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Feelings of presence and perceived social support in social virtual reality platforms

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ABSTRACT

Social virtual reality (social VR) platforms are gaining popularity among users. Previous qualitative research suggests that feelings of presence can make these platforms an attractive environment to obtain social support from others. Building on these exploratory insights, we carried out a quantitative study to illuminate how different types of presence in social VR platforms facilitate social support. The results of a large survey conducted among users ($N = 1231$) show that feelings of social presence and self-presence are predictors of perceived social support and that this perception of social support is positively associated with users' subjective well-being. Perceived social support is greater for women than for men, and it differs across platforms, although with small effect sizes. These results underline the role of presence in the perception of computer-mediated social support, suggesting that the affordances of social VR make it a particularly well-suited medium for facilitating beneficial interactions among users.

1. Introduction

The growing penetration of virtual reality (VR) devices in the market (IMARC Group, 2021), together with the large bets that some major technology companies (e.g., Meta, Microsoft) are making on the so-called *metaverse* (Brown, 2021), suggest that social interactions in VR environments may become more ubiquitous in the near future. In recent years, numerous social VR platforms, like VRChat, AltspaceVR, Rec Room or Horizon Worlds, have already appeared on the market, offering users a novel format of online social interaction. Although they vary in several aspects, one of the common denominators of these platforms is that they rely on the use of immersive technology (VR headsets), which contributes to eliciting a feeling of presence in users (Cummings & Bailenson, 2016). Feelings of presence ("a psychological state in which virtual objects are experienced as actual objects in either sensory or nonsensory ways"; Lee, 2004, p. 27) experienced in social VR platforms have been previously associated with positive outcomes, such as a greater sense of relatedness and entertainment (Barreda-Ángeles & Hartmann, 2022), although they also have downsides, like the greater realism making harassment situations feel more threatening for victims (Blackwell, Ellison, Elliott-Deflo, & Schwartz, 2019). However, given the novelty of social VR platforms, and despite some early investigations, the effects of their use on users is not comprehensively understood by now.

Therefore it is a timely and relevant endeavor to examine the (positive and negative) effects of social VR platforms on users, to anticipate potential benefits and risks, and guide optimal design and use choices. One important potential outcome of using social VR is social support, that is "the perception or experience that one is cared for, esteemed, and part of a mutually supportive social network" (Taylor, 2011, p. 189). Past research suggests that users often employ (more traditional) social media technologies to seek and provide social support, and that supportive, technology-mediated interactions might involve significant benefits for users (e.g., Liu, Wright, & Hu, 2018; Oh, Ozkaya, & LaRose, 2014). In the case of social VR, however, the insights into how its use may facilitate social support are very sparse, and to date have been purely based on qualitative research with a very limited number of participants (e.g., Acena & Freeman, 2021). In particular, the effects of feelings of presence (as a distinctive characteristic of social VR platforms compared to other media technologies), on social support have not been empirically examined from a quantitative perspective. In addition, we also know little about the users that benefit from social support based on social VR. In the present article, we tackle these research gaps by examining how feelings of presence on social VR platforms predict

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perceived social support and how user characteristics and platform type affect feelings of presence and perceptions of social support. In summary, our research provides a first empirical quantification of three central theoretical questions, namely (1) how does the use of social VR platforms affect users' perception of social support and their subjective well-being, (2) what role does the illusion of presence in its different facets (spatial, social and, self-presence) play in this perception of social support; and (3) what factors predict both feelings of presence and perceived social support in this context.

1.1. Social VR platforms

The term "social VR" refers to 3D virtual spaces, primarily accessed using VR head-mounted displays, that allow (geographically distant) users to interact with each other using avatars (Maloney & Freeman, 2020; Sykownik, Graf, Zils, & Masuch, 2021). The VR headsets block the perception of the physical surroundings and replace it with digital representations that respond to user actions in a way that simulates real-world behavior and experiences (e.g., turning the head leads to an update of the visual field). Social VR avatars replicate the users' movements in real-time, allowing for social interactions that mimic real-world interactions in many ways (Bailenson, 2018). Thus, these platforms offer users a high level of social *bandwidth* ("the breadth of social cues potentially transmitted in a channel"; Fox & McEwan, 2017, p. 302) compared to less immersive media (e.g., users can approach the others in the virtual space, use gestures and proxemics cues, or even whisper each other's ear). In terms of communication affordances (cf. Fox & McEwan, 2017), social VR platforms allow for real-time (i.e., not persistent or editable), personal (as opposed to broadcasted), and private (the user controls who receives the messages) social interactions, with high conversational control. Qualitative research suggests that social interaction in these platforms often feels more "natural" and "intimate" than in other media like social networking sites or video-conferences (Maloney & Freeman, 2020).

Users currently use social VR platforms to engage in activities related to socialization (e.g., hanging out with friends or meeting new people), entertainment (e.g., gaming, exploring worlds, or crafting avatars), and, to a lesser extent, also learning and working activities (e.g., attending events, learning languages) (Barreda-Ángeles & Hartmann, 2022; Sykownik et al., 2021). Across this variety of activities, users can access remotely located communities of users with similar backgrounds, interests, or attitudes. Early qualitative research (e.g., Acena & Freeman, 2021) suggests that, through them, these platforms might thus provide opportunities for seeking and receiving social support.

1.2. Social support in online social interactions

Social support is a multidimensional concept that encompasses diverse subtypes, including emotional support (e.g., comfort, expressions of caring, validation), instrumental support (e.g., assistance, tangible goods), and informational support (e.g., information, advice). Social support (and, particularly, emotional social support; Trepte & Scharkow, 2016) is key to an individual's subjective well-being (Thoits, 2011), understood as the extent to which "the person subjectively believes his or her life is desirable, pleasant, and good", Diener, 2009, p. 1). Interestingly, perceiving that support is available (i.e., perceived social support) is often more beneficial than the actual support received (Gleason & Iida, 2015).

People often seek and receive various types of social support not only from offline relationships, but also from online social activities, such as participation in communities and forums (e.g., Mo & Coulson, 2008), gaming (e.g., Trepte, Reinecke, & Juechems, 2012), and interactions with family, friends, and acquaintances in social networking sites (SNS; e.g., Liu et al., 2018). Several features can make online applications attractive places to seek and obtain social support: for instance, they can provide access to large communities of people with different profiles (which are perhaps not available among the user's offline network), and they can facilitate getting a quick response to a support request regardless of geographic location. Online interactions can also lower the cost of maintaining relationships with physically distant strong and weak social ties and, in some cases, being anonymous can help the user feel more comfortable dealing with certain issues (Rains & Wright, 2016; Vitak & Ellison, 2013; Walther & Boyd, 2002). Social VR platforms share many of these features, suggesting that they might also help users gain social support.

