit sich. Im virtuellen Setting fehlt es etwa an nonverbaler Kommunikation und Interaktion, was zu einer anderen Teamatmosphäre führen kann. Darüber hinaus werden Moderierende und Teilnehmende mit mehreren verschiedenen Kommunikations- und Informationsströmen gleichzeitig über Sprache und Text konfrontiert. Auch vermeintlich kleine Interaktionen wie Zeigen, Hervorheben oder Organisieren erfordern stets eine Werkzeugfunktion und virtuellen Aufwand, was bei Workshops vor Ort weniger kompliziert ist. Diese können zu einer Überlastung führen und erfordern eine automatisierte Unterstützung von virtuellen Workshops.

Eine solche Unterstützung kann mit einem virtuellen Kollaborator (VK) gestaltet werden. Dieser basiert auf einem technologiebasierten Agenten, der in der Lage ist, seine Umgebung wahrzunehmen, Informationen zu verarbeiten, Entscheidungen zu treffen und zu lernen, auf sie einzuwirken und mit Menschen und anderen Maschinen zu interagieren, um ein gemeinsames Aufgabenziel mit mehr oder

weniger Autonomie zu erreichen [2]. Beispiele dafür sind Sprachassistenten wie Siri von Apple, Alexa von Amazon oder Cortana von Microsoft. Aufgrund ihrer konstanten und schnellen Entwicklung sowie ihrer Anpassbarkeit an die Bedürfnisse der Menschen wird die Zusammenarbeit mit technologiebasierten Agenten immer attraktiver [3]. Ein VK geht dahingehend jedoch weiter: er ist nicht nur auf Assistenzfunktionen beschränkt, sondern als ein gleichberechtigter virtueller Teamkollege in einer kollaborativen Arbeitsumgebung zu betrachten, der mit dem Benutzer agiert [4].

Nass & Moon (2000) zeigten etwa in ihrer Social Response Theorie, dass Nutzer von Computern diese durchaus menschlich behandeln, etwa indem sie ihnen menschliche soziale Kategorien wie Geschlecht oder Ethnie zuteilen, höflich gegenüber dem Computer sind oder den Computer als „Spezialisten" bezeichnen [5]. Langer (1992) bezeichnete dieses Verhalten als „mindless behavior", als unbedachtes Verhalten, bei dem Individuen auf zuvor erlernte Konzepte und Muster zurückgreifen, ohne sich des Gegenübers bewusst zu werden [6-7].

Eine große Anzahl von Forschungsartikeln befasst sich bereits mit der Zusammenarbeit zwischen Mensch und Technologien wie künstlicher Intelligenz (KI), und zeigt ein großes Potential der KI für die Zukunft der Arbeit auf [8-9; 10-12]. Spezifische Faktoren wie Vertrauen und Skepsis gegenüber der KI [13-14] werden bereits erforscht. Es mangelt jedoch an einem ganzheitlichen Ansatz und besonders an Gestaltungswissen für KI-gestützte virtuelle Zusammenarbeit im Kreativitätsprozess. Insbesondere die organisationale Sichtweise ist noch nicht ausreichend erforscht, was bereits von Forschenden über Forschungsagenden [15-16] und Podiumsdiskussionen [2] eingefordert wird.

An dieser Stelle positionieren wir unsere Forschung und untersuchen aus organisationaler Sicht, welchen Herausforderungen Moderierende und Teilnehmende in kreativen digitalen Workshops im Vergleich zu analogen Workshops gegenüberstehen und wie ein VK gestaltet werden kann, um den identifizierten Herausforderungen zu begegnen. Zu diesem Zweck stellen wir zwei Forschungsfragen auf. **F1: Wie unterscheiden sich die Designprinzipien eines VK für digitale Workshop-Situationen von denen für analoge Workshop-Situationen? F2: Welche Designprinzipien lassen sich aus organisationaler Perspektive für einen VK explizit für digitale Kreativworkshops definieren?** Diese Forschungsfragen zielen auf Designprinzipien (DP) für einen VK in digitalen Workshop-Situationen ab. Durch einen Vergleich zwischen DPs für digitale Workshop-Situationen und denen für analoge werden spezifische Besonderheiten in der Gestaltung für virtuelle Settings herausgearbeitet. In diesem Zusammenhang wurde eine zweiphasige Interviewstudie innerhalb einer Kreativeinheit eines Industrieunternehmens (KEI) durchgeführt, die im Nachfolgenden genauer erläutert wird. In einer ersten Iteration wurden analog durchgeführte Workshops mit verschiedenen Fachbereichen wie Logistik oder IT betrachtet, die in diesem Artikel als Referenz für die Veränderungsbedarfe dienen. Die zweite Iteration beleuchtet digital durchgeführte Workshops genauer. Im vorliegenden Artikel werden die Herausforderungen, Anforderungen und Designprinzipien in analog und digital durchgeführten Kreativ-Workshops miteinander verglichen.

Wir verfolgen einen explorativen qualitativen Ansatz, indem wir semi-strukturierte Interviews mit Teilnehmenden und Moderierenden von Kreativitätsworkshops durchführten, die von einer KEI durchgeführt wurden. Zunächst wird die Forschungsumgebung – die digitale und analoge Durchführung von Workshops der KEI – an einem Beispiel vorgestellt. Anschließend präsentieren wir unsere Ergebnisse mit den identifizierten Anforderungen (AF) sowie den Designprinzipien bei analogen (aDP)

und digitalen (dDP) Workshops für den VK. Wir setzen die Diskussion unserer Ergebnisse in Verbindung mit vorhandener Literatur fort und skizzieren die Grenzen unserer Forschung. Zum Schluss ziehen wir ein Fazit und stellen unseren Beitrag heraus.

12.2. Wissenschaftliche Vorgehensweise

Kreativeinheiten in Industrieunternehmen als Forschungsumgebung

Im Folgenden wird zunächst die Arbeitsweise der untersuchten KEI im analogen sowie digitalen Kontext erläutert. Die KEI orientiert ihre Arbeit stark am Design Thinking-Ansatz im 6-Phasen-Modell nach Meinel et al. (2009) (s. Abb. 1) [17]. Design Thinking (DT) ist eine Methode zur Lösung bestehender Probleme, und bindet frühzeitig verschiedene Stakeholder mit unterschiedlichem Hintergrund ein [18]. Im Vordergrund stehen dabei konsequent die Bedürfnisse der Nutzer, die in jeder Phase einbezogen werden. DT folgt einem strukturierten, iterativen Prozess, in dem ein multidisziplinäres Team verschiedene (Kreativitäts-)Methoden zur Erreichung des Phasenziels einsetzt [19].

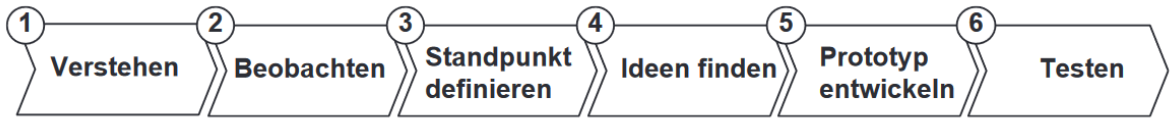

Abbildung 1: 6-Stufiger DT-Prozess nach [17]

Je nach Phase im DT-Prozess wird ein thematisch passender Workshop konzipiert, was im Folgenden beispielhaft sowohl in der analogen als auch in der digitalen Durchführung anhand der dritten Phase „Standpunkt definieren“ erläutert wird. Schallmo & Lang (2020) beschreiben diese Phase wie folgt: „Die [aus den vorherigen Phasen] gewonnenen Erkenntnisse werden ausgewertet, interpretiert und gewichtet. Dabei werden die Erfahrungen des gesamten Teams zusammengefasst, um eine gemeinsame Basis zu schaffen. Hierbei wird eine typische, fiktive Person [(„Persona“)] erstellt, die ganzheitlich beschrieben wird. Dabei ist es wichtig, relevante Fakten von nicht relevanten Fakten zu trennen.“ [20].
Durchgeführt wird der analoge Workshop in einem Raum mit Utensilien zum kreativen Arbeiten wie Whiteboards, Stifte, verschiedene Arten von Papier und anderes Zubehör zum Visualisieren und Gestalten [21]. Zu Beginn des Workshops wird durch die Moderierenden eine Einleitung sowie ggf. eine Vorstellung der Teilnehmenden gegeben, sofern sich diese noch nicht kennen. Dann wird die Agenda vorgestellt. Teil der Agenda sollten nicht nur inhaltliche und praktische Bestandteile sein, sondern auch Pausen [22-23].
Danach beginnt die inhaltliche Arbeit. Ziel der hier beschriebenen „Standpunkt definieren“-Phase ist es, die zuvor geführten Interviews zu sichten, zu synthetisieren und zu analysieren. Dabei werden die Interviewinhalte auf Klebezettel geschrieben und auf dem Whiteboard verteilt. Anschließend spricht das Team über die Inhalte: welche Erkenntnisse gab es? Was war überraschend? Was wurde besonders häufig genannt? Auf was wurde gar nicht eingegangen? Solche und weitere Fragen können bei der Synthese der Interview-Inhalte hilfreich sein. Ist das Team mit den Inhalten vertraut, können verschiedene Visualisierungstechniken eingesetzt werden [24].

