Is it Part of Me? Exploring Experiences of Inclusive Avatar Use For Visible and Invisible Disabilities in Social VR

Katrin Angerbauer
katrin.angerbauer@visus.uni-stuttgart.de
VISUS, University of Stuttgart
Germany

Phoenix Van Wagoner
pvanwagoner@fullerton.edu
College of Business and Economics,
California State University Fullerton
United States

Tim Halach
st162105@stud.uni-stuttgart.de
University of Stuttgart
Germany

Jonas Vogelsang
Jonas.Vogelsang@visus.uni-stuttgart.de
VISUS, University of Stuttgart
Germany

Natalie Hube
natalie.hube@visus.uni-stuttgart.de
VISUS, University of Stuttgart
Germany

Andria Smith
asmith@is.mpg.de
Max Planck Institute for Intelligent
Systems
Germany

Ksenia Keplinger
kkeplinger@is.mpg.de
Max Planck Institute for Intelligent
Systems
Germany

Michael Sedlmair
michael.sedlmair@visus.uni-stuttgart.de
VISUS, University of Stuttgart
Germany

Abstract

Social Virtual Reality (VR) platforms have surged in popularity in recent years, including among people with disabilities (PWD). Previous research has documented accessibility challenges, harassment, and negative experiences for PWD using disability signifiers in VR, primarily focusing on those with visible disabilities who encounter negative experiences. Yet, little is known about the experiences of people with invisible disabilities in social VR environments, and whether positive experiences are also common. To address these gaps, we designed inclusive avatars (avatars with disability signifiers) and investigated the lived experiences of 26 individuals with both visible and invisible disabilities immersing themselves in social interactions in VRChat for a week. We utilized a mixed methods experience sampling design and multilevel regression to explore the relationships between social interactions of PWD in VR and various psychological outcomes. Our results indicate that PWD, both visible and invisible, experienced positive and negative social interactions in VR. These interactions, in turn, significantly influenced users' overall experience with inclusive avatars, affecting aspects such as emotional responses, engagement levels, satisfaction with the avatar's design, and perceptions of inclusion in VR. Qualitative interviews of 18 participants allowed for a more nuanced exploration of the experiences of PWD by giving voice to users who are rarely studied in depth. Findings provided unique insights into both the positive and negative experiences of PWD, as well as identified key design factors influencing user experience in social VR.

CCS Concepts

• **Human-centered computing → Empirical studies in accessibility**.

Keywords

social VR, inclusive avatars, lived experiences, accessibility, diary study

1 Introduction

Social Virtual Reality (social VR) platforms like VRChat[1] or Rec-Room[2] experienced a vast increase of popularity in recent years as a result of the COVID-19 pandemic and the growing availability of VR headsets for consumers [55]. In social VR, users can share synchronous embodied experiences in 3D spaces and can connect by talking, playing games, dancing, and other activities [53]. As the usage of social VR increases, human-computer interaction (HCI) researchers have begun to illuminate the possibilities of this technology not only as a medium for conducting research [55, 58], but also as a powerful, dynamic, social context with implications for users' safety and satisfaction [43]. However, the experiences of people with disabilities (PWD), in particular those of people with invisible disabilities, in social VR environments are not yet fully understood.

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[1]https://hello.vrchat.com/
[2]https://recroom.com/

In the field of accessibility research, the potential of VR is well recognized [47], yet challenges related to accessibility remain a central concern [25, 48, 66]. Previous research shows how PWD are (inadequately) represented in image descriptions [6], AI-generated pictures [40], or games [51]. Virtual reality is no different, and in particular, 3D representations through avatars have increasingly come into focus as an important area of research within the community [65]. To begin, if PWD want to present their disability through their avatars they have limited options [41, 73, 74]. This is unfortunate, as the choice of the virtual self-representation or avatar impacts people's social interactions and self-perceptions [71]. Research in this area is still in its early stages; however, recent studies have examined the impact of inclusive avatar representations for visible disabilities [41, 73] and found that using an avatar with a disability signifier can result in harassment. Critically, more research is needed to uncover the drivers of good and bad social VR experiences for users of visible and invisible disability signifiers.

In our work, we explore the situations PWD [3] encounter when using an inclusive avatar and the impact these experiences have on emotions, behavior, and other psychological phenomena. Specifically, we investigate the factors that may shape the experiences of disabled participants when using inclusive avatars. To this end, we conducted a diary study (N=26) in VRChat, employing experience sampling surveys [70] and follow-up interviews to capture both qualitative and quantitative accounts of PWD's experiences when using avatars with disability signifiers.

Through our design, we capture both positive and negative social interactions and link them to a range of user outcomes. We replicate the previous findings of Zhang et al.[74], showing that while users experienced negative interactions such as harassment, they also encountered positive interactions. Importantly, our mixed methods approach allows us to identify that not all negative interactions users experienced are, in fact, related to the inclusive avatar. Instead, these experiences may be reflective of the general VRChat environment. Further, our approach provides an in-depth view of positive situations where inclusive avatars facilitate connections with peers or therapeutic encounters related to their disability. Counter-intuitively, this is especially true for people with invisible disabilities whose disability signifiers are not as prominent.

In short, our research makes the following contributions: (i) we replicate prior research on disability signifiers and extend them to invisible disabilities; (ii) we identify positive and negative social VR experiences for both types of disability signifiers and their potential drivers and (iii) show the impact of those experiences on the users' emotions and other psychological measures.

2 Background and Related Work

VR broadens the ways people can explore and express their identities through virtual avatars, significantly impacting psychological and social interactions[71]. However, for disabled users, the opportunities presented by virtual worlds and technology are often accompanied by challenges. One of the main challenges is the accessibility of technology or platforms [18, 25]. Additionally, social barriers and stigma present significant concerns [74]. Stigma has

been shown to influence whether a PWD chooses to disclose their disability in various contexts, including the workplace [36], social media [24], dating, [54] and virtual worlds [20, 50].

Previous research indicates that despite stigma, some PWDs decide to disclose their disabilities to foster awareness [50] and promote activism [8, 41]. Social VR platforms can thus serve as effective venues for advocacy [33]. This phenomenon has been documented in studies on Second Life,[4] one of the early social virtual platforms on PC. Research on Second Life found that it provided PWDs with opportunities for activism and identity exploration [8, 14], while also facilitating important social connections [9, 68, 69] and enhancing psychological well-being [26, 67]. Building on these findings, our research utilizes VRChat as a platform due to its wide usage and flexibility in avatar customization through user-uploaded models [73, 74]. Unlike many other virtual environments, VRChat allows users to upload their own avatars, enabling the creation and use of avatars that accurately reflect diverse identities, including those with disabilities. This flexibility allows users to access and use inclusive avatars that reflect disabilities through specific "*disability signifiers*", as defined by Zhang et al. [73, 74] .

In the following, we provide an overview of related research, focusing on self-representation through avatars, social VR as a space for diverse and historically under-served groups, and disabled representations in VR through inclusive avatars.

2.1 Social VR and Marginalized Groups

Research on social VR is still in its early stages but is rapidly expanding. While there is general research on design [43], social behavior and relationships [11, 21, 44], communication [4, 45], and activities [42, 53], less is known about social VR for historically under-served and marginalized groups.

The existing evidence largely highlights the drawbacks for members of historically under-served and marginalized communities when they use social VR. For example, research documents how harassment is not uncommon for members of the LGBTQ community as well as women [23, 62], suggesting the importance of protection mechanisms. Likewise, existing power dynamics and inequalities outside of social VR shape individual experiences and interactions [39]. That said, social VR has been shown to have the potential to be a safe space, where one can explore one's identity and connect with others in the community in a positive way [1, 35]. We believe such benefits also exist for members of the disabled community when using disability signifiers. Ultimately, social VR has the potential to be beneficial for those with visible and invisible disabilities alike, with initial evidence suggesting opportunities for enhanced mental health [15] and decreased social anxiety [72]. Overall, while social VR holds potential for positive impacts on marginalized groups, it requires careful consideration of accessibility, safety, and inclusive design to realize these benefits fully.

