Something Personal from the Metaverse: Goals, Topics, and Contextual Factors of Self-Disclosure in Commercial Social VR

Philipp Sykownik
philipp.sykownik@uni-due.de
University of Duisburg-Essen
Germany

Divine Maloney
divinem@clemson.edu
Clemson University
USA

Guo Freeman
guof@clemson.edu
Clemson University
USA

Maic Masuch
maic.masuch@uni-due.de
University of Duisburg-Essen
Germany

ABSTRACT

Current Social VR literature provides limited insight on one of the most critical behaviors for developing and maintaining interpersonal relationships: self-disclosure. Therefore, we present an online survey (N = 126) investigating how users disclose personal information to each other in Social VR. Our results indicate that many participants see in Social VR access to authentic connections with others despite tending towards skepticism and privacy concerns. Most users disclose sexuality-related information, lifestyle preferences, and personal goals. In contrast, information that breaks anonymity, such as real names and more intimate aspects of oneself, are shared less commonly. Thereby, self-disclosure decisions depend on factors like the relationship to or age of disclosure recipients, the privacy of a virtual environment, the group size, or the activity context, and is driven by different goals, i.a., relational development or exploration of oneself. These insights advance the understanding of current Social VR users and their behavior by directing future research on self-disclosure-based relationship building in Social VR and outlying broader design implications for the future metaverse.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in collaborative and social computing**; *Virtual reality*.

KEYWORDS

self-disclosure, social virtual reality, online social interaction

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1 INTRODUCTION

Disclosing personal information to others is one of the most important factors influencing the formation and maintenance of interpersonal relationships. It thus forms the basis for healthy social ties to acquaintances, friends, and significant others [2, 39, 74]. Modern computer-mediated communication technologies contribute to interpersonal communication and relationships in large parts of private and public life (e.g., [18, 26, 30, 59, 91]) and impact how we reveal personal information to others [9, 51]. The study of self-disclosure (i.e., sharing personal information with others) in computer-mediated social contexts has become established in HCI research. In particular, it focuses on how individual self-disclosure is affected by technological affordances of a specific medium designed for social communication like social networking sites (e.g., [72, 90]) and virtual social worlds (e.g., [34, 69]).

A novel venue for mediated social experiences is Social VR, an emerging ecology of commercial applications for avatar-based remote social interaction in shared virtual environments using VR technology (i.e., head-mounted displays) [53, 54, 65]. Social VR offers embodied and immersive social experiences comparable to face-to-face interaction due to its verbal and non-verbal expression capabilities [49, 79], and the variety of social activity contexts it offers [44, 49, 53, 54, 58, 76, 89].

Alongside the access to a new communication venue like Social VR naturally comes the question of how its technological qualities affect aspects of social interaction like self-disclosure. Though, HCI research only recently began to study self-disclosure in Social VR. Insights so far based on user interviews demonstrate trade-offs between enjoying natural ways of self-disclosure and being concerned about privacy risks [50]. However, users reported feeling comfortable disclosing both emotional, and personal information [50]. Although previous findings provide interesting insights into individual attitudes and behaviors of a few Social VR users, they do not allow the identification of general patterns of attitudes and behaviors related to self-disclosure in Social VR. For example, current findings do not provide insights into quantified tendencies to disclose or not disclose certain topics or how different context factors may generally influence the disclosure of certain information types. With our study, we wanted to identify such general patterns of opinion and behavior by answering the following research questions:

RQ1 What do users think about disclosing to others in Social VR?

RQ2 What topics do they disclose?
RQ3 What goals drive their self-disclosure?
RQ4 What contextual factors influence their disclosure?
RQ5 What technical channels do they use to disclose?

In contrast to previous interview approaches, we conducted an online survey to obtain data from a potentially larger number of Social VR users. By choosing this approach, we eventually contribute to the still-emerging domain of Social VR research by increasing the representative value of our results. Approaches like ours and previous works that reach out to current Social VR users directly provide insights into the actual day-to-day usage patterns and experiences. These insights enable us to grasp the potential significance of Social VR for satisfying basic social needs today and in the future induced by social interactions like self-disclosure. Further, understanding users' rules dictating their disclosure of personal data in Social VR is mandatory to inform the design of safe and healthy virtual spaces, given current public controversies on the general handling of user-generated data in virtual reality [24, 66]. Additionally, our work is timely as the COVID 19 pandemic has reshaped our world with its far-reaching social distancing measures, which significantly increased the need for alternatives to physical meetings and also revealed issues with existing technical solutions [5]. Furthermore, investigating these questions in particular in the context of Social VR contributes to the basic understanding of social interactions in virtual environments that may become part of the future metaverse. The metaverse refers to a concept of a persistent digital world that converges technologies like AR and VR with physical reality and succeeds the internet of today. The term goes back to the 1992 novel *Snow Crash* by Neal Stephenson [73], and is currently broadly discussed in public after the restructuring of *Facebook*, which now belongs to the parent company *Meta* [56, 81].

2 BACKGROUND

In this section, we briefly review the literature on the basics of self-disclosure and provide some examples of how computer-mediated communication introduces technical characteristics that influence how people engage in self-disclosure. As our goal is not to compare self-disclosure in Social VR directly to other forms of computer-mediated self-disclosure, we do not provide a broader and nuanced review of literature in this area. Subsequently, we summarize the current Social VR literature landscape, emphasizing the role of Social VR for interpersonal relationships so far and in the future. Lastly, we discuss the few existing insights on self-disclosure in Social VR and explain our work's contribution to this limited research domain.

2.1 Self-disclosure

Self-disclosure is the verbal or non-verbal revealing of personal information to others [20, 29, 38, 61, 84]. The revealing of personal thoughts, experiences, and feelings stimulates basic needs for social connectedness and involves neural and cognitive activities associated with feelings of reward and thus is intrinsically rewarding [78]. Derlega and Grzelak (1979) described five main motivations of self-disclosure in their functional theory (as cited in [61]): social validation, relief of distress, relational development, identity clarification, and social control. Depending on situational cues and individual attributes, one or several of these motives eventually motivate people towards self-disclosure as a means to achieve social rewards. Thereby, the process of disclosing personal information is always a balancing of the possible rewards and the risks posed by the potential vulnerability of revealing sensitive personal information to others [2, 20]. As a strategy to maximize beneficial disclosure outcomes and minimize its risks, establishing a dyadic boundary surrounding oneself and trusted recipients within a safe environment functions as a privacy control mechanism. Within such a boundary, intimate disclosures are most likely to happen in conversations with close friends or with strangers [20].

Literature categorizes types of self-disclosure behavior along various dimensions such as the depth or intimacy of information, breadth or thematic diversity of information, the duration, frequency, authenticity, or the willingness to disclose [2, 12, 38, 64]. Further, self-disclosure literature provides many findings and ongoing discussions on various factors that influence self-disclosure. However, as a detailed review would be out of this paper's scope, we instead refer to a literature overview by Ignatius and Kokkonen [35] that define three broad categories of potential influencing factors: characteristics of the disclosing like their motivation and mood, characteristics of the recipients like the relationship to them, their age, perceived status, or number of recipients, and situational factors like the environment's aesthetics, interpersonal touch, cultural context, or the used communication channel.

Self-disclosure is inherently integrated with the development of social relationships according to the Social Penetration Theory [2, 14]. This theory explains how social relationships deepen over time and move from casual, superficial encounters to intimate and meaningful, long-lasting relationships. Thereby, self-disclosure functions as a fundamental driver for relationship development, as with the reciprocal act of disclosing personal information, people get to know each other better [2, 14]. Accordingly, disclosing personal information and the type of disclosed information determines how fast and in what direction a relationship develops. The onion model is a popular metaphor that describes the interrelationship between self-disclosing different types of information and interpersonal bonding [14]: just as an onion can be taken apart layer by layer until its core, more and more personal and intimate information about each other is revealed along the development of a relationship. Thereby, outer layers can be associated with superficial, less intimate information typically disclosed early in relationships, such as likes and dislikes in clothing and music. Middle layers reflect more intimate topics, like political views, personal goals, spiritual values, or deep fears, typically disclosed later in relationships. The innermost layer, i.e. the core, represents the most intimate information related to one's concept of self or core personality. People share this information usually with significant others, close friends, or close family members that represent the final stages of relationship development (Taylor & Altman, 1987 as cited in [14]).

