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Systematically Conceptualizing Social VR Research – A Design-oriented Framework

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Full research paper

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Abstract

Social Virtual Reality, focusing on virtual connectivity among users, is an emerging technology and a fundamental element of visions such as the metaverse. However, scholars argue that comprehensive definitions and integrated theoretical conceptualizations of social VR are still missing. Due to the many modalities and degrees of freedom of virtual environments, IS researchers can benefit from such frameworks to orient explanatory research into social virtual phenomena and design social VR systems. To fill this conceptual gap, we conceive social VR as a designed environment and methodically develop a theoretical scaffolding drawing on conceptual building blocks of Design Science Research methodology, such as the explication of purpose and constructs. From this perspective, we define key terms and identify Goffman's interactionist theory of social interaction as a suitable conceptual basis for a theoretical framework that offers guidance for the systematic design and analysis of social VR phenomena in research and practice.

Keywords Social Virtual Reality, Metaverse, Design, Virtual Interaction, Theory Framework, VR.

1 Introduction

Despite the tremendous technological and business advancements of virtual reality (VR) technologies in recent years, their support for virtual social interaction, also called social VR, still requires systematic conceptualization. This is emphasized in a series of major research gaps relevant to advancing social VR and related technological systems but under-researched (Thuan et al. 2019). These gaps include insufficient definition, inexplicit scope and missing delineation, missing theory in social VR design linking concepts with each other (Holopainen et al. 2021), and missing positioning within the information systems (IS) field.

While various individual elements of social VR have already been studied (e.g., Kolesnichenko et al. 2019; Yassien et al. 2020; Torro et al. 2022; Luo et al. 2023), the lack of an abstract conceptual foundation and general design framework for the emerging class of social VR systems is in stark contrast to the growing importance of virtual connectivity among users. Here, social VR is regarded as a "part of a diverse and rapidly evolving media ecology" (McVeigh-Schultz et al. 2018) and a fundamental building block of the metaverse, defined as "a massively scaled and interoperable network of real-time rendered 3D virtual worlds which can be experienced synchronously and persistently by [...] users with an individual sense of presence" (Ball 2022, p.35). Practical applications of such social VR systems include remote teamwork (such as Meta's Horizon Workrooms) and VR commerce (Trier et al. 2024).

A better understanding of social VR's basic constituents and their interplay is particularly prevalent for IS research because the rich interaction and communication among users has many modalities (speech, mimics, gestures, text) with considerable degrees of freedom, e.g., when expressing the self or interacting with others. Social VR also adds the *spatial* dimension as a novel parameter of digital social user behaviors, which, for example, requires users to choose a position and social distance from another user. Further, complex sociological phenomena such as institutionalizing communities in 3D chat locations or spatial group work can be observed in virtual environments. This social and spatial complexity is also why previous theories for group systems in computer-supported cooperative work (CSCW, summarized in Fjeld et al. 2002) are not easily extendable.

Against this backdrop, we aim to address the lack of definition and theory (Holopainen et al. 2021) and evolve a theoretical scaffolding that systematically defines the foundational concepts of social VR and connects them to a guiding theoretical framework. Such a conceptual foundation is crucial for positioning existing research into a larger social VR research discourse and helps to elicit existing gaps and future research opportunities systematically. Moreover, as social VR is a context humans intentionally design, a theoretical foundation also offers application as a kernel theory (Walls et al. 1992) that can be the starting point for analyzing existing and designing future social VR systems from a design science research (DSR) perspective. We formulate the corresponding research question for our two-fold objective as follows: *What are the main theoretical concepts of social VR phenomena, and how can they be linked into a framework useful for explanatory and design science research?*

We aim to address the need for more definition and theory within the social VR context, which is distinct from general VR. Our objectives are to develop a framework that clarifies the unique aspects of Social VR – such as social presence and interaction in shared virtual spaces – and to show how these concepts apply to both theoretical research and practical system design. Thus, we aim for a twofold contribution: First, defining concepts and identifying kernel theory for social VR systems helps explanatory researchers better understand social VR phenomena and, by extension, human and organizational behavior in the metaverse or smaller-scale environments. Second, we produce new design knowledge for the design science researcher by developing a starting point for a "nascent" design theory (Heinrich and Schwabe 2014; Tuunanen et al. 2024), setting foundations for three of six core components of a design theory as well as guidelines for incorporating them into a DSR project.

To develop our contribution, we now first introduce our methodological perspective and explicate the foundational terminology of social VR. Then, we link the concepts together to derive and propose a guiding four-layer framework for social VR research and design. We then discuss and illustrate the implications and usefulness of this integrated theoretical foundation for IS researchers who engage in explanatory or design science research.

2 Theoretical Background

Extensive research has been done on *virtual reality* (VR), of which we see Social VR as an extension. We begin by discerning two contending perspectives on VR. Based on these considerations, we will justify the choice of our methodology.