Anschließend werden die gewonnenen Informationen z.B. in einer User Journey zusammengefasst. Die User Journey stellt den Weg der Nutzung einer Lösung dar. Dabei sollen vor allem die unterschiedlichen Phasen und Bedürfnisse in diesen sowie die Erfahrungen und Kontaktpunkte der Nutzer dargestellt werden [25]. Dafür wird ein Template mit den entsprechenden Feldern erstellt, das unter Nutzung eines Whiteboards befüllt wird. Die Teammitglieder besprechen gemeinsam die Inhalte für die entsprechenden Felder und füllen diese per Hand aus. Die Moderation als neutrale Stelle achtet während des gesamten Prozesses vornehmlich darauf, die Diskussionen zu unterstützen, etwa durch Fragen oder eigene Impulse. Nach Durchsprache aller Einzelaufgaben werden die nächsten Schritte diskutiert. Dabei kann es vorkommen, dass aufgrund der iterativen Natur des DT-Prozesses das Team einen Schritt zurück geht, etwa merkt, dass noch weitere Informationen zu den potentiellen Nutzerinnen und Nutzern notwendig sind [21]. Ist der Workshop beendet, muss das Moderationsteam den Workshop nacharbeiten und eine lückenlose Dokumentation des Workshops anfertigen.

Digitale Workshops erfolgen bei der KEI ebenfalls nach den oben beschriebenen DT-Prinzipien und Ablauf, unterscheiden sich jedoch in der Durchführung, Während bei analogen Workshops ein physischer Raum zur Verfügung gestellt wird, finden digitale Workshops im virtuellen Raum statt. Die hier vorgestellte KEI nutzt Microsoft Teams als Kollaborationstool, vornehmlich die Konferenz-Funktion. Vorbereitet wird der Workshop durch entsprechende Erläuterungen und Templates mithilfe von Powerpoint-Folien, die in der Konferenz präsentiert werden. Konkret wird zunächst jeder einzelne Schritt mündlich und zusätzlich schriftlich auf der Folie erläutert. Im nächsten Schritt werden die Teilnehmenden in Gruppen von maximal sechs Personen aufgeteilt. Jeder Gruppe steht ein Moderationsteam bestehend aus zwei Personen zur Verfügung. Die Gruppen können mithilfe der „Break out rooms“-Funktion in Microsoft Teams automatisch randomisiert gebildet werden [26].

Dann startet die inhaltliche Arbeitsphase mit den vorbereiteten Templates. Dabei stehen dem Moderationsteam zwei Varianten zur Verfügung: Entweder schreiben die Teilnehmenden direkt in die Templates, etwa beim lauten Brainstorming [27-28]. Oder aber die Teilnehmenden schreiben ihre Gedanken zunächst mithilfe der Chatfunktion von Microsoft Teams für sich selbst auf [29]. Ist die Bearbeitungszeit abgelaufen, gibt das Moderationsteam ein Signal, bei dem alle Teilnehmenden gleichzeitig ihre niedergeschriebenen Gedanken in den Gruppenchat senden. Anschließend präsentiert jedes Teammitglied, und das Moderationsteam überträgt die vorgestellten Inhalte zu Dokumentationszwecken vom Gruppenchat in das vorbereitete Template. Dies eignet sich besonders, wenn Teilnehmende noch nicht häufig mit dem verwendeten Programm gearbeitet haben. Nach diesem Prinzip werden alle Arbeitsphasen durchgeführt. Auch hier wird abschließend über nächste Schritte gesprochen und eine Feedbackrunde durchgeführt. Durch die digitale Bearbeitung in den Templates während des Workshops entfällt die Nachbereitung zumeist oder kann dadurch zumindest stark eingegrenzt werden.

12.3. Durchführung qualitativer Interviews und ihre Resultate

Wir erhoben Daten aus der Perspektive potenzieller Nutzer eines VK, indem wir zwei Interview-Reihen mit jeweils zwölf halbstrukturierten Interviews mit einer Dauer von dreißig bis vierzig Minuten durchführten [30]. In den Interviews wurden zunächst Herausforderungen analoger und digitaler

Workshops sowie Anforderungen an einen VK bezogen auf diese behandelt. Anschließend wurden Unterschiede zwischen der analogen und der digitalen Durchführung sowie den entsprechenden Anforderungen an einen VK für diese diskutiert.

Tabelle 1: Kriterien und Merkmale der befragten Personen aus der Interview-Reihe 1 zu analogen Workshops

Interviewte	Workshop-Erfahrung	Relevante Ausbildung
aM1-aM3	Hoch	Zertifizierter DT Expert
aM4	Hoch	Agile Coach
aM5	Durchschnittlich	Keine, Praxiserfahrung
aT1	Durchschnittlich	In Ausbildung zum DT Expert
aT2	Durchschnittlich	Keine
aT3-aT7	Durchschnittlich	Keine

Tabelle 2: Kriterien und Merkmale der befragten Personen aus der Interview-Reihe 2 zu digitalen Workshops

Interviewte	Workshop-Erfahrung	Relevante Ausbildung
dT1-dT2	Hoch	Häufig teilgenommen
dT3-dT5	Durchschnittlich	Häufiger teilgenommen
dM1-dM3	Durchschnittlich	Keine, Praxiserfahrung
dM4-dM5	Hoch	In Ausbildung zum DT Expert
dM6-dM7	Hoch	Zertifizierter DT Expert

Die Interviewpartner wurden nach ihrer Rolle als Moderierende (M) oder Teilnehmende (T) sowie nach der jeweiligen Workshop-Erfahrung ausgewählt, die zuvor als Kriterium definiert wurden. Die Workshop-Erfahrung wurde für die Moderierenden anhand der Anzahl der durchgeführten digitalen Workshop-Moderationen (Hoch > 50; Durchschnittlich < 50 Workshops) seit der Lockdown-Situation durch die Covid-19-Pandemie bemessen. Die Workshop-Erfahrung für Teilnehmende wurde anhand der Anzahl der teilgenommenen digitalen Workshops (Hoch > 10 Workshops; Durchschnittlich < 10 Workshops) seit der Lockdown-Situation durch die Covid-19-Pandemie bemessen.

12.4. Resultate und Diskussion

Vergleich zwischen Analog und Digital

Im Folgenden wird auf **F1** eingegangen, und die Unterschiede und Gemeinsamkeiten zwischen der analogen und digitalen Workshop-Durchführung explizit dargestellt. Abbildung 2 zeigt Designprinzipien für einen VK für digitale Workshops mit Übereinstimmungen (grüner Haken) und Abweichungen (rotes Kreuz).

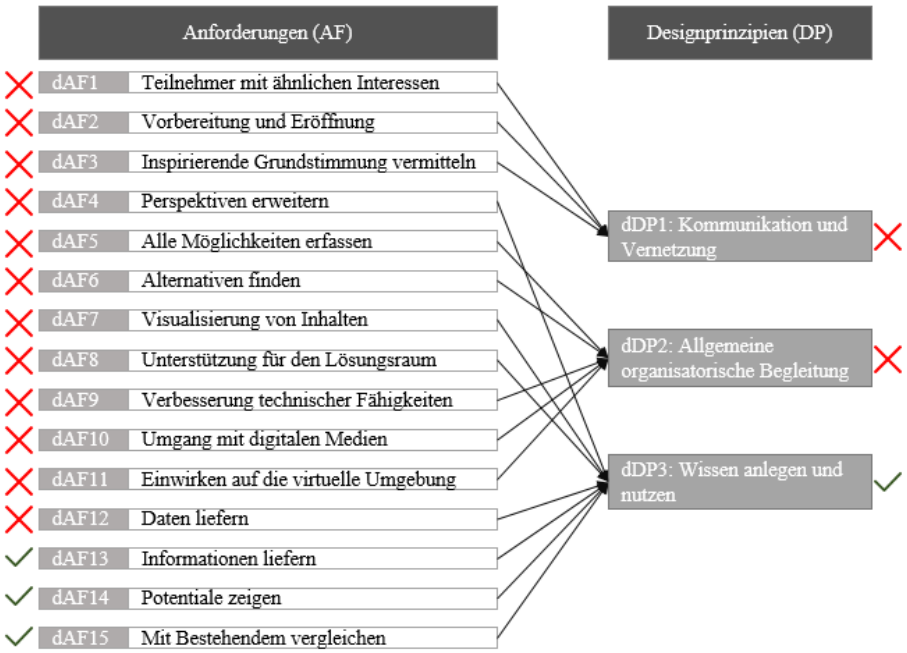

Abbildung 2: Designprinzipien eines VK für digitale Workshops mit Übereinstimmungen und Abweichungen vom VK für analoge Workshops