2.2 Self-Representation through Virtual Avatars

Per definition, an avatar is a digital representation of oneself in digital spaces [49]. Recently, diverse avatar representation gained more and more attention [16]. While avatar design for VR has been studied extensively [30, 57], we know that user preferences

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[3]We mix person-first and identity-first language in this paper, as preferences vary across disabled communities [2]

[4]https://secondlife.com/

for design can vary as a result of personal factors [19] as well as the usage context [7, 31]. Ultimately, avatar design affects the VR experience by increasing or reducing immersion, presence, or embodiment [17]. Avatar design can impact self-perception [5], the users' activities, and interactions with others. In particular, Yee et al. [71], present the Proteus effect, which describes how the characteristics of avatars influence user behavior. Studies by Liu [37] revisit this effect in the context of creativity and Freeman et al. [22] investigates the Protheus effect in social VR showing that social VR facilitates the exploration of gender identities and helps foster the understanding of one's cultural identity. Even though less studied, these dynamics of avatar representation are likely also relevant to disabled identities [29].

2.3 Inclusive Avatars

There are limited possibilities to represent diverse identities in VR [46, 47, 50], especially for disabled representation.

While there are automatic approaches to create able-bodied avatars [27], to date there only exist proof-of-concept versions for more diverse avatar creators [38], and inclusive avatar creation possibilities are not integrated into VR platforms [30, 73]. As such, it is unsurprising that inclusive avatars remain an understudied and timely research topic. We extend and build upon recent research efforts on the topic of inclusive avatars for people with disabilities. Mack et al. [41] studied the design and usage scenarios for non-embodied avatars for PWD, presenting design guidelines for the latter. Recent work has started to derive design suggestions for embodied avatars for people with sensory impairments [73] and invisible disability representation [28]. We built on this knowledge to study embodied avatars for VRChat. Importantly, embodied avatars with a visible disability are studied by Zhang et al.'s work [74] showing that in VRChat users of such avatars experienced harassment. We take this reasearch one step further by including invisible disability signifiers coupled with daily quantitative measures to capture the lived experiences of users with visible and invisible disabilities and disability signfiers.

3 Method

We employ an exploratory mixed method approach [13] to illustrate the lived experiences of individuals with disabilities while they use inclusive avatars in social VR. Our research focuses on the following research questions:

RQ1: How do individuals experience situations and interactions while utilizing inclusive avatars depicting their (in)visible disabilities, particularly focusing on their feelings of belonging, authenticity, and representation?

RQ2: In which situations do they use the inclusive avatar and how do they feel about it?

To answer these questions, we conducted a study in VRChat by surveying and interviewing 26 individuals with (in)visible disabilities regarding their experiences with using inclusive avatars in social VR during a two-week period.

3.1 Participants and Procedure

Our participants were recruited via the crowd-sourcing platform Prolific[5]. They had to be at least 18 years old and registered with Prolific as having a disability. Ultimately, 63 participants were invited to participate in our study and use an inclusive avatar. Of those, 26 fully completed the study. A total of 13 [6] participants also completed a qualitative interview upon completing their study period of using an inclusive avatar.

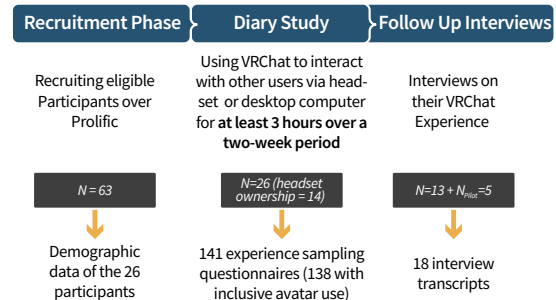A summary of participant demographics of our diary study can be found in Table 1.

Figure 1: Overview of our study procedure and the resulting data. In the interview phase we also included the transcripts of our five pilot participants as the interview protocol was the same as in the diary study.

Participation in the inclusive avatar study consisted of three steps. First, participants completed a recruitment and onboarding survey hosted on Prolific. This survey asked participants to describe their disability, to select a pre-made inclusive avatar they felt best represented them and provided detailed instructions on how to install VRChat and begin using their inclusive avatar. Second, participants were asked to spend a minimum of three hours using their avatar in VRChat over a period of two weeks. Participants not owning a VR headset could use VRChat over a desktop app, which also provided full functionality. To ensure multiple unique experiences, participants were asked to complete a minimum of three play sessions on different days. After each session, participants completed an experience sampling survey to capture the details of their Inclusive Avatar experience. To foster social interactions, participants were told to spend at least 10 minutes each play session interacting with other users. Finally, after the two weeks spent using their avatar, participants were invited to be interviewed about their experiences in a closing survey. Participants were compensated for their time and paid based on the time they spend using their avatar and completing surveys. In total, participants could earn up to 98.70 pounds for their time spent using the avatar, completing questionnaires, and the interview. Figure 1 depicts our study process and the resulting data.

Table 1: Demographic data of all participants participating in the diary study. The column "EO" shows the ethnic origin, "Black" is short for Black/African/Caribbean. "Exp" is the experience of the participants in VR Chat, and "DSU" is the different disability signifiers used by the participants. ⊘ = None, ↗ = cane, ♿ = wheelchair, ♿ = electric wheelchair, ⏣ = wheeled walker, and ✿ = sunflower. The column "HMD" indicates whether or not participants owned a head-mounted display or VR headset.

P_ID	Age/Gender	EO	Exp	Disability	DSU	HMD
P6	25-34/Male	Black	<3 m	Mobility	⊘, ♿, ♿	No
P7	35-44/Male	White	None	Physical, hearing loss	↗, ♿, ♿	Yes
P8	45-54/Female	White	<1 y	Visual	↗, ✿	No
P9	18-24/Female	White	None	Mobility and Autism	↗	Yes
P10	35-44/Male	White	<1 y	Hearing	✿	No
P11	25-34/Male	White	None	Autism	✿	No
P12	25-34/Male	White	None	Chronic pain, ADHD.	↗	Yes
P14	25-34/Male	White	2y <	Neurodiverse	✿	Yes
P15	18-24/Male	Mixed	<1 y	Learning disability	↗	Yes
P16	25-34/Non-binary	White	<3 m	Physical, autism, ADHD	↗, ✿	Yes
P17	18-24/Male	White	<2y	Dyslexia	✿	Yes
P18	25-34/Female	White	None	ASD	✿	Yes
P19	35-44/Female	White	<2y	Deafness	↗, ♿	No
P20	35-44/Male	White	None	Depression/anxiety/PTSD	✿	Yes
P21	25-34/Female	White	<3 m	Anxiety disorder	✿	No
P22	25-34/Female	Black	2y <	Autism	⊘, ✿	No
P23	25-34/Female	White	2y <	Spinal stenosis	⊘, ⏣, ✿	No
P24	25-34/Male	White	<3 m	ADHD, physical	♿, ♿, ⏣	No
P25	18-24/Female	White	<3 m	Autism, Fibromyalgia	♿, ✿	Yes
P26	25-34/Male	White	None	Bipolar Disorder Type 2	✿	No
P27	35-44/Male	White	<1 y	ASD/Autism	↗	Yes
P28	25-34/Male	White	<1 y	Neurological Trauma	↗	No
P29	55-64/Female	White	None	Depression and Anxiety	✿	Yes
P30	25-34/Male	White	2y <	Partially blind, mental health issues	✿	Yes
P31	55-64/Male	Mixed	None	Mobility	♿	No
P32	35-44/Female	White	None	Mobility	↗, ✿	Yes