Virtual Reality as Phenomenon and Artefact. As the initial point of departure, our research focus requires a thorough understanding of the nature of VR. A key point is to differentiate the *technology* of VR from the *perceived phenomenon*, for "a device-driven definition of virtual reality (…) fails to provide any insight into the processes or effects of using these systems" (Steuer 1992, p.73). For that, we define VR in line with Jerald (2016) as a computer-generated digital environment that can be experienced and interacted with as if that environment were real. *Reality*, as a fundamental element of the term VR, refers to how things *are*. Jerald (2016) differentiates objective and subjective reality, where the former exists independently of ideas concerning it, while the latter is what is actually experienced or seen. Next to these, Ropohl (2009) suggests the notion of *intended reality* in the context of socio-technical systems (STS). It refers to the artificial world humans create for their purposes and only exists against the background that someone thought this world should exist. Thus, it is not understandable as a given world but only as a made world. Turning to the other element of the term VR, i.e., *virtual*, there are two basic views on the nature of virtuality, especially in computer-simulated virtual realities. In the first view, virtual is defined as "being in essence or effect, but not in fact" (Sherman and Craig 2003, p.6). There is no real object behind it, just a perception – a stimulus that makes our mental model believe that some object is behind it without that object even existing. This definition is that of the virtual as the non-real, i.e., as the *opposite of the real*. Combined with the term reality as something real, this understanding of virtuality implies that VR is merely an *illusion* of reality in the perception of its users. The second definition relevant to our research equates the virtual with the *ideal* (artificial), as the opposite of the material. In this view, the real is distinguished from the potential or the possible – where there are various possibilities that the real world can assume, and one of them has been realized (Bluemink 2020). In this perspective, virtual objects in the virtual environment are real digital objects with their own meaning and without the need for direct correspondence with real objects. For example, a digital folder exists as an ideal virtual object, which does not exist in this form in the real world but still does exist – as something artificial (ibid.).

The above definitions point to a crucial distinction: We must understand VR as both a *perceived illusion* and a *created artificial world*. As such, VR is an intended reality, emphasizing that VR has a *designer* who intentionally created an intersubjective experience and recipients or *users* who perceive it - possibly also in unintended ways. The two views are not mutually exclusive but co-exist in a dialectical relation: When a designer creates an artificial social world, they need to remember that *illusions* play a significant role from the perspective of its users. As people will relate perceived stimuli to their known mental models, illusions play a vital role in designing *and* explaining social VR. Often, VR systems rely on both components meant to create a realistic illusion (e.g., spatial perception) and other components meant to enable things that would not be possible in the real world (e.g., glowing objects that draw attention). From the perspective of an external observer who evaluates how people use social VR to achieve some outcome (e.g., solving a business task), the quality of the illusion and, with that, the users' perceptions may well be more important than the intended virtual reality. From this dialectic conceptualization of virtual reality, we can derive that the notion of *VR as an artefact* is the primary view of the *designer*. In contrast, the notion of *VR as an illusion* belongs to the *observer,* who views the perception of this virtual creation as a phenomenon to study. IS researchers create for users as designers and study the impact of design on users as observers. Both views are interdependent. Thus, our framework must differentiate the technological *system* representing the designed *creation* and *illusions* as experiential phenomena as key domains. We further note that the illusions are a means for users to attain a particular *outcome* (e.g., performance, entertainment).

Methodological Perspective. Social VR, inheriting this property as a subclass from VR, is a designed environment humans deliberately create – an artefact. Therefore, we structure our conceptualization effort by drawing on methodological elements of DSR due to its dual focus on theory and design. This approach is well-suited to the paper's objectives because DSR allows for systematically exploring and developing theoretical concepts (e.g., social interaction in virtual environments) while guiding the practical design of social VR systems.

Our conceptualization effort focuses on theory as the link between explanatory and design research. A theoretical foundation contributes a scaffolding for explanatory studies of social VR phenomena but also offers a starting point for systematic design (Peffers et al. 2007; Walls et al. 1992; Gregor and Jones 2007). The initial abstract phases of DSR reflect this link as they require researchers to explicate essential aspects such as the knowledge base, the purpose, the scope, or the main theoretical constructs that later inform and guide design and implementation (Gregor and Jones 2007). To account for this complementarity of explanatory and design research, we closely aligned our conceptual framework with the components of a *design theory* (DT) proposed by Gregor and Jones (2007). Thus, it can be viewed as a preliminary stage of DT or a "nascent" DT (Heinrich and Schwabe 2014) serving as a foundation for future design science research. In DSR, a DT is a description of the design of a complex system (ibid.),

at its core, a prescriptive theory for artifact construction (Fischer et al. 2010). This facet of DSR is thus closely related to theory development and may also deliver helpful insights for explanatory research. One of the six core components of a DT is "justificatory knowledge" (Gregor and Jones, 2007) referring to DSR's knowledge base. Going forward we explicate the theoretical background using the differentiation into Ω Knowledge and Λ Knowledge (Gregor and Hevner 2013). Ω Knowledge informs the understanding and context of problems or phenomena, grounding a design in available definitions and theories. Λ Knowledge refers to what can be learned from *existing* (social VR) systems or processes. Following this distinction, we now first discuss abstract theoretical concepts (i.e., Ω Knowledge), followed by examining studies that analyzed existing social VR instances (i.e., Λ Knowledge).