Unterschiede

Der größte und am häufigsten genannte Unterschied von virtuellen zu analogen Workshops ist das Fehlen von Körpersprache und direktem Feedback. Die Chance, einen ersten Eindruck von einer Situation und ihren Teilnehmenden zu bekommen, fällt vollständig weg. Oft ist die Atmosphäre zu Beginn eines Workshops sehr zurückhaltend und die Teilnehmenden sprechen nicht miteinander, bis das Moderationsteam den Workshop offiziell eröffnet hat Während es in digitalen Workshops durch die mangelnde Körpersprache also eher problematisch ist, die Teilnehmenden zu vernetzen und anzuregen, zu sprechen und sich zu beteiligen, ist es in analogen Workshops eher problematisch, die Gruppe ausbalanciert sprechen zu lassen und ein gemeinsames Ziel zu verfolgen. Aus diesem Grund wird die Objektivität des VKs vorausgesetzt, um eine neutrale Instanz innerhalb der Gruppe zu schaffen und um sicherzustellen, dass der Input von jedem Teilnehmenden gleich behandelt wird **(aAF1, aDP1)**: "Nicht 100% neutral, aber ich denke, die Wahrnehmung wäre, dass sie zumindest auf der Basis der Daten, die sie aufnimmt, alles gleich behandelt und nicht etwas anderes als untergeordnet" - aT10. In zahlreichen Studien wurde bereits untersucht, dass KI-gestützte Systeme die Rolle eines empathischen Teammitglieds übernehmen können, das Feedback zum Team gibt und auch kritische Punkte anspricht [2, 31-34].

Die administrative Vorbereitung eines analogen Workshop wie die Organisation und Gestaltung wurde häufig als Herausforderung genannt. Das Protokollieren und das Aufzeigen von Zusammenhängen zwischen verschiedenen Ergebnissen wurden als sehr zeitaufwendig beschrieben, ebenso das Erstellen von Protokollen und das Ausfüllen von Vorlagen [35]. Dies wird auch vom VK erwartet: "Ich würde jetzt erwarten, dass ich ein Transkript des Gesprächs bekomme und der Mitarbeiter die Nachbereitung oder so macht." – aM2 **(aAF3, aDP1)**. Eine Studie von Dolata et al. (2019) etwa zeigte, dass KI-fähige Systeme in der Lage sind, bei administrativen Arbeiten wie dem Erfassen, Transkribieren und

Archivieren von Dokumenten und Sitzungsprotokollen während des Workshops zu helfen oder über verschiedene Wege wie E-Mails oder Messenger zu kommunizieren [36]. Bei der digitalen Durchführung hingegen war eine dezidierte Planung und Vorbereitung unabdingbar, und erforderte mehr Zeit und Aufwand als bei der analogen Variante. Es war notwendig, alle Möglichkeiten, die während des Workshops auftreten könnten, durchzugehen und gleichzeitig Alternativen vorzubereiten, falls etwas nicht klappen sollte **(dAF5, dAF6, dDP2)**. Darüber hinaus mussten die Ziele des Workshops genauer definiert werden, um die Methoden und den Prozess darauf abzustimmen: "Man muss den ganzen Workshop öfter durchgehen, was sind die Möglichkeiten in den interaktiven Sitzungen, und welche Alternativen haben wir." (dM4). Durch die Nutzung digitaler Medien wird die Nachbereitung wiederum wesentlich erleichtert. Hier zeigen zahlreiche Studien, dass ein VK bei der Entscheidungsfindung helfen kann, indem dieser verschiedene Denkschritte bei einer komplexen Entscheidung repräsentiert [37-38].
aM1, aM2 und aM4 erwähnten, dass es mitunter schwierig sein kann, geeignete Methoden zu wählen, in andere Methoden zu wechseln, oder aber auch neue Methoden auszuprobieren. Dahingehend könnte der VK Methoden vorschlagen, die auf dem Workshop-Ziel **(aAF4, aDP3)** oder der Stimmung der Teilnehmenden **(aAF5, aDP1)** basieren, um besser auf die Bedürfnisse der Gruppe einzugehen: „Auch Methoden, wie man so ein Thema angeht, damit halt die durchführende Person einfach eine Zielsetzung hat, was sie eigentlich machen soll.“ – aT7. Es wurde in mehreren Studien festgestellt, dass KI-fähige Systeme in der Lage sind, Gruppenentscheidungsprozesse sowie Teamergebnisse zu beeinflussen, um die Ziele ihrer Nutzer zu erreichen [32, 39-40].
Es wurde häufig genannt, dass in der analogen Durchführung eher der Fokus darauf lag, auf die Teilnehmenden einzugehen, während die Problematik bei der digitalen Durchführung eher darin bestand, den Lösungsraum im DT allgemein kreativ anzugehen: "Die ersten drei Phasen des Design Thinking Prozesses sind digital gut machbar, danach wird es schwieriger." (dM7). Dies liegt daran, dass die letzten drei Phasen mehr Visualisierungsmöglichkeiten benötigen **dAF7, dDP3)**, die in der digitalen Umsetzung eher schwierig sind. Daher ist die klare Notwendigkeit, die Ergebnisse durch den VK über (bewegte) Icons, Symbole oder auch Wortwolken visuell zu unterstützen und aufzubereiten (dM4). Cautela et al. (2019) untersuchten in einer Studie, inwieweit derzeit die DT-Praxis mithilfe von KI übernommen oder unterstützt werden kann. Während die ersten drei Phasen des DT-Prozesses – wie etwa Recherchen, Vorschläge geben, und Daten analysieren - gut umzusetzen sind, fehlt es an Applikationen, die auf die Ideenfindung und andere kreative Prozesse eingehen [41].

Gemeinsamkeiten

Neben diesen Unterschieden gab es jedoch auch einige Gemeinsamkeiten in der digitalen und analogen Durchführung von Kreativworkshops. Hinsichtlich analoger Workshops wurde erwähnt, dass die eigene Meinung während einer Workshop-Situation zurückgehalten wurde, weil man der Meinung war, dass es an entsprechendem Wissen oder Erfahrung fehlte, um wertvolle Beiträge zu leisten: "Ich spreche erst, wenn ich von meinen Gedanken halbwegs überzeugt bin" – aT6. Um dieser Herausforderung vorzubeugen bzw. entgegenzuwirken, wird vom VK erwartet, dass er schnell und zuverlässig **(aAF6, aDP2)** Informationen sammelt und verarbeitet, wie Studien von Waizenegger (2020) und Seeber (2019) zeigen [31, 14]. Auch in digitalen Workshops soll der VK den Prozess durch die Bereitstellung von