3.2 Apparatus and Measures

We created our inclusive avatars with ReadyPlayerMe[7] and added the disability signifier with Blender [8] and Unity[9]. We opted to provide a set of pre-made avatars, which we directly uploaded to VRChat in a space for avatar sharing. Figure 2 shows the base avatars and Figure 3 the disability signifiers. The base avatars were designed to reflect a diverse range of ethnicity and gender. As disability signifiers, we modeled mobility aids and the "hidden disability sunflower", similar to the lanyard used to signal invisible disabilities in real life according to the "hidden disabilities sunflower

scheme". The scheme originated in the UK but is getting more and more known worldwide [60]. Thus, we considered the sunflower signifier a fitting symbol to start with for representing an invisible disability, as it is also subtle [28]. All our disability signifiers have the possibility to be turned off, a requirement that originated in a pilot study. Participants could indicate which disability signifier they used throughout the study, as also shown in Table 1: None ⊘[10], cane ↗[11], wheelchair ♿[11], electric wheelchair ♿[11], wheeled walker ⏣[12], and sunflower ✿[11]. Each base avatar could be combined with each disability signifier, so in total participants had 60

(a) avatar 01   (b) avatar 02   (c) avatar 03   (d) avatar 04   (e) avatar 05   (f) avatar 06

(g) avatar 07   (h) avatar 08   (i) avatar 09   (j) avatar 10   (k) avatar 11   (l) avatar 12
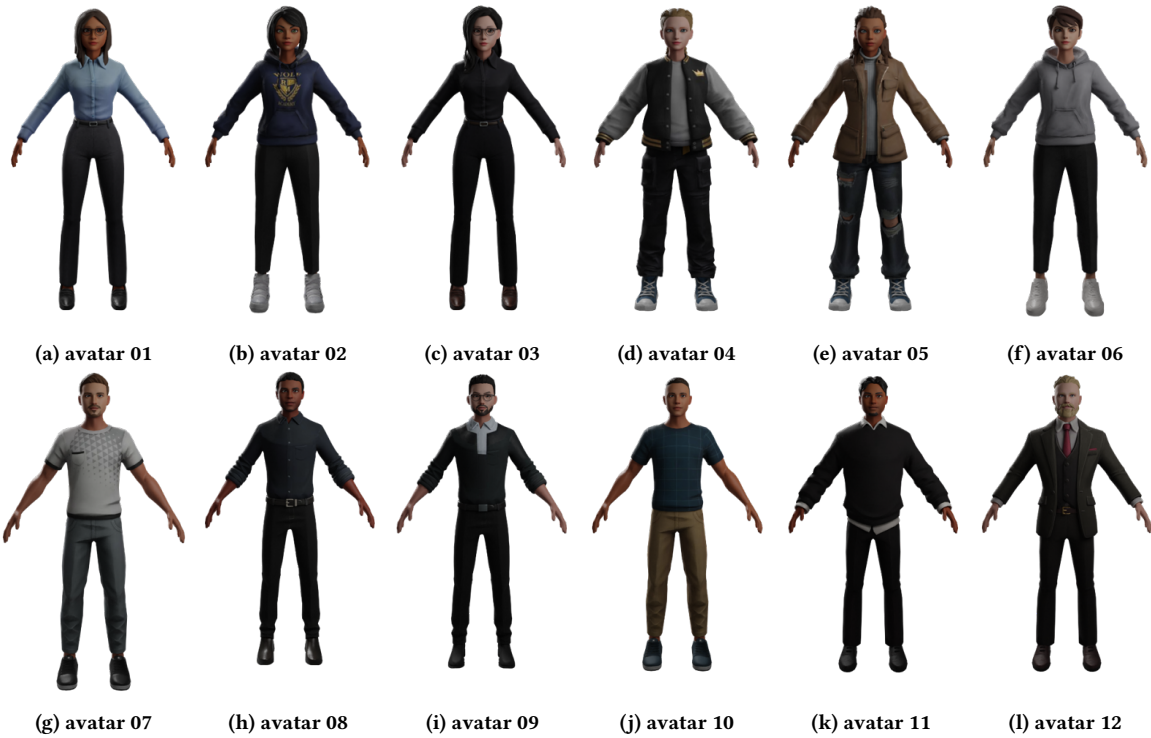
Figure 2: Overview of our base avatars modeled for the study.

(a) walking cane left   (b) walking cane right   (c) sunflower patch   (d) electric wheelchair   (e) wheeled walker   (f) manual wheelchair
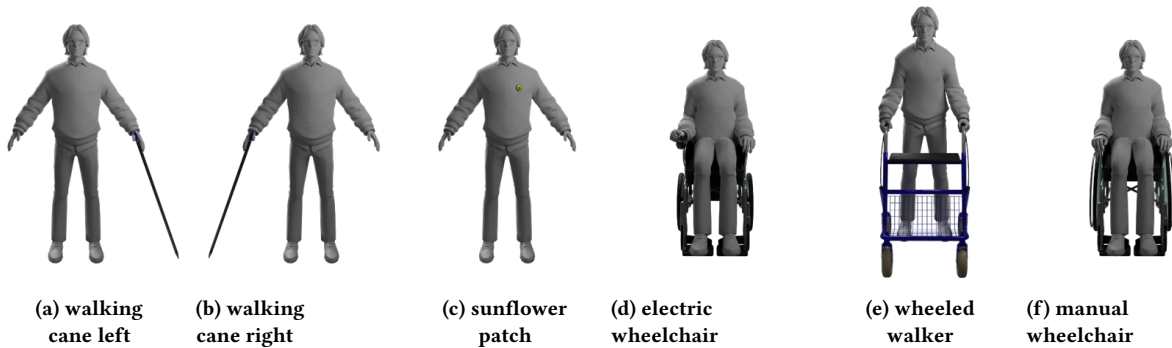
Figure 3: Overview of our disability signifiers modeled for the study.

avatars to choose from. The questionnaires throughout the study were administered via Qualtrics [13]. Interviews were conducted over Zoom, Webex, Teams, VRChat and in written form (for accessibility reasons).

Our experience sampling questionnaire is based on the diary study questionnaire by Zhang et al. [74]. However, we also included psychological measures detailed below.

Critical events (events). We captured significant social interactions participants encountered when using their inclusive avatar

adapted from experience sampling research [52, 56]. First, participants indicated whether they had experienced a significant interaction when they were using their avatar that day. If a participant responded "yes," they were then asked to describe the event and report whether they felt the event was positive or negative.

Current emotions (emotions). We assess current emotions using the five-item Lebender PANAVA scale [61] which features emoticons to gauge participants' feelings. This scale is tailored for capturing emotions in the moment. Two items measure positive feelings or positive activation (Spearman-Brown reliability =.77), two measure negative feelings or negative activation (Spearman-Brown reliability =.59), and one assesses overall mood (valence).

Psychological connection to avatar (connection). How connected participants felt to their avatar during their experiences was measured by the Real-Self Overlap Scale (RSOS) adapted from Lenton et al. [34] and Aaron et al. [3] For our study, respondents saw an image containing pairs of circles that ranged from barely touching to almost completely overlapping. One circle in each pair was labeled "who you are right now", in our case referring to the avatar, while the other circle was labeled "real self."

VRChat Engagement (engagement). VRChat engagement was measured using three items from the Utrecht Work Engagement Scale to measure state engagement at work [59], adapted to the VRChat context. The items were "When using VRChat, I felt bursting with energy", "I am enthusiastic about VRChat," and, "I get carried away when using VRChat. Cronbach's alpha was .75.