2.1 Existing Theories on Social VR Phenomena – Ω Knowledge Base

Explicating the theoretical foundation of basic concepts and theories is particularly important as social VR is still considered as insufficiently defined (Thuan et al. 2019). We begin by unfolding key definitions and subsequently link the concepts into a framework to aid explanatory research and social VR design.

Social VR as an Interaction Phenomenon. Unfolding the foundational constituents of *social* VR requires adding a social dimension to the previously established aspects of VR. A particularly suitable approach for theorizing social VR as a phenomenon is the micro-sociological perspective and in particular *symbolic interactionism*. Interactionism is concerned with describing all the possible complex situations of people and interactions that shape human behaviors (Mead 2015). For our domain, Goffman is a relevant proponent of interactionism, as he offers a detailed conceptualization of three "basic interaction units" (Goffman 1967, p.144) of *face-to-face interaction rituals* that we consider as particularly compelling for structuring virtual social interaction.

First, Goffman proposes the concept of a *social occasion*, defined as "an event […] that is looked forward to and back upon as a unit" (ibid.) with a time and place of occurrence. It sets the tone for what happens during and within it. The social occasion alludes to the purpose of the social interaction. It frames certain behavioral settings and expectations of participants. Second, there is a so-called *gathering* of two or more individuals. Members of the gathering include all and only those who are at the moment in one another's immediate presence. This gathering refers to the set of interdependent actors. In the context of social VR, the gathering of *virtual social actors* is then summarizing any virtual entities in the scene that appear to be acting as subjects with a social purpose (often exhibiting some form of human-like appearance or behavior). Two main types of *virtual actors* are distinguished: avatars and agents (Fox et al. 2009; Biocca 2014). *Avatars* are digital (or virtual) representations of real people, offering them a virtual body inside the virtual environment. A person's avatar may be para-authentic, i.e., striving for exact representation of the real person. It may also be artificial (alter-self), i.e., constructed and unrepresentative (Lee et al. 2004; Dunn and Guadagno 2012). Avatars fulfill purposes of interaction and communicating symbols or cues. They influence social presence. Agents, on the other hand, are entirely virtual entities controlled by a computer program (Biocca 2014). Agents may appear in many different shapes and forms, some of them anthropomorphic or even seemingly sentient. Third, Goffman defines the *situation* as "the full spatial environment anywhere within which an entering person becomes a member of the gathering" (Goffman 1967, p.144). The situation can be seen as the place, in which the gathering of virtual actors happens. "Situations begin when mutual monitoring occurs and lapse when the next to last person has left" (ibid., p.144). As this situation addresses the spatial dimension, it alludes to the important concepts of *place and space* theorized in the interactionist theory of place attachment (Saunders et al. 2011). Here, space is conceived as existing independently of concrete content and extends infinitely (Harrison and Dourish 1996). Place is described as containers in this space that describe specific, spatially delimited areas (Saunders et al. 2011) with a clearly cognitive psychological component. Space becomes a place when people endow it with value and attach meaning to it – often through social interaction. From a social VR perspective, we conceive the situation/place dimension to contain all aspects about the spatial environment in which the interactions occur, i.e. the surrounding virtual environment with its objects and how this environment should be perceived by the actors.

The above elements of Goffman's theory of social interaction provide a useful foundation for the key components the social VR phenomenon that we label (a) the *social occasion*, (b) the *gathering of actors* and (c) the surrounding *spatial situation*. The *interaction* is the central phenomenon that emerges from the interplay of these elements. They have a spatial and a temporal component and thus represent the dynamic of the interaction episode. Interactions emerge when the gathering of actors in a spatial situation (or place) is enacted through behaviors (including communication), framed by the general social occasion (e.g., an event). They can take place between actors or between actors and objects of the spatial situation. Through interactions actors explore the spatial situation and build various forms of relationships with objects or other actors, such as proximity-based relations, mutual displays of

behaviors, shared attention, visual or conversational interactivity. Interactions in the spatial situations may vary across the following dimensions: (a) the degree to which states may be altered by the actions of its users (mutability), (b) the richness of interaction possibilities, defined by the range of inputs and stimuli (interactivity), and (c) the responsiveness as the "time taken for the system to …respond to a user event" (Delaney et al. 2006). Over time, a social structure may emerge from social interactions between actors, referring to "shifting" and "evanescent" gatherings (Goffman 1967, p. 2). The character of such manifestations is heavily influenced by the number of people, their persistence, and their emergent modes of interaction, such as coercion, competition, conflict, cooperation, exchange or negotiation. While interactions emerge as the interplay of situation, gathering and occasion, we also need to note that designers need to anticipate and intentionally design for them during the development of social VR (e.g. allowing to pick up an object). Figure 1 visually represents this foundational conceptual structure of the social VR phenomenon. For brevity, we refer to it as the *virtual social interaction triangle* (VISIT).

