frontiers in ICT

ORIGINAL RESEARCH
published: 07 December 2017
doi: 10.3389/fict.2017.00027

Trauma and Self-Narrative in Virtual Reality: Toward Recreating a Healthier Mind

*Iva Georgieva**

Department of History and Philosophy of Science, The University of Tokyo, Tokyo, Japan

This study discusses the concept of virtual selves created in the virtual spaces [e.g. social network services or virtual reality (VR)]. It analyzes the activities in the different virtual spaces and claims that experience gained there can be transferred to real life. In respect to that, the effects of the VR treatment on the self as well as the concept of *creating a life story* are analyzed as interconnected. The research question which arises from these considerations is how to look at psychological trauma in order to explain the effectiveness of the usage of VR for treatment of traumatic disorders. The proposal in the study is to see trauma as a shift in the normal storyline of the narrative people create. With this concept in mind, it might be possible to support the claim that reliving traumatic events, regaining control over one's life narrative, and creating new stories in the VR aids the treatment process in the search for meaning and resolution in life events. Considering the findings of researchers who argue in the field of self-narrative and traumatic treatment, as well as researchers on virtual selves, virtual spaces and VR, this study discusses the virtual as a possible medium to experience narratives and utilize those narratives as better explanatory stories to facilitate the therapeutic process of recovery and self-recreation. This study supports the idea that VR can be used to visualize patients' narratives and help them perceive themselves as active authors of their life's story by retelling traumatic episodes with additional explanation. This experience in the VR is utilized to form healthier narratives and coping techniques for robust therapeutic results that are transferred to real life.

Keywords: virtual self, virtual space, virtual reality, narrative, trauma, therapy

OPEN ACCESS

Edited by:
Enrico Capobianco,
University of Miami, United States

Reviewed by:
Pierpaolo Cavallo,
University of Salerno, Italy
Steven Demets,
Quant ICT, Belgium

***Correspondence:**
Iva Georgieva
ivavgeorgieva@gmail.com

Specialty section:
This article was submitted to Digital Health, a section of the journal Frontiers in ICT

Received: *05 July 2017*
Accepted: *21 November 2017*
Published: *07 December 2017*

Citation:
Georgieva I (2017) Trauma and Self-Narrative in Virtual Reality: Toward Recreating a Healthier Mind. Front. ICT 4:27. doi: 10.3389/fict.2017.00027

INTRODUCTION

Since the beginning of the Internet, a new understanding of the boundaries of reality has been created. The increasingly complex experience of people "being online" has a multifaceted effect on their lives. People create virtual selves in various virtual spaces as part of their everyday life and aim at gaining various experiences there. The connection and the mutual influence between the virtual selves and their creators—the real selves are a subject of various studies (Floridi, 2012; Jin, 2012; Kim and Shyam Sundar, 2012; McCreery et al., 2013; Suh, 2013). Moreover, the impact of the virtual spaces and especially virtual reality (VR) and its immersiveness on the self-image (Behm-Morawitz, 2013), as well as its application in therapeutic practices such as therapy in VR are receiving growing interest nowadays. However, concerns regarding VR's possible health hazards (Harwood et al., 2014) are also brought to light as part of the aspects of the virtual spaces utilization.

This research looks at the construction of the self-image and self-narrative in the virtual spaces [e.g. social network services (SNS)]. It connects this process to the explanation of the effect of therapy in VR as a treatment method which uses VR to treat various anxiety disorders, including posttraumatic stress disorder (PTSD). The research explores the notion of VR and its effect on human health (Rizzo et al., 2002) and looks at it through a philosophical prism to see how it can serve as a "playground" (Turkle, 1994, 1995; McCreery et al., 2012) to try out and obtain possible new experiences. It also sees the possibility to create or recreate one's life story (Schechtman, 1996) by adding explanatory meaning to life's events.

The study focuses on VR as the most immersive type of virtual space. Augmented reality (AR) and mixed reality (MR) also have potential as therapeutic environments. Still, their potential is focused on different direction (e.g., keeping connection with reality). They also lack the full immersiveness that can be obtained in VR and is sought as treatment effect. In this sense, the essence of the experiences that can be obtained through AR and MR is different from the one in VR; hence their potential for therapy could be a promising topic for a separate study.

MATERIALS AND METHODS

Definitions

To make an overview of the terminology used in the study, it is necessary to say that it is based on a research which proposes a philosophical point of view for the notions of virtual space, virtual environment, VR, and virtual self. The study utilizes the concept of *self-narrative* (Schechtman, 2011) to look into the essence of psychological trauma as a form of discrepancy in the personal story people create in their lifetime (Georgieva, 2017). For the connection between the idea of virtual on one hand and the idea of trauma and life story on the other hand, the study focuses on the concept of *transfer of experience* (Georgieva, 2011b) from the virtual space to the real life in the form of life experiences. It also discusses the immersiveness of the virtual space and the application of the feeling of presence in PTSD therapy (Mantovani and Riva, 1999; Bouchard et al., 2010).

By analyzing how people form and interact with their virtual selves in the virtual spaces, this study would like to observe the influence of technology on the self in the context of the concept of life story and to stress on the influence of technology in shaping personal identity (Floridi, 2012). It can be said that the narratives which one creates in the virtual space of VR "play different roles in constituting identities" (Schechtman, 2012, p.343), which could help the real self in the process of recovery from traumatic events.

To see how this could happen, the study analyzes the changes in the virtual self and the evolution of its connection with the real self which can be detected in the various experiences in the virtual. The study discusses whether there are *different* or *similar* virtual selves created and whether the creation of virtual selves is merely a process of experimentation done by bringing elements of the offline lives into the online context (Linares et al., 2011) as a way to improve one's self. The study considers that the ability to recreate one's persona online could be a major reason that makes the virtual space—attractive, VR—immersive, and therapy in VR—effective treatment method. That is why, the study discusses therapy in VR as a treatment method which utilizes the immersiveness of VR and creates a narrative context to re-experience trauma, form habituation of stressful stimuli and build resilience by offering the patients a "canvas" to relive a new life story.

To discuss trauma in the context of self-narrative, it is necessary to also define its essence in PTSD. PTSD is an anxiety disorder affecting many people around the world. Causes for the disorder are events that are connected with fear or threat for own life or the life of others, physical, and/or psychological assault or abuse, etc. The origins of the disorder can be sought in the examples of soldiers exposed to traumatic war experiences (Zoladz and Diamond, 2016) pointing to the fact that usually these events defy the normal life line and bring psychological suffering. Defining what kind of events cause PTSD (Maercker and Perkonigg, 2013) and in what way trauma is perceived in the context of someone's life story can answer questions such as why some people are more prone to suffer from the disorder and, therefore, help the efficient treatment of each of the types of trauma that are present (Novick, 2005).