Users currently use social VR platforms to engage in a variety of activities. The existing platforms have different focuses; for instance, some are more focused on social events (AltspaceVR), others on games (Rec Room), others on the creation of spaces and content (Horizon Worlds). However, despite the variety of activities that predominate in different platforms, most of them have one thing in common: they focus on providing (synchronous) social interaction between users. This element is already evident in the slogans that these platforms employ: "Be together, anywhere" (https://altvr.com); "Create. Explore. Together." (https://oculus.com/horizon-worlds); "Bigscreen is your virtual hotspot where you can hang out with friends" (https://bigscreenvr.com); "Rec Room is the best place to build and play games together" (https://recroom.com/). Although a systematic exploration of these activities is, to date, still a pending task, existing research indicates that users predominantly use these platforms to socialize with other users (Sykownik et al., 2021), whether it is simply hanging out with others in "public spaces" (e.g., the campfire in AltspaceVR or the Rec Center in Rec Room), attending events together with other users, creating virtual worlds together, or playing multiplayer games in which social interaction is often a central element (e.g., Freeman & Acena, 2021; Maloney & Freeman, 2020; Maloney, Freeman, & Robb, 2021). Through these activities, users can access remotely located communities of users with similar backgrounds, interests, or attitudes and make new friends or maintain contact with existing ones (Maloney et al., 2021). Central to the present study, relational regulation theory (Lakey & Orehek, 2011) proposes that perceptions of social support are determined by ordinary interactions (e.g., conversations, shared activities) with an affective component, and not necessarily require explicitly supportive actions. Accordingly, the different activities that occur in social VR may provide a suitable setting for users to interact with others, to develop relationships via either spontaneous conversations or participation in shared activities and, eventually, develop supportive relationships (Freeman & Acena, 2021).

Some preliminary qualitative research already points in this direction. The study by Freeman and Acena (2021) suggests that, often (and even when they were not explicitly looking for them), users' of social VR platforms end up making meaningful and supportive connections with other users. Another example is the study by Acena and Freeman (2021), which provides preliminary, qualitative evidence that LGTBQ users can find "safe spaces" on social VR platforms where they can express themselves freely and build relationships with users with similar attitudes and backgrounds, from whom they may obtain social support (see also Freeman et al., 2022). Besides, the strong representation of groups with a clear purpose of providing (both informational and emotional) social support on some of these social VR platforms (e.g., LGTBQ groups, groups on mental health awareness, religious discussions, or tutorials on technology or musical creation, among many others) also points to the utility of these platforms to seek and receive social support.

1.3. Online social support and well-being

Although technology-mediated social interactions may contribute to social support, the effects of online social support on users' well-being are less clear. Research on the effects of online social support (e.g., on SNS) on well-being has yielded mixed results, with some studies showing evidence of a direct positive effect (Gilmour, Machin, Brownlow, & Jeffries, 2020; Oh et al., 2014; Oshio, Kimura, Nishizaki, &

Omori, 2020), and others not finding such an effect (e.g., Li, Chen, & Popiel, 2015; Trepte, Dienlin, & Reinecke, 2015; Utz & Breuer, 2017). A possible explanation for the mixed evidence is that, as shown by Burke and Kraut (2016), when interacting with others on SNS, more personal and elaborate communication with strong social ties (e.g., close friends) positively impact well-being, while superficial interactions with weak social ties do not. Moreover, as suggested by Trepte et al. (2015), the technical affordances of SNS might hinder developing intimate and close interactions, thus minimizing the chances to obtain emotional support, which is closely linked to well-being (Gleason & Iida, 2015). Indeed, research shows that often online support is less effective than in-person support (Lewandowski, Rosenberg, Jordan Parks, & Siegel, 2011), and, accordingly, the study by Li, Chen, and Popiel (2015) stresses that receiving social support *online* does not always involve feeling supported *in general*.

In the case of social VR platforms -and unlike SNS like Facebook- initial qualitative research suggests that, due to creating a sense of presence and allowing for embodied interaction through avatars, these platforms provide a more intimate, close and natural communication than other media (Maloney & Freeman, 2020; Maloney, Freeman, & Wohn, 2020; Sykownik et al., 2021), which could facilitate obtaining emotional support on these platforms (e.g., Acena & Freeman, 2021). However, scholars only started to empirically illuminate to what extent users of social VR platforms actually obtain social support. Most existing research on social aspects of social VR platforms has not focused on whether and how users can obtain social support from them, or addressed the topic only as a side issue (see Table 1 for a summary of existing literature in the topic). A laudable exception is the study by Acena and Freeman (2021) that provided valuable initial insights on the topic, with a focus on LGTB users. However, the findings build on interviews with a small sample of eight members of the LGBT community (combined with a "participant observation" method). Hence, the small and specific sample of this study makes it difficult to generalize its findings to other types of users.

Social VR platforms can foster natural and intimate forms of communication (Maloney, Freeman, & Robb, 2020; Maloney & Freeman, 2020; Sykownik et al., 2021), and social VR users often perceive social interactions in social VR platforms as very similar to real-life interactions (Freeman & Acena, 2021; Moustafa & Steed, 2018). Thus, the similarity between social VR interactions and in-person interactions could make social support received on social VR contribute to users' perception of social support in general (i.e. regardless of whether it is offline or online; Li et al., 2015), increasing chances of a positive impact on users' well-being. Thus, our first hypothesis is:

H1. : Perceived social support through social VR platforms is positively associated with subjective well-being, and this relationship is mediated by the user's general perception of social support.

1.4. Antecedents of online social support: The role of presence

Qualitative reports point to feelings of presence in social VR platforms as a factor helping the development of close social bonds (e.g., Maloney & Freeman, 2020; Moustafa & Steed, 2018), which could in turn have a positive impact on social support perceived (e.g., Reis & Franks, 1994). Presence is broadly defined as the feeling of "being there" (Skarbez, Brooks, & Whitton, 2017). Although there are many divergent conceptualizations and approaches to the concept, many authors (e.g., Haans & IJsselsteijn, 2012; Lee, 2004; Wirth et al., 2007) agree on understanding it as a "largely automatically generated and mostly sensory-driven perceptual sensation or feeling that is introspectively accessible" (Barreda-Ángeles & Hartmann, 2022, p. 2).

Rather than treating presence as a unitary construct, several scholars make a distinction between different types of presence, including spatial presence, social presence, and self-presence (Lee, 2004). In short, spatial presence (or "place illusion"; Slater & Sanchez-Vives, 2016) refers to the

Table 1
Summary of existing studies on social interaction in commercial social VR platforms.