Avatar Satisfaction (satisfaction). Avatar satisfaction was measured using the three-item scale developed by Seashore et al.[64] and again adapted to our context. Participants were instructed to report their agreement to items "right now, in this moment." Items include, "Right now, I am satisfied with my avatar", and "Right now, I like using my avatar", and "I do not like my avatar right now" (reverse coded). The items range on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). Cronbach's alpha was .92.

Perceived inclusion (inclusion). Inclusion in the experience sampling questionnaire was measured using 16 items developed by Jansen et al.[32]. Eight items assessed belonging, and eight items assessed authenticity within the group. Participants indicated the extent to which they agreed or disagreed with each statement based on their experiences using VRChat that day. Items included, "The people in VRChat I interacted with today give me the feeling that I belong.", "The people in VRChat I interacted with today gave me the feeling that I fit in.", and "The people in VRChat I interacted with today allow me to be who I am." Items range from 1 (strongly disagree) to 5 (strongly agree). For the belonging subdimension Cronbach's alpha was .94, and for authenticity, it was .95.

For more details of our study setup we refer to our supplemental material[14].

4 Results and Discussion

In the following, we consider the data of 141 experience sampling questionnaires (138 with inclusive avatar use), 26 entries for recruitment and concluding questionnaire each as well as 18 interview transcripts for analysis.

4.1 Quantitative Results

For the quantitative analysis, we only consider the data of the daily survey with inclusive avatar use.

Figure 4 and Figure 5 provide a descriptive overview of our results regarding experienced connection to the avatar, participants' emotions, avatar satisfaction, and VRChat engagement. Of the 138 avatar sessions reported in the data, 23% (33) included a critical event, 19 negative events and 14 positive ones.

Figure 6 shows the correlation matrix of events occurring and our measures. Further, we performed statistical analysis via multilevel

regression modeling to uncover the impact of critical events on our other measures. The occurence of positive and negative events were considered as two variables PositiveEvent and NegativeEvent with binary values (1 signaling an event occured).

Before performing the statistical analysis, we first ran a null model to examine the within-person variation inherent to each of our daily measures. The variance accounted for by the within-person component of our variables was 78% for state positive emotions and 73% for state negative emotions, 38% for engagement, 45% for avatar satisfaction, 35% for authenticity, 73% for perceptions of inclusion. These percentages represent the proportion of variation in our state measures that occurs within each participant over time and can be attributed to the variability in user experiences across play sessions. The level of within-person variability warrants the use of multilevel modeling. Therefore, analyses were carried out in Stata [15] with mixed effects modeling using the "mixed" command. The multilevel data were identified via a nesting ID assigned to each participant.

Our results show that positive emotions were significantly impacted by positive events ($\gamma = 0.95, p = .007$). Likewise, when negative interactions took place, we saw a statistically significant decrease in positive feelings ($\gamma = -1.09, p < .001$). For negative feelings, negative events greatly increased the level of reported negative emotions ($\gamma = 1.49, p < .001$) while positive events had no impact ($\gamma = -0.35, p = .283$).

When looking beyond feelings, we see a similar pattern across variables measured in the study. Positive interactions tended to have a positive impact on engagement ($\gamma = 0.75, p = .002$), connection ($\gamma = .83, p = .005$), satisfaction ($\gamma = 0.56, p = .057$), inclusion as belonging ($\gamma = 0.57, p = .007$), and inclusion as authenticity ($\gamma = 0.69, p = .001$). On the other hand, negative interactions resulted in negative consequences for engagement ($\gamma = -0.43, p = .033$), connection ($\gamma = -0.58, p = .019$), satisfaction ($\gamma = -0.72, p = .003$), inclusion as belonging ($\gamma = -0.94, p < .001$) and inclusion as authenticity ($\gamma = -1.07, p < .001$). These results show that critical events in VRChat had the potential to be either positive or negative for users of inclusive avatars. Further, this variability in experiences using an inclusive avatar significantly impacted different facets of the avatar experience, ranging from emotions, to engagement, connection, and satisfaction with the avatar itself, to perceptions of inclusion within the virtual environment. Critically, most user sessions did not include a significant interaction that stood out as being abnormally positive or negative. This finding is important in and of itself as it suggests that impactful negative experiences may be a relatively rare occurrence. The intercept in each of these models indicates that, in the absence of these critical incidents, the average experience of using an inclusive avatar was positive. Figure 7 visualizes these results, as well as the means and 95% confidence intervals associated with each type of experience across study variables.

4.2 Qualitative Results

To uncover thematic patterns in our qualitative data, we used thematic analysis [10]. Three researchers coded the first interview together to develop an initial codebook. Afterward, the coding was

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[14]https://doi.org/10.18419/darus-4426
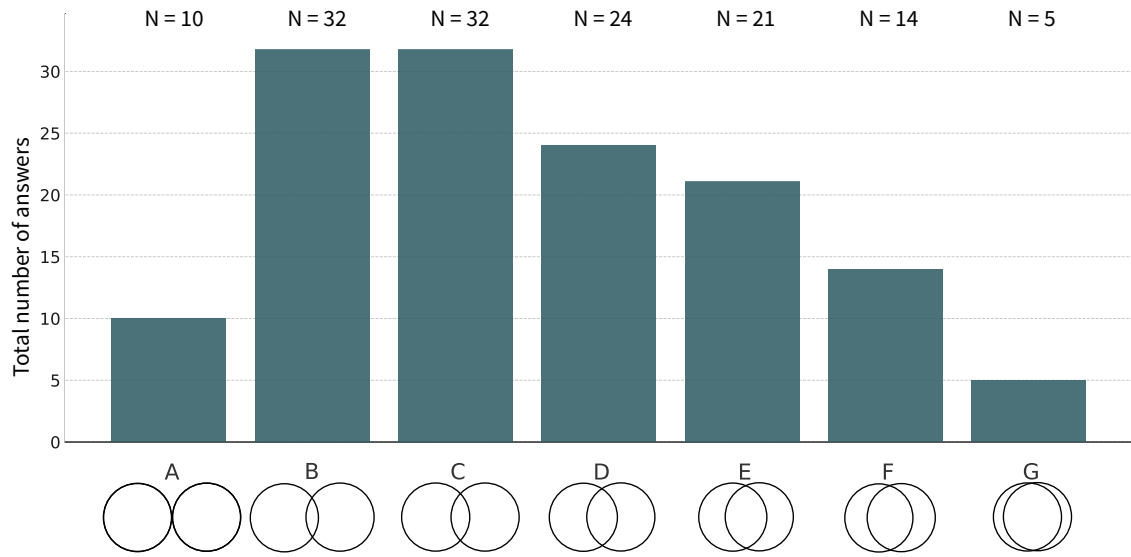
[15]StataCorp 2021, version 16.1