Hypothesis

On the basis of findings from the study of the virtual self created in the virtual space (Georgieva, 2011b; Schechtman, 2012), the following hypothesis is formulated: the creation of virtual selves serves as a form of experimentation work to change one's real self-image and life story. This is possible through the transfer of virtual experiences to real life as real-life experiences such as the ones during treatment of PTSD in VR. In addition, when considering why the virtual has such effects it is possible to suppose that it might be easier to perceive changes happening in the virtual, and therefore, it could be faster to adapt and learn through experiences in the VR rather than through exposure in real environments (Georgieva, 2017). When these considerations are connected with the narrativity concept, it might be proposed that if trauma is considered a discrepancy in the narrative of the self then therapy in VR could serve as a facilitation technique which helps to interpret and accept that disturbance into the narrative's unity (MacIntyre, 2013) and to restructure the existing or form a new, healthier narrative.

This is achieved through the characteristics of VR such as gradual exposure in an adaptable environment where people find it easier to learn and play with their self-formation as it has been done before in the virtual spaces (Turkle, 1995). The aim of this study is to confirm whether the above explanation of the VR utilization in PTSD treatment can be put in the narrative context for creation of the self and be plausible to support VR as a powerful tool among the various treatment techniques for PTSD. Moreover, the study explains PTSD treatment through changes in the narrative creation.

Methods

This study adopts the method of analysis of the effects that the virtual spaces have on human self. It uses argumentation for the utilization of the different types of virtual spaces as technologies

to influence the human self-identity and story-telling ability starting with the impact of social media as one type and VR as another type. The study has an interdisciplinary approach exploring the technology's usage in health care in the psychological context of conditions such PTSD and its treatment. In addition, the method sees human life as a story through the prism of the narrative account from the phenomenological research. Finally, the study interprets how treatment of PTSD in VR could be considered effective in the context of these concepts and in what way VR works for the visualization and adaptation of the patient's narrative in therapy. The explanatory investigation of the advantage of VR in comparison with other treatment methods utilizes a philosophical point of view toward the experiences in the virtual as self-forming and the process of bringing the effect of such experiences in real life as therapeutic results.

Furthermore, as an exploratory investigation of the effects and the usage of the virtual spaces, the study utilizes two qualitative surveys performed during period of 5 years. The purpose is detecting tendencies in attitude toward the usage of these spaces and the creation of virtual selves as part of the human ability to tell stories and explain life events.

Because of the anonymous nature of the data, informed consent in electronic form (not written) was obtained from the participants before filling the questionnaire, thus not requiring approval from the Ethics Committee of The University of Tokyo (ethics approval was not required as per institutional and national guidelines). The data collection method follows the tenets of the ethical standards of research in The University of Tokyo.

RESULTS

Exploratory Investigation

The two surveys regarding the virtual spaces and the virtual selves created in these spaces were conducted using online questionnaire forms. The first survey (2011) was named "Questionnaire about your online (Internet) activity" and had four sections with 15 respondents. The second survey (2016) was named "Online life and experiences in virtual spaces" and had four sections with 27 respondents.

The questions in the first survey were directed toward topics about duration of Internet usage, types of spaces used (e.g., news websites, social media, etc.), level of attachment (addiction) to virtual spaces, types of virtual selves (similar to or different from their real selves) created in virtual spaces, connection between activities in real and virtual spaces, and effect of the virtual spaces on reality (e.g., communication, relationships, performance, etc.). The questions in the second survey were directed toward topics about duration of Internet usage, experience in VR, level of attachment (addiction) to virtual spaces, types of virtual selves (similar to or different from their real selves) created in virtual spaces, connection between activities in real and virtual spaces, and effect of the virtual spaces on reality (e.g., communication, relationships, performance, etc.), positive and negative experiences induced by online experience, evaluation of features of the virtual spaces (immersion, safety, easiness, etc.), difference between online and real self (idealization), transfer of the effect from the experience from the virtual to the real.

The two surveys on online and VR activity are employed to describe how people perceive themselves and how they evaluate their experiences in virtual spaces. These empirical results are analyzed in the philosophical framework regarding the construction of personal identity online (Schechtman, 2012) to support the hypothesis of transfer of experience through the influence of VR for the narrative recreation of the self with the purpose of forming a healthy narrative and life story. Supposing the experiences in VR are transferred to the real self as fully significant experiences, then it can be possible to argue that with this transfer a therapeutic reconstruction of the real self is made through the reconstruction of the self-narrative in story-making environments such as VR.

Results of Exploratory Investigation

The findings from the two surveys can be summarized as follows. Survey 1 (2011).

(1) Involvement in and addiction to the Internet, fields of online interest (**Figures 1A,B**)

Big part of the participants in the survey confirmed that they spent more than 30 h per week online mentioning activities, such as communication, social networking, followed by entertainment and study, searching for news, and obtaining information. All the participants agreed that they "had the experience of procrastinating on real-life tasks by being online" (Georgieva, 2011a). More than half of them admitted to be or to have been addicted to some kind of virtual space, such as games or social media websites. Still, the majority claimed that their Internet activities had not affected their real-life performances and relationships. As for those who said they had experienced such effects, they tended to describe them as positive instead of negative. This confirmed the positive attitude toward online activities and their effects regardless of the claims related to procrastination and addictive behavior. To confirm this, half of the respondents said that they did not agree that there was a large negative effect of their Internet usage.

(2) Interpersonal communication and gender play (**Figures 2A,B**)

More than half of the participants agreed on the fact that they "found it easier to communicate with certain people online instead of offline" (ibid.). But, the majority firmly admitted that they did not consider the relationships that started online to be strong and long lasting. Among the reasons mentioned for this included such characteristics of online experiences as "not … tangible," not "face to face," "virtual i.e. pseudo" (ibid.). Few participants had started relationships online and then transferred them into their offline lives and most of them still continued having those relationships in their lives. Moreover, few participants were willing to answer the questions about online gender swapping. Only 13.3% confirmed pretending to be the opposite sex online. One of them did online gender play for a period of 1 year. The reasons the participants gave included "for fun" (ibid.) or because of knowing the benefits of gender play in the specific environment. These answers, although limited, showed that there are people who still engage in gender play as described previously (Turkle, 1995).