Reference	Method (*N* sample)	Main topic addressed	Main Findings
Acena and Freeman (2021)	Qualitative interviews ($N = 8$) and participatory observation	Social support for LGBTQ users	Social VR (1) allows to connect to other users in a way that feels like face-to-face due to embodied interactions; (2) constitutes a *safe space* for building social relationships
Barreda-Ángeles and Hartmann (2022)	Survey ($N = 220$)	Psychological benefits associated with feelings of spatial and social presence	Feelings of spatial and social presence in social VR are positively associated with feelings of relatedness and enjoyment of activities
Freeman and Acena (2021)	Qualitative interviews ($N = 30$)	Motivations for and experiences of building interpersonal relationships	Embodiment in avatars makes shared activities more engaging
Freeman, Acena, McNeese, and Schulenberg (2022)	Qualitative interviews ($N = 30$)	Collaborative activities	Feelings of embodiment boost feelings of co-presence and facilitate collaborative activities
Freeman and Maloney (2021)	Qualitative interviews ($N = 30$)	Presentation and perception of self	Social VR allows for experimentation with own self (e.g., playing being a different person) and how it is presented
Freeman, Maloney, et al. (2022)	Qualitative interviews ($N = 59$)	Strategies to approach non-cisgender identity	Social VR allows non-cisgender users to express and experiment with their identity in novel ways
Freeman, Zafanifad, et al. (2022)	Qualitative interviews ($N = 30$)	Experiences of harassment	The technical features of social VR allow for new forms of *embodied* harassment
Maloney and Freeman (2020)	Qualitative interviews ($N = 30$)	Factors that make social interactions meaningful	Embodiment in avatars and full body tracking make activities more engaging and meaningful
Maloney, Freeman, and Robb (2020)	Participatory observation (during three months in three platforms)	Children experiences in social VR	Children benefit of using their virtual bodies to communicate with others (e.g., virtually hugging)
Maloney et al. (2021)	Qualitative interviews ($N = 20$)	Motivations and experiences of teenage users	Social VR allows for rich social interactions beyond playing games (e.g., using social VR as a *social hub*)
Maloney, Freeman, and Wohn (2020)	Qualitative interviews ($N = 30$) and observational data	Non-verbal communication	Embodiment in avatars facilitates non-verbal communication, making social

(*continued on next page*)

Table 1 (*continued*)

Reference	Method (*N* sample)	Main topic addressed	Main Findings
			interactions feel natural
Maloney, Zamanifard, and Freeman (2020)	Qualitative interviews (N = 30)	Perceptions of anonymity and privacy	Most users feel comfortable to disclose emotions and personal information in social VR
Moustafa and Steed (2018)	Diaries and qualitative interviews (N = 17)	Social interactions in small groups	Emotions experienced by users are, overall, very similar to those that would be experienced in a face-to-face interaction
Sykownik et al., (2021)	Survey (N = 273)	Motivations for social VR use and activities	Most users experience higher social closeness in social VR compared to other online media
Sykownik et al. (2022)	Survey (N = 126)	Self-disclosure in social VR	Social VR allows for "authentic" connections between users
Zamanifard and Freeman (2019)	Analysis of social media posts (N = 650)	Long-distance relationships in social VR	Social VR allows long-distance couples to experience emotional states that are to some extent similar to the ones they can experience in face-to-face interaction

feeling of being physically located in the virtual environment (Wirth et al., 2007). Social presence ("a sense of being with another", Biocca, Harms, & Burgoon, 2003, p. 456) is conceptualized as the feeling of being co-located and connected with other sentient beings (Biocca et al., 2003; Oh, Bailenson, & Welch, 2018). For most authors, social presence involves not only awareness of the presence of others, but some degree of social interaction or engagement with them (Skarbez, Brooks, F. P., & Whitton, 2017). Finally, self-presence (or embodiment) refers to the users' feeling that the body of their respective VR avatar is their actual body (Kilteni, Groten, & Slater, 2012). When accessed with a VR headset, the immersive properties of VR platforms enhance feelings of presence: features like head and body tracking, stereoscopy, or a wide visual field contribute to spatial presence (Cummings & Bailenson, 2016); aspects like the visual representation of the others, interactivity, and social cues, among others, contribute to social presence (Oh et al., 2018); and the use of avatars that track and replicate user's movements in real-time leads to self-presence/embodiment (Kilteni et al., 2012).

Several reasons exist why the three dimensions of presence, as experienced on social VR platforms, can contribute to enhancing perceptions of social support. First, social presence plausibly enhances the perception of social support. Social presence is often related to a sense of co-presence, psychological closeness, and intimacy with others (Biocca et al., 2003; Oh et al., 2018), as proposed by social presence theory (Short, Williams, & Christie, 1976). At the same time, the degree of intimacy and closeness between the interacting partners is an important determinant of the perception of social support (particularly, emotional support; Hobfoll, Shoham, & Ritter, 1991; Reis & Franks, 1994).

Second, regarding spatial presence, theoretical accounts of embodied cognition suggests metaphorical associations between physical and mental concepts (Bargh, Schwader, Hailey, Dyer, & Boothby, 2012). Accordingly, in social VR platforms, the illusion of being there, and of being physically close to others' avatars, could trigger perceptions of psychological closeness, which could, in turn, lead to more intense perceptions of social support. Some previous evidence points in this direction (Acena & Freeman, 2021; Maloney & Freeman, 2020), and the quantitative results by Barreda-Ángeles and Hartmann (2022) shows that feelings of spatial presence in social VR are predictors of the sense of relatedness with other users. Even in non-interactive scenarios, like documentaries and journalistic pieces, feelings of spatial presence have been linked to empathy (e.g., Barreda-Ángeles, Aleix-Guillaume, & Pereda-Banos, 2020), which is also an antecedent of social support (Devoldre, Davis, Verhofstadt, & Buysse, 2010).

Third, regarding self-presence, being embodied in an avatar allows one to virtually make and receive socially supportive gestures like hugging, touching, a clap on one's shoulder, or shaking hands. Both theoretical accounts, like the person-centered theory of supportive communication (Jones & Bodie, 2014), and empirical research (Colvin, Chenoweth, Bold, & Harding, 2004), suggest that these type of nonverbal communication can enhance the perception of social support. Self-presence could also intensify the effects of such gestures since they would appear to address one's own body. Therefore, our second hypothesis is as follows:

H2. : Feelings of social presence (H_{2a}), spatial presence (H_{2b}), and self-presence (H_{2c}) are positive predictors of perceived social support in social VR platforms.

Beyond feelings of presence, another important factor that may affect perceptions of social support on social VR is the frequency of use (e.g., Kim, 2014; Stefanone, Kwon, & Lackaff, 2012). Given that the perception of social support is associated with intimate relationships (Hobfoll et al., 1991; Reis & Franks, 1994) that usually take repeated interactions to be built (Laurenceau, Barrett, & Pietromonaco, 1998), frequency of use may be a key determinant of users' ability to obtain social support. Therefore, our third hypothesis is:

H3. : Frequency of use of social VR platforms predicts the social support perceived on these platforms.