Figure 4: Results of the RSOS questionnaire with overall number of answers. The left circle was labeled with who you are right now and the right circle had the label "real self".
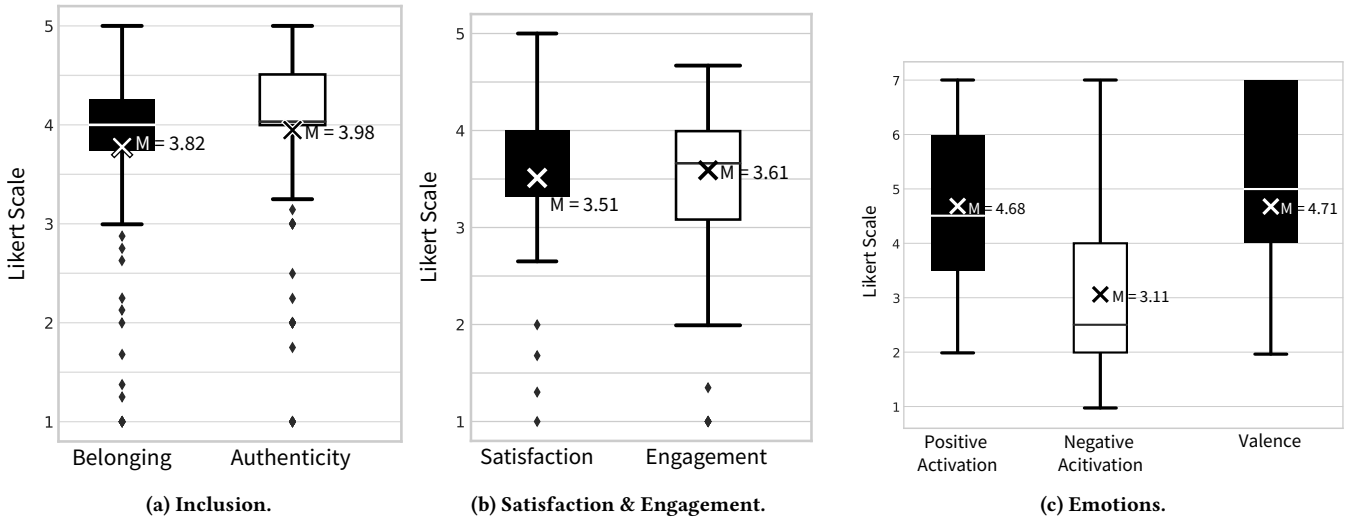

Figure 5: Boxplots of our measures. The median is represented by the central line within each box. The edges of the box represent the first and third quartiles, and the whiskers represent the range of the data for each measure. Means are denoted by an "X".

split up among the researchers, with continued discussion and reconciliation of codes. During the coding process, the codebook was iteratively refined and extended. The codebook was also used to categorize free-text answers in the experience sampling survey, here we considered all 141 entries.

On average, people filled out five questionnaires ($SD = 3$) with a maximum of 15 questionnaires. Further, the average time in VRChat was $M = 11.02$ ($SD = 6.19$) hours. The hidden disability sunflower patch was the most used disability signifier and the avatar in Figure 2i was the most used base avatar.

In contrast to Zhang et al. [74], we did not enforce the use of an avatar with or without disability signifier during a specific amount of time; instead, we strongly encouraged participants to use inclusive avatars whenever they felt comfortable. This enabled us to analyze the avatar choices made by participants.

Interestingly, some people did switch between avatars and disability signifiers. P7 explained that they wanted to *"gauge people's reactions."* There were also two participants in the diary study who attached our disability signifiers to their own avatars. In three cases,
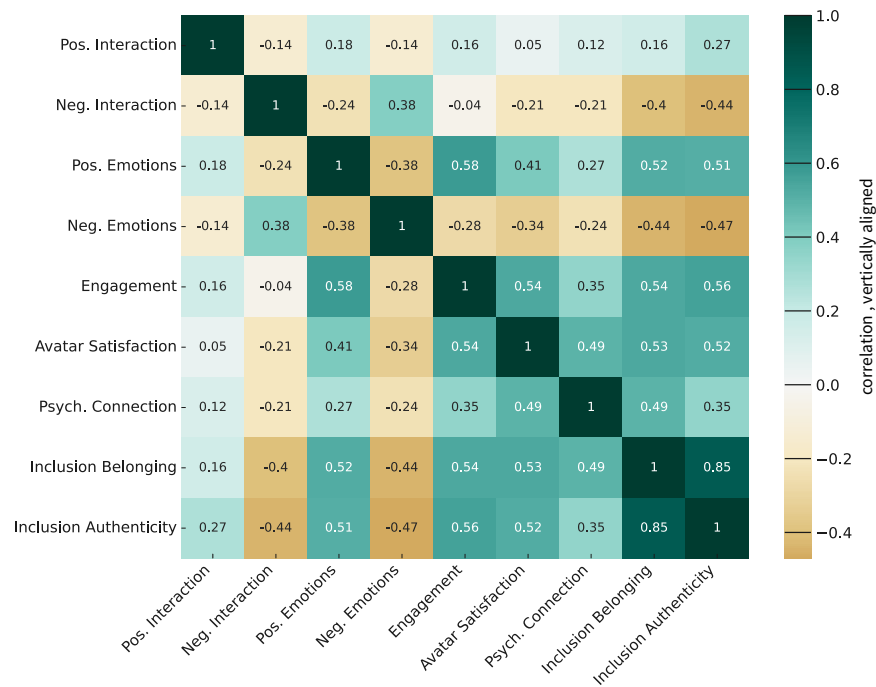
Figure 6: Correlation matrix of our measures related to positive and negative interactions (events).

participants did not use the inclusive avatar and in four other instances they reported switching the aid off. Reasons for not using the inclusive avatar or disability signifier include the fear of the reaction of others: *"I was embarrassed by the prospect of using my disability avatar, but will try to do it in a later session" (P23)*, or feeling the need to *"mask it" (P22)*. P6 and P19 used another avatar to escape reality: (*"[I] just wanted to be normal today" (P6)*; *"I used my fursona, she made me feel strong on a day I am weak" (P19)*.

4.2.1 How represented and included do participants feel while using the avatar? In general, participants seemed to feel included, as Figure 5a indicates. However, the outliers also point to moments of exclusion which corresponds to the qualitative feedback we gathered.

Feelings of inclusion and exclusion. In our questionnaires and interviews, seven people mentioned feelings of exclusion (five participants with a visible disability signifier and two with the sunflower), whereas 14 mentioned feelings of inclusion. P3, P9, P19 and P29 mentioned both being excluded as well as included at times. For example, P29 states: *"So it depended [when] people were actually talking to me or [when we] were playing a game, I felt totally included. But then there were times when there [were] large groups of people and my anxiety was obviously at a higher level that I didn't feel included at all."* According to P5 and P30, the inclusive avatar did not have an impact on their feelings of inclusion: *"It's just it's a little hard in general to feel included into the VR community because it's so many people. [...] I don't think it made me anymore included into the VR community that I already am" (P5)*. P30 adds: *"I don't normally feel super included. I would say that I didn't feel any different than how I would have normally"*.

On the positive side, P14 commented: *"I never wore an avatar that showed people I had a disability before. I thought it was direct all conversations towards my disability and people would ignore me or change the topic because it was an awkward conversation topic. But while someone did change the topic after I explained it, it was because they accepted and were totally comfortable with it and continued to treat me like a regular person, like anyone else."* At the same time, P19 perceived the specific behaviors as signs of exclusion, both by people *"being cautious"* or *"[being] more harsh, people [...] questioning [their] intelligence"*. P31 did not feel included at all due to the lack of social interactions and harassment and voiced their frustration: *"Completely excluded. Felt that all the time. Well, except when I was being bullied. I was included when I was being bullied"*. Besides exclusion related to social interactions and their disability signifiers, P20 attributed the perceived lack of inclusion mostly to their age: *"I just don't like always being the odd one. I literally did not find a single person my age in there"*.