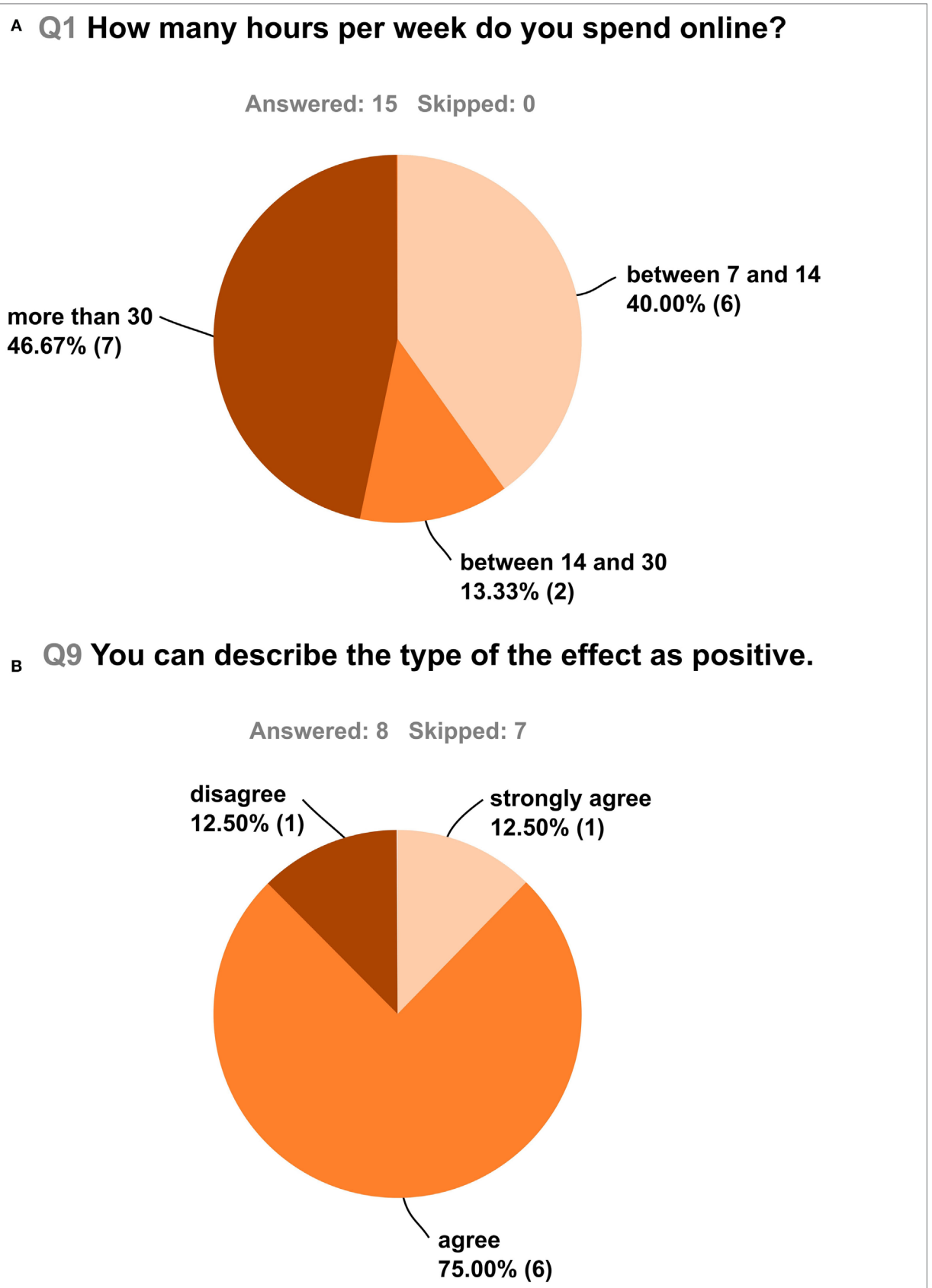


FIGURE 1 | Involvement in and addiction to the Internet **(A)**, fields of online interest **(B)**.