Furthermore, it is important to notice, however, that the feelings of (social, spatial, and self-) presence are not only a function of the technical properties of the system, but they are determined by contextual and individual factors as well. Among them, gender appears to be an important factor. Gender not only seems to affect feelings of presence but also of perceived social support. Some research suggests that women might feel lower levels of spatial presence in VR environments (Felnhofer, Kothgassner, Beutl, Hlavacs, & Kryspin-Exner, 2012). At the same time, meta-analytical evidence indicates that (at least in interactions on SNS), women experience higher levels of social support (Liu et al., 2018; Tifferet, 2020). Hence, whereas, according to H_2, women should perceive lower levels of social support in social VR, as a consequence of the lower levels of presence, it is possible that other mechanisms compensate for this effect.

Besides gender, users' age could also affect perceptions of social support, not only because age can be associated with different use patterns (Liu et al., 2018; Pfeil, Arjan, & Zaphiris, 2009), but also because there is some evidence that older users could feel lower levels of presence (Bangay & Preston, 1998; Bohdanowicz, Kowalski, Cnotkowski, Kobyliński, & Biele, 2020).

Finally, the specific characteristics of different social VR platforms might be another important factor that is affecting social support and should be taken into account. Social VR platforms vary in many aspects, such as the ability given to users to personalize their avatars, or the type of activities (e.g., games, events) that a platform supports (Liu & Steed, 2021). These factors could affect not only the experienced levels of presence, but also the ability to obtain social support by using that platform (Rains & Wright, 2016). Given the lack of conclusive evidence on the interaction between users' gender and age, and platforms characteristics, on feelings of presence and perceived social support, we

explore this issue through the following research question (RQ):

RQ_1: How do the user's gender and age, and platform used, affect the experienced feelings of (social, spatial, and self-) presence, and perceived social support in social VR platforms?

2. Method

2.1. Participants

An anonymous online survey was conducted among social VR users in May 2021. Respondents were recruited by posting requests for participation in social VR and VR-related forums in Reddit as well as by posting ads on related Facebook groups. The messages and ads directed participants to the online survey. To stimulate participation, participants who completed the survey could participate in a raffle of two $50,- Amazon gift cards (by leaving their email address in a separate file, so the survey data remained anonymous).

A total of 2059 participants completed the survey. Of these, data from 828 users were removed from the sample because they stated they did not use social VR platforms, or because of indications of fraudulent responses, duplicated responses, very improbable ages (e.g., older than 100 years old), or lack of variability in the responses (responding with the same value across all the items in the scales in the survey). Hence, the final sample consisted of 1231 users of social VR platforms aged between 14 and 74 years old ($M = 27.92$; $SD = 10.06$). Most participants (893) were male (73% of the sample), while female participants (293) represented 24% of the sample (the rest of the participants identified themselves as non-binary, "other", or preferred not to respond, 4%). Most participants were located in the United States (66%), followed by the United Kingdom (6%), Canada (5%), and the Netherlands (2%) (other countries: 11%; no response: 10%).

The majority of the participants reported using only one headset (63%), or two (25%), although around 12% of the participants had three or more. The most commonly used headset was Oculus Quest 2 (33%), followed by Oculus Rift (23%), HTC Vive Cosmos and HTC Vive Pro (17% each). Most respondents were users of more than one social VR platform ($M = 2.30$; $SD = 1.22$). Specifically, 35% of the participants reported being regular users of two platforms, 33% reported using only one, 22% used three different platforms, and the rest (10%) reported using four or more platforms. The most commonly used platforms were VRChat (54%), followed by Rec Room (37%), Big Screen (25%), and Facebook Horizon (22%). The collected dataset is publicly available in the Open Science Framework.

2.2. Measurements

Perceived Social Support in Social VR. An adapted version of the four-item subscale for social support from friends, from the Multidimensional Scale of Perceived Social Support (MSPSS, Zimet, Dahlem, Zimet, & Farley, 1988), was used. We focused on social support from friends rather than from other types of social ties (e.g., acquittances or strangers) because (relatively) strong social ties are more effective in providing social support than weaker social ties (e.g., Burke & Kraut, 2016; Christenfeld et al., 1997; Manago, Taylor, & Greenfield, 2012). Therefore, we maximize the chances that users report perceptions of social support, allowing to analyze whether they are correlated with feelings of presence, as hypothesized.

Participants were asked to report the level of social support that they obtain specifically from social VR interactions. Samples of the items used are: *I can count on my social VR friends when things go wrong* and *I have friends on social VR with whom I can share my joys and sorrows*. Participants responded using five-point Likert-type scales, ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*). This type of scale was used as well for the rest of the measurements below. The scale showed good reliability (Cronbach's $\alpha = 0.87$).

Perceived General Social Support**.** Participants were asked to report their perceptions of social support *in general* (as opposed to social support obtained specifically from social VR interactions), using the same items as for social support on social VR, but adapted to account for the level of perceived social support in general (e.g., *I can count on my friends when things go wrong*; *I have friends with whom I can share my joys and sorrows*). The scale showed good reliability (Cronbach's $\alpha = 0.88$).

Well-being. Self-reported well-being was measured with an adapted version of the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). To shorten the scale and increase the chances that participants finished the survey, the three items with the highest factor loadings were selected out of the total of five items in the original scale. The three items used were: *In most ways my life is close to my ideal*; *The conditions of my life are excellent*; and *I am satisfied with my life*. These items formed an internally reliable scale (Cronbach's $\alpha = 0.82$).

Social Presence. An adapted version of the five-item social presence subscale from the Multimodal Presence Scale for virtual reality environments (Makransky, Lilleholt, & Aaby, 2017) was used to measure social presence. The scale contained items like *When I use social VR, I feel like I am in the presence of another person in the virtual environment* and *When I use social VR, I feel that the people in the virtual environment are aware of my presence*, and its reliability was good (Cronbach's $\alpha = 0.82$).

Spatial Presence. An adapted version of the four-item self-location subscale from the Spatial Presence Experience Scale (Hartmann et al., 2016) was used to measure the feeling of being located in the virtual environment while using social VR applications. The items were adjusted to refer to the use of social VR (e.g., *When I use social VR, I feel like I am actually there in the social VR environment*; *When I use social VR, it feels as though I am physically present in the social VR environment*). The reliability of the scale was good (Cronbach's $\alpha = 0.80$).