2.2 Computer-mediated Self-disclosure

Today, communication technologies play an essential role in interpersonal communication and thus are also an established instrument of self-disclosure. Although the scientific discourse does not readily permit general statements about the differences between

face-to-face and computer-mediated self-disclosure, there is consensus that specific technology-induced key characteristics moderate online self-disclosure [60, 71]. This section only provides a brief overlook over selected affordances of modern computer-mediated communication that are typically discussed in self-disclosure literature.

A crucial characteristic is the varying degree of anonymity that some systems provide over different communication channels (e.g., social network sites, forums). Thereby, an increase of anonymity may promote disclosure of intimate information as a result of the perception of increased comfort, and lower accountability [7, 15, 36, 75]. Also, the absence of social cues, like non-verbal communication signals, or low degrees of perceived social presence (e.g., in text-based vs. avatar-based interaction) are assumed to promote self-disclosure on different dimensions as it reduces the perceived uncertainty caused by the missing of social cues [6, 71, 82]. Another critical feature often provided by media that allow asynchronous communication is the editability of messages before and after the actual disclosure. Editability enables a conscious and strategic selection, as well as the composition of different self-disclosing media content, which can paint a particularly filtered self-image [22, 83]. Further, platforms like *Facebook* integrate communication channels that allow users to engage in dyadic contexts similar to face-to-face situations (e.g., through private messages) or in large-audience contexts that have no face-to-face equivalent (e.g., broadcasts to an anonymous public through status updates). Users choose different channels for self-disclosure depending on the anticipated social rewards: e.g., social validation is mainly achieved by public status updates, whereas private messages instead account for relation development [9]. More generally, ubiquitous access via mobile communication devices allows for a constant low-threshold opportunity to reveal oneself to others and to be aware of others' disclosures [51]. However, while online self-disclosure induces positive feedback loops with beneficial psychological outcomes [3, 43], the characteristics above can also have significant negative consequences arising from tendencies to compulsive self-disclosure behavior [21].

Unlike the aforementioned types of sociotechnical systems that typically involve self-disclosure via text-based communication, other systems like online games often utilize avatar-based interaction within a synchronous communication context, introducing other types of affordances. In particular, animated, anthropomorphic avatars add a layer of natural non-verbal communication cues, like gestures, postures, or mimics, depending on the fidelity and mode of control of the system at hand. Further, avatars can often be individualized in terms of visual traits, allowing users to create a virtual representation of themselves that may identically reflect their physical appearance or consciously differ from it. Accordingly, scholarship demonstrates avatars' longstanding ability to satisfy the need for expressing and presenting one's self online [16, 19, 31, 41, 63]. However, avatars affect not only the types of communication channels that are available for self-disclosures but can also affect self-disclosure itself in subtle or unconscious ways. For example, perceived avatar-self similarity in terms of appearance and psychological and behavioral attributes may promote or inhibit self-disclosure as a function of induced feelings of either self-presence or identifiability within a virtual environment [34]. Further, based on the popular *Proteus Effect* self-avatar perceived attributes, like one's avatar's attractiveness, can affect one's self-disclosure behavior: e.g., controlling a more attractive avatar leads to more intimate self-disclosures compared to controlling a less attractive avatar [87]. Furthermore, avatars are not only relevant for how we disclose but also for how we perceive others' self-disclosure. Accordingly, a study comparing the perception of video-based and avatar-based self-disclosure found that an avatar-based disclosure can be perceived as authentic as a video-based disclosure of an actual human and also induce comparable levels of empathy [69].

After we have exemplified in this short overview that technological affordances can impact self-disclosure, in the next section, we introduce Social VR, a popularity-gaining genre of applications based on avatar-mediated interaction.

2.3 Commercial Social VR

Social VR refers to a genre of commercial multi-user VR applications that enable remote users to interact with each other in shared virtual environments through VR technology (e.g., immersive head-mounted displays). Within these virtual social worlds, users are commonly represented by avatars which they control with their body movement due to tracking technology [53, 54, 65]. Since 2015, Social VR applications have grown in popularity and today are, in fact, predominantly used to socialize with others [76]. Popular platforms include *Altspace VR, VRChat, Horizon Worlds*, and *RecRoom*. These platforms are owned by companies like *Microsoft, HTC*, and *Meta* (formerly *Facebook*), which indicates the commitment of large technology companies towards potentially reshaping the future of mediated interpersonal communication. Despite fundamental similarities, a brief look at these applications shows that they can roughly be distinguished based on the specifics surrounding their implemented avatar systems and the number and types of different activities users can engage in. Early Social VR literature provides a high-level analysis of different platforms' avatar-systems [40]. It illustrates how different applications provide varying capabilities related to, i.a., in-world avatar customization, avatar import features, the use of humanoid or other avatar styles, or the support of communication features like automated facial expressions [40]. Activity-wise, recent literature illustrates that Social VR users engage in diverse social and entertainment activities provided by such platforms [8, 44, 76]: having conversations, hangouts or intimate meetings with strangers or known others in private or public spaces, playing integrated or community-made games, creating and exploring different worlds, watching video content, listening to music, gathering for social events like parties [8, 76]. Interestingly, users not only show usage patterns that are directly attributable to the available platform features (e.g., world creation with creation tools). They also describe use cases that were probably not intended by the platforms' creators, such as sleeping in *VR Chat* within user-created so-called sleep worlds [44].

Social VR applications are rooted in the domain of collaborative virtual environments [11], and, although it is still an emerging consumer application genre, the current literature on this specific subject is already diverse. It includes literature that aims to systematize the landscape of commercial Social VR design practices (e.g., [37, 40, 53, 79]), as well as an increasing body of work that focuses

on specific aspects of user behaviors and experiences for example, in the context of harassment [13], different user groups [1, 45, 46], general user motivations [44, 76], usability issues [42], relationship building during COVID 19 global pandemic [48], and psychological benefits induced by platform engagement [8].

In sum, previous research indicates that Social VR offers a variety of social experiences comparable to face-to-face interactions in terms of verbal and non-verbal expression capabilities in group or intimate contexts [44, 49, 49, 53, 54, 58, 89]. In particular, Social VR affords rich non-verbal interactivity which mimics that of the offline world, including gazes, nods, and other forms of naturalistic behavior [49]. Moreover, recent work found initial empirical evidence for associations between facets of Social VR engagement and psychological benefits like feelings of relatedness, self-expansion, and enjoyment [8]. Thus, Social VR's promise is the access to authentic and meaningful social interactions over distance [8, 25, 44, 48, 76, 89]. This promise is relevant not only in times of limited opportunities for real-world social interaction but also in cases where individual people may not be capable of engaging in face-to-face social interaction. That it has potential to fulfill this promise has been demonstrated in previous work on its capabilities to support meaningful relationships [25, 48, 89, 89] and interactive social experiences [44, 48]. It also satisfies social needs [76] and has beneficial psychological outcomes [8]. Moreover, recent trends in research indicate that Social VR can even introduce novel social experiences in the future as it provides fundamentally different approaches to mediate social interaction experiences. For example, by augmenting familiar social cues with virtual social artifacts (e.g., adding visual effects to virtual high-fives) [52, 68, 77]. Concluding, as self-disclosure is an essential part of social interaction and relationship building, by studying it in the context of Social VR, we aim to advance the understanding of how users create meaningful social interaction and bonds in Social VR.

2.4 Self-disclosure in Social VR

Social VR shares similarities with other online non-VR platforms we described in section 2.2 in the way people can communicate with each other. For example, users in Social VR can remain anonymous, can have representations of varying realism and style, can communicate with each other asynchronously via text messages, and can disclose to only few individuals or larger groups of users in private as well as public contexts. Though, as Social VR is primarily designed for synchronous social interaction via VR technology, other aspects from social network sites or forums, like the editability of messages and ubiquitous access to the platforms may be less prevalent. Further, Social VR platforms offer a variety of social activities based on real-time interactions, that may introduce novel social contexts for self-disclosure, that are not realizable on other platforms.