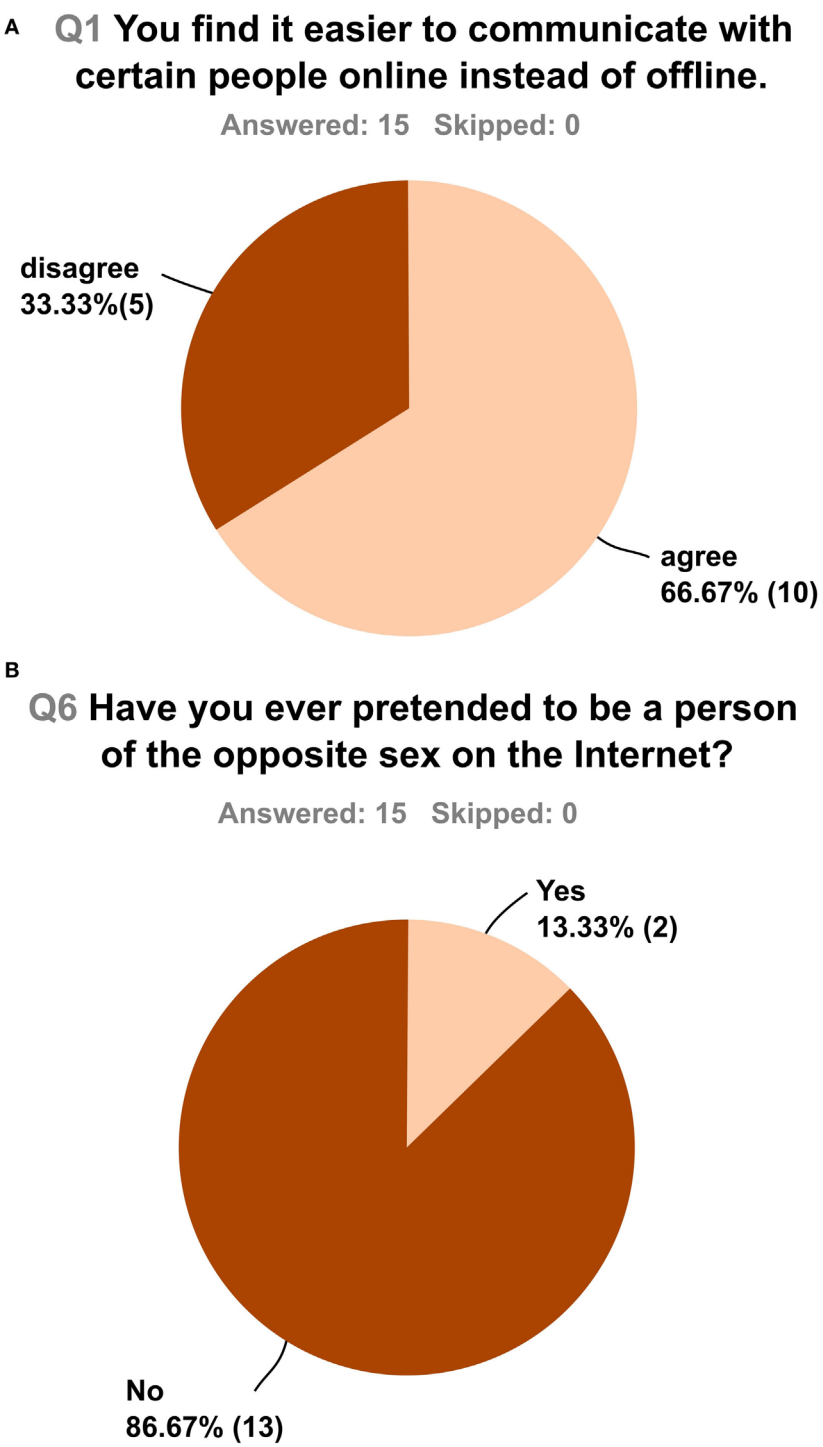


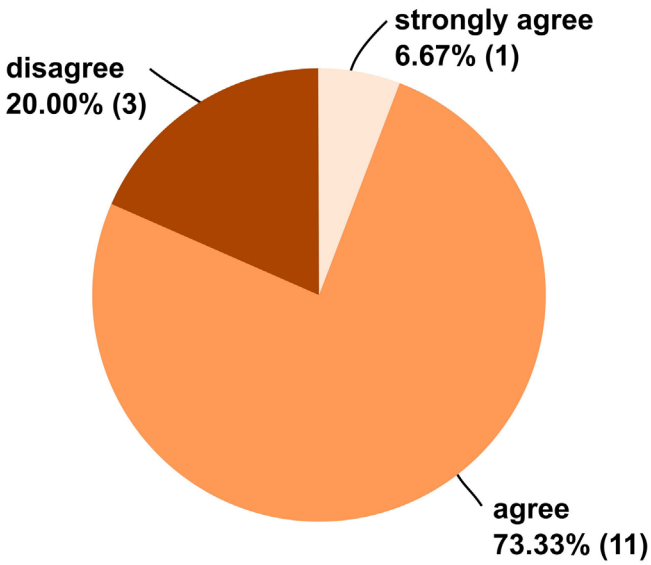
FIGURE 2 | Interpersonal communication **(A)** and gender play **(B)**.

(3) Privacy problems of online identity and the similarity of the virtual self (**Figures 3A,B**)

The third part of the first survey grasps the differences in the impact of the virtual spaces on the self. Almost half of the participants said they had deleted their "online profiles, accounts, etc." (Georgieva, 2011a) and mentioned reasons for this the ease of creating and destroying an online identity. One response defined the reason for the deletion as addiction to a particular website. Even though it was defined as addiction, it seems

A **Q9 You think that people pretend, play with their self-representation and tend to be different from their real selves while being online.**

Answered: 15 Skipped: 0



B **Q10 You can say that the difference between yourself online and offline is significant.**

Answered: 15 Skipped: 0

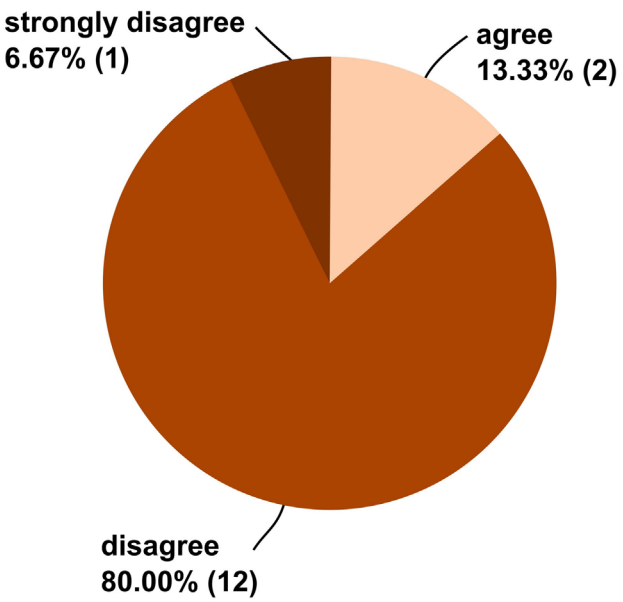


FIGURE 3 | Privacy problems of online identity **(A)** and the similarity of the virtual self **(B)**.

that the user was able to manage the problem by deleting the profile. Regardless of the various privacy problems online (van Kokswijk, 2007), in this questionnaire, only 13.3% confirmed they had such problems and these did not seem really troubling for their virtual self because they occurred very commonly (e.g., in e-mail communication). The same percentage of people as above said that they had been "bullied, assaulted, hacked, or any other kind of subject of negative actions on the internet" (Georgieva, 2011a). These were still actions with minor impact [e.g., "cussing" (ibid.)].

When turning to the identity presentation online, 26.7% of the users said that they were always "surprised by the differences in the identity of a person online and in real life" (ibid.). They were then asked about the claim: "You think that people pretend or play with their self-representation and tend to be different from their real selves while being online" (ibid.). A large part of the participants agreed with it. However, 80% of them disagreed with the statement: "You can say that the difference between yourself online and offline is significant" (ibid.). Though the support for these two claims seems contradictory, it actually shows one tendency—people tend to play and pretend with their virtual selves online but that does not mean that they are different from their true selves. The play and the change that happens online are result from the specifics of the virtual space—people feel free to easily change their self-image in the virtual environment.

(4) Difference in online and offline experiences (**Figures 4A–C**)

26.7% of the people said that they have had some strong (positive or negative) experience and the effect of these experiences has been transferred from the virtual space to their real lives. The examples they gave referred to positive experiences in general, and there were also few negative examples such as upsetting news. When asked about their reaction to the following scenario: "If you are able to take a short break or time off from your work/study, you would rather prefer the internet/being online" (ibid.), the largest percentage agreed. However, when asked about a modified case in the next question, "If you are able to take a short break or time off from your work/study, you would rather prefer real life/being offline" (ibid.), more than half of the respondents agreed. It seems that people, when asked about their real life (and feel like it is being compared to the virtual space), need to reassure that they are more attached to it, rather than to the experiences in the virtual. Survey 2 (2016).

(5) Effect of the virtual spaces on the self (**Figures 5A–C**)

The second survey shows stronger tendency to experience the effect of the virtual space in a positive and negative way, or to transfer that experiences. Majority agree that they use their online activity to induce positive emotions of different kind, showing that they utilize this feature of the virtual space, without considering its strong effect as uncontrollable. However, 87.1% also agree that in the same way online content might have similar strength in its bad influence of negative emotions. In addition, more than half admit that their online activity has helped them overcome problems in real life. In the examples how they managed to overcome such problems, the respondents give such examples as "feminist support groups," "finding answers to my issues and questions" (Georgieva, 2016) and the like.

(6) Experiences and self-image in the virtual spaces (**Figures 6A–C**)

To check whether the users in the second survey experiment with the virtual spaces, a question about trying new experiences was met with 64.5% who answered they did such kind of changing perspective experiences in the virtual. However, another discussed here topic, namely, utilizing the virtual space to create a "better" version of one's self, was included in the question about idealizing one's image online, where more than half of the participants admitted they create and present a more positive image of themselves online. In particular, they gave examples such as "many people do this in any form of impersonal communication" or "talking about my positive image only can motivate me and people around me" (ibid.). When asked about creating similar or different image of themselves, the biggest percent was given to the category of "similar." "Rather similar" and "different" share the next large percentages in the answers. It seems that the tendency to create similar virtual self in a more positive, idealized form is becoming mainstream.