Informationen und Hintergrundwissen unterstützen (dT2). Durch semantische Analysen und Stichwortsuchen sollen nicht nur Daten **(dAF12, dDP3)**, sondern auch breites Wissen **(dAF13, dDP3)** zur Unterstützung der Recherchephasen generiert werden: "Der VK könnte breites Wissen zu bestimmten Stichworten in visualisierter Form anbieten." – dT2. Weitere Studien zeigen, dass von KI-fähigen Systemen erwartet wird, dass sie Muster sammeln, analysieren, synthetisieren und identifizieren, die in den vorgestellten Workshop-Situationen direkt genutzt werden können [42-43].
Für digitale Workshops wurde häufig angeführt, dass der VK in der Lage sein sollte, die Idee eines Anwenders im Hinblick auf Potenziale und Einsatzmöglichkeiten **(dAF14, dDP3)** sowie auf bereits bestehende oder ähnliche Ideen **(dAF15, dDP3)** durch eine Verbindung zum Internet zu analysieren (dT2). Für analoge Workshops sollte diese Fähigkeit genutzt werden, um bestehende Lösungen, etwa aus sozialen Medien **(aAF7, aDP2)**, als weiteren Impuls oder Anregung zu finden: "Es kann einen Hinweis geben, indem man auf soziale Medien oder andere Quellen verweist und sich davon inspirieren lässt" - Ma3. Studien zeigen, dass von KI-fähigen Systemen erwartet wird, dass sie Muster sammeln, analysieren, synthetisieren und identifizieren, die in den vorgestellten Workshop-Situationen direkt genutzt werden können [42-43].
Das Sprechen vor dominanteren Teilnehmenden war in beiden Fällen problematisch, da nicht nur einzelne Teilnehmende, sondern die gesamte Gruppe von der Meinung der dominanten Person beeinflusst wird, was zu einer einseitigen Workshop-Struktur führen kann. Aus diesem Grund wird vom VK erwartet, dass er die Redeanteile überwacht **(aAF2, aDP1)**: „Dass jeder über ein Gadget verbunden ist, dass er dann merkt 'ok hier sind zwei oder drei Leute nicht so aktiv im Gespräch'" - aT7. Damit sollen die Redebeiträge gemessen und entweder der gesamten Gruppe oder nur dem Moderierenden transparent gemacht werden, um notwendige Maßnahmen zur Wiederherstellung der Balance zu treffen.
Auch in digitalen Workshops war eine ausbalancierte Diskussion gewünscht, jedoch in Form einer Perspektivenerweiterung **(dAF4, dDP3)**, z. B. als Sparringspartner zum Austausch von Meinungen (dM2, dT2). Da KI-gestützte Systeme verschiedene Aufgaben übernehmen, aber nicht von einem Menschen geleitet und kontrolliert werden, können so traditionelle Macht- und Kontrollhierarchien infrage gestellt werden. Dies kann einen direkten Einfluss sowohl auf die Ergebnisse eines Workshops als auch auf das Verhalten der dominanteren Teilnehmenden haben [44].

Spezifische Designprinzipien für digitale Workshops

Im folgenden Abschnitt wird auf **F2** eingegangen, und spezifische DPs für digitale Workshops entwickelt. Aus den Herausforderungen und Anforderungen wurden nach dem Design Science Research-Ansatz von Hevner et al. (2000) und Gregor et al. (2020) DPs abgeleitet [45-46].
<u>Kommunikation und Vernetzung</u>
Um Teilnehmende mit ähnlichen Interessen und Fähigkeiten zusammenzubringen **(dAF1, dDP1)**, sollte der VK in der Lage sein, Informationen aus Datenbanken und Netzwerken aus dem Intra- und Internet zu sammeln und zusammenzubringen (dM2). Dies sollte ein Anreiz zur Vernetzung und zum Austausch sein. Im Vorfeld könnte auch ein Workshop-spezifisches Profil erstellt werden. Die Vernetzung sollte jedoch nicht zu aktiv, sondern eher unterschwellig und subtil erfolgen: "So etwas wie 'Kennen Sie XY? Sie ist auch agiler Coach.', basierend auf dem, was in meinem LinkedIn- oder Intranet-Profil steht." - dM2. Weiterhin sollte der VK als Gastgeber verschiedene virtuelle Räume für unterschiedliche

Situationen zur Verfügung stellen und mit einem Begrüßungstext und der Einleitung einer Vorstellungsrunde **(dAF2, dDP1)** ansprechend gestalten (dT1, dM4): "Der VK könnte durch die Räume gehen, er könnte sagen: 'Hier ist, was auf der Tagesordnung steht', wie ein Chatbot." (dT1).
Der VK könnte hinsichtlich der fehlenden Körpersprache und mangelnden Vernetzung der Teilnehmenden unterstützen, indem dieser anhand von Stimm- und Gesprächsanalysen Stimmungen erkennt und entsprechende Tipps an die Moderierenden gibt oder direkt steuernd auf die Teilnehmenden einwirken (dT1, dM6). Gleichzeitig könnte auch eine öffnende und inspirierende Grundhaltung vermittelt werden **(dAF3, dDP1)**, um den kreativen Prozess in den Workshops anzuregen: "Wenn die Leute offen sind, eine Art Coaching durch den VK zu bekommen, könnte das helfen" (dM6). Tseng et al. (2019) zeigen, dass ein VK auch bei der Bildung von Teams helfen kann, indem die Mitgliederkandidaten auf psychologische Weise analysiert werden, um passende Profile zu identifizieren [45]. Daneben zeigen Kocielnik et al. (2018) und Tseng et al. (2019), dass ein VK auch bei Reflektionsphasen unterstützen kann, was wiederum Coaching-Aktivitäten von Moderierenden unterstützen kann [47-48].

Allgemeine organisatorische Begleitung

Ein weiterer wichtiger Faktor ist die Arbeit mit digitalen Werkzeugen. Sowohl Moderierende als auch Teilnehmende nannten technische Fähigkeiten und den Umgang mit digitalen Medien als wichtige Faktoren für eine erfolgreiche digitale Durchführung **(dAF9, dAF10, dDP2)**. Der VK sollte in der Lage sein, Fragen über Text zu beantworten oder unbeantwortete Fragen an die Moderierenden am Ende des Workshops weiterzugeben (dT1, dM5, dM6). In Form eines Chatbot soll der VK Tipps und Tricks im Umgang mit virtuellen Schnittstellen aufzeigen, um die Kompetenzen der Teilnehmenden im Umgang mit den Medien zu erweitern (dT1, dM5, dM6). Außerdem sollte der VK die Teilnehmenden und Moderierenden während des gesamten Kollaborations- und Kreativitätsworkshops begleiten (dT1). Dabei sollte der VK organisatorisch und unterstützend auf die unmittelbare virtuelle Umgebung einwirken **(dAF11, dDP2)** (dT1). Ein VK wird in der Literatur darüber hinaus ohne anthropomorphen Hintergrund vorgeschlagen, z. B. zum Zugriff auf Gebäudeinformationen [49] oder zur Verbesserung der Zugänglichkeit von Unternehmensinformationen [50]. Dies könnte entsprechend auf Informationen zum Umgang mit Medien übertragen werden.

12.5. Fazit, Beitrag und Grenzen

In dieser Studie stellen wir Unterschiede und Gemeinsamkeiten in der analogen sowie digitalen Zusammenarbeit mit einem VK dar. Hinsichtlich **F1** zeigen wir einerseits deutliche Unterschiede in den DPs auf. In digitalen Workshops liegt der Schwerpunkt auf der Vernetzung, der kreativen Arbeit sowie auf dem hohen Aufwand bei der Vorbereitung. Demgegenüber steht bei analogen Workshops eher im Fokus, eine ausbalancierte Diskussion zu erreichen, Einfluss auf die Gruppe insgesamt zu nehmen sowie den Aufwand in der Nachbereitung zu reduzieren. Gemeinsamkeiten bestehen in der Wissenserzeugung und der Informationsbereitstellung. Hinsichtlich **F2** zeigen wir DPs auf, die spezifisch für einen VK in digitalen Workshops gelten. So soll ein VK in digitalen Workshops die fehlende Körpersprache durch Anreize zum Vernetzen der Teilnehmenden sowie zur Kommunikation miteinander überwinden, und Unterstützung im Umgang mit digitalen Werkzeugen und einer virtuellen Arbeitsumgebung bieten.

Besonders im Fokus steht in der Beantwortung von **F1** und **F2** der praktische Nutzen unserer Studien. Wir haben im vorliegenden Vergleich insbesondere die Unterstützung eines VK im organisationalen Kontext einer Kreativeinheit untersucht. Wir bringen dabei spezifische DPs im Hinblick auf ein soziotechnisches System ein, die als Grundlage für die weitere Forschung im Bereich der virtuellen Zusammenarbeit und der Unterstützung der Zusammenarbeit in einem organisatorischen Umfeld dienen kann, das zuvor meist an einem gemeinsamen Standort arbeitete [2, 31, 51]. Wir spezifizieren Herausforderungen, die sich aus der digitalen Zusammenarbeit von Teilnehmenden ergeben, die von zu Hause aus arbeiten und versuchen, Lehren aus der physischen Zusammenarbeit in die digitale Durchführung von Kreativitäts-Workshops zu übernehmen, dargestellt als Anforderungen.
Unsere Studien weisen einige Grenzen auf. Wir haben bisher nur eine KEI in nur einer Industrie betrachtet. Weitere Forschung könnte einen branchenübergreifenden Blick auf die Thematik geben. Dazu gehören auch unterschiedliche Herangehensweisen in den Kreativ-Einheiten. Zudem wurden in diesen Studien analoge und digitale Workshops getrennt voneinander betrachtet. In zukünftiger Forschung kann eine Verknüpfung von analogen Workshops mit digitaler Unterstützung diskutiert werden. Außerdem kann der Fokus verstärkt auf den DT-Prozess gelegt werden, indem untersucht wird, an welcher Stelle im DT-Prozess ein VK eine Entlastung für Moderierende darstellen kann. Aufbauend auf unseren Studien eignet sich abschließend eine empirische Untersuchung, um die qualitativ entwickelten Inhalte zu validieren.