However, the most outstanding difference between Social VR and other venues of computer-mediated social interaction like social network sites and non-immersive virtual environments, is that users interact with each other while being immersed in a virtual environment that they perceive from a first-person perspective, and where they embody and control an avatar. As such, Social VR presents a naturalistic opportunity for self-disclosure which nearly mimics that of the offline world. Current applications already enable diverse channels of specific non-verbal communication cues [79] and the simulation of intimate interactions like virtual body contact (e.g., hugs, holding hands, and dancing), which may lead to new forms of computer-mediated self-disclosure that resemble experiences from face-to-face interaction but are not supported by other technologies. Further, more recent work indicates that avatar-based communication in VR could combine beneficial impacts of anonymity of online communication with experiential qualities of face-to-face interaction [4, 67, 69].

While avatar-based communication in Social VR introduces its own technological affordances that may impact relationship building through self-disclosure, only one study, to the best of our knowledge, has investigated modes of self-disclosure in commercial Social VR so far [50]. This work conducted 30 in-depth user interviews focusing on the type of information shared and to whom users disclose while emphasizing users' privacy concerns introduced by the applications' technological affordances. The findings demonstrated that users feel comfortable disclosing both personal and emotional information and detailed that Social VR requires trade-offs relating to revealing information to better use the system. These trade-offs also reflect, that Social VR provides new ways of wanted or unwanted self-disclosure by implicitly embedding disclosure of gender-related information or body capabilities in the system by using voice chat and body tracking. Thereby, people differed in their decision to disclose only to others they are already familiar with, or only to anonymous others they do not know. Relating to the factors contributing self-disclosure [35], these findings provide initial evidence, that in Social VR characteristics of the recipient (relationship with him or her), and situational factors (different communication channels) affect self-disclosure decisions. Though, there are further potential recipient and situational characteristics that may impact self-disclosure and relate to Social VR features recently investigated or highlighted in literature: access to public and private spaces [37, 54], interaction between young and old [45, 46], access to diverse activities and varying group sizes [8, 44, 76, 89]. Further, the motives behind self-disclosure in Social VR, as well as insights into what communicative affordances users utilize for disclosing themselves has not yet been addressed. Furthermore, previous findings are based on a relatively small number of users due to the applied methodology. These gaps and limitations motivate our own research questions and choice of method to naturally extend current insights and provide a broader perspective on self-disclosure in Social VR.

3 METHOD

As opposed to previous work that applied extensive interviews with only a few Social VR users [50], we decided to collect data from a larger number of users by conducting an online survey. This would allow us to increase our results' representative value and identify potential patterns of opinion and behavior related to self-disclosure shared by many users. Further, by mainly applying closed-ended questions with answer categories derived from the literature (e.g., self-disclosure goals, Social VR activities) instead of open-ended questions, we potentially increase the survey's response rate by

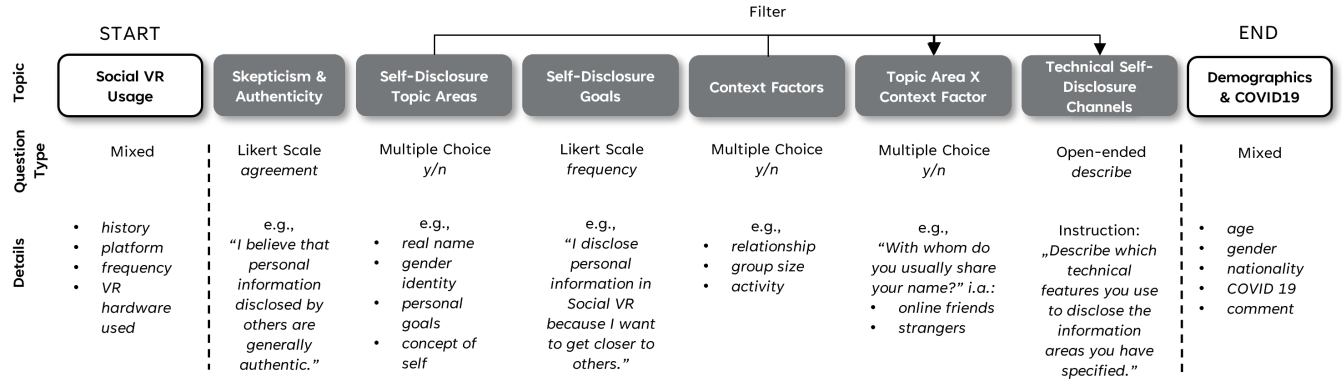

Figure 1: Survey structure with information on question types and example items for each of the survey topics.

increasing the convenience of answering the questions. In the following, we will explicate the survey design and the procedure of data collection.

3.1 Survey Design

The survey structure is illustrated in Figure 1 and is roughly composed of three major parts: Social VR usage data, self-disclosure, and demographic information.

3.1.1 Social VR Usage, Demographics & Confounding Variables. To characterize the sample adequately in terms of Social VR expertise, we asked participants to indicate when they started using Social VR, how they would characterize their usage intensity, favorite platform, and mode they use (VR vs. Desktop). They were further instructed to refer their survey responses to their favorite Social VR platform. As demographics, we assessed gender identity, age, nationality, and (as an open-ended question) identity aspects that participants thought of being relevant to the subject of interest. Further, we asked participants if their Social VR engagement started or intensified in the course of the COVID 19 pandemic and if self-disclosure in Social VR now plays a more critical role for them due to the pandemic. We included the last part to estimate any confounding effects induced by personal challenges during the pandemic situation at the time of the survey [17].

3.1.2 Skepticism & Authenticity. To assess the general opinion on self-disclosure, we asked participants to indicate their general skepticism towards self-disclosure, if they had any privacy concerns, and if they think their own and others' self-disclosure in Social VR is authentic.

3.1.3 Self-disclosure Topic Areas. We crafted a catalog of three different topic areas, including relationship-building topics, identifiers, and sexuality. In sum, participants were asked to indicate along 12 individual items whether they do or would disclose a specific information type. Topics associated with relationship-building were defined based on assumptions of the Social Penetration Theory [2, 14] and represent the types of information that humans typically disclose to others in the course of social relationship development. The topics range from information that we would disclose rather to someone we have met only recently to information we would only disclose in an intimate, long-lasting relationship. Accordingly, we assumed that participants would implicitly associate the different topics with different degrees of intimacy. They were asked to indicate if they disclose or would disclose information from the following topic areas, ranging from lower to higher degrees of intimacy: lifestyle preferences, goals and aspirations, religious and political convictions, fears and fantasies, their concept of self. The topic area identifiers included external contact information, residence information, physical appearance, and real name. Recent research on LGBTQ+ communities in Social VR [1] motivated the inclusion of the sexuality category, which contains the information types biological sex, gender identity, and sexual orientation. Identifier and sexuality information reflect aspects of one's identity and anonymity directly related to technological affordances of avatar-based interaction in Social VR (e.g., use of custom user names and avatars and voice chat).

3.1.4 Self-disclosure Goals. To assess what social rewards drive self-disclosure in Social VR, we created five items based on the functional approach to self-disclosure [61] that assess how often each of the following goals drives self-disclosure in Social VR: self-expression, relationship development, social validation, social control, identity clarification.

3.1.5 Context Factors. We chose to include several Social VR features recently investigated or highlighted in Social VR literature as potential influencing factors on self-disclosure. Each of these factors represents social contexts in which social encounters in Social VR typically happen. Further, these factors relate to general influencing factors of self-disclosure in other contexts based on the literature review. As socializing is one of the key motivations for Social VR engagement [76] and relationship to others affects self-disclosure in face-to-face interaction [2, 14, 35] we included the relationship to others as one contextual factor.

As Social VR applications typically grant access to either public or access-controlled private spaces [37, 54], we included the privacy of a virtual space as another contextual factor. This feature relates to the privacy control mechanism of establishing dyadic boundaries as safe spaces for self-disclosure [20].

We considered the conversation partner's age as a relevant context factor, as Social VR practically does not restrict usage to specific age groups, and previous work found that adult-minor interaction underlies complicated dynamics in Social VR [45, 46]. Age is also a potential impact factor of self-disclosure [35].