Self-presence. An adapted version of the self-presence subscale from the Multimodal Presence Scale for virtual reality environments (Makransky et al., 2017) was used to measure self-presence. Since all the items in the original subscale had very high factor loadings (Makransky et al., 2017), the original subscale was shortened by using only the three items (out of the original five items) with the highest factor loading.. The items used were *When I use social VR, I feel like my avatar is an extension of my real body within the virtual environment*; *When I use social VR, I feel like my avatar and my real body become one and the same; When something happens to my avatar, it feels like it is happening to my real body.*). The scale provided acceptable reliability (Cronbach's $\alpha = 0.78$).

Frequency of Use. The frequency of which respondents used social VR was measured with the question *How many times do you use social VR on average per week?*. Participants used a slider to select an answer between 0 and 10 (with one decimal).

2.3. Data analysis

A confirmatory factor analysis (CFA) was conducted using the *lavaan* package (Rosseel, 2012) in *R* in order to validate our measurement model. The resulting goodness-of-fit indicators, $\chi^2(215) = 877.96$; $p < .001$; CFI = 0.94; RMSEA = 0.05, 90% CI [0.047, 0.054]; SRMR = 0.05, were analyzed using the equivalence testing procedure described by Yuan, Chan, Marcoulides, and Bentler (2016). *T*-size CFI and RMSEA were calculated ($CFI_t = 0.937$; $RMSEA_t = 0.054$) and compared against the adjusted cutoff values (Marcoulides & Yuan, 2017; Yuan et al., 2016). The results indicated that the CFI_t did not reach the adjusted cutoff value of what is generally considered a good enough fitting (for a model with these characteristics, above 0.94 for CFI_t; Marcoulides & Yuan, 2017). Since modification indices suggested relevant cross-loadings of some of the items used, a subsequent exploratory factor analysis was then carried out. It showed that, specifically, one item from the spatial presence scale (*It seems as though I actually take part in the action of the virtual environment*) and one item from the self-presence scale (*I feel like my avatar is an extension of my real body within the virtual environment*) were having relevant loadings (>0.20) on the social presence factor. After removing these two items, the CFA yielded a clear

improvement on model fitting, $\chi^2(174) = 599.672$; $p < .001$; CFI = 0.96; RMSEA = 0.04, 90% CI [0.041, 0.049]; SRMR = 0.036, and the results of equivalence testing indicated now a good fitting of the measurement model to the data ($CFI_t = 0.953$; $RMSEA_t = 0.048$) according to the adjusted cutoff values (Marcoulides & Yuan, 2017).

The measurements were also tested for discriminant validity (Henseler, Ringle, & Sarstedt, 2015), as well as for common method variance and multicollinearity, using a Harman test (Tehseen, Ramayah, & Sajilan, 2017) and a full collinearity test (Kock & Lynn, 2012), respectively. The results (presented in detail in the Supplementary Material) indicate that our measurements provided good discriminant validity and were not significantly affected by common method variance or multicollinearity.

Once the measurement model was validated, and in order to test hypotheses 1 to 3, a structural equation model (SEM) was fitted with Maximum Likelihood estimation and bootstrapped standard error (5000 samples). The model included the hypothesized relationships between the variables, as well as correlated error terms between the three types of presence (since they are often correlated; e.g., Barreda-Ángeles & Hartmann, 2022). The model did not fit the data adequately, $\chi^2(200) = 1008.09$; $p < .001$; CFI = 0.93; RMSEA = 0.06, 90% CI [0.054, 0.061]; SRMR = 0.08, according to the results of equivalence testing ($CFI_t = 0.932$; $RMSEA_t = 0.061$). This suggested that relevant relationships between the variables were neglected in the model. Therefore a second SEM with additional paths was fitted, based on theoretical grounds. First, the adapted SEM included a direct path between frequency of use and general social support, in order to account for potential negative effects of frequency of use on the overall perceived social support (e.g., because of the use of social VR potentially displacing other social activities; Kraut et al., 1998). Second, since feelings of presence in social VR can have other positive effects on well-being, not mediated by perceptions of social support (e.g., providing fun experiences; Barreda-Ángeles & Hartmann, 2022), direct effects of the three types of presence on well-being were also included in the model. Third, given that both feelings of presence can motivate the use of social VR (Sykownik et al., 2021) and, at the same time, frequent use could increase feelings of presence (e.g., by habituation to the technology and reducing potential cybersickness; Gavgani, Nesbitt, Blackmore, & Nalivaiko, 2017) the model also allowed for residual covariation between frequency of use and the three types of presence. Indicators of model fit, $\chi^2(193) = 723.15$; $p < .001$; CFI = 0.96; RMSEA = 0.05, 90% CI [0.044, 0.051]; SRMR = 0.05, were evaluated using the equivalence test procedure, which showed a good performance of the model ($CFI_t = 0.944$; $RMSEA_t = 0.051$; "close" fit to data; Marcoulides & Yuan, 2017).

Finally, RQ_1 was examined by fitting a series of four linear regression models, in which social presence, spatial presence, self-presence, and perceived social support in VR platforms were considered outcome variables. Participants' age and gender (including only males and females), together with the frequency of use, and the use of different social platforms, were included as predictors. Given the large diversity of social platforms used, we only included the four most frequently cited platforms (VRChat, Rec Room, Bigscreen VR, and Facebook Horizon). In the regression model for perceived social support, we also included the three dimensions of presence as predictors, in order to examine the effects of the other predictors while controlling for the effects of presence.

3. Results

Table 2 shows the means, standard deviations, and correlations between the variables included in the model (calculated excluding the two items showing cross-loadings in the CFA analysis). As shown in the table, all variables are significantly correlated with each other, with the exception of frequency of use with social support in general, and frequency of use with social presence.

The results of the SEM are summarized in Fig. 1. H_1 forecasted a positive effect of perceived social support from social VR interactions on well-being, mediated by the perception of social support in general. The model shows a strong, positive association between social support from VR and social support in general ($\beta = 0.60$; $p < .001$), and positive effect of social support in general and well-being ($\beta = 0.29$; $p < .001$), while the direct effect of social support from VR on well-being was not significant ($\beta = -0.05$; $p = .41$). A mediation analysis was conducted following the bootstrap approach (Hayes, 2009) with 5000 bootstrap samples. It shows as well significant indirect ($\beta = 0.19$; $p < .001$) and total effects of social support from using social VR on well-being ($\beta = 0.13$; $p = .03$), thus supporting H_1.