Participants who did not feel represented by the inclusive avatar may have another understanding of their disabled identity. When looking at the qualitative interview data, most participants stated they felt represented by the avatar to some extent, e.g. P28 stated: *"The actual appearance [... was] pretty good and in line with [...] how I think of myself."* Interestingly, we also had voices that did not connect to their avatar (P31), did not feel comfortable using it (P30) or did not feel represented (P20). P20 expressed the wish to change the avatar in one of their daily surveys (*"I mentioned changing my avatar to something more suited to me and was told that mine is iconic now and it suits me"*) and P30 actually used their own avatar toward the end of the study (*"I have avatars I make that I feel more*
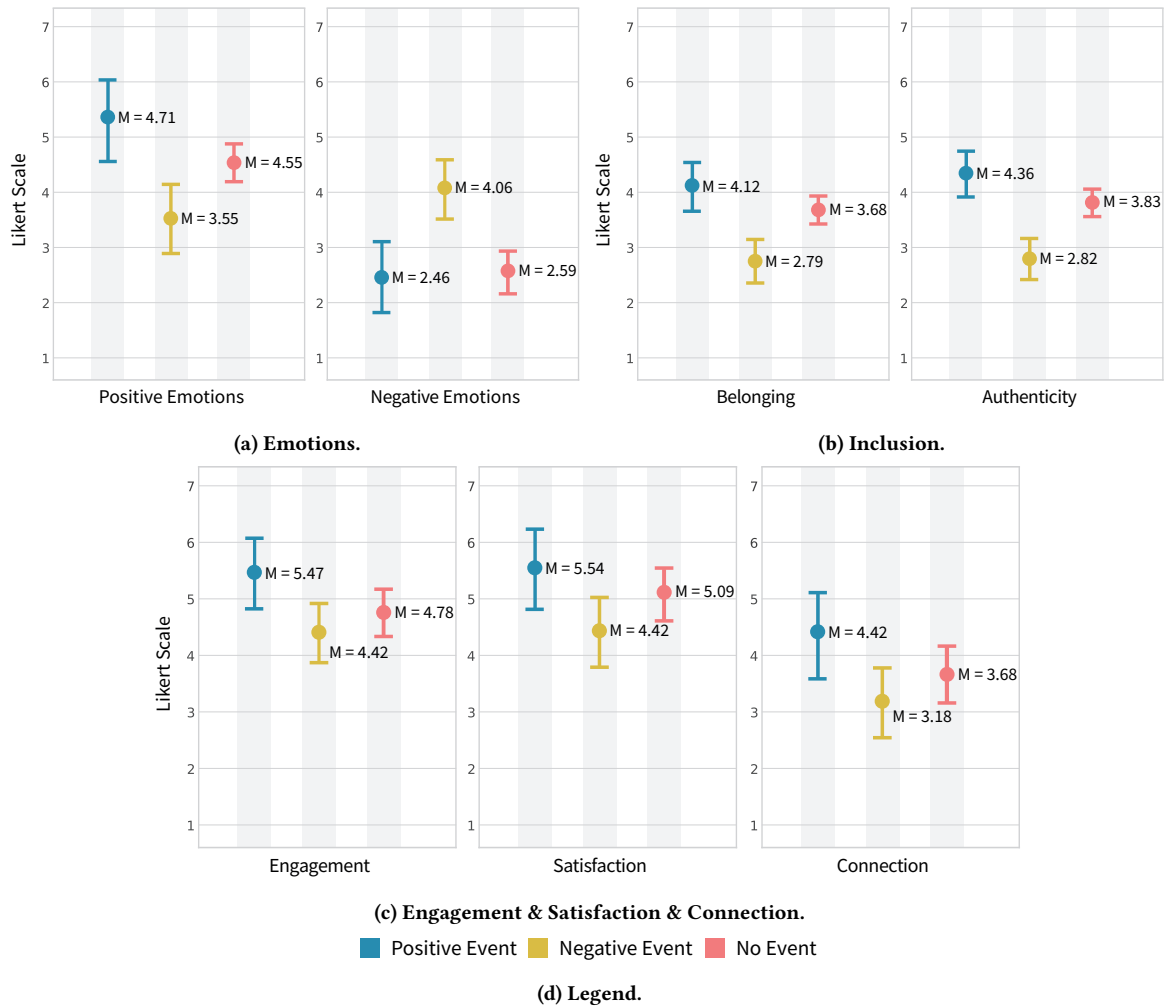
(a) Emotions.

(b) Inclusion.

(c) Engagement & Satisfaction & Connection.

■ Positive Event   ■ Negative Event   ■ No Event

(d) Legend.

Figure 7: 95% Confidence intervals of the means of our measures with respective events occuring.

comfortable in and can like identify better in.") The feelings towards the avatar could be related to their perception of their disabilities as their stories indicate: When talking about their disability, P31 shared: *"I don't see myself in the disabled light up. Always had a problem seeing myself like that. Every time I think of myself, I actually think of myself in the future, walking again. Normally. I know that's weird, but even after all these years [accepting] that I'm well and truly disabled, it's been a difficult thing."* P20 expressed: *"Yeah, not really represented. Just purely because a nobody got [the sunflower] and [...] I don't feel the need to [...] make it a big thing. [...] I don't feel the need to to label myself anything. I just understand what I am."* Finally, P30 said: *"I don't necessarily consider any disabilities of mine to be an identifying trait. They're more of just an attachment that's something I deal with. It's not something that I mentally would identify as a part of my personality. "* These stories hint that if disability is not considered as part of one's identity, the perception of the avatar could be different.

4.2.2   What kind of situations do people encounter when using the avatar? After analyzing the impact of critical events on our quantitative measures, we further looked at the event descriptions to categorize them. We found that people described events related to VRChat in general(14/33), situations related to the inclusive avatar (14/33) and technical issues (5/33). When looking at positive and negative events separately, 9/14 positive events were related to the inclusive avatar, and four were VRChat related, while one described the solution to a technical issue on VRChat. For negative events, ten were VRChat related, five described inclusive avatar related events, and four focused on technical issues.

Aside from the specifically reported events, we can also infer positive and negative experiences related to the inclusive avatar based on the qualitative comments and interview data.

Finding peers. In the experience sampling questionnaire, as well as the interviews, seven participants mentioned that the avatar helped them to connect to peers. Especially the sunflower disability signifier seemed to encourage connections to others. P17 stated: *"I*

was asked by someone if the sunflower meant what they thought it meant and [...] then went on to tell me they also had a hidden disability which we spoke about for a while over a few beers which was actually really nice. I have since added them as a friend." This also happened to P11: "*Someone did ask about the sunflower patch to represent my hidden disability, and I replied that it was to show my autism. I was then able to explain to them in what ways my autism affects me. In fact, I found out the person I talked to had ADHD.*" P14, P20, P21, and P26 also reported instances where they connected with others due to their disabilities. For people with visible disabilities, it happened only for P1, who was surprised about the positive effect the disability signifier had: "*I was just going to say it opened up the conversation and instead of it just being a pity party, it was people understanding me. And then they would talk about their own experiences with similar conditions and it would just be a learning experience for everyone.*"

Having therapeutic encounters. Six participants, one using a cane and the others sunflower disability signifier during the study, shared stories about how the inclusive avatar helped them to build up their confidence and even develop themselves. P17 explained: "*I was much more comfortable in my own skin when using this avatar which made me more confident and made it easier to start conversations with others*", whereas P11 "*[felt] more at peace with [themselves]*". For P21 and P16 it seemed like exposure therapy "*to talk to strangers*" or to "*use mobility aids in public settings*". P2 and P14 describe their "*therapy sessions*" in depth. P2 details: "*And as scary as it was at first, [...] it's [...] a goofy, roundabout therapy. [...] I noticed it wasn't hard to talk to people last time I went out after talking to people using this. So maybe it could be therapeutic to me to be able to go and talk to people like looking as myself in VR chat and then that carry over to the real world. [...] So imagine if I used it for like a month of like just a couple nights a week just talking to strangers. You know, like maybe I could actually go back to before my being social how I used to be before I developed like [Post Traumatic Stress Disorder and ...] the social anxiety related to it.*" P14 describes: "*It was [...] like a[n] impromptu therapy session with several other people that [...] were all neuro-atypical as well. So it was really like a it was like a couple therapy sessions almost for me.*"

Getting attention. In 66 out of 138 VRChat usage sessions, participant report that their disability was not mentioned or talked about. 41 of those sessions were by people using the sunflower. Still, similar to other work [74], 16 of our participants also noted that the inclusive avatar served as a communication starter and attention grabber, which was regarded as positive as well as negative. As P6 explicitly mentions: "*When I switched there was a little bit of there was there was some level of difference in my interaction with people, in people trying to get to know me and people trying to get to know what had happened to me. And it also increased the level of cyber bully I think. So it does it had the the good and the ugly side so.*" P1 also expressed that it opened up conversations about their disability: "*[The cane] definitely opened up a conversation. [...] someone would walk up to me and it would start off, oh, is that a pimp cane? [...] I'd be like, no, this is actually my disability*". P31 in contrast, criticized that talking about one's disability can also be "*a little traumatizing*".