Due to the diversity of activities offered in Social VR [76], social encounters can happen in a dyadic, small group, or large group contexts, which can impact self-disclosure in face-to-face contexts [35]. Thus, we also included the context factor group size and the activity type in the survey.

For each f the factors, participants were asked to indicate if it affects their decision to self-disclose in their favorite Social VR application. Additionally, they could indicate other contextual factors that were not reflected in our pre-selection.

3.1.6 Topic Area X Context Factor. For each context factor, we further derived specific social contexts that would allow us to understand how each factor may influence self-disclosure. Participants were asked to indicate if they would disclose certain information in a specific context filtered by the possible combinations of the topic areas and context factors they indicated earlier in the survey. For example, if participants indicated to disclose information related to their self-concept and that the privacy of a virtual space affects their disclosure decision in general, they had to indicate if they disclose information related to their concept of self in the following contexts: private spaces, public spaces.

3.1.7 Technical Self-disclosure Channels. As Social VR provides several channels for self-disclosure that may be used voluntarily or forced [50] and extend disclosure opportunities usually provided in other social online worlds (e.g., natural gesture-based communication) or face-to-face conversation (e.g., emotes), we asked participants to think about the technical channels they use to disclose the information they indicated earlier in the survey. As opposed to the previous survey sections, we decided to apply open-ended questions in this section, as previous work explicates that users may use certain platform features in ways other than those intended by developers or researchers (e.g., sleeping in VR [44]). By asking open-ended questions, we prevent participants from being influenced by only asking them about channels we expect them to use and preserve the opportunity to identify novel ways of self-disclosure that users may have devised in Social VR.

3.2 Data Collection

We advertised this survey in several channels related to Social VR, VR, and sample recruiting via posts on *Reddit*, *Discord*, *Facebook*, and a *WhatsApp* group we got invited into by Social VR users. Participants were required to be at least 18 years old and be actively engaged in a Social VR app (e.g., Recroom, VR Chat, Neos VR) at the time of the survey. We asked admins for permission before posting survey links in each community. After the first two weeks, we have made a re-post, accompanied by already collected statistics on general sample information (e.g., survey completion rate, Social VR usage statistics, and the favorite platforms so far) to maintain community attention. Eventually, we did a second re-post after two months in the *AltspaceVR, Bigscreen, Neos VR, RecRoom*, and *VRChat* community to achieve a more balanced data set in terms of Social VR platforms. Data collection lasted from mid-May to the end of July 2021.

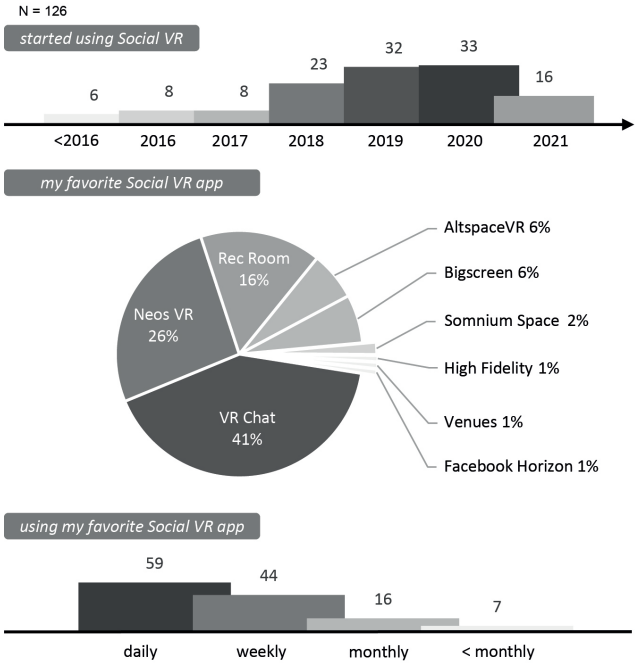

Figure 2: Social VR usage habits of the sample.

We hosted the survey on a custom installation of the survey application *Lime Survey*. There was no compensation for participation. The first author's faculty's ethics committee approved the survey and we followed the ethical considerations for Social VR research outlined in Social VR Literature [47].

3.2.1 Data Exclusion Criteria. Participants were excluded from the analysis if their responses met one of the following criteria: empty data set, indicated being under 18 years old, using Social VR mainly in desktop and not VR mode, indicated a VR app that we do not refer to as Social VR (e.g., Beat Saber), left survey before technical self-disclosure channels part, too short processing time measured against average survey time, presence of obvious non-serious answers in open-ended questions.

4 RESULTS

From 221 survey responses, we obtained 126 complete and 95 incomplete responses. To increase the data for analysis, we also decided to include incomplete datasets that only missed demographic data, as we did not aim to search for associations between these and other data in this initial investigation of the topic. After checking all entries against exclusion criteria, we ended up with **126 valid responses**.

4.1 Demographics, Social VR Usage & COVID

Among the 126 valid entries, 107 participants indicated their gender identity: 77 cis male, 14 cis female, 11 non-binary, five transgender female. Five participants indicated to be unsure about their gender

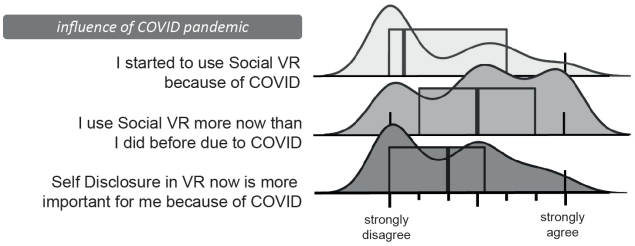

Figure 3: Combined density and box plots illustrating answer distribution regarding the impact of the COVID 19 pandemic on Social VR usage habits.

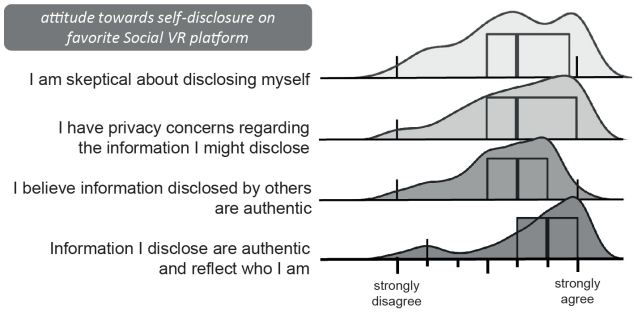

Figure 4: Combined density and box plots illustrating answer distribution regarding the general attitude towards self-disclosure in favorite Social VR application.

identity or gender-questioning. Age ranged from 18 to 60 years (n=107) with an average age of 28.35 years (*Mdn* = 26). Most participants lived in North America at the time of the survey, with 62 from the United States of America and nine from Canada. One participant each lived in Mexico and Brazil. Thirty-two participants lived in Europe, with most of them in the UK (8), Germany (6), Poland (4), Sweden (3), Netherlands (2), Denmark (2), and one participant each in eight other European countries. Six participants lived in Australia.

Figure 2 illustrates the sample characteristics in terms of Social VR usage habits. 64.3% started using Social VR in 2019 or later. 83% indicated either *VR Chat*, *Neos VR*, or *Rec Room* as their favorite Social VR app. Six other applications were each indicated by less than ten people. 46.8% indicated to use their favorite Social VR app daily and 34.9% weekly.

The COVID 19 pandemic seems to have affected the Social VR usage habits of some participants (see Figure 3). 58.9% slightly or strongly disagreed with having started Social VR because of the pandemic (*Mdn* = 1.5). 46,4% slightly or strongly agreed that the pandemic increased their Social VR engagement (*Mdn* = 4). 25% agreed that self-disclosure in Social VR got more important for them because of the pandemic (*Mdn* = 3). However, response ranges of all three questions cover the entire scale and indicate inter-individual differences among participants.

4.2 General Opinion

Overall, the general attitude towards self-disclosure in Social VR was ambivalent as many participants tended to agree with negative as well as positive statements (see Figure 4). 60.3% of participants at least slightly agreed to be skeptical (*Mdn* = 5) and 64.8% slightly or strongly agreed to have privacy concerns (*Mdn* = 5) regarding disclosure of personal information on their favorite Social VR platform. 57.1% slightly or strongly agreed with perceiving others' information disclosed to them being authentic (*Mdn* = 5) and 79.4% slightly or strongly agreed disclosing authentically to others (*Mdn* = 6). However, the response ranges of all questions cover the entire scale and indicate inter-individual differences among participants.