12.6. Literatur

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13. Prototyping a Conversational Agent for AI-Supported Ideation in Organizational Creativity Processes

Debowski, N., Tavanapour, N., & Bittner, E. A. (2022c). Prototyping a Conversational Agent for AI-Supported Ideation in Organizational Creativity Processes. In 55th Hawaii International Conference on Systems Sciences (HICSS). Virtual Event. Pp. 604-613.

Abstract

In this study, we present design guidelines (DGs) for the development and improvement of a virtual collaborator (VC) for Design Thinking (DT). Based on interviews in an ex-ante study, we designed a first prototype of a VC. From an ex-post evaluation using focus group discussions, we derive strengths, weaknesses, opportunities and threats of the VC. Strengths of the VC are good structure, giving inspiration as well as pace and accuracy. Opportunities are to set level of detail, give a more humane representation, and linking search with other DT phases. Weaknesses are not always suitable content and the VC being rather suitable for research phases as well as one-sided communication and no empathy. Threats are questionable search filters and too narrow focus of search. We then derived DGs for further improvement of the VC, addressing the weaknesses, threats and ideas from participants.

13.1. Introduction

Due to the Covid 19 pandemic and the recurring lockdown situations since March 2020, the world of work has been forced to move from a presence-oriented and analog environment to a virtual one in a very short time. Employees have therefore been confronted with virtual tools with the help of which they collaborate to fulfill their professional activities [1]. One scenario for such collaboration are digital workshops within organizations that were conducted on-site before the pandemic. In addition to benefits, virtual collaboration also brings new challenges for workshop facilitators and participants. In the virtual setting, for example, there is a lack of nonverbal communication and interaction, which can lead to a different team atmosphere [2-3]. Furthermore, facilitators and participants are confronted with several different streams of communication and information simultaneously via speech and text [4-5]. Even supposedly small interactions such as pointing, highlighting, or organizing always require a tool function and virtual effort, which is less complicated in on-site workshops. These can lead to increased stress, so called technostress that Christian et al. define as “an adaptation problem because of the inability of workers to deal with new ICTs that are changing rapidly and healthily using them” [4] and require automated support for virtual workshops [4-6]. Especially during creative work, the lack of appropriate tools for digital visualization is problematic [6].

To support virtual creative collaboration, a virtual collaborator (VC) can be designed. The VC is a conversational agent (CA) based on artificial intelligence (AI) which is able to perceive its environment, process information, make and learn decisions, act on them, and interact with humans and other machines to achieve a common task goal with more or less autonomy [7]. Due to their constant and rapid development, as well as their adaptability to people's needs, collaboration with CAs is becoming more and more attractive [8]. However, a VC goes further in this respect: it is not limited to assistance functions, but should be considered as an equal virtual teammate in a collaborative work environment,

acting with the user [9]. We are looking at an alternative to conventional ideation sessions for creative units in the automotive industry by providing a creative impulse generator that supports virtual ideation sessions. Our focus is an organizational environment that worked mostly co-located beforehand and is particularly new to virtual collaboration. The focus groups we interview are familiar with the DT approach as this is the prevalent work mode in their business units. In the following study, we want to find answers on the following research questions:
RQ1: Which strengths and weaknesses do potential users see in the presented prototype?
RQ2: Which opportunities and threats do potential users see in the presented prototype?
RQ3: What wishes and ideas do potential users have in order to improve the prototype´s usability?
The research questions aim to obtain feedback on the artifact - the prototyped VC - with respect to strengths, opportunities, weaknesses, and threats of the VC. Further design ideas will also help in the further development. With the help of the feedback, the artifact is to be improved. In this paper, we firstly present theoretical background about cooperative creativity and the implementation of conversational agents in this regard. Afterwards, we derive strengths, weaknesses, opportunities and threats (SWOT) as well as ideas on the design of a VC. Based on two iterations of developing a VC using expert interviews (ex-ante) as well as focus group discussions on a prototyped VC (ex-post), we derive three additional DGs for further development and improvement of the VC.

13.2. Theoretical Background & Related Work

Cooperative Creativity and Design Thinking

Sonnenburg [10] defines creativity as follows: "Creativity is the context-bound potential for meaningful novelty that unfolds in action" [10] whereas he defines cooperative creativity simply as creativity that is performed by two or more people. Cooperative creativity is influenced by four important parameters. The first parameter is cooperation itself. Argyle [11] defines cooperation as "acting together, in a coordinated way at work, leisure or in social relationship, in the pursuit of shared goals, the enjoyment of the joint activity, or simply furthering the relationship." [11]. Besides cooperation, communication is an essential parameter of creativity and a core element of creative cooperation. Two important and fundamental theories exist in this regard. According to Luhmann [12], communication consists of three selections: the selection of an information, that of a communication or that of an understanding. He distinguishes between the action and the communication itself. He defines that action is the mere communication of a piece of information, while communication is the understanding of the information, or the understanding that a piece of information has been communicated [12].
The third important parameter is the human being as a central actor, who can grasp his environment multisensually, but also via different communication media. Humans possess this ability due to their biogenetic systems as well as due to their nervous and psychic systems and organism. Luhmann explains this as the thoughts or feelings are not relevant for the maintenance of the communicative process, but only the communicated information. Language has a significant influence on creativity because of its diversity. It can activate creativity [10].
The last important parameter is interaction. It is the "reciprocal influence of individuals on each other's actions during their immediate physical presence" [13]. The prerequisite for this is the joint presence of

people, as well as the perception between people. A situation-bound perceptual space is created. Important processes are then perceiving as well as communicating. The perception is thereby a precondition in the environment, while the communication is already the operative elaboration of the interaction. Presence enables reciprocal perceptions and orientations, and opens and closes interaction. For an interaction to persist, at least two communication participants are needed to support the communication process. In addition, direct exchange of information allows for rapid response and feedback. This leads to a creativity dynamic, which is particularly important for the development of something new.

Finally, communication in interaction insists on the "turn-taking principle," which states that only one person speaks while everyone else listens. Typically, the roles of speaker and listener alternate permanently. This approach to the topic ultimately achieves actual engagement with it, whereby speech contributions are selected and controlled, and complexity is reduced in this way [10].

Design Thinking (DT) is one method for cooperative creativity. DT is a method for solving existing problems, and involves various stakeholders with different backgrounds at an early stage [14]. The process discussed here is the approach in the 6-phase model according to Meinel et al. [6] (see Figure 1). DT follows a structured, iterative process in which a multidisciplinary team uses various (creativity) methods to achieve the phase goal [15].

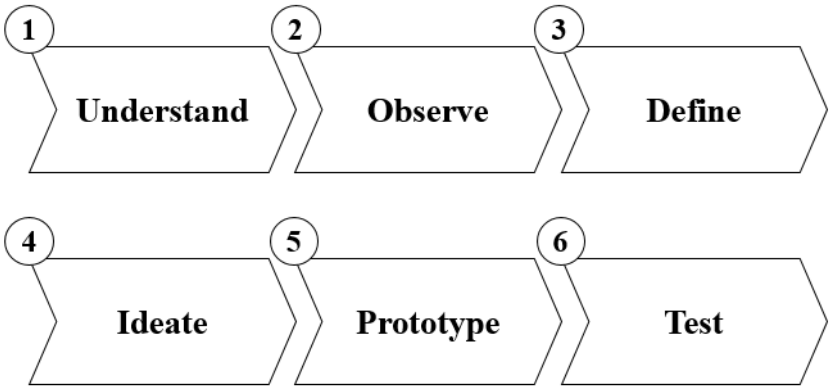

Figure 1: 6 step Design Thinking process according to [6]

In this approach, the phases are Understand, Observe, Define, Ideate, Prototype and Test, which build on each other but can be iterated if needed [16]. The Ideate phase is the focus of this study. Schallmo & Lang describe it as follows: "In this phase, ideas are generated through the use of creativity techniques which are intended to fulfill the previously identified needs. These ideas are grouped and revised. Subsequently the ideas are described and evaluated." [15]. People and their needs represent the central source of inspiration for new ideas. Only in second and third place it is examined which ideas are technically feasible, and economically viable [17].