Being subject to rude comments and bullying. Participants with visible disability signifiers (P6, P7, P9, P19, P24, P31, P32) also reported instances of bullying and rude comments. For example, P24 was called "*a cripple*", P7 was mockingly addressed as "*Stephen Hawking*" or "*crippled Gordon Freeman*". P9 reported an incident of bullying "*having a bit of an effect on [their] mental health*" and P6 stated: "*I had mixed experience because there were times I was on VRChat with the avatar and I was spoken to fairly by everyone [... but I] had some abusive behaviour by some individual. [...] On that very day, I almost wanted to quit*".

P26 was the only participant with the sunflower disability signifier mentioning insults directed toward them, however, "*was not negative from an aspect of a disability standpoint. [The insulter] thought the flower was a broadcasting of homosexuality*" and directed homophobic speech at them.

4.2.3 How was the overall VRChat experience? Our qualitative analysis also provides additional insights into participants' VRChat experience in general, especially focusing on the avatar culture or the climate in public worlds.

Avatar culture. Interestingly, besides social feelings of inclusion and exclusion mentioned above, five participants also described their emotions concerning their humanoid avatar "*stand[ing] out*" (P30). P26 detailed: "*You know, walking around as a human was the anomaly*". New or less frequent VRChat users like P20 and P26 were astounded by the "*crazy, [...] sexual [avatars]*" (P20). P26 said: "*I wasn't aware people could tear themselves into dinosaurs [...] I thought [...] everyone had a human-based avatar.*" Further, P2 and P30, both active players in VRChat explained the importance and the stigmas of avatars within the community. P30 says the avatar might already shape the following interactions: "*[If] I don't like those type of avatars, so I probably have a negative perception of them which probably [...] trickle[s] down to my interactions with individuals wearing them.*" and P2 details: "*[Y]ou're kind of treated like a second class citizen if you use one of [the default avatars].*"

Toxicity of public worlds. The toxicity of public world was also mentioned by participants. In particular, P7 noticed it a lot: "*The mix of older and younger people in the worlds was very toxic. Not all but a large number were very rude borderline abusive.*" P20 and P29 among others notice that younger kids or teens are disturbing at times: "*[Today VRChat was] full of children screaming everywhere*" (P20); "*[N]ot that I have anything against children, but honestly they can be annoying*" (P29).

4.2.4 When would people use inclusive avatars in general? As detailed above, during the study, the inclusive avatar was used 98% of the time. However, we were interested in whether people would see the need for an inclusive avatar in general. In our concluding questionnaire, we asked whether our participants would like to continue using the avatar and in which situations. 11 participants answered they would use an inclusive avatar, if available and only three answered that they would not like to use an inclusive avatar in the future. Reasons for using the inclusive avatar were the design of the avatar (P12, P21, P22, P26), the felt authenticity and representation (P6, P9, P19), feeling comfortable (P8, P16), and the positive experiences participants had (P14, P17). Interestingly, reasons for

not using the inclusive avatar at all in the future did not relate to negative experiences but to the avatar design.

However, 12 participants answered that the inclusive avatar use would depend on the situation. Based on the interviews and survey comments, we now discuss some thoughts participants had on when to use or not use the inclusive avatar.

Being safe. An important reason for using or not using an inclusive avatar is feeling safe. In contrast to other participants, P23 felt most comfortable in larger groups for *"blending in"*: *"I felt more comfortable using the avatar in large groups of people because I didn't draw much attention. Other people's avatars were also so attention-drawing – either huge or funny or both – that I blended in most of the time."*, and they would not use it if *"[they] drew too much attention to [themselves]"*. However, there were also other voices that prefer smaller circles or friends like P16, who explained: *"If there was a public world or game domain in which people are more often discriminated against for being disabled, then I would not want to visibly show my disability."*. In a similar direction, P27 pointed out: *"[I would not use the inclusive avatar in a situation] where I'd be without friends or other supports. People on VR Chat can be...hostile."* Another place where people would feel safe was among other disabled people, as, for example, P22 pointed out: *"[I would use the inclusive avatar in] a VRChat room for special needs" (P22).*

Having and building up stronger connections. Related to being safe, people mentioned they would like to use the avatar in social situations with close friends and family or where they would have the aim of establishing deeper connections when meeting new people, e.g. *"[i]n a situation where I am trying to meet people in a deeper level and discussing more serious matters" (P10).* On a related note, P17 wanted to continue using the inclusive avatar to find peers: *"[I want to use it] in [VR] bars so I can meet more people like me" (P17).* P8 said, it would be helpful to signal needs: *"In all cases where I would like help or support to do a task".*

Escapism. Escapism from the real world was another factor that played a role for participants, P24 and P32 described they would not use the inclusive avatar in situations that also hold limitations in real life: *"Dancing worlds as it's pretty hard to join in when in a wheelchair" (P24)*; *"Possibly would not if I was to go clubbing/to a party, or participating in sports games virtually as they are things I feel physically inadequate taking part in for real" (P32).* Others mentioned game scenarios as well, especially role-playing games: *"[I]n a role-playing game, it's not important because [...] you might want to look completely different" (P29).* P19 also stressed wanting to be different on some occasions: *"When I wanted to be a completely different person. When I was my Fursona."* Interestingly, for P9 it was important to be represented even in *"fantasy worlds"*: *"[E]ven though the character is made to represent you, there's no option to add any indication that you have a disability. It's kind of like in these fantasy worlds, there's no space for disabilities, which I kind of find a bit disheartening at times."*

Workplace settings. Mainly in our interviews, we asked about the usage of the avatar also in workplace settings. Of the 16 who talked about it, 13 in general liked the idea of communicating their disability and their associated needs with an inclusive avatar. For example, P19 explained: *"I would use in a work context, maybe slightly more*

willingly [compared to a social context], because I have to [...] disclose [...] any special requirements [...] in relation to [...] equipment and needs". Further, they did not want to *"to hide [their] disability" (P22).* In contrast, P14 would not feel comfortable sharing their disability: *"I'm not sure if I like if I would be ready for like the questions that might arise".* P7 also mentioned that the attention of the employer should not be focused on the disability only: *"People should know [...] about it. But again it shouldn't be pointed out [...]. The person [is there] to do a job. They're not there because they're disabled to do the job";* and P31 has concerns regarding the power dynamics and fears discrimination, if not in a privileged position: *"[Using the inclusive avatar in a workplace setting] could work if you're one of the bosses and you used it for your identity and you're high enough up that people wouldn't mess with you [...]. In the other case probably not a good idea."*

Aside from that, it was mentioned that VR meetings are not common at their jobs and it depends on the company culture (P7, P9) and that the avatar should look like oneself: (*"You probably do want more of a model that's like simple and kind of looks like you" (P5)*).

5 Reflections and Future Directions

Based on the results outlined above, we now reflect critically on our research questions as well as our study process and limitations. We discuss our findings and provide suggestions for future research in the context of inclusive avatars.