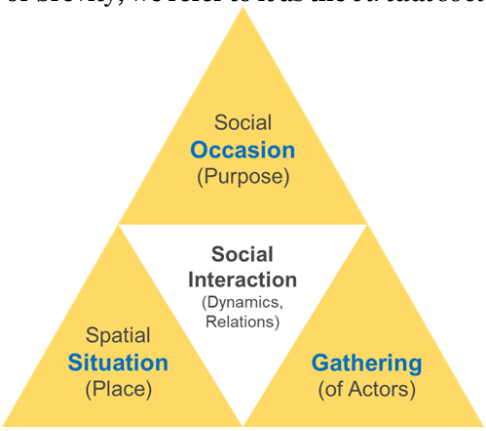

Figure 1: Virtual social interaction triangle (VISIT) with theoretical elements of social interactions in social VR

Cognitive Illusions. We already noted that the capability of providing perceivable *illusions* is an important element of a social VR system. Such *illusions* result from the *cognitive perception* of the quality of the created social VR phenomenon. For its participating users, the virtual environment creates the illusion of being real, touching the fundamental principles of human cognition and our capability to obtain knowledge about what is 'real'.

The *face-to-face-interaction illusion* is the emerging perception of communicating (both verbally and through body language with other virtual social actors (computer- or user-controlled) as if non-mediated (Jerald 2016). This presupposes a series of underlying illusions such as the *single-space illusion*. This illusion is the perception of operating in the same virtual space as other users (i.e., dealing with a "single reality") despite being dislocated from each other. Related to this illusion is the perception of a shared experience, as an event or activity that is knowingly shared with another person, i.e., "experiencing a stimulus simultaneously with someone else" (Boothby et al. 2014, p. 2210). In social VR it is only possible to create a virtual shared experience when the single-space illusion holds for the actors. The most widely studied illusions that differentiate social VR from other interaction paradigms are the three *presence illusions* (Lee 2004; Oh et al. 2018). First, *telepresence* (also spatial presence or physical presence) is "the extent to which one feels present in the mediated environment, rather than in the immediate physical environment" (Steuer 1992, p. 75]. Second, *self-presence* is "the extent to which the virtual self is experienced as the actual self" (Oh et al. 2018, p. 2) and relates to the virtual representation of the user's self. Finally, *social presence* (also co-presence) refers to the "sense of being with another" (Biocca et al. 2003, p. 456) and is the extent to which one perceives to have "access to the intelligence, intentions, and sensory impressions of another" (Biocca 1997, p. 22). Social presence includes three dimensions: Sense of co-location, mutual awareness, and "perceived availability of others for social interaction" (Schultze and Brooks 2019, p. 735). A related antecedent to social presence is *shared focus* relates to a "joint focus of visual and cognitive attention" of a social group (Goffman 1967, p. 144). As social VR has a spatial dimension, other relevant illusions are the *place illusion* - the perception of "I am here" in a virtual place, despite knowing that I am physically not (Kilteni et al. 2012). Further, the *self-embodiment illusion* (also known as Sense of Embodiment; SoE) is a user's perception of one's own body's spatial representation in VR as "my body" – or in more detail: "SoE toward a body B is the sense that emerges when B's properties are processed as if they were the properties of one's own biological body" (Kilteni et al. 2012, p. 375). It involves a sense of agency (e.g. moving a hand controls the virtual hand), a sense of body ownership and a sense of self-location in space where one feels to be located.

Often, explanatory social VR research in fact explores one or more such illusions, e.g. social presence (e.g., Schultze and Brooks 2019, Yassien et al. 2020) or self-embodiment (Freeman et al. 2021).

Social VR System. From the above conceptualization we can finally derive that social VR *systems* are information systems that generate or trigger the above social VR phenomena by presenting artificial stimuli so that users perceive a series of illusions that support and enable desired use outcomes. Examples of such outcomes are processing information, engaging in activities, accomplishing tasks, developing relationships, or building confidence, trust and identification with a social group (e.g. Luo et al. 2023; Torro et al. 2022). For this purpose, a virtual environment consisting of a virtual place and virtual social actors is technically created and instantiated. Users can interact with it using immersive input and output devices (e.g. head mounted displays). Social interactions within the situation in the virtual environment are, to some extent, perceived as non-mediated (face-to-face-interaction illusion).

2.2 Existing Design Theories and Artifacts – ∧ Knowledge Base

Relevant conceptual elements of social VR can also be derived from examining existing implementations of social VR environments as well as studies of available features or user behaviors in these contexts. In DSR, the according literature is also called the ∧ knowledge base (Gregor and Hevner 2013). Due to the limited length of this article, we now briefly introduce a few representative studies that analyzed existing platforms to create categories or taxonomies of features as design frameworks. We further outline some conceptualizations that study social VR instances and episodes to explain user behaviors and emerging phenomena. Finally, we compare these studies to the conceptual elements to identify existing gaps.