4.3 Topics of Self-disclosure

Overall, participants indicated to disclose all of the queried information categories. However, the topic areas partly differ significantly in the number of participants who disclose.

On average, identifiers like external contact information, one's physical appearance, and one's real name, are the topic areas that least participants are disclosing on their favorite Social VR platform (around 35%)(Figure 5). However, over half of participants would share residence-related information (e.g., country or area of residence).

Sexuality-related information tends to be disclosed from most participants on average (<73%).

Information pertaining to relationship building is revealed by varying numbers of participants. Most participants disclose lifestyle preferences (92.06%), and personal goals and aspirations (74.60%). Less than half of participants disclose religious and political convictions, and fears and fantasies (each 38.89%). However, roughly half of participants disclose or would disclose information related to their concept of self.

4.4 Goals of Self-disclosure

Self-disclosure seems to be variably motivated by different goals (Figure 6), though all goals included in the survey seem to drive self-disclosure to at least some extent.

Overall, getting closer to others (*Mdn* = 5), and getting oneself and others to understand oneself (*Mdn* = 5) seem to be most often the motivation behind self-disclosure for most participants. However, the other goals are also at least sometimes relevant for 50% of the participants (each with *Mdn* = 4). Comparing the distribution patterns of responses for each goal, relieving distress, and influencing others' self-disclosure behavior have the most responses below sometimes and thus a subtle tendency towards being less relevant than the other goals. Further, distribution information indicates partly significant inter-individual differences, as response ranges cover the entire scale for all goals.

4.5 Importance of Context Factors

Figure 7 illustrates the general importance of the context factors relationship, privacy, age, group size, and activity based on relative

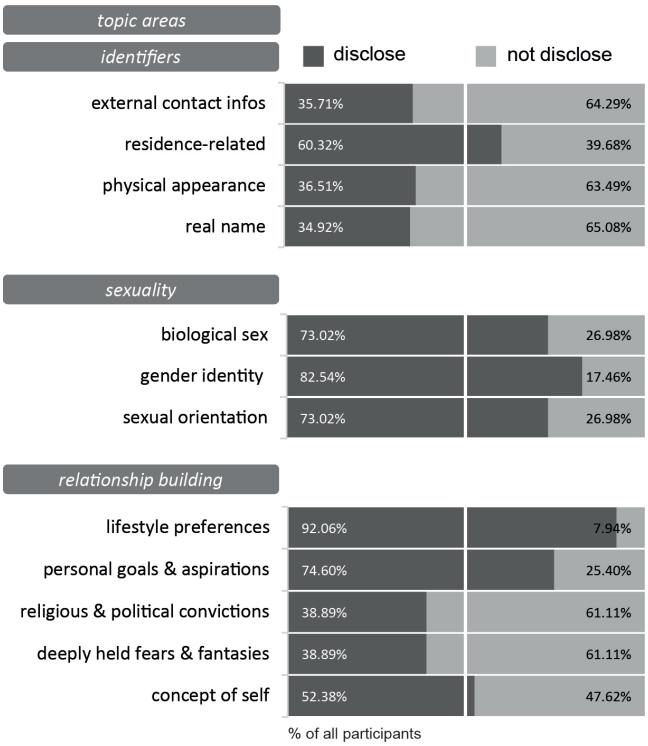

Figure 5: Relative frequencies for how many participants reveal different information on their favorite Social VR platform.

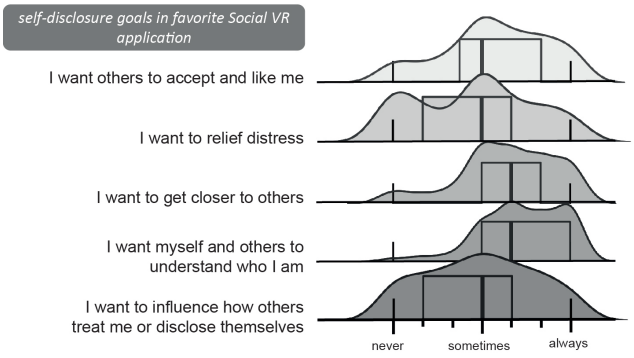

Figure 6: Combined density and box plots illustrating answer distribution regarding how often self-disclosure goals motivate self-disclosure on favorite Social VR platform.

frequencies of participants' answers. The bar chart of Figure 7 illustrates the relative frequencies of how many participants indicated that a factor is important to them when deciding to disclose in general. In summary, each of the assessed factors is important for at least some participants, as each factor was indicated as such by over 50% of participants. Though, relationship to the communication partner seems to be most important, as it was indicated by most of the participants (91.27%), followed by the privacy of the virtual environment (73.02%), the conversation partner's age (65.08%), the group size (60.32%), and the activity in which communication takes place (57.94%).

16 participants indicated additional factors that influence their disclosure decision that we synthesized to the following seven categories: the general impression of the communication partner (4 mentions), contact opportunities on other digital communication platforms (3 mentions), influence from drugs like alcohol (3 mentions), perceived reciprocity (3 mentions), perceived geographical background of partner (2 mentions), the current conversation trend (1 mention), and the perceived platform security (1 mention).

Complementing the bar chart, a heatmap in Figure 7 illustrates the importance of each factor for disclosing the different types of information. It is crucial to note that the % values in the heatmap are relative to the individual subsets of participants that indicated they would disclose the cell row's topic (illustrated in Figure 5). We deliberately decided not to indicate frequencies relative to the whole sample, as this would not reflect the survey structure. As described in the Methods section, we designed the survey to ask respondents only about topic-factor combinations resulting from their respective individual statements about the topics they disclose and the factors that influence them. Thus, the cell values indicate the number of participants of aforementioned subsets, that indicated later in the survey to disclose the corresponding information only in some of the specific contexts associated with the context factors (e.g. people that disclose their real name only in private but not in public environments or vice versa). In general, the higher the value, or the darker the hue of a cell in the heatmap of Figure 7, the more people indicated with their response pattern that the respective context factor is important for their disclosure decision. In other words, the darker a cell's hue, the higher the probability that the disclosure of the type of information depends on the context factor, or, the more important the factor seems to be for the disclosure decision. Thus, the heatmap effectively identifies general patterns of the factors' relevance for individual topics. Based on this color-coding a brief look at the heatmap indicates, that relationship seems to be of particular importance for disclosing identifiers, personal goals and aspirations, fears and fantasies, and the concept of self. In contrast, age consistently appears to be somewhat less important for the disclosure of each topic. Regarding the other factors, no specific pattern occurs in the heatmap. Though, it can be summarized that based on values from 20% to around 50%, each context factor seems to influence the self-disclosure of individual topics to some degree.

4.6 Self-disclosure in Different Contexts

Figure 8 illustrates what kind of influence the contextual factors have on the disclosure of individual pieces of information and shows in which specific contexts of their favorite Social VR application participants disclose certain information. For this purpose, we present relative frequencies in a heatmap to reveal general patterns of the context factors' influence. As with the heatmap in Figure 7, the cell values do not refer to the total sample but to individual subsets of participants according to the information they disclose and factors that influence them. Though, Figure 8 uses a diverging color-coding

Figure 7: Relative frequencies of which factors impact self-disclosure decision in general (bar chart) and for specific topics (heatmap).

consisting of blue hues for high values, yellow hues for medium, and red hues for low values. Generally speaking, blue areas in the heatmap indicate contexts where many participants would disclose certain information, whereas red areas indicate contexts where many participants would not disclose certain information. Accordingly, yellow areas represent contexts where no obvious preference can be identified.

In summary, there are some clear patterns of self-disclosure behavior for each of the context factors in the sense that there are specific contexts in which disclosure is either more or less likely to happen than in other contexts. These patterns are illustrated in the heatmap by consistently colored columns, whereby there are both blue and red-colored columns within a context factor area. In the following, we briefly summarize the patterns of self-disclosure for each context factor.