The model also shows positive associations between feelings of presence and social support perceived from social VR interactions (H_2). In particular, social presence ($\beta = 0.40$; $p < .001$) and self-presence ($\beta = 0.47$; $p < .001$) are predictors of the social support perceived in social VR. However, spatial presence was not ($\beta = -0.03$; $p = .65$). Therefore, H_{2a} and H_{2c} were supported whereas H_{2b} was not. Covariance between the different types of presence is apparent in the model (Table 3). In the light of them, we explored the possibility (not included among our initial hypotheses), that spatial presence may contribute to feelings of social and self-presence, then having an indirect effect on perceived social support. To examine this question, we conducted a parallel mediation analysis, based on a bootstrap approach (5000 samples) proposed by Hayes (2009). The results show that spatial presence is a significant predictor of both social presence ($\beta = 0.57$; $p < .001$) and self-presence ($\beta = 0.64$; $p < .001$), and it has two significant indirect effects on social support on VR, via social presence ($\beta = 0.23$; $p < .001$) and self-presence ($\beta = 0.30$; $p < .001$), with a considerable total effect ($\beta = 0.50$; $p < .001$).

Our third hypothesis (H_3) predicted a positive association between the frequency of use of social VR platforms and the perception of social support from the social interactions happening on those platforms. It was confirmed by the positive and significant path ($\beta = 0.06$; $p < .001$) between these two variables in the model. The model also revealed some interesting relationships between variables not included in our initial hypotheses. Specifically, frequency of use has a direct, negative (albeit weak) effect on the perception of social support in general ($\beta = -0.08$; $p < .001$), and feelings of self-presence showed a direct positive effect ($\beta = 0.31$; $p < .001$) on well-being.

Finally, regarding the effects of age, gender, and platform used (RQ_1) on presence and social support, the regression analyses (summarized in Table 4) showed significant effects of gender on the experience of using social VR: women reported more intense spatial and self-presence than

Table 2
Means, standard deviations, and Pearson zero-order correlations between the variables.

	M	SD	1	2	3	4	5	6
1. Social support VR	3.56	0.99						
2. Social support general	3.95	0.83	0.45***					
3. Well-being	3.59	0.92	0.24***	0.30***				
4. Social presence	3.95	0.78	0.34***	0.43***	0.18***			
5. Spatial presence	3.67	0.88	0.42***	0.31***	0.24***	0.45***		
6. Self-presence	3.11	1.12	0.45***	0.19***	0.27***	0.08**	0.50***	
7. Frequency of use	5.34	2.65	0.3***1	−0.01	0.12***	−0.04	0.17***	0.37***

* $p < .05$; ** $p < .01$; *** $p < .001$.

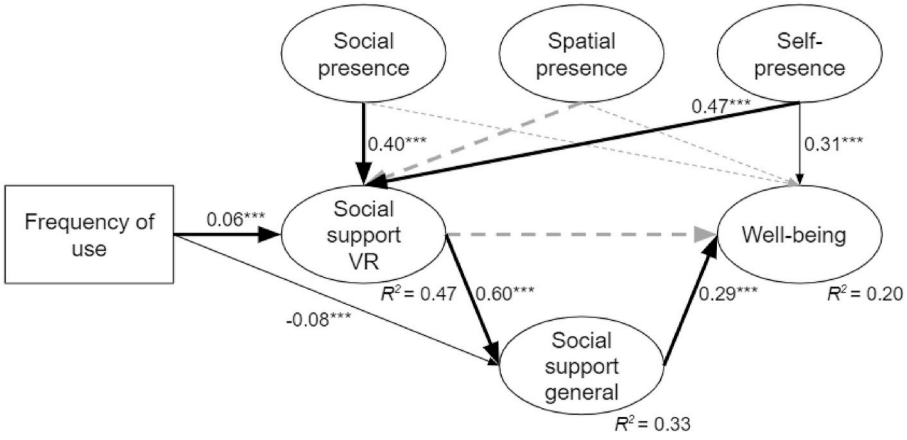

Fig. 1. Summary of the structural equation model.*$p < .05$; **$p < .01$; ***$p < .001$ ***Notes.*** Black lines represent significant paths in the model. Dashed grey lines represent non-significant paths included in the model. Bold arrows represent paths included in the hypotheses; non-bold arrows represent paths added ex-post to improve model fitting. Significant paths show the standardized regression coefficients.

Table 3
Residual covariance between variables accounted in the SEM.

Variables	Estimate
Social presence <—> Spatial presence	0.57***
Social presence <—> Self-presence	0.10**
Social presence <—> Frequency of use	−0.14
Spatial presence <—> Self-presence	0.64***
Spatial presence <—> Frequency of use	0.51***
Self-presence <—> Frequency of use	1.11***

Table 4
Summary of the regression models.

	Social presence	Spatial presence	Self-presence	Social support VR
Intercept	4.27***	3.36***	2.04***	0.40*
Age	−0.01***	−0.01**	0.00	−0.01*
Gender	−0.02	0.17**	0.43***	0.15**
VRChat	0.03	0.00	−0.07	0.12*
Rec Room	0.15**	0.12*	0.04	−0.09
Facebook Horizon	−0.09	0.18**	0.43***	0.15*
Bigscreen	0.15**	0.14*	0.11	−0.07
Frequency of use	0.00	0.04***	0.11***	0.07***
Social presence				0.29***
Spatial presence				0.15***
Self-presence				0.31***
Observations	1186	1186	1186	1186
R^2	0.06	0.05	0.20	0.37
Adjusted R^2	0.06	0.05	0.20	0.36

*$p < .05$; ** $p < .01$; *** $p < .001$.
Notes. Gender was dummy-coded as follows: 0 = male; 1 = female. For each platform: 0 = non-users; 1 = users.

men, as well as more intense perceptions of social support. Age mattered, too. Older users reported lower levels of social and spatial presence, and (probably, as a consequence of it) of social support obtained from their social VR interactions. The different platforms showed a variety of effects, with no clear patterns. Users of VRChat did not report experiencing stronger presence (no matter which type), but higher levels of social support than non-users. Users of Rec Room experienced higher levels of social and spatial presence than non-users, but not of self-presence or social support. The use of Facebook Horizon was associated with higher levels of spatial presence, self-presence, and social support, whereas users of Bigscreen VR experienced more intense social and spatial presence than non-users. However, most of these effects were very small (partial Cohen's $f^2 < 0.02$; Cohen, 1988), making their practical relevance disputable. The only two effects with a relevant effect size were the effects of gender and the use of Facebook Horizon on self-presence (partial Cohen's $f^2 = 0.04$ and 0.03, respectively, which are considered "small" effect sizes; Cohen, 1988).

4. Discussion and conclusions

Our results show that feelings of social presence and self-presence are associated with perceptions of social support in social VR applications, and this has a positive impact on perceptions of overall social support and, indirectly, on the users' subjective well-being. Thus, our study points to presence-related affordances of social VR as facilitators of social support, confirming quantitatively (as far as we know, for the first time) what previous qualitative research has already suggested in this respect (Acena & Freeman, 2021; Freeman & Acena, 2021).