Social VR Design Choices. McVeigh-Schultz et al. (2018) examined a series of available social VR applications such as RecRoom, AltspaceVR or Facebook Spaces. The authors identified a number of typical design elements such as mechanisms of navigation, opportunities to customize avatars, private initial places, 'lobby' areas where first social encounters occur, and social mechanics for friending and blocking. While this derived list offers a first orientation, there is no model being constructed and a theoretical grounding of the categories is lacking.

Avatar Affordances in Social VR. Kolesnichenko et al. (2019) analyze common user environments (e.g. Facebook Spaces, Mozilla Hubs, Rec Room, AltspaceVR, VRChat, etc.) and derive a framework of so-called avatar affordances in social VR. They include locomotion and navigation mechanics, creation of individual environments, customizing humanoid versus non-humanoid avatars, facial expressions, personal space mechanisms and social mechanics. This analysis is however not offering any conceptualization of resulting social VR elements. The focus on avatars sheds light on the actor dimension, but ignores other relevant VISIT elements, such as the spatial situation.

Social VR Design Taxonomy. The Social VR Design Taxonomy of Handley et al. (2022) also followed an inductive approach where the authors analyzed a larger set of 44 VR environments. This approach is deriving three abstract domains from the empirical assessment: (a) 'the self' including aspects such as avatar representation, (b) 'interaction', with aspects such as communication types or rights, and (c) the 'environment 'comprising aspects such as the openness of the environment or the spawning area. The framework examines, which platforms offer which features. It is not fully aligned with interactionist theories though, as it does, for example, not explicitly address the role of the occasion for the virtual interaction or the interplay between the elements. Further, it does not consider illusions and their influence on outcomes.

Design Space for Social Presence in VR. The conceptual model by Yassien et al. (2020) is called Design Space for Social Presence in VR. It centers on a theoretical process of achieving *shared presence*. This causal view on variables that result in a relevant outcome enables an abstract framework with logical chains, which at the same time is more open and flexible with regards to how the desired variables and effects can be designed. On the other hand, it remains unclear what the final use outcome is once presence (as an illusion) is perceived (e.g. user trust or performance). The focus is further not covering social VR environments, where the spatial situation is important, e.g. during object-based interaction.

Interactional process model of social presence. Schultze and Brooks (2019) propose a model of how *social presence* is accomplished in virtual space. The final form is interlocking involvement obligation with a high degree of social presence. The model highlights the importance of mutual awareness, a social occasion or the social validation of one's virtual presence. User agencies are foregrounded while cues of the designed spatial situation are not addressed, including avatar design, shared objects, or the social touch of the interaction environment.

After investigating these relevant conceptualizations, we note that existing approaches provide valuable starting points and concrete social VR elements but also show several gaps. The studied approaches

either focus on the perspective of creation by deriving descriptive categories of features or, alternatively, suggest theoretical models that elucidate how to attain a particular degree of social presence (illusions) in social VR platforms. Existing feature inventories (McVeigh-Schultz et al. 2018; Kolesnichenko et al. 2019) are not explaining how the derived functionalities influence desirable target effects. Also, further innovative use cases are possibly overlooked by using existing systems at the point of departure. It is thus important to look beyond the typical (ego-) perspective of avatars as users to avoid overlooking the important influences of the design of spatial situations and their objects. The contributions that address illusions selectively focus on (the illusion of) presence as one outcome effect but are not linking the illusion to design choices of the social VR phenomenon to attain the effect. More generally, the many mosaic pieces of social VR (Ω and Λ) knowledge need to be pieced together so that the concepts surrounding the term can be clearly defined, distinguished from and related to each other. This resonates with Lee's et al. (2021) finding that researchers are still far from an integrated theory base that coherently relates all these aspects. Definitions of conceptual terms are essential, as social VR research has not yet produced a widely accepted definition of its core terms.

3 Towards an Integrated Conceptualization of Social VR

Based on our overview of existing definitions of *main theoretical concepts of social VR phenomena* and the analysis of implemented systems, we now return to our research objective and develop an integrated framework of social VR that links all these concepts in a way that can guide *researchers and designers*. As we aim to address both these academic stakeholders we derive the framework based on DSR methodology and principles: We first elaborate a working definition of social VR as a point of departure. Then, we then follow the theory-oriented elements of the DSR approach by Gregor and Jones (2007), which requires explicating the purpose and scope (causa finalis) and collecting "justificatory knowledge" or kernel theories from the literature. Based on this foundation, we finally assemble all constructs (causa materialis) into an integrated framework of social VR.