4.6.1 Relationship. In terms of the type of relationship, the heatmap shows a clear tendency for self-disclosure to be more likely if the recipient was known better. More precisely, participants for whom the relationship is important to disclose a particular topic would probably disclose it to people they know better. This pattern is illustrated in the columns associated with friends (online and offline), which contain higher values than those associated with loose friends, which have higher values than the stranger column. Further, there seems to be a slight tendency for disclosing information pertaining to sexuality and relationship-building to people only known online rather than to people also known offline (e.g., sexual orientation, fears and fantasies).

4.6.2 Privacy. Most people willing to disclose a particular topic depending on the privacy of the virtual environment would do so in a private space with regulated access and rather not in a public space. Though, information regarding one's biological sex, gender identity, and lifestyle preferences are comparably likely to be disclosed in public or private virtual spaces without a clear tendency towards a positive or negative disclosure decision.

4.6.3 Age. Those participants that base their disclosure decision on the age of the conversation partner do so in clear patterns. Across all topic areas, self-disclosing to younger people is not preferred, whereas disclosure to same aged and older people is very likely, with a slight preference for same-aged people.

4.6.4 Group Size. A clear pattern of disclosure preferences is also revealed for the context factor group size: The bigger the group of potential recipients, the less likely it is that people disclose personal information. Thereby, the heatmap reveals a clear preference of dyadic or small group contexts over groups of more than 10 people where it is unlikely that people disclose personal information. This pattern is consistent across all information categories. However, external contact information seems to be only disclosed in dyadic contexts. Similarly, fears and fantasies, and the concept of self, also tend to be disclosed rather in dyadic contexts than in small groups.

4.6.5 Activity. Those who disclose certain topic areas depending on the activity context also do so in certain patterns: hangouts and intimate get-togethers are activities where participants would most likely disclose personal information. Although there are some information categories without a clear preference for or against other specific activity contexts (e.g., identifiers during gaming or lifestyle preferences during world exploration), the heatmap reveals a tendency against disclosure of personal information during other activities than hangouts and intimate get-togethers.

4.7 Technical Channels of Self-disclosure

84 participants provided free-text responses regarding the technical channels they typically use to disclose the information they indicated earlier in the survey. In total, these 84 participants provided 446 responses, from which we derived the categories conversation, avatar, profile, environment, external apps, and media. Figure 9 illustrates relative frequencies of how often the individual categories were mentioned. We assigned answers to several categories when appropriate. A clear majority of responses describe how participants disclose information verbally, i.e., they talk about it. A large proportion of the participants that provided answers specified this

Figure 8: Heatmap that illustrates self-disclosure decisions in different contexts.

and referred explicitly to voice chat, but in some cases also to a conversation via text chat. Still, 16% of participant responses referred to the avatars in general or specific aspects of the avatar system, such as appearance, gestures, and poses, or its locomotion, when describing how they disclose personal information. All other categories of technical channels were only addressed in less than 10% of the responses. These include disclosing information via images and text in user profiles, or via the virtual environment, such as designing it or interacting with specific objects in it. Furthermore, responses occasionally referred to disclosing via external applications, such as *Discord*, *Facebook*, or *Twitter*, and disclosing via sharing specific media such as images or music.

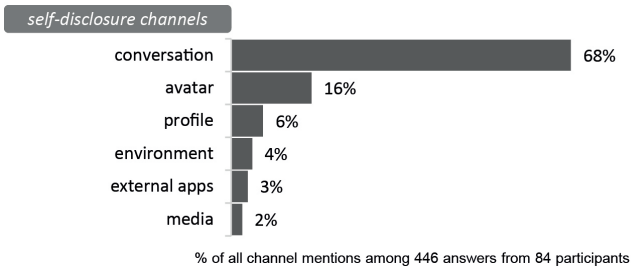

Figure 9: Relative frequencies of the indicated technical channels of self-disclosure.

5 DISCUSSION

Self-disclosure inherently integrates with establishing and maintaining interpersonal relationships. We thus set out to investigate how Social VR users disclose personal information to identify basic patterns of socializing in Social VR. We directly addressed the limitations of previous work on self-disclosure in Social VR with our work. We can now provide broader insights into general opinions on and patterns of self-disclosure behavior in commercial Social VR applications.

5.1 Key Insights

Answering our research questions, we summarize the following main results: **RQ1**: Our results indicate that Social VR provides access to authentic connections with others despite user skepticism and privacy concerns. **RQ2**: We observed that information that breaks anonymity, such as real names, and topics associated with more intimate aspects of oneself, seem to be shared less commonly. Most commonly, sexuality-related information, as well as lifestyle preferences, are disclosed. Though, over a third of users would disclose information related to personal identification, sexuality, and diverse topics of presumably varying degrees of intimacy. **RQ3**:

While different social rewards may motivate self-disclosure in Social VR, relational development and identity clarification seem to be most important for most users. **RQ4**: Accordingly, the relationship to others impacts disclosure-decision of most participants, in particular for topics of higher intimacy and those that break anonymity. However, the privacy of the virtual environment, age of recipients, the group size, and the activity context are also relevant contextual factors that impact the disclosure decisions of at least half of the participants. Further, if participants base their disclosure decision on one of the context factors, they do it in clear patterns. Accordingly, specific contexts where disclosure is most likely to happen are interactions with friends or acquaintances, in private spaces, with same-aged or older people, in dyads or small groups, and during explicitly social activities like hangouts and intimate get-togethers. **RQ5**: Thereby, self-disclosure happens mainly verbally through conversation.

These findings represent, in particular, an extension of insights on self-disclosure in Social VR previously collected in only one study [50]. As most of our participants indicated the relationship to someone as an important influencing factor for self-disclosure, we see the previously described pattern of disclosing depending on familiarity confirmed [50]. This becomes especially clear again in our results on self-disclosure in different types of relationships (Figure 8). Further, as we found the relationship not being equally relevant for the disclosure of different topics (Figure 7), our result also aligns with the pattern described previously, that some participants are open to sharing information with anyone [50], though, we would conclude that this behavior pattern only applies to a minority of users. Similarly, we did not find clear evidence for another pattern described previously: utilizing anonymity for disclosure [50]. While about two-thirds of our participants do not disclose information that would violate anonymity (Figure 5), only the very fewest of those for whom relationship type matters share any information at all with strangers. However, it should be noted that anonymity, e.g. through avatars or usernames, does not directly equate to the degree of familiarity in a relationship (for example, if you have talked to someone several times but still do not know their real name or address). Our results regarding the types of information disclosed also extend findings describing that users disclose personal as well as emotional information [50] by providing a more specific look at what different types of information are being revealed and by how many people. Last, our results also confirm an ambivalent attitude towards self-disclosure in Social VR due to privacy concerns (Figure 4) [50].

The following sections will discuss the individual key insights in more detail and elaborate on the alignment with other related work.

5.1.1 Authentic Connections Despite Skepticism. Our findings align with the previous work that describes Social VR as a medium of authentic social experiences [25, 44, 48, 76, 89]. Moreover, we argue that this general opinion rises from technological affordances that mimic experiential qualities of face-to-face interactions [4, 67, 69]. However, this authenticity is accompanied by skepticism and privacy concerns regarding self-disclosure, which is understandable since authentic information should be more worthy of protection than inauthentic information. Additionally, it could be an expression of interfering perceptions of identifiability and self-presence due to the use of avatar-mediated interaction, which can have beneficial and inhibiting effects on self-disclosure [34]. Accordingly, these concerns may further express the authenticity and emotional value of self-disclosure in Social VR. Following this assumption, the complex interplay between feeling enforced to disclose certain information to use the platform effectively (e.g., voice, movement) and the perceived risk that the platform, or other users, can capture and use this information in unintended ways [50] becomes more significant. Thus, platforms should consider the patterns of self-disclosure behavior identified in our survey to provide users with access to social contexts where they feel comfortable and safe to disclose themselves to others.