DISCUSSION

Analysis of the Findings from the Two Surveys

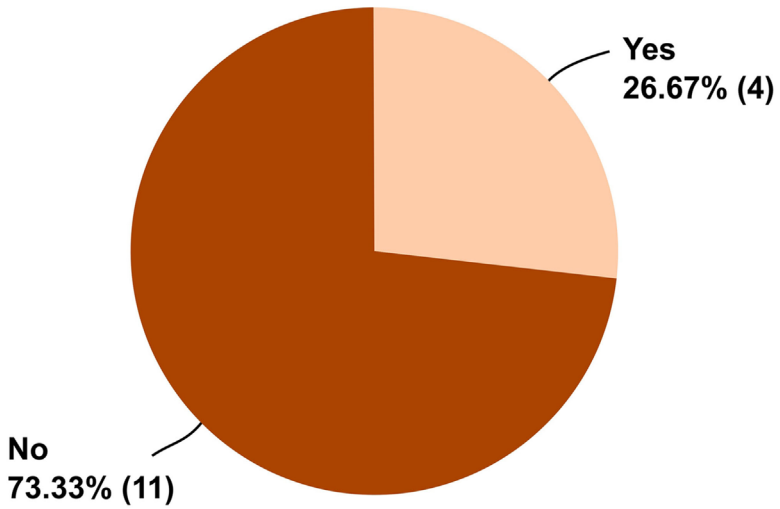
The number of participants in both surveys is limited; however, the detailed answers which they shared provide data with sufficient importance. A further exploration with greater number of participants could bring more insights into the problem of the influence of the virtual spaces and the formation of virtual selves there, as well as the concept of the transfer of experience.

Majority of the respondents showed preference to maintaining a virtual self which is not hidden or anonymous, but is usually a similar representation of the real self of the person and is used in various social interactions in the virtual space. For example, 80% of the respondents claimed that they did not find significant differences between their online and offline selves (Georgieva, 2011a). It seems that the experiments with the different type of the virtual self are becoming less popular compared to previous tendencies in virtual space utilization (Turkle, 1995).

However, it is necessary to point that the different type of virtual self is important since it can give a field for exploration of the self which could be impossible in reality. The perspective to see the self in a different light could be connected with the application of VR in therapy (Wiederhold and Wiederhold, 2008). In certain cases, the self-image used in this treatment application of the virtual space can be the image of the different virtual self because the treatment in the cases of phobias or stress will use a simulation of the traumatic experiences with the person involved, but then will seek detachment from the self while experiencing the problem's simulation (Riva et al., 2010). Of course, certain

A **Q1 Have you had a strong experience online and then transferred that experience from the virtual environment into the real life e.g. pleasant emotions, shocking, etc.?**

Answered: 15 Skipped: 0



B **Q3 If you are able to take a short break or time off from your work/study, you would rather prefer Internet/being online.**