5.1 RQ1: Reflecting on the Inclusive Avatar Experience

Overall, our results are quite positive. Qualitative and quantitative results show that despite some incidents of harassment and toxicity in VRChat, participants generally felt positive emotions. Further, we documented several positive social interactions for PWD in social VR and outlined their potential and value for people with visible and invisible disabilities. Importantly, when asked to describe their avatar experience in our concluding survey, more than half of our participants (16) described their experience in a positive way. While the results look promising, more research is needed. Our approach was exploratory and we did not employ an experimental design with a comparison condition. Nevertheless, our combined results suggest potential drivers for positive our negative experiences in social VR. Specifically, we observed important differences between those with visible and invisible disabilities, both in their social interactions, experiences, and identity. .

Influence of disabled identity perception. Previous research shows that there are different preferences of users with disabilities in virtual worlds and social VR. Some users want to show disability pride by disclosing their disability while others want to hide aspects of their disability [8, 50, 74]. This preference, and how it changes over time is an important area for future research. From our qualitative data, we saw ten people in the process of accepting their disability as a part of their identity. It is likely that this shaped their experience, as for example, P4 explained: *"Maybe [...] it's because I can accept my disability [...] if I wouldn't accept it I would have problems or troubles in playing or in accepting [...] these kind[s] of avatars. But just because I'm OK with my [normality] and I can laugh about it [...].*

I think it's worth [using the inclusive avatar]." As inclusive avatar users encounter important social interactions, such preferences and identity processes may tip the scales towards more resilience in negative situations. We suggest future research explores this possibility.

We also saw participants with internalized ableism, *"[wanting to be] normal"* by using no disability signifier (P6) or *not accepting* their disability (P31). This resulted in participants not feeling connected to the inclusive avatar. Highlighting the complexity and differences between users, P12 liked using the avatar, because they thought *"[not] many people saw [their] avatar as that of someone with a disability.".* All combined, this further suggests internalized ableism and identity are important considerations when using avatars with disability signifiers. Related work [19] shows that insecure participants tend to favor more attractive avatars. This may also apply to inclusive avatars such that participants with internalized ableism may prefer avatars without disability signifiers. That said, there were participants who clearly accepted their disability, but perceived it as something *"attached to them"* rather than part of their identity, which aligns with Bloustien and Wood's [8] findings from Second Life. In these cases, participants did not see the need to use an inclusive avatar. We believe that every understanding of identity is valuable and that every person holds multiple identities. We should rigorously explore the impact of multiple identities, and especially intersectionality to improve inclusive design efforts.

Influence of disability signifier. In our study, we saw people with visible disabilities describing fewer positive and more negative situations compared to people using the sunflower disability signifier. The presence of negative situations replicates the findings of Zhang al. [74], who observed negative behavior towards people with visible disability signifiers. However, this might be due to the fact that we had more people using the sunflower. Qualitative results showed that the sunflower did not attract as much attention and was discussed less frequently, compared to visible disability signifiers. Interestingly, even though the sunflower was less noticeable, participants with invisible disabilities seemed to find it easier to find peers who share an invisible disability. This only happened once to a participant with a visible disability signifier. This suggests that people with invisible disabilities may be more represented in social VR [72] and that users with visible disabilities such as mobility disabilities may have limited access to VR technology [48]

5.2 RQ2: Reflecting on Avatar Usage Scenarios

Coming together in safe spaces. Generally, participants seemed very open to using an inclusive avatar. However, feeling safe or willing to be vulnerable seemed to be an important pre-requisite for using an inclusive avatar, which mirrors disability disclosure strategies in social media [24]. To promote safety, participants called for dedicated inclusive spaces where disabled communities could meet in VR. Of course, creating safe spaces alone is not enough; it is critical that harassment is mitigated in general [23, 62, 63].

Social VR therapy. Our data suggests that inclusive avatars can influence the perception of one's self. Participants reported group experiences akin to positive *"therapeutic"* situations. This suggests that inclusive avatars present one potential avenue for positive

community experiences in ways that may benefit social anxiety, and facilitate connection around other invisible disabilities. Importantly, part of this effect was described as VRChat reducing barriers for participants to open up and start conversations compared to real life, a finding that is in line with recent work investigating social VR as a place for therapy [15, 72]. Future research should explore the role an inclusive avatar could play in such therapeutic efforts.

Disabled identity development. Freeman et al. [22] provide evidence that social VR helps to explore one's identity with respect to gender and race, potentially facilitating acceptance of various characteristics. We see similar tendencies in our data. Some participants were surprised by their experience. P1 even stated: *"I know I use VR to try to escape from my disability and the pain that it brings. [...] that's why I thought bringing the cane into VR would just remind me of it instead of just making me feel more immersed in the world".* P14 also explored their identity with their disability through their avatar: *"I would say that I've never really identified [...] as someone with a disability. [...] I've never [...] been very [...] open about it with a lot of people. And wearing the avatar [...] opened the door and, like, gave me permission in a way [...] that it was OK to [...] talk about it".* However, there could be negative developments as well: individuals struggling to accept their disability could be more susceptible to negative experiences, which in turn could reinforce their negative feelings towards themselves. We did not see this trend in our data, still, three of four people who expected negative experiences also reported an overall negative experience. The positive and negative effects of inclusive avatars on identity are topics that should be investigated in future studies.

5.3 Challenges and Limitations of the Study

Recruiting participants and the VRChat environment both presented a major challenge for this project. In a pilot study, we had a drop-out rate of 97%, potentially because of technical difficulties and accessibility problems with VR but also some health-related cancellations. When starting the diary study, we implemented some changes to counteract those effects. First, we did not strictly require head-set usage anymore. Second, we simplified the process of the study by providing the pre-made avatars. And third, to acknowledge "crip time" and disability-related difficulties, we extended the period the study was running without adjusting the minimum usage time required. For the diary study, we saw a drop-out rate of 59%. Whether or not this is related to our changes in the study setup, we cannot say, but nevertheless, we thought those changes might be helpful for the community for future studies. Our setup has several limitations. By not strictly requiring headset use due to the aforementioned difficulties, not all participants had fully immersive experiences. While exploratory analyses showed no differences between participants with headsets and those without in our data, our small sample size limited our ability to investigate the impact headset usage had on avatar perceptions. Future studies should investigate the impact of VR headset use.

Unfortunately, we could only cover a limited amount of intersectional [12] experiences, as our participant sample was mostly White and men. Intersectional effects likely play an important role in experiences with inclusive avatars. We suggest scholars explore intersectionality in future research. Further, the use of pre-made

humanoid avatars simplified the study process for the participants but could have influenced their feelings towards the avatar, as some disclosed a desire for more customization options in the future.

6 Conclusion

In this paper, we conducted a mixed methods experience sampling study with PWD to capture the lived experiences of those with visible and invisible disabilities as they used avatars with disability signifiers in social VR. With our study, we illuminate real-time feelings, perceptions about the social VR environment (belonging, authenticity), thoughts about inclusive avatars (avatar satisfaction, psychological connection to avatar), and engagement in dynamic social VR spaces. Our findings suggest that both positive and negative social interactions can impact users' emotions, satisfaction, and sense of belonging and authenticity in virtual spaces. Qualitative interviews reveal that disability signifiers, while holding the potential to induce harassment, also facilitate opportunities for connection and community building. Our results also suggest that more research is needed to fully understand the implications of disability signifiers, in particular for those with invisible disabilities. We suggest looking into factors like disability identity perception for future research as those could potentially influence the inclusive avatar experience. Our study contributes to a small but growing literature by being one of the few studies that focus on the real-time emotions of participants using avatars with disability signifiers during important social interactions. We hope our research opens up new avenues of research into the direction of inclusive avatar use and the associated lived experiences.

Acknowledgments

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