The relationship between social presence and social support is not particularly surprising: feeling that we interact with others and that they pay attention to us seems fundamental for certain forms of social support (e.g., emotional, validation, self-esteem), as recognized by different theories on social support (e.g., relational regulation theory; Lakey & Orehek, 2011; or the person-centered theory of supportive communication, Jones & Bodie, 2014). What is most interesting in our data is that those who experience greater self-presence also reported perceiving greater social support in VR. The association between self-presence and social support could be explained in terms of the impact of *embodied* nonverbal, supportive actions (e.g., hugging, touching one's shoulder, patting one's back; Maloney, Freeman, & Robb, 2020; Freeman et al., 2022): the more the users feel that those actions are addressed to their real body, the higher their potential positive impact might be. Additionally, the naturalness and richness of nonverbal behaviors might facilitate the development of closer social bonds (e.g., as proposed in social presence theory; Short et al., 1976), which are central to the perception of social support (Thoits, 2011). Therefore, it is possible that users experiencing higher self-presence simply make more *use* of their virtual body in the interaction with others, displaying higher levels of nonverbal behavior, which would lead to closer social connections and, eventually, stronger experiences of support (e.g., Freeman et al., 2022). While our research suggests an association between self-presence and social support in VR, the specific mechanism behind this association is

still not totally clear. In this sense, some previous (Baccon, Chiarovano, & MacDougall, 2019) research points to the combination of the ability to use non-verbal cues and a sense of anonymity as factors that could enhance self-disclosure of information, which is often considered as a pre-requisite for the forge of social bonds (Carpenter & Greene, 2016). Future research should explore whether the combination of feelings of self-presence and anonymity explain perceptions of social support in social VR.

Our data show that spatial presence, on the contrary, does not have a direct impact on perceived social support, but may affect it indirectly, by increasing social presence and self-presence. These results seem to indicate that the feeling of being there only affects the perception of social support to the extent that it facilitates social interaction with others, by increasing the feeling of being in the same space with others (social presence) and the feeling of interacting with others using one's own body (self-presence). Thus, rather than a factor that directly affects the perception of social support (as discussed in the introduction), spatial presence might be more of a facilitator of social interaction, which may, in turn, lead to the perception of social support.

Our results contribute as well to a better understanding of how social support is facilitated online, beyond the context of social VR. Some studies that have failed to find a relationship between perceived online social support (on SNSs) and user well-being have attributed this disconnect to the characteristics of social interaction on SNSs (e.g., Meshi & Ellithorpe, 2021; Trepte et al., 2015). Thus, relatively superficial interactions (e.g., "likes", comments on posts), although perceived as displays of social support (cf. Carr, Wohn, & Hayes, 2016), may not have the beneficial effect on subjective well-being that more substantial forms of offline social interaction (e.g., hanging out with friends in the real world) can have (e.g., Lewandowski et al., 2011). In this respect, relational regulation theory (Lakey & Orehek, 2011) argues that social support takes place primarily in the context of ordinary, day-to-day social interactions with an affective component (rather than in explicitly supportive interactions, like discussing how to cope with stress), and that settings that constrain relational elaboration may therefore also constrain the positive outcomes of the interactions. Compared to SNSs, social VR platforms allow for more natural and socially *richer* communication (Maloney et al., 2020), and a wider range of activities (e.g., hanging out in a VR world, attending events, or playing games together; Barreda-Ángeles & Hartmann, 2022), which could facilitate relational elaboration, and thus explain the effects of social support on VR on the perception of social support in general and well-being. Hence, the naturalness of communication and the scope of social activities afforded by the technology could be key factors to explain the potential beneficial effects of media technologies, which should be examined in further detail in future research on media use and well-being.

In our data, the frequency of use of social VR platforms positively impacted the social support perceived on these platforms, but this effect was considerably small. Moreover, the effects of frequency of use, together with the effects of the three types of presence, explained only about half of the variance of the social support users report to have received in VR ($R^2 = 0.47$). This suggests that other factors need to be taken into account to explain how social support is shaped by social VR use. The type of activity performed and the type of social ties with which activities are performed (Burke & Kraut, 2016; Carr et al., 2016; Rozzell et al., 2014), as well as the quality of the user's offline social networks (Dai, Wang, Kong, Dong, & Tian, 2021), may determine the extent to which users obtain social support from their online social interactions. These factors were not analyzed in our study, but could be key to fully understand the effect of frequency of use on social support. On the one hand, we focused only on perceived social support from friends, leaving aside perceptions of social support from other types of social ties (e.g., acquaintances or strangers). The motivation for this was that, overall, stronger social ties tend to be more effective in providing social support than weaker ones (e.g., Christenfeld et al., 1997; Manago et al., 2012). Because we intended to understand the role of presence in enhancing social support, we decided to focus on social support we deemed more likely to observe in social VR platforms (i.e. social support from friends). Hence, a limitation of our study is that we did not analyze how presence might affect social support received from weaker ties in social VR, like strangers, and potential impacts on users' well-being.

Regarding the activities that users perform in social VR platforms, we considered that, since the large majority of them (if not all) include (synchronous) social interaction as a central component, they can, in general, provide an adequate setting for users to perceive social support from other users (cf. Hrastinski, 2008; Litt, Zhao, Kraut, & Burke, 2020). This does not preclude that some activities may have a higher impact on social support than others. Certain activities (e.g., participating in an LGTBI support group once a week; or watching a movie with friends who live in another city from time to time), even if performed less frequently, could have a greater impact on the perception of social support than more frequent activities (e.g., playing games with strangers on Rec Room several hours a day) that do not result in the development of close social bonds. This would dilute the effect of frequency of use on perceived social support, helping to explain the relatively small effect of frequency of use on perceived social support in the social VR platforms.

At the same time, our results show a (weak) direct, negative effect of frequency of use on the perception of social support in general. This suggests that when users spend time on activities that do not favor the perception of social support, in some cases the use of these platforms may perhaps take time away from offline social activities (e.g., Maloney et al., 2021) that might be more beneficial, in line with the internet displacement hypothesis about online social interactions (Kraut et al., 1998). Another possibility would be that the causal relationship would be in the opposite direction: those users who have less offline support would tend to spend more time in social VR (in line with the internet *replacement* hypothesis; cf. Paez et al., 2020). However, the cross-sectional design of our study does not allow us to elucidate this issue. Thus, it is important that future research on this topic pays specific attention to the type of activity and the type of social contact with which it takes place, as well as the quality of the user's offline social network, using longitudinal designs to shed light on this question. In order to understand the net effect of social VR use on (general) social support, and whether it may lead to a replacement, displacement, or (perhaps) a reinforcement (cf. Dienlin, Masur, & Trepte, 2017) of social interactions in the physical world, scholars might also want to more systematically compare users and non-users of social VR in the future, and potential differences in social support received by users vs. non-users of VR.