Answered: 15 Skipped: 0

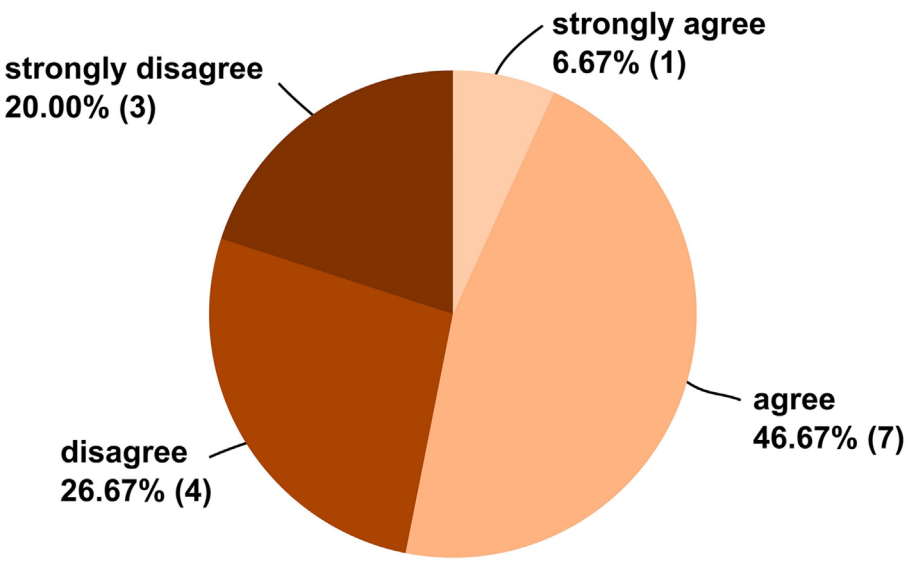


FIGURE 4 | Continued

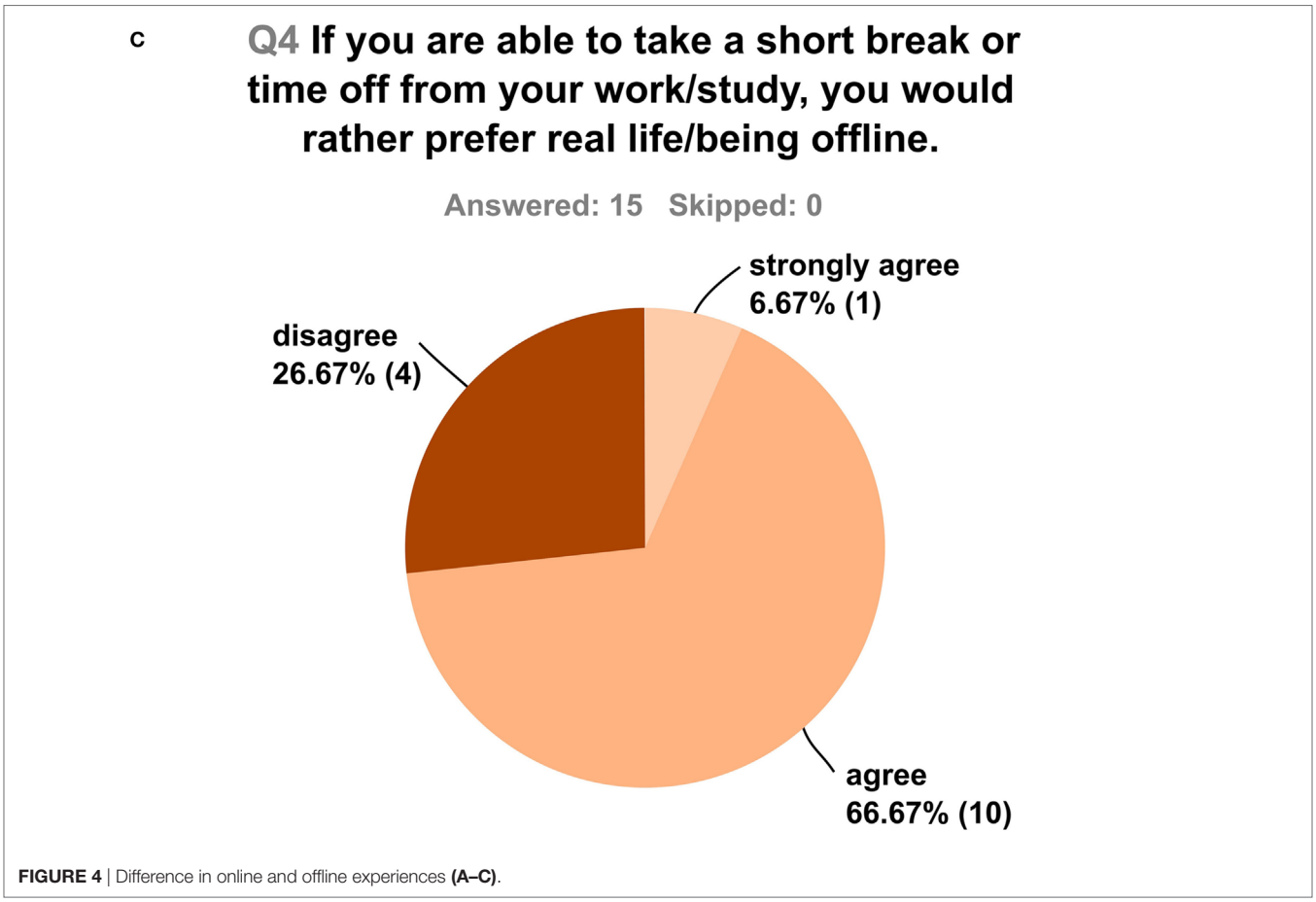


FIGURE 4 | Difference in online and offline experiences **(A–C)**.

applications of the virtual spaces require engaging the similar type of the virtual self [e.g., educational activities (Mitchell et al., 2007)] which shows the experimental grounds for self-creation in the virtual.

When the virtual self forms a too strong connection with the experiences in the virtual space it is possible to talk about virtual selves of "individuals for whom online identity becomes in some sense more important than offline identity" (Rodogno, 2012, p.17). In addition to that "extended online activities may have interesting repercussions on our personal identity" (ibid.). If there is a tendency to become more connected and open through the experience of the virtual selves, then such negative examples of "attachment identity" (ibid.) can serve as an example of the influence of the virtual spaces as engaging realities. On the other hand, this influence could be utilized in positive ways in practices to actually help the human self. The way people use virtual space to present themselves shows not only who they imagine to be (Cooper, 2011), but, as detected in several of the surveys' answers, who they intend to become. This image of the self is usually a better, advanced, or more positive than the self they have created so far. This process of change seems facilitated by the specifics of the virtual space itself as confirmed in the surveys' results.

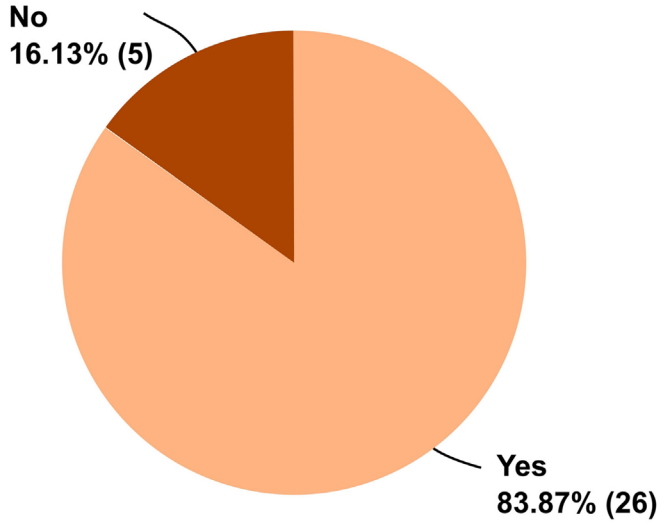
The virtual space has become a place to define and show your personalized self. If in the beginning no one knew you're a dog on the Internet [as proposed in the famous dog cartoon by Peter Steiner for The New Yorker (Steiner, 1993)], now users' Facebook likes can help understanding their personal traits (Kosinski et al., 2013). Such changes should be used for practices with positive outcome for the support and the development of the real selves.

The Concept of the Virtual

The era of information technology introduced new terms for describing various online spaces—"virtual" and "cyber," which were discussed in various contexts describing the changes in everyday life that Internet and VR bring about (Turkle, 1995, 2005, 2011; Chalmers, 2005; van Kokswijk, 2007). Of the two, the term "virtual" seems a broader term which conveys a meaning of something being "in essence" and "intelligible" even though not perceived as "real." For example, adopting a philosophical point of view toward the metaphysics of the "virtual" (Heim, 1993) could help describing it as something "not real" or at least not part of the physical world. However, it must be considered that in computer technology context the "virtual" has its own representations like "profiles," "agents," "rooms," etc. which serve and affect the physical world and the real selves in various ways. For example, virtual images seem real to the user and a facial expression in a realistic 3D simulation "looks just like real,"

A **Q1 Do you use your online activity to make yourself feel better – for example, to watch funny videos, scroll through pictures of good memories, and so on?**

Answered: 31 Skipped: 0



B **Q3 Have you felt bad by your presence online – for example, content made you jealous, you spent too much time online, and so on?**

Answered: 31 Skipped: 0

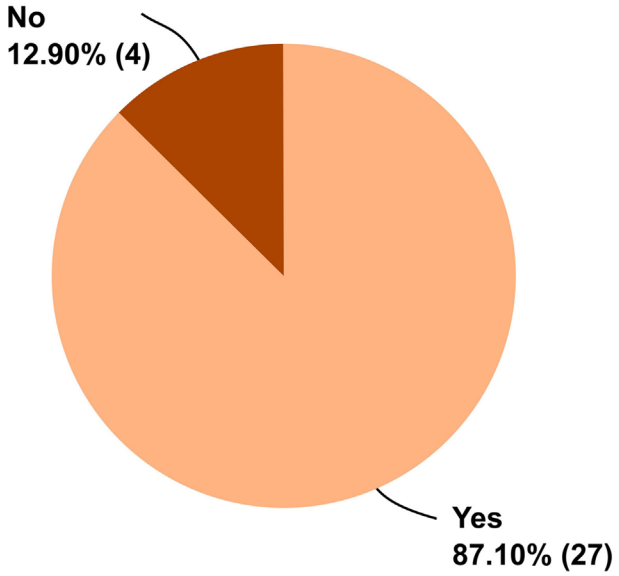


FIGURE 5 | Continued

FIGURE 5 | Effect of the virtual spaces on the self **(A–C)**.

evoking range of emotions. The realism and the immersion of the story which are specific for the virtual could be the reason for such images to be influential.