3.1 Definition, Purpose and Scope

The framework is oriented by a guiding definition of social VR. There are several definitions of social VR proposed in the literature. For example, one view emphasizes the role of the metaverse: "The latest technological iteration of the metaverse is what we refer to as social virtual reality (VR), …At its core, social VR… refers to 3D virtual spaces where multiple users can interact with one another through VR head-mounted displays and can be traced back to concepts in primitive virtual worlds." (Maloney 2022, p. 11). Another approach is to derive the definition of social VR from the more general VR definition. For example, Jerald (2016, p. 9) defines VR as a "computer-generated digital environment that can be experienced and interacted with as if that environment were real." Grounding in these proposals we derive the following definition: *Social Virtual Reality is an immersive, presence-based interaction paradigm where connected actors communicate through a virtual (three-dimensional) environment that can be experienced, shared, and interacted with as if it were real.*

From this definition we can infer a formulation of a *purpose* of social VR. Existing definitions are not yet explicitly differentiating the two fundamental conceptualizations of virtuality as introduced in the theory section - the creation of new "reality" versus providing illusions for users. Addressing and linking these two viewpoints is necessary, as the ontological status of social VR is located between that of an illusion-induced individual *experience* and that of a created digital *artifact*. Corresponding to these two aspects, the first purpose of social VR is the *creation* of a virtual social situation in which social interactions can occur. Following Goffman's definitions, this would require a group of virtual social actors who are present together in a shared spatial situation and share an understanding of the social occasion that brings them together. The second purpose of social VR is to enable the *illusion* that users perceive their social interactions with a certain degree of perceived non-mediation. Based on these considerations, we can specify: *The main purpose of Social Virtual Reality is the realization of a virtual social situation, consisting of a gathering of virtual social actors in one another's immediate presence, a shared place, and a mutual understanding of the occasion and the nature of the encounter. Within this virtual social situation, social interactions occur between the actors, which are perceived to a certain degree as non-mediated.*

Accordingly, *social VR systems can be defined as information systems that can generate and provide virtual social realities.* For this purpose, a virtual environment consisting of a virtual spatial situation and virtual social actors needs to be created via presenting appropriate stimuli of spatial and temporal experience to users. They can interact with it using immersive input and output devices. The systems enable social interactions within the situation in the virtual environment, which are, to some degree, perceived as non-mediated. Social VR systems thus have the *goal* of enabling interactive possibilities of

togetherness in experiencing and working out solutions, especially if face-to-face meetings are not feasible (pandemic, travel restrictions, time constraints, etc.). Further, they offer joint presentation possibilities for complex issues, guided by the meaning of the social occasion and located in spatial situations. A main derived *goal*, which all social VR systems share, is the triggering of social-presence perceptions in its users – and in the long run – addressing the general human need to return to a more pristine form of sociality without perceiving temporal or spatial separation (i.e. the loss of a shared "place" to interact).

3.2 Main Constructs of Social VR

After creating the scaffolding of social VR through outlining the definition, purpose and system's scope, we can now integrate the main constructs from our review of the Ω Knowledge and Λ Knowledge (Gregor and Hevner 2013) into a systematic framework. In DSR, this conceptual model is also referred to as causa materialis and orients the subsequent system design (Gregor and Jones 2007). Figure 2 provides an overview of all key constructs, which we group into four different layers.