Usually, ideas are developed with the help of brainstorming or brainwriting [18], individual work is combined with group work and brainstorming is combined with brainwriting [19]. Following Engeln [20], an introduction is first given by the facilitator [20]. Then, in a first round, ideas are obtained and presented in writing or visually. These are hung up in a gallery, for example on metaplan walls, and discussed to develop them further afterwards. Finally, the ideas are presented to the team and grouped into a pool of ideas [20].

But how can cooperative creativity be promoted in ideation sessions, which are executed exclusively in a virtual environment and not in presence? In the next chapter, we will show how this process can benefit from the application of an appropriate design of a VC.

Artificial Intelligence & Conversational Agents

Increasingly in focus and closely linked to the field of AI are human-like conversational agents (CA) such as Steve Worswick's project "Mitsuku" [21]. The use of CAs is particularly suitable for frequent requests for simple information, but also in sales for gaining new customers and customer retention. They can also be utilized for services within companies and for HR processes [22]. Technically, today´s CAs are usually based on AI. Siepermann et al. state that "[AI] deals with methods that enable a computer to solve tasks that […] would require human intelligence." [23].
The technology allows to collect, analyze, synthesize, and identify patterns that can be used directly in ideation sessions [24-25] as well as have a direct impact on both the outcomes of a workshop and the behavior of participants [26]. Tseng et al. (2019) show that a CA can also help in team formation by analyzing member candidates in a psychological manner to identify matching profiles [27]. While the first three phases of the DT process - such as delivering information and suggestions [3], as well as analyzing data [25] can be implemented well through AI, applications that address ideation and other creative processes are lacking [28]. A large number of research articles already address the collaboration between humans and technologies such as AI, showing a great potential of AI for the future of work [29-32]. Specific factors such as trust and skepticism towards AI [33-34] are already being explored.
In particular, the use of machine learning, whereby a computer independently generates knowledge from experience, is suitable in the implementation of CAs, especially natural language processing and understanding. The CA processes unstructured strings of letters, such as transposed words, and derives the correct content from them [35]. Natural language generation, i.e. the automatic production of natural language, is used in the context of CAs to formulate an answer for the dialog that the user can understand. Existing information such as formulations and text modules are supplemented with dynamic information to form complete sentences. This also makes it possible to analyze emotions and moods based on the written text, such as through IBM's Watson Tone Analyzer [36] or Text Analytics from Microsoft [37]. However, we follow the definition of the virtual collaborator (VC) by Siemon et al. who define it as a "coequal virtual teammate in a collaboration setting" [9]. This term will be used in the following sections. In the following, we want to present our understanding of DT and ideation sessions that need to be supported by a VC for virtual ideation sessions.

13.3. Research Approach

Design Science Research

We conducted a Design Science Research (DSR) project along the three-cycle view of Hevner [38] (Figure 2) to design and develop an artefact, which in our case is the VC [38]. To do so, we start the relevance cycle to inform the design of the artefact with insights from the application domain, which in our case are insights from experts within an organization. Additionally, we also start the rigor cycle to consider insights from the knowledge base regarding conversational agents and creativity for the VC.

In sum we derive design guidelines within the design cycle and utilize them to build the artefact (see section 4). We evaluate our artefact before we report the results to the application domain and the knowledge base to close the relevance and rigor cycles.

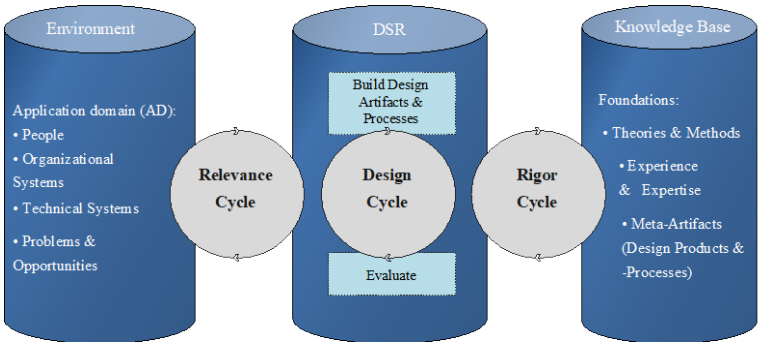

Figure 2: Three-Cycle View according to [38]

Venable et al. [39, 41] propose a 2-by-2 framework of evaluation strategies in DSR. On the one hand, the framework shows the dimension artificial vs. natural evaluation against ex-ante vs. ex-post evaluation on the other hand [39]. Distinguished by the time when the evaluation is conducted, ex-ante evaluation allows to evaluate a system or a technology before it is chosen and implemented whereas ex-post evaluation is conducted after implementation [40]. This allows not only a variety of combinations in the evaluation, but also the multiple employment of methods, depending on the artifact and the goal [41]. In the present case, the goal is to achieve rigor, i.e., that the artifact produces improvement despite organizational difficulties.

Expert Interviews (Ex-Ante)

We derived DGs for the VC from literature, conducted expert interviews, and validated them in an ex-ante qualitative study according to Gregor et al. [42]. We collected data from the perspective of potential users of a VC by conducting twelve semi-structured interviews lasting thirty to forty minutes [43], addressing challenges of digital workshops as well as requirements for a VC related to them. The participants were selected according to their role as facilitator (F) or participants (P) as well as according to their respective workshop experience (for F: High > 50; Average < 50 workshops; for P: High > 10 workshops; Average < 10 workshops). The DGs (see section 4) were developed among others following the approach of Gregor et al. [42] which states to develop DGs according to the following structure: ***"For (implementers) to (aim) for (users) in (which context) (actions, use of other artifacts, series of these actions) lead to or allow users to accomplish aim (justification for believing that mechanisms will lead to achieving the aim)".***

Focus groups (Ex-Post)

For ex-post evaluation, a prototype was built based on the DGs from the qualitative study as well as on theoretical input stated in section 2 and 3. According to March & Storey [44], a prototype is a suitable method to generically implement a solution for a certain problem to assess the solution´s suitability [44].

The specific goal is to evaluate the current prototype and to further develop the prototype with additional functionalities and design features, thus, deriving further DGs [41].
In the ideation phase, ideas will be created by using different creativity techniques, which might be able to fulfill the previously identified needs. These ideas are grouped and revised. Subsequently the ideas are described and evaluated [15]. In the prototype, a CA was used as a source of inspiration for the ideation phase. Participants were presented with the following scenario:
"We are design thinkers, and we developed the persona Tim in the "define viewpoints" phase. In the next phase - Ideation - we want to look for a solution to Tim's challenge. Our system supports us in this."
In this study, the design challenge we want to conduct an ideation on is *"How can we design the design thinking community even more interactive?"* The participants should put them-selves in this situation accordingly.
As a reference point, Bucher et al. [45] suggest among others "artifact against real world" [40] where the artifact is employed in a real world situation and then assessed. In the present study, an external evaluation using the focus group method was carried out with 16 participants, "who [were] not involved in the construction of the artifact to be evaluated" [40, 46].
The participants were selected according to their experience with ideation sessions which were both conducted during community meetings and in projects (see Table 1). Three focus group evaluations were run with two groups with 5 participants each and one group with 6 participants which is sufficient according to [47]. The evaluation took place in a community meeting lasting 40 minutes.

Table 1: Sample focus group participants

Gender	Age	Current Position
M	29	UX Researcher
M	26	UX Researcher
M	39	Innovation Manager
M	38	Innovation Manager
M	40	Innovation Manager
F	31	Communication Manager
F	30	Innovation Manager
M	34	CA Developer
F	28	HR Manager
M	33	HR Manager
F	54	Software Developer
M	48	Software Developer
M	38	Agile Coach
F	34	UI Designer
F	28	Agile Coach
F	52	UI Designer

Since the topic is relatively new, the focus group method is suitable here. The questionnaire for the discussion was processed in a specific question sequence [48-50]:
What are your thoughts on artificial intelligence?
What strengths do you see in the presented prototype?

What weaknesses do you see in the presented prototype?
Which opportunities do you see in the presented prototype?
Which threats do you see in the prototype presented?
What ideas or wishes do you have beyond that?
Do you have any questions or comments that you have not been able to ask so far?
Venable [41] differentiates five purposes from which one stated in this study is "Evaluate an instantiation of a designed artifact to establish its utility and efficacy (or lack thereof) for achieving its stated purpose." [41]. This purpose implies that this evaluation is preliminary and the artifact will be further developed. As various studies state, feedback for further improvement of the design of the artifact is crucial and essential in design research [38, 51, 52].