This consideration can be connected to the research findings about media impact on PTSD onset (Galea et al., 2005). In such cases, there is underestimation of the strength of the perceived effect and the imagery which is not happening here and now is disregarded as "not realistic" enough. This research would like to point out the strong influence the virtual representations and simulations have. It should be noted that "virtual environments, compared to classical advertising media, provide users with a higher level of presence, more perceptual and psychological immersion" (Grigorovici, 2003, p. 191). Therefore, it seems that virtual spaces are more immersive, however, considered "simulated" and "unreal." This dualistic account could add up to their effect through the expectation that they are safer than the real spaces.

Types of Virtual Spaces and Virtual Selves

Considering the findings from the two Surveys here is a proposed classification of the virtual spaces as used in the research:

(a) "this survey is designed to address your online behavior when you are using different Internet media like SNS, applications, and so on. The questions concern activities performed both on computers and handheld devices (smartphones, tablets, and so on), and do not make any difference between those."
(b) "this survey is designed to address your experiences in virtual spaces. By 'virtual spaces' we mean any simulated spaces that represent real or fictional worlds—for example, like the ones in 3D simulations, computer games, or VR." (Georgieva, 2016).

These descriptions show two main virtual spaces—the type (a) applications which offer experiences online (e.g., SNS) and the type (b) simulated environments offering alternative realities (e.g., computer games). This distinction between the two is necessary because they affect human perception of reality and self in a different way. However, both seem to have strong effect on human thinking and behavior which can be supported by the results from the surveys (Georgieva, 2011a, 2016) and research on the effect of virtual spaces and social media (e.g., Kramer et al., 2014).

The two surveys intention is to show how the virtual spaces influence people. For example, 53% answered "Yes" to the question "Can you say you have been/are addicted to some kind of virtual environment—game, website, service, etc.?" (Georgieva, 2011a), while 83% answered "Yes" to the question "Has your online activity helped you overcome problems in real life?" (Georgieva, 2016). It seems that the virtual spaces of the type (a) do have strong positive and negative effects. As for the type (b), studies of VR immersiveness (Grigorovici, 2003) show that the more immersive the virtual spaces, the stronger the impact on human perception. Research on the relation between low self-esteem and problematic internet use (Widyanto and Griffiths, 2013) or findings regarding issues like game addiction (Schoenfeld and Yan, 2012) show that the higher immersion factor the stronger the effect on human emotions and perceptions of self. The influence on self-image (Cooper, 2011) and the power to change perception

[e.g., induce serious cyber-sickness (Bruck and Watters, 2009)] support the hypothesis that the experiences in the virtual could be transferred to the real with enough strength and significance (Georgieva, 2011b).

Immersiveness

Now, let us connect the impact of virtual spaces to treatment by looking at research about the principles of therapy in VR and put it in the context of the immersiveness concept. Chalmers questions the simulation of VR for being an illusion of an external reality (Chalmers, 2015). He makes analogy with the experiences of mirrors where looking oneself usually does not provoke illusory experience of someone being on the other side of the mirror but a non-illusory experience of someone on this side of the mirror observing the reflections that are result of the mirror's ability to reflect images. VR presents an image which resembles the real one and evokes feelings and actions similar to the ones people have toward real images. For example, avatar customization used in weight reducing program (Waddell et al., 2015) is used to show how self-projection to a virtual image affects one's