5.1.2 Disclosing Lifestyle Anonymously. Our results regarding the limited disclosure of physical **appearance** and **real names** indicate a preference of staying anonymous concerning information that would allow one's identification in the physical world. This preference aligns well with our findings regarding users' skepticism and privacy concerns and previous findings on general patterns of self-disclosure [50]. From a technological perspective, Social VR applications support and encourage a preference for anonymity as they allow the creation and use of custom usernames and avatars that do not necessarily need to reflect their physical appearance or a human at all. Though, considering advances in the creation of photo-realistic avatars that resemble users' physical appearance [62], this may become an interesting future venue for research into user preferences. Further, we see a tendency to keep social interactions inside Social VR based on limited disclosure of **external contact information**. As with the avatar systems that support anonymity, Social VR applications usually provide diverse communication channels that allow for synchronous and asynchronous communication and thus reduce the need for other communication platforms. Further, staying in one ecosystem of communication should also increase the individual control of what personal information may be shared with others. However, it is interesting to note that information related to **residence** (country, region, address) is or would be shared by around 60% of people. Since we did not distinguish between specific residence information, it is ultimately impossible to say what type of information participants were referring to here. However, since the other identifier information is or would be shared by only one-third of the participants, we assume that the participants most likely referred to approximate information that would not easily allow locating a precise residence.

While most participants disclose or would disclose information related to **sexuality**, this is mainly true for cisgender individuals, based on a retrospective look at responses when split by gender identity of participants. In particular, half of the participants who identified as non-binary showed no willingness to disclose this information; this is likely due to concerns of privacy and harassment of this particular group in Social VR [1].

Lifestyle preferences and **personal goals and aspirations** are disclosed by the majority of participants. Based on assumptions of the Social Penetration Theory[2, 14], these findings reflect that,

in particular, information that is usually disclosed early in relationships is disclosed by most participants. This could either indicate that our participants predominantly had younger relationships at the time of the survey, or that Social VR is not a place for deeper relationships or information usually associated with more intimate relationships. Though, given that most participants only have used Social VR for two or one years at the time of the survey, we would assume that our sample is likely to represent in particular users with relationships that had not the chance to last long enough yet. Further, as over half of the participants indicated to disclose information related to their **concept of self**, the most intimate information according to the Social Penetration Theory, some users at least see in Social VR a safe environment for disclosing such information (e.g., due to anonymity), independent from the relationship type. Even if we cannot make any final conclusions on the specific reasons behind disclosure or non-disclosure of certain information, or comparisons to participants' offline self-disclosures, we would interpret our findings as a further indication that Social VR, due to its focus on avatar-based communication, combines characteristics of both, face-to-face and anonymous online-communication [4, 34, 67, 69]: it mimics experiential qualities of face-to-face interaction and how relationships are established there in the course of revealing more intimate information to others, while providing measures of anonymity, that may provoke the disclosure of information types usually shared within long-lasting relationships.

5.1.3 Disclosing for Diverse Social Rewards. Self-disclosure goals can overlap and motivate the disclosure of personal information to different degrees depending on the social situation [61]. We see this assumption confirmed for Social VR but note a slight tendency toward relational development and identity clarification. The relational development goal aligns with insights described in another study that social needs, in particular, motivate Social VR engagement [76]. Further, given that socializing activities like conversations are among the most popular user activities [76] our findings indicate that users satisfy the socializing need by disclosing personal information to others, in particular. Concerning the goal to clarify one's own identity, we also notice alignment with previous findings indicating that next to social needs, needs pertaining to the self also drive Social VR engagement [76]. In addition, previous interviews revealed that the use of avatar-systems in Social VR, especially the customization features, also influence how one perceives and defines oneself [27]. Thus, identity clarification is not only reflected in the use of the avatar-system, which is a defining feature of Social VR [40] but also in the process of self-disclosure based on our results. In addition, self-disclosure in Social VR seems to serve all of the goals queried in the survey, which could motivate the assumption that Social VR users, similar to users of social networking sites, use different platform features to target individual goals [9].

5.1.4 Contexts Moderate Self-Disclosure. All context factors investigated in our survey can be considered relevant for self-disclosure in Social VR. This result is a valuable finding. It illustrates that self-disclosure in Social VR follows specific rules and patterns and results from the interplay of different contextual factors. In particular, the type of relationship stands out as a context factor, as participants coherently consider it relevant for disclosing specific types of information (Figure 7). In contrast, while also relevant for over half of the participants in general, the other context factors do not show crucial relevance for the disclosure of certain information. Though, as all influencing factors considered in our survey were indicated as relevant by at least half of participants, we conclude, that selected impact factors on face-to-face self-disclosure (e.g. relationship, age, group size) [35], moderate self-disclosure also in Social VR. Further, recently investigated key features of Social VR (e.g., private and public worlds, different age groups, various activities) also affect self-disclosure and thus how people socialize.

Our results further allow us to identify how the individual context factors affect self-disclosure decisions. In line with the assumptions of the Social Penetration Theory that self-disclosure is positively associated with the degree of familiarity between people [2, 14] those participants for whom the type of **relationship** to a potential recipient is important are most likely to share information with friends and almost never with strangers. It also aligns with recent findings on the beneficial effects of relational closeness to the audience on self-disclosure in the context of distress disclosure on social media [90]. However, those for whom the relationship is a significant moderator seem more likely to share intimate information with friends and acquaintances whom they only know online. This is not true for identifier information, however. We see this aligning with previous assumptions, that anonymity can have promoting and identifiability inhibiting effects on self-disclosure [34].

Although we did not find indications for **age** being in particular relevant for deciding to disclose specific topics, there are clear patterns of disclosure behavior for those people that base their decision on the recipients' age. Said pattern reflects a preference for revealing oneself to same-aged and older people and is consistent with findings from prior scholarship involving the co-habitation of adults and youths on Social VR platforms [45, 46]. Maloney et al. demonstrated that adults and youth do not always co-mingle well together, affecting what sort of information is disclosed to whom. For example, adults may disclose information that is not age-appropriate for youth or may choose not to disclose information because they feel that youth are listening. This sort of interactivity creates distinct tensions between these two groups, primarily since youth are known to be a large portion of the user base for Social VR platforms [46].

Similar to age, the **privacy**, **group size**, and **activity** context were also not of particular importance for disclosing specific topics. However, if it matters to a person, consistent patterns predict a positive or negative disclosure decision. Thus, regardless of the topics, with few exceptions, private environments, in particular, are used for self-disclosure. In contrast, public environments are only considered for sharing superficial or partly sexuality-related information. Fittingly, predominantly dyads or smaller groups seem to be appropriate contexts, rather than groups of over ten people as often found in public lobby spaces. Activity contexts appropriate for self-disclosure are predominantly explicitly social occasions, such as hangouts or intimate get-togethers. All other contexts explicitly oriented towards other activities, such as gaming or video watching, seem rather inappropriate. Overall, these patterns strongly correspond to the reported skepticism and privacy concerns, and general face-to-face communication strategies for controlling the context

of self-disclosure [20], as they reflect the establishment of dyadic or small group boundaries within private environments [20].

5.1.5 Unused Disclosure Channel Potentials. Our results show that users mainly use the verbal channel, i.e., voice chat features, to disclose personal information, and thus illustrate how Social VR mimics experiential qualities of face-to-face interaction [44, 49, 49, 53, 54, 58, 89]. However, this focus on verbal communication also illustrates a yet to explore space of opportunities for communication affordances beyond what reality has to offer (e.g., augmentation of virtual social interaction) [52, 68, 77]. We suggest that researchers, developers, and users alike should engage in the exploration of that design space to extend opportunities for self-disclosure beyond features already offered by avatar customization in current Social VR applications that promote identity-exploration [27].

5.1.6 Value Beyond COVID?. Eventually, we cannot conclusively assess the potential impact of the COVID 19 pandemic. Although some participants used Social VR more during this time than before, the data tend to argue against the increased importance of self-disclosure in Social VR during the pandemic, thus supporting assuming that our results are representative for times before and after the pandemic.

5.2 Limitations & Future Directions

Our work has several limitations that we reflect on in the following. Due to the applied method as well as recruiting of participants via *Reddit* and similar platforms, the core limitation of our study is a homogeneous sample in terms of the platforms and demographic groups it represents. Further, our recruiting process led to a convenience sample that tends to represent Social VR users who also engage on the platforms where we advertised the survey. Thus, we cannot make any definitive assumption about Social VR users that do not have the following attributes: cis male, from the US or other western cultures, do not use *VR Chat* or *Neos VR*, do not engage on *Reddit* or *Discord*. Further, as the platforms themselves do not publicly share social VR user demographics, we cannot conclusively assess how representative our sample is of the actual population of Social VR users. Though this issue also applies to other Social VR research that uses the same recruiting strategy as we did, e.g., [8, 44, 76], and researchers have yet to find solutions to this problem.