13.4. Design and Development

Design of the VC

In the following, the DGs from the expert interviews (ex-ante) are shown. We used the Microsoft Teams interface template as Microsoft Teams is also used in the organization for everyday communication and work. According to the interviewees (n=3), the VC should be able to support the process by providing examples or inspiring images or sounds, information and background knowledge, conducting semantic analyses and keyword searches to generate not only data but also broad knowledge to support the research and creative phases in DT. DG1 is therefore stated as follows:
"For facilitators to support knowledge generation and exchange for participants in virtual ideation workshops in organizations by providing visualized information and background knowledge using automated semantic analyses, keyword searches, showing examples, inspiring images or sounds because searching for information regarding a specific topic might take up a lot of time during a workshop that might be needed for other phases in the DT process."
Also, the VC should take on the role of a participant and fact provider, and at the same time visualize the generated knowledge, as the interviewees stated in the ex-ante study (n=4): "The VC could offer broad knowledge on certain keywords in a visualized form".
The interviewees suggested for the VC to either focus on harmonization and cooperation or focus on complementing their own ideas. In this way, new connections could also be pointed out to broaden the perspectives further and to obtain the broadest possible picture. DG2 is therefore stated as follows:
"For facilitators to support idea generation and evaluation for participants in virtual ideation workshops in organizations by providing information about similar products/services/ideas from the internet because research about existing products/services/ideas might be time consuming."
Using the analytical power of AI, for DG 2 it was frequently stated that the VC should be capable to analyze and evaluate the idea of a user regarding potential and fields of application. In addition, this should also be analyzed for already existing or similar ideas by connecting to the internet.
For DG3, the VC should also be able to contribute directly to broadening perspectives by providing either opposite or similar views on a topic (n=4). DG3 is therefore stated as follows:
"For facilitators to support idea generation and provide inspiration for participants in virtual ideation workshops in organizations by providing new perspectives from different points of view, e.g. from a

specific user group´s perspective because user centricity is key for successful innovation resulting from the application of DT."

Development of the VC

The prototype was built using the platform Botsociety [53]. By employing the DGs from the ex- ante study, a conversation flow was designed according to the ideation process of [15], see section 2.3. DG1 is applied in the VC by presenting background knowledge and information using keyword search and semantic analysis. These are delivered in the form of concrete content, such as an image, report or scientific article. This content is intended to serve as a source of inspiration and provide background knowledge on a particular topic.
This process is taken up directly in DG2, in which, with the help of the VC, information and examples of similar products or services are provided by means of a connection to the Internet as a point of comparison for what is being worked on, for example from other industries.
This step is followed by DG3, in which content is requested from different perspectives, for example from that of a previously created persona. This is indicated in the VC by having the possibility to match the generated content from the ideation session against a previously stored persona.

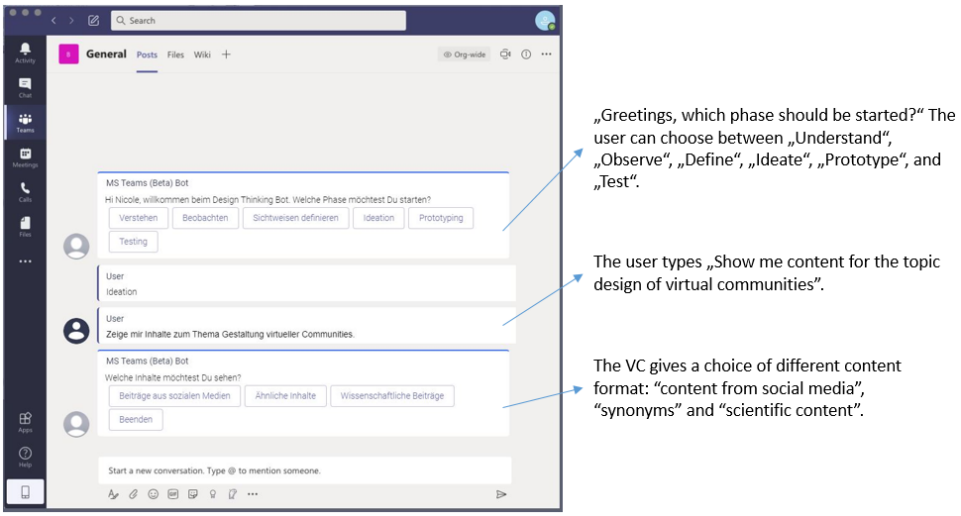

Figure 3: Snippet – Prototype: Start of the process (see https://bit.ly/3DRQOGe for more snippets)

13.5. Evaluation and Findings

Procedure

The evaluation took place in a virtual meeting using Microsoft Teams. In the beginning, a basic introduction to AI and creativity was given so that all participants had the same understanding of the topic. Besides, a short discussion was conducted to further clarify and define the scope of the initial challenge to ensure that all participants have a common understanding of the conditions of the prototype. Then, the VC was demonstrated twice. Afterwards, the participants gave feedback on the prototype according to the sequence of questions above.

In the beginning of the demonstration, the VC asks which phase of the 6 step DT process the user wants to start. We click on “Ideation” to start the ideation session. After that, we type the topic of the ideation session, here “Show me content for the topic design of virtual communities”. The VC gives a choice of different content format: “content from social media”, “synonyms” and “scientific content”. In the demonstration, we click on each format to show the respective results. On “content from social media”, we see a report about virtual communities as well as a training on building up virtual communities derived from LinkedIn. Clicking on “synonyms”, we see peripheral content on this topic such as about events. On “scientific content”, we get scientific papers on design guidelines for virtual communities as well as on designing a virtual learning platform from ResearchGate.

After clicking through all possibilities given in the ideation session, we get to choose from either “additional ideation”, “align with previously set persona” or “finish ideation”. We choose to close the ideation session, and the VC thanks us for using it as well as asking for feedback. After the first round of presenting and explaining the VC, we ran another round.

We conducted a SWOT analysis VC and evaluated the output of the focus group discussions by phrasing and coding the contents as well as quantifying the statements. By doing so, we identified central topics as well as different opinions of the participants through inductive analysis according to Block et al. [54]. We explicitly did not consider group effects, mimics and gestures in our analysis [55].

Focus group results

SWOT Analysis

We evaluated the VC with a SWOT analysis present its result in Table 2.

Strengths: The participants of the focus groups stated that the VC is well subdivided into the sections “content from social media”, “synonyms” and “scientific content” and well broken down (n=13). This content selection was considered sufficient by the participants. The procedure was very easy and fast to follow, simple questions were formulated. The approach described above was considered as guiding and also as an ice breaker for initial input search: “you are guided even more based on the process of the VC”. If this procedure didn't exist – the participants stated - it would be seen as an obstacle: “I know which direction I can move in”. Therefore, the VC guides well because “You have to deal with what content you want”. Besides, the communication with the VC was simple and good in short texts. The handling of the VC was considered as a “perfected Google search”.

Table 2: Results of the SWOT analysis (n= number of statements)

Strengths	**Weaknesses**
- Good structure (n=13) - Provides inspiration (n=8) - Pace & Accuracy (n=7)	- No suitable content (n=7) - No empathy (n=3) - Not suitable for ideation (n=3) - One-sided communication (n=3)
Opportunities	**Threats**
- Set level of detail (n=6) - Link with other DT phases (n=2) - Text to speech (n=2) - Represent more humanely (n=1) - Deeper evaluation (n=1)	- Provide stimuli (n=8) - Questionable search filter (n=5) - Focus too small (n=5)

The VC gave a variety of sources and different foci with the sections. Although it was compared to a Google search, it was stated positively, that the VC is “made for searching innovations in the field, not only general things”. The user interface was well designed using the Microsoft Teams interface template as Microsoft Teams is also used in the organization for everyday communication and work. The participants stated that the VC was easy to use: "Easy to understand, usable even without explanation, not only for design thinkers.”. It was considered as an advantage that it is possible to “look at the phase first” and that “you can also text with the bot”.

The content was perceived by the participants as implicit inspiration for the ideation session (n=8). Especially “if I know exactly what I need, it's good”. It was also stated, that participants can learn from the function of the bot though it is important that the human user explicitly types in what he or she is looking for. Providing inspiration, a specific topic can also be perceived in a different perspective: "I realize 'wow, that could have been interpreted that way'". According to the participants, it is especially within the ideation interesting to look at other industries and look up analogies.

The participants stated that using the VC is quick and easy (n=7). Especially the pace of information being delivered by the VC was convincing to them. Getting quick information means quick progress: “You get information fast, you advance quickly”. The “quick selection by just a click” was pleasant to use. The VC was also perceived as accurate, providing information and inspiration directly linked to the searched topic.