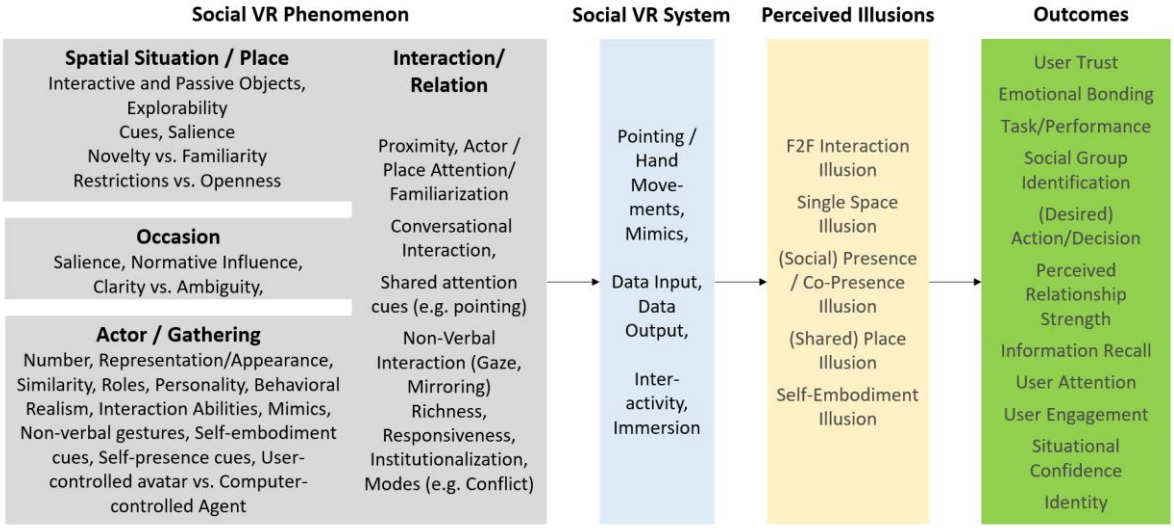

Figure 2: Main Constructs of social VR and their four Layers

Social VR Phenomenon. The starting point of our framework is based on the virtual social interaction triangle (VISIT) to represent the interactional phenomenon (cf. Figure 2, left block). This layer consists of the realization of a virtual social setting, consisting of a *gathering of virtual social actors* in one another's immediate presence, a shared *spatial situation* (or place), and a mutual understanding of the *occasion* (the nature of the encounter). Within this virtual social setting, situated social interactions occur between the actors. The elements of this category ground in the introduced interactionist constructs such as the spatial situation, the occasion and the gathering of actors (cf. Goffman 1967; Fig. 1). As introduced in more detail in the theory section, interactions describe the dynamic component of social VR, emerging when the gathering of actors in a spatial situation (or place) is enacted through behaviors (including communication), framed by the general social occasion (e.g., an event). Interactions can take place among actors or between actors and objects of the spatial situation. Through interactions actors explore the spatial situation and build various forms of relationships with objects or other actors, such as proximity-based relations, mutual displays of behaviors, shared attention, visual or conversational interactivity.

Social VR System. Social VR systems are positioned as the second layer in the framework. They are information systems that generate and present the social VR phenomena to its users. One important technological quality is *immersion,* i.e., the objective degree to which a social VR system provides stimuli for the perceptive system – or the "power" with which the user is "sucked in" (Heim 1995). For this purpose, a virtual environment consisting of a virtual place and virtual social actors is technically instantiated and run. Users can interact with it using immersive input and output devices. Social interactions within the situation in the virtual environment are, to some extent, perceived as non-mediated. Technically, the system takes data input from users and presents data output to them. Such data includes movements or location changes but also eye and mimics tracking as well as other system interactions (e.g. grabbing, textual displays, user interactions). Social VR systems further need to synchronize multi-user activities across networked users.

Perceived Illusions. Illusions (cf. Figure 2, third block) are user perceptions of being in the virtual environment and interacting as if non-mediated. They derive from the quality of the system's technical representation of the social VR phenomenon. As summarized in the framework and introduced in the theory section, the face-to-face-interaction illusion is the emerging perception of communicating (both verbally and through body language) with other virtual social actors as if non-mediated (Jerald 2016). This presupposes a series of underlying illusions such as the place illusion, the single space illusion, the experience of social presence and the acceptance of an actor's embodiment as the actor's real 'face'. In this context, the single-space illusion is the perception of operating in the same virtual space as others (i.e., dealing with a "single reality") despite being dislocated from each other and operating on distributed nodes generating autonomous spaces. Another important perceived illusion is the social presence illusion, defined as the "sense of being with another" (Biocca et al. 2003, p. 456); recognizing and feeling the presence of another social actor; perceiving to easily have "access to the intelligence, intentions, and sensory impressions of another" (Biocca 1997, p.22). Social presence results from a perception of the co-presence illusion, as the sense of being in the vicinity of others (Schultze and Brooks 2019, p. 735). The place illusion is the perception of "I am here" in a virtual place, i.e., space with attached meaning, despite knowing that I am physically not. Finally, the self-embodiment illusion (Sense of Embodiment, SoE) is the perception that emerges when a virtual body's "properties are processed as if they were the properties of one's own biological body" (Kilteni et al. 2012, p. 375).

Outcome Effects. Finally, the actors' perceived illusions of a social VR phenomenon that is processed and presented by the system may eventually lead to a series of outcome effects on the level of individuals, groups or organizations. These possible outcomes are summarized in the fourth layer of our framework. Example outcome effects are: user trust, emotional bonding among participants, task performances, identification with the participating social group, the execution of desired actions or decisions, changes in perceived relationship strength or qualities, information processing (recall), user attention levels, engagement, or individual confidence (e.g. Luo et al. 2023). This list is not complete and further outcome factors may be specified by users, facilitators or other stakeholders. Achieving particular such outcomes is a possible design objective that guides developers of concrete social VR system instances, such as systems for trust-building in VR-based team exercises of dispersed employee groups.

4 Discussion

With our systematically derived social VR framework we fill an important theory gap in the literature. While there is considerable academic interest on social interaction in VR environments, explanatory research is usually investigating a limited set of factors or an individual causal relationship without thoroughly explicating the whole social VR domain. Studies of the design of social VR platforms often examined existing instances and created lists of functionalities without linking these results to a comprehensive theory-driven framework, even though DSR methodology frequently calls for this as a starting point of their process models (Walls et al. 1992; Peffers et al. 2007; Gregor and Jones 2007). To fill this conceptual void for an emerging technology that is likely becoming a corner stone of future virtual ecologies, we thoroughly explicated and clarified the underlying terminology, which often was just taken for granted. Based on this effort, the four layers of constructs describe how a (1) social VR phenomenon is a complex combination of particular VISIT elements and is then (2) technically provided through a system so that (3) particular cognitive illusions are perceived by users, which may eventually result in (4) intended and unintended outcome effects. The definition of VR itself highlights that for this designed environment, creation and a perception are both relevant and interlinked. With our specific design-oriented take on theory development, we ensure that this link is maintained so that the framework is a useful starting point for both explanatory research and social VR design science research.