Another interesting aspect of our results is that not all the positive effects of social VR on users were mediated by perceptions of social support. We also found a direct positive effect of self-presence on well-being, suggesting other potential benefits of social VR use, which might involve, for instance, entertainment, creative activities, or activities associated with escapism or self-expansion (cf. Barreda-Ángeles & Hartmann, 2022). The interaction between different types of activities, social ties, and different beneficial outputs in social VR is also a matter for future research.

Another related aspect of our results that deserves further scrutiny is that perceived social support in VR only had an indirect effect on well-being, via general social support. This can be interpreted in, at least, three ways. First, perceived social support in social VR could be seen by users as part of the overall social support that they have in their lives. This would imply an important difference with other media (e.g., SNSs), in which the perception of online and offline social support (and the effects of both) is more clearly differentiated (e.g., Li et al., 2015). Second, another possibility is that the social support received in VR allows users to gain more social support in their social interactions in physical reality. This could occur, for example, if users create new social connections on social VR platforms, or reconnect with old contacts through these, and that these then lead to enhanced interactions in the physical world (i.e., a *reinforcement* effect, Dienlin et al., 2017). Some qualitative studies document cases where this has occurred (Freeman &

Acena, 2021). Third, it could also be that this effect is due to other variables that may be confounded with social support: using social VR could not only trigger social support, but at the same time might enhance users' social skills (Freeman & Acena, 2021) or (e.g., in the case of some transgender users; Freeman & Maloney, 2021) help them clarifying aspects of their identity. These improvements in social skills could facilitate users' social interactions in the physical world, and in turn make these interactions more socially supportive. Accordingly, a better understanding of the impact of social VR platforms on users' well-being will require examining these possible mechanisms.

According to our results, women and younger users seem to benefit more from these platforms to obtain social support. In contrast to what has been reported in other studies (Felnhofer et al., 2012), in our sample, women also reported higher levels of spatial presence and embodiment (although the reasons for this are not apparent). At the same time, women and young people (in particular, adolescents) are also more exposed to some of the dangers of social VR, such as harassment situations (e.g., virtual groping; Basu, 2021), and a greater sense of presence can make those negative experiences more intense and vivid (Blackwell et al., 2019). Thus, our results also underscore the need to ensure safe environments so that these users can take advantage of the potential benefits of these platforms in a safe manner.

In this respect, an interesting question to explore in future research is not only the effects of presence on victims, but also on (potential) aggressors. In principle, feelings of presence might minimize or eliminate some of the factors that are related to the disinhibition of toxic online behaviors, such as the invisibility of the victim or the asynchrony of the interaction (Casale, Fiovaranti, & Caplan, 2015; Suler, 2004). Thus, feelings of presence could make aggression in social VR feel more similar to real-life aggression, hindering the moral disengagement that facilitates the perpetrator's aggressive behavior (Bandura, 2002). This could suggest a lower prevalence of aggressive behavior or online harassment in social VR compared to other less immersive media (and, indirectly, contribute to facilitating the attainment of social support in VR, by reducing users' negative experiences). However, there is evidence that harassment-related behaviors are relatively common in social VR platforms (Freeman, Zafanifad, et al., 2022), which highlights our still poor understanding of the impact of presence on aggressors. Perhaps, perpetrators' media awareness or knowledge that "this is just mediated" suffices in overruling any inhibitory effects of presence on harassing others in VR (e.g., see Hartmann & Hofer, 2022)? Clearly, we need more research on how presence (and media awareness) impacts both victims and aggressors in social VR environments to make these platforms safer environments for all, where users can effectively seek and obtain social support.

Our study has limitations that deserve to be pointed out, beyond those already discussed. First, the cross-sectional nature of the survey prevents us from drawing definitive conclusions about the causal direction of the relationships between the variables analyzed. It could be the case that, for example, those users who receive more social support also experience greater social presence because of it. Thus, while the correlations found are a condition for such relationships, future research should further demonstrate causality using longitudinal or experimental designs. Furthermore, in our study we focused on the perceived social support from friends. By focusing on close relationships, it is possible that the estimate of social presence obtained was increased by this type of relationship (although it seems unlikely, on the other hand, that the type of relationship affected the estimates of spatial and social presence). This is an additional reason to include perceived social support from other types of social ties in future research on the topic.

Second, given that there is (to our knowledge) no public information (on the sociodemographic and platform usage characteristics) of social VR platform users, it is not possible to determine to what extent our sample is representative of the target population. However, other studies that have employed surveys to study social VR users (Barreda-Ángeles & Hartmann, 2022; Sykownik et al., 2021, 2022), have obtained samples that match ours in several aspects (~75% male users, with a mean age between 20 and 30; most of them based in the US; VRChat being the most used platform). Thus, although the representativeness of the sample remains unknown, at least it is similar to that used in other studies on this medium, which helps to make the results comparable between studies.

Finally, we have not analyzed the different types of social support. The type of activities that take place on social VR platforms suggests that users may receive more informational support (e.g., in activities such as guided meditation meetings) or emotional support (e.g., in LGTBQ groups) than tangible support (which is less common in online settings; e.g., Liu et al., 2018). However, the extent to which one or the other types of support are more or less frequent, and the type of activities and social ties through which they are obtained, is something that has also been left out of our study. Likewise, although our results show differences between different platforms, we have not analyzed why these differences occur. We have also focused on a specific, very generic dimension of well-being (life satisfaction), while more specific dimensions (e.g., loneliness, stress) have not been examined here. Similarly, our measure of frequency of use accounts for the number of times users employ these platforms per week, but does not provide an estimate of total time (which may be difficult to obtain accurately through self-reporting). More precise measures, such as activity logs, should be considered in future studies. Finally, the data suggest that our sample contains mainly heavy users of social VR platforms (more than five times per week, on average). Users who receive more support may be motivated to use social VR more; it is thus possible that our sample overrepresents those receiving higher levels of social support and does not totally represent the experience of the overall user base. To understand in more detail the benefits of social VR for well-being, all of these issues will need to be explored in detail in future research.

CRediT author statement

Vincent van Brakel: Conceptualization, Methodology, Investigation, Data Curation, Formal analysis, Writing - original draft; Writing - review & editing. **Miguel Barreda-Ángeles**: Conceptualization, Methodology, Data curation, Formal analysis, Supervision, Writing- original draft preparation, Writing - review & editing. **Tilo Hartmann**: Conceptualization, Methodology, Formal analysis, Writing - review & editing.

Declaration of competing interest

None.

Data availability

The data underlying this article are available in the Open Science Framework at https://doi.org/10.17605/OSF.IO/RK4NM

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2022.107523.

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