Opportunities: The participants see several opportunities to achieve better results with the VC once developed. Setting the level of detail was the most stated chance for the VC (n=6), meaning providing information on related topics to broaden the focus and finding more information than the user itself would find. Also, setting specific search criteria seems important:

“One is always looking for something specific, setting the level of detail would be good”. Other participants considered an advanced view: “Give the CA more criteria, refine the search, and show final results in a detailed view”. After the first results, the search criteria should be refined: “If I change x and y, what is the outcome?”

Besides, the participants see further opportunities for the VC by interspersing examples to a topic to stimulate thinking in a different direction: "similar content, but somehow different”. Information should be presented as compressed as possible such as single words: "Short pistol shots that build on each other" rather than whole articles.

Another statement (n=1) suggested a more humane representation and communication of the VC: “So far still very framed, not very human. The texts have been repetitive, if they were different words and more colloquial and nuances would differ, it would be more human”. Communicating in more informal language as well as having a less static but more natural flow of the dialog would support this suggestion. Other statements regarding opportunities for the VC were text-to-speech and speech-to-text communication (n=2), deeper evaluation using the power of AI (n=1) as well as linking the contents to other DT phases, e.g. to Prototype (n=2).

Weaknesses: The biggest weakness is the potentially not suitable content brought by the VC (n=7). It was stated that the search is limited in the way that many suggestions are proposed to the user. Therefore, one difficulty might occur: “You cannot always select, a filter function would be very important.”. According to the participants, the content does not need to be structured to the fullest but should cluster

and be more summarized: “It should be more summarized. Usually, we use Post Its, now I get articles. The results should be smaller, more compact.”
Besides, the participants stated that the VC in the current state does not deliver enough input. Alternative terms towards the topic should be searchable as well as more matching content to the topic should be shown which is a conflict to showing shorted results. Also, it was stated, that the delivered content are rather impulses like in a research phase: “The actual work, to pour the content from the article into an idea, this would have to be performed by the human.” Finally, some participants (n=3) found the VC more fitting in research or in the Observe or Understand phase of DT.
A one-way communication was criticized by the participants: “The bot does not challenge me. If I don't know exactly what I need or search for, the exchange with a real person is helpful”. Also, actively ending the conversation was perceived as too exhausting: “If I don't search anymore, I don't search further. The bot should end the session by itself”. Finally, the VC did not manage to show empathy. It was perceived as not being able to recognize emotions, and that interaction and speech is lost.
Threats: The stated threats were regarding search filter and the set focus. Regarding the selection e.g. for social media (n=5), the question was raised what the selection of the VC is based on: “Yes, LinkedIn shows trends, but no critical perspectives”. There is a threat of one-sided information, but getting both positive and negative is considered giving a better overview of a topic. The process behind the selection should be shown: “It is not clear how he got to the result, what was the selection process?” Also, the source of the contents is important to accept the linked knowledge: “Where does the content come from? Fake news can be everywhere”.
Regarding the set level of detail, the participants stated that it is too small (n=5). Considering this, the participants were afraid to have a very narrow view on the topic. It was assumed that the VC works with keywords: “Not really relevant content based on keywords, I think AI does not recognize the focus very much with keywords”. It was considered easy to “slip into a bubble” which might lead to priming in thinking or in the ideation session itself. Besides, the participants were afraid that AI cannot recognize emotions and, therefore, does not know which emotions are most important for a community.
Ideas: Several ideas were developed by the participants during the discussions. The most discussed and stated idea was that the VC can provide more stimuli (n=8). Using the currently provided content, the participants stated that the VC could also provide input for research, prototyping and testing, e.g. get inspiration for functions (“ideas come to you while you are building the prototype”), find interesting testing formats or go into cross sectoral research (“where else do we have this issue?”). However, this input needs to be given subtly: “creativity of the individual must be in the foreground, examples should be interspersed to a topic to stimulate to think in a different direction”. Another way of providing stimuli is to deliver pictures for inspiration: “like a kind of stimulus picture method, would have opened up a different horizon”. This could support the flow of the ideation phase. Also, individual words can work as stimuli: “briefly skim over them and extract the essence to be able to say whether this gives us a new perspective”.
The participants also suggest to give the possibility to set search filters (n=5). It was suggested to give a broad overview in the beginning of the search and narrow it down for further focus: “Instead of going further I´d like to narrow down the search, which context, which parts of the text are important etc. Setting in percent, e.g. 20%, so side infos should come through”. Criteria catalogs could help doing so

as well as stating conditions or clustering the search in phase-, content-, or group-related content: "I want to use it like spices in the kitchen, e.g. always search these pages, search with these terms, in this time period, in those languages".
The participants suggested to give different views and perspectives during the ideation phase to promote diversity. Providing a digital exchange with further views and perspectives might balance out the lack of exchange with humans. The following perspectives were suggested: experienced coach, different user groups, beforehand provided persona and different combinations of those.

Resulting Guidelines for the VC

We derive the following design guidelines (DG) for a VC in a virtual workshop from the conducted focus group discussions that will be used for further development and improvement of the VC. DGs were derived from the weaknesses, threats and ideas stated in the focus group discussions following the DSR approach of Hevner et al. [42] and Gregor et al. [51].
The VC should overcome one-sided communication as well as become more humane. Therefore, the VC should be able to show empathy, and deliver empathic and suitable contents for the topic. We state DG4 as follows:
"For facilitators to support diverse perspectives in virtual ideation workshops in organizations by providing a variety of views and perspectives on a topic based on different user groups because empathic thinking helps to react on previously defined challenges and needs of a persona."
Furthermore, the VC should be able to show suitable content. This goal should be achieved by giving the users the possibility to set their own focus and level of detail in order to achieve individual results. Therefore, we state DG5 as follows:
"For facilitators to support communication of participants and VC in virtual ideation workshops in organizations by providing the possibility to set a certain focus and change level of detail according individual topics and interests because different stages of ideation sessions need different detail in stimuli and results."
Besides, the VC should provide stimuli in the form of pictures or words from different perspectives, considering the beforehand and following DT phases as well as get further information on how other industries deal with a specific topic, we derive DG6:
"For facilitators to provide stimuli in virtual ideation workshops in organizations by providing pictures, key words, and sounds as well as information about the specific topic in other fields/industries/… because various stimuli can bring out even more creative ideas and solutions."

13.6. Contribution and Limitations

In summary, our research contributed to theories and concepts on collaboration with AI and virtual collaboration itself [3, 7, 56]. We contribute specific DGs with regard to a prototype demonstrating AI-supported ideation sessions for users in an organizational environment, derived from weaknesses, threats as well as ideas stated by focus groups. The DGs can serve as a foundation for further development and improvement of the prototype as well as for further research in virtual collaboration and virtual ideation sessions supported by AI.

Our focus was to provide these for an organizational environment that worked mostly co-located beforehand and is particularly new to virtual collaboration. Especially in organizations, CAs are becoming more important which requires considering aspects such as methods and current systems used in the organization as well as reducing redundancies in tool landscape [33-34] which is provided by this study. By using the Microsoft Teams template from Botsociety, we give a realistic environment of the VC to the focus groups. However, CAs are mostly seen as mere support systems limited to assistance functions such as the collection, analysis and synthesis of information [24-25]. In our case, we investigated how a VC as a teammate is seen by the focus groups. DT facilitators and practitioners can already derive implications from this study for their remote practice by considering the presented prototype as additional virtual teammate.

Our study shows some limitations. Even though we have looked at different business units, we have only looked at one industry so far. Further research could give a cross-industry view of the issue. This includes different approaches in creative units. In addition, the study at hand has covered virtual ideation sessions only. In addition, more focus can be placed on linking the different DT phases with each other, e.g. linking the ideation phase with the earlier definition phase and the following prototyping phase. Incorporating group dynamics should also be addressed in further studies. Finally, building on our study, further development of the prototype is necessary.

13.7. References

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App. A: Evaluating the D!Think Bot: a Conversational Agent for the Creativity Process

Debowski, N., Cvetkovic, I., Tavanapour, N. & Bittner, Eva (o.J.). Evaluating the D!Think Bot: a Conversational Agent for the Creativity Process. In Information Systems Frontiers. (under review)

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Eidesstattliche Versicherung

Hiermit versichere ich, Nicole Debowski-Weimann, geboren am 08. Februar 1993 in Wolfenbüttel, dass ich die vorliegende Dissertation mit dem Titel „Design Thinking with a Bot - Supporting the Design Thinking Process through a Conversational Agent“ selbst verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel genutzt habe.

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