4.1 Guidance for Explanatory Research

The conceptual overview provides a more structured starting point for *explanatory research* that often uses typical methods such as experiments, observations, or ex-post interviews. First, academics can now more systematically and theory-driven define the social encounter in VR using the 3 main elements of the interactionist VISIT model plus the emerging interaction forms. These elements can be used to specify and control the many influence variables of the context (e.g. office versus leisure places, moving, interacting), which is particularly relevant for designing experiments that rely on allowing only specific intended variations, while all other factors need to be consistent.

To give an example, researchers can thoroughly define the spatial situation with desired interaction opportunities, e.g., an office room or a team lab with a 3D model of some machine on a table with seats.

The gathering of actors could involve two avatars in business casual outfits who cannot leave their assigned seats after spawning. Actors can grasp the model and turn it, but not relocate it. They can use their hands and speak. The occasion could be defined as a planned interaction on a team task in an engineering context to reduce the material costs of changing a product design. This occasion can be mentioned to the avatars and there can be cues in the spatial settings such as information displays. The intended interaction forms between avatars and the spatial environment are implicitly resulting. The goal of the researchers may be to study a particular illusion such as the benefit of a perceived co-presence in a shared space. Here, the measured outcome could be team performance or perception of social relationship qualities. Again, the framework shows which illusions are typically involved in a social VR encounter and which outcomes could be studied. For an experiment, researchers can finally define how to create two different variants of the virtual experiment so that the factor of interest is measurable as a difference between the experiment setups. For example, the respondents might can the interaction modes from walking around in the experimental group versus sitting at a fixed place in the control group. On a more general level the four-layer model shows which outcomes of interest can be studied (e.g., trust or identity formation), and which diverse illusions may jointly influence these outcomes. The list of illusions can also be used to study their mutual interplay. The system layer informs how the illusions can be created in experiments and points to options for measurements.

4.2 Guidance for Design Science Research

As intended in the research objective, the four-layer social VR framework is also a starting point for researchers engaging in design science. Here, we suggest to follow up with the next steps of the DSR approach by Gregor and Jones (2007) that we already started with: Our presented theoretical constructs (causa materialis) are the foundation for defining, in a next step, the causa formalis component. It refers to "the abstract 'blueprint' or architecture that describes an IS artefact" (Gregor and Jones 2007, p. 322). For example, using a 3D real-time development environment such as Unity or Unreal Engine, the social VR system implements the elements of the virtual social interaction triangle (VISIT) such as agents on a welcome counter, as well as other furniture and the user avatars. These different entities together constitute the *Virtual Interaction Environment*. This next step would require further design decisions about how users can interact with input and output devices in a way that allows certain interactions in the VR context (e.g. grabbing, waving, exploring). The design of the place derives from the intended occasion narrative (e.g., business negotiation in a neutral restaurant setting) and whether a place illusion is invoked. The next design theory element addresses the causa efficiens, that is the description of how to implement the proposed conceptual approach on a technical level. In our context, the virtual interaction environment of the system architecture needs to be implemented in detail. For that we adopt the terminology of the technical construction process of a scene in the Unity development environment, which is widely used for VR development (Unity 2022) with a well-adopted technical nomenclature of terms such as entities, transform components or objects, which implement the conceptual VISIT elements and their properties. After designing the conceived social VR phenomena, the four-layer model can be used to determine variables of interest that enable researchers to systematically evaluate their design. For example, the designer may want to measure the system's ability to create certain illusions such as social presence that bring about outcomes such as increased trust levels or group identity perceptions of remote workers. This step is similar to the explanatory research trajectory above. An example where the design is based on our conceptual model is provided in (Trier et al. 2024).

5 Conclusion

Our extensive conceptual effort contributes a first treatise that systematically structures the many key components, properties, and requirements that define the innovative class of social VR systems on an abstract level. We believe that our proposed theory-based framework offers an important point of departure for researchers in areas such as Human-Computer-Interaction, Computer-supported cooperative Work or Service Systems Design. Our specification can contribute to attaining a higher level of coherence for the important next steps of developing and evaluating various separate social VR systems. At the same time, our contribution can be used as a scaffolding for categorizing and researching novel use cases, such as socializing among community members, virtual onboarding groups, team meetings, or customer interactions in VR. Here, we particularly emphasize social interactionism as a promising and very established research perspective for understanding virtual social interactions. Next to guiding dedicated designs of software support for teams, serious games in a social group or the like, our conceptual contribution also allows to systematically explore existing platforms such as Meta Spatial for their comprehensiveness and completeness. As such, researchers can systematically create and explore social virtual realities as a potential cornerstone of designing future immersive experiences in the future workplace or the public metaverse.

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