Our results do not provide a comprehensive understanding of all facets of self-disclosure in Social VR but must be considered with the following limitations. As we assessed self-report data outside of Social VR and the subject of investigation, i.e., self-disclosure, our results' validity is limited by participants' ability to reflect on their behavior in Social VR actively. Consequently, we only provide a user-filtered high-level perspective on a series of potentially complex interrelationships. Further, as we mainly used closed-ended questions based on already known concepts from the literature, our results do not provide insights into how self-disclosure in Social VR is based on novel concepts exclusive to this medium (e.g., novel topics, goals, or influencing factors). Thus, our results can only guide discussion of familiar concepts in the context of Social VR. Furthermore, the generical description of categories of topic areas in the survey may have caused participants to have interpreted the categories not as intended. We also did not assess user characteristics beyond demographics and Social VR usage and thus can not conclude the impact of personality traits. These limitations are grounded in the deliberate reduction of survey length and complexity to achieve a greater response rate. As we wanted to reach intrinsically motivated participants, we did not offer any compensation for participation. However, we nevertheless needed to balance the anticipated participant effort, achievable level of detail, and validity of the insights.

These limitations directly translate into suggestions for future work: (1) The collection of data that informs about the demographics of the Social VR user population. (2) Elaborate strategies to assess large-scale samples representing the Social VR user population. (3) Further detailed investigations of specific topic areas and context factors and how they influence individual self-disclosure decisions. It may be valuable to consider methods like ethnographic studies and controlled user studies in Social VR or scientific lab prototypes to decrease dependency on participants' ability to remember and reflect on their behavior while not being in VR. (4) Further, other methods, like ethnographic studies or open-ended questions, may be applied to identify novel aspects related to self-disclosure that can not directly be linked to concepts already known from the literature. (5) Investigate user characteristics and their predictive role for self-disclosure in Social VR. In particular, we currently can not make any assumption about why certain context factors are not relevant for up to 40% of participants or why users deliberately decide against disclosing certain information in Social VR. Additionally, we advocate (6) exploring, designing, and evaluating novel technical self-disclosure channels Social VR offers.

5.3 Implications towards the Metaverse

Currently, large technology companies signal a push towards more *immersive* (e.g., AR/VR) venues for social interaction over a distance that may become the future metaverse(s). Our findings coupled with early scholarship on interpersonal communication, interactivity, and self-disclosure in virtual worlds [10, 23, 28, 32, 33, 50, 85, 88] point towards a few likely trends of the future metaverse(s). It should be noted that these suggestions for the metaverse are ever-evolving and, with new features and technical affordances, may become obsolete soon. We offer these suggestions as to directions for Social VR amid the 2020-2021 global COVID 19 pandemic.

5.3.1 Representation as a Modality for Self-disclosure. Our findings demonstrate that beyond verbal interactivity, one's avatar is the most often mentioned means of self-disclosure. Findings from Maloney et al. also demonstrate the users' connection to the avatar as a form of communication [49, 50]. This trend will likely continue as virtual avatars allow for more dynamic forms of representation and interactivity. For example, Wohn et al. demonstrated that users could adapt and provide ownership towards having additional limbs and non-human bodily configurations [86]. Designers and developers should push interactivity, including self-disclosure, beyond traditional forms of communication (e.g., voice, traditional non-verbal behavior). We emphasize more embodied forms of self-disclosure as some users have been known to prefer avatar-mediated communication [49], which demonstrate that non-verbal communication can afford much more beyond traditional verbal conversation

in Social VR [49, 79]. This key affordance signals toward potentially new forms of interactivity via more nuance use of spatial and avatar-mediated affordances. For example, how can avatar-based communication mediate intimate forms of communication (e.g., self-disclosure) and thus extend affordances of verbal communication? Moreover, what can we learn and extend upon from nonverbal forms of interactivity, which can then inform more immersive forms of nonverbal behavior such as sign language [80]?

5.3.2 Opportunities for Relationship Building in Safe Spaces. The overwhelming majority of our participants referenced the context of relationship as important for self-disclosure in Social VR. Therefore, we suggest that creators of present and future metaverse(s) should mimic opportunities of self-disclosure from the offline world. In particular, we point them towards Rubin et al.'s six factors of interpersonal communication to induce experiences that relate to pleasure, affection, inclusion, escape, relaxation, and control [70]. These experiences, in turn, can be driving factors of relationship-building based on mutual disclosure of lifestyle preferences, personal goals, fear & fantasies, religious & political convictions, and concept of self. Thereby, our results illustrate that users want to establish safe spaces where these experiences can be enjoyed. We thus highlight the importance of providing users with corresponding measures to establish safe spaces for relational development and self-disclosure.

5.3.3 Security & Privacy. Although Social VR mimics the experiential qualities of face-to-face interaction, it raises new challenges for self-disclosure and online privacy, not necessarily associated with face-to-face interactions. For example, in its beta-phase *Meta's Horizon Worlds* included security and privacy measures like "[...] *If you mute, block or report someone, a trained safety specialist, who will not appear as an avatar, may remotely observe and record the situation to ensure your safety.*[...]", or "[...] *which is why your Oculus headset will capture the last few minutes of your experience in Horizon on a rolling basis.*[...]" [55]. The amount of information users can share in a Social VR system is much more than they can through many other sociotechnical systems such as social network sites or online games. For example, Social VR affords the intentional or unintentional sharing of tremendous personal physiological information, including facial features (e.g., through avatar creation or facial tracking), behavioral patterns, and voices. Moreover, as social VR becomes increasingly technical, this will create more embodied forms of communication, creating an additional data source (e.g., motion-tracked data, body movements, gait). This modality provides tremendous opportunity but also risks towards user identification, safety, and privacy. On the one hand, how can this data create and inform more human interpersonal communication? On the other hand, how does it force users to give up biometric data to use the system effectively [50]? Additionally, recent work points towards the identification of user identity up to 95% even when other personally identifiable information is redacted [57]. It also creates ethical dilemmas for users and platforms. For example, can the decision to disclose personal information on a specific platform last forever? Similar to tweets and posts? How and when can this information be deleted? We urge platforms towards transparency in data and privacy controls, which has occurred in other modalities like social media. This will be a crucial pillar in how creators can protect the user integrity of present and future metaverse(s).

5.3.4 Identity & Disclosure Challenges in the Governance. Social VR platforms also face additional privacy and security challenges, specifically linking vs. not linking offline and online identities. The argument for platforms to link one's offline identity is that one's offline identity may be essential in some cases. One example is different forms of mal-conduct on Social VR platforms. For example, Maloney et al. detailed an instance of virtual sexual assault of youth in VRChat [45], with likely little to no punishment for the perpetrator. If user identities were linked to offline identities, these could be disclosed to the perpetrators' local authorities. Yet, the anonymity of most platforms based on online identification via an email address provides distinct challenges for safety, security, and communication on platforms. We suggest a mix of both, linking users' offline identity towards their account and allowing them to choose how they would like to be presented on the platform. Since the users in our study prefer anonymity, we suggest platforms provide universal anonymous avatars that protect the identity of the users, which will still allow for comfort when interacting and communicating online.

6 CONCLUSION

Given that Social VR already provides access to meaningful social experiences over distance, we set out to investigate self-disclosure, one of the fundamental drivers of building and maintaining interpersonal relationships, in commercial Social VR applications. These applications seem to be a venue for authentic disclosure of diverse personal information, where, as in offline communication, the relationship with others moderates self-disclosure in particular. However, our findings indicate that individual self-disclosure decisions can result from complex interactions of different contextual factors that Social VR applications afford. At the same time, users have privacy concerns and seem to value privacy and anonymity in the virtual environment. However, self-disclosure in Social VR benefits relationship building, identity exploration, and other social goals. Considering this, it is essential that the design of Social VR today and in the future addresses user concerns and creates safe spaces for social experiences that match user preferences for specific social contexts. As a starting point, researchers and practitioners can refer to the broader challenges and opportunities for designing the future metaverse(s) that we pointed out.

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