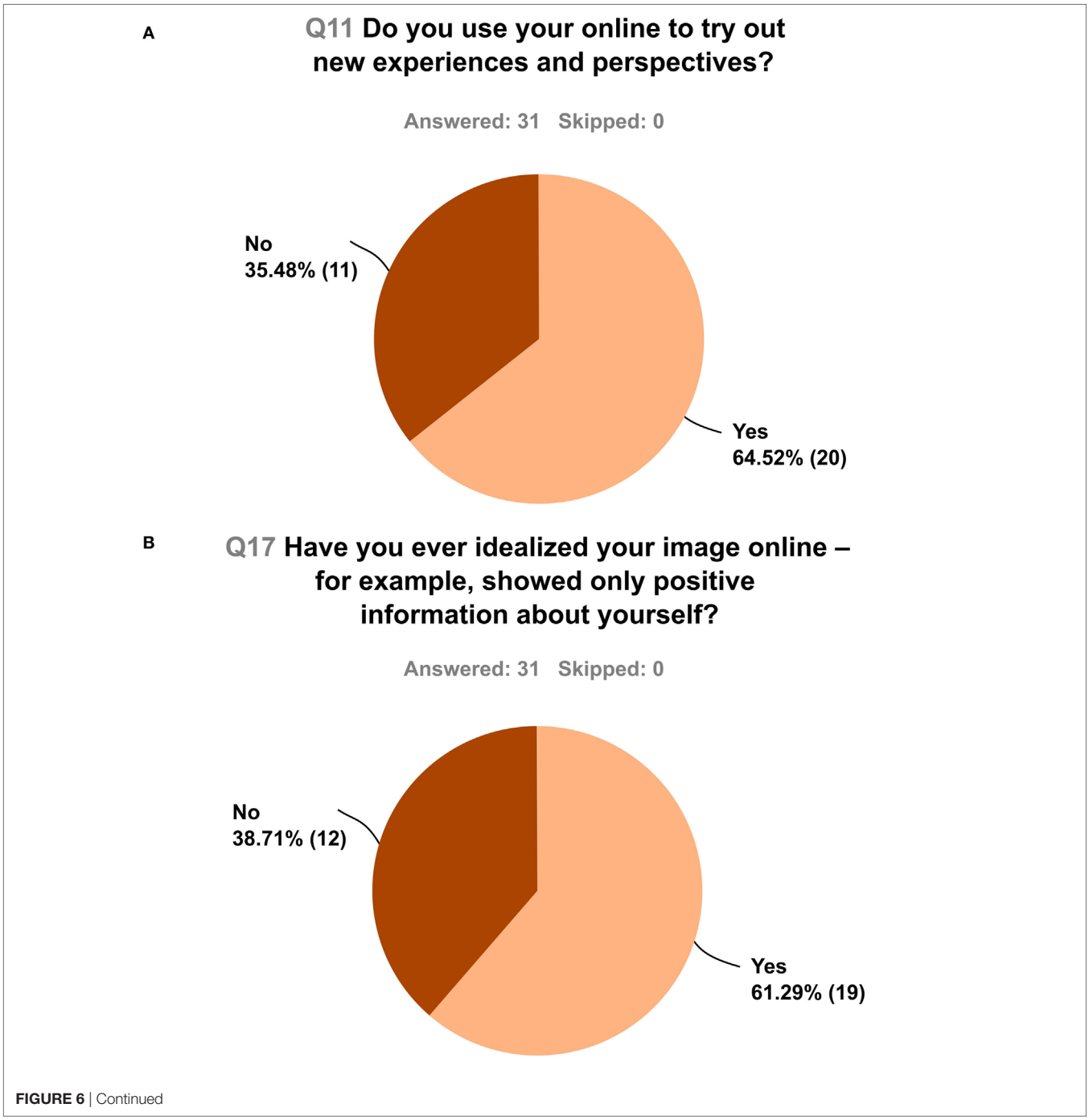


FIGURE 6 | Continued

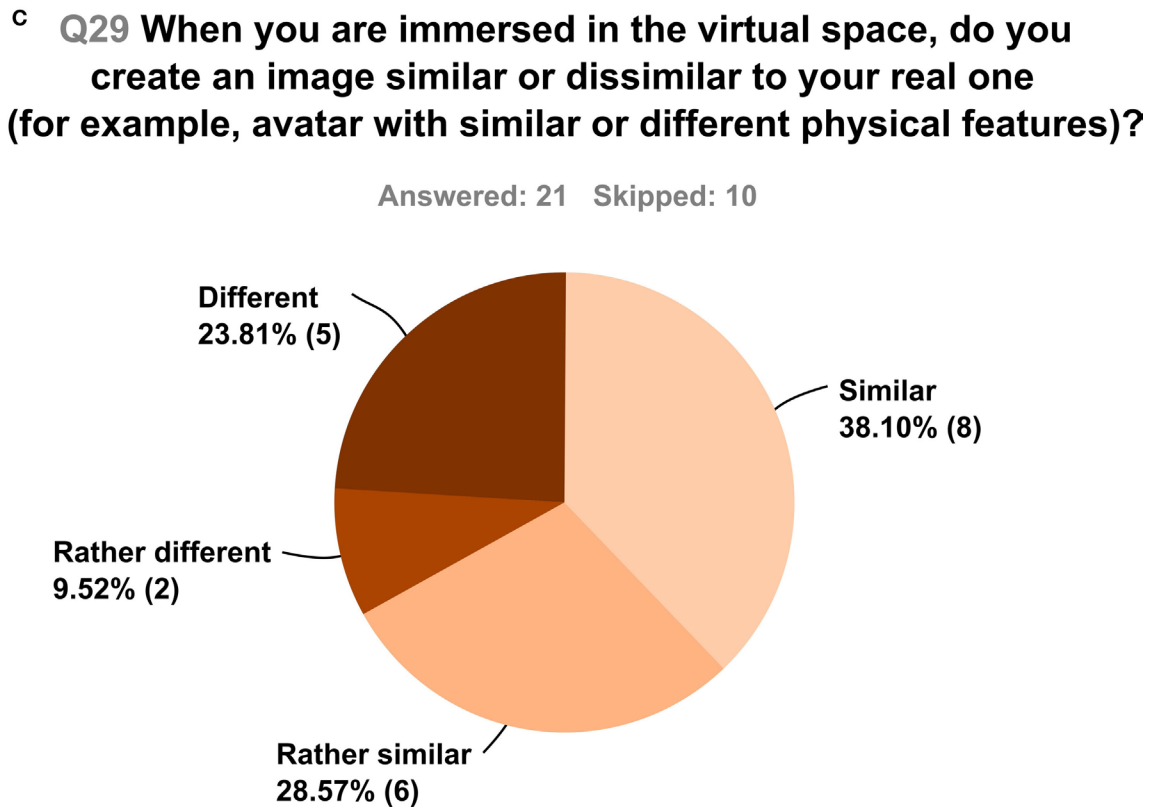


FIGURE 6 | Experiences and self-image in the virtual spaces **(A–C)**.

condition and awareness. Therefore, during VR exposure, one is so immersed in the experience that the boundary between the simulation and reality dissolves. This effect is utilized in therapy in VR where images of trauma-related cues evoke the reactions necessary for therapeutic results without presenting real danger for the physical body.

For the same immersiveness reason, there exist some limitations to the utilization of VR. For example, VR poses risks for addictive behavior in users (Schoenfeld and Yan, 2012; Zhou and Leung, 2012) and prolonged immersion in VR provokes cyber-sickness (Bruck and Watters, 2009). In addition, part of the challenges immersiveness evokes is to separate the "real" from the "unreal." In this sense, a careful administration of VR exposure could serve the therapeutic purposes.

Possibilities in Front of the Virtual Selves

Considering the findings of the surveys regarding the different selves created in the virtual, it seems that the self-representations in the virtual spaces have changed. The anonymous virtual selves created in the beginning of the virtual space revolution offered options to create a self different from the one people have as social persona in the "real world." Schechtman describes this as follows: "[people] have relatively few constraints on player identity and activity and no well-defined goals or rules" (Schechtman, 2012, p. 330). The freedom to experience multiple faces of the self and to experiment with self-image creation was possible since the beginning of the virtual emergence (Turkle, 1994). This could be well described as the ability to "take advantage of the opportunity to explore and express elements of personality that they cannot or do not express" (Schechtman, 2012, p. 332) in real space.

Floridi describes the experiments people do online as some kind of transfer of experience: "one may certainly try one's best to show them who one might reasonably be, or wish to become, and that will tell a different story about oneself that, in the long run, will affect who one is" (Floridi, 2012, p.272). It seems that people use virtual space to represent not only the way they want to be, but also what they intend to become and this intention for self-image improvement is facilitated by the specifics of the virtual space such as feeling of freedom, easiness, and flexibility.

The possibility to experience a different aspect of the self which the virtual spaces offer should be explored from the perspective of health care when utilized to aid treatment. It seems that a balance between similar and different self or transition from similar to a self with a slight difference (improvement) is what is the highest merit of the story-telling feature of the virtual.

Narratives and Virtual Selves

To discuss the narrative concept from philosophy in the context of the virtual space experiences, Schechtman (2011) describes narrative as a necessary tool for temporal and causal explanation

of the different events occurring in life. This tool helps putting order in a set of events one cannot change by interpreting those events as part of an ongoing story to support the self especially when faced with adverse life experiences. This story cannot change facts about life, but can restructure the ideas in the story used to explain these events.

Now, let us see how to achieve this through experience in the virtual spaces. It was discussed that people can experiment and form their self-image and life story there (Turkle, 1994; Georgieva, 2011a, 2016; Schechtman, 2011). Even if the persona people create and maintain in the virtual space is different from their real-life narrative, the experience of different kind of narratives which affect the real self can teach how to change one's thinking patterns (e.g., in games), how to exercise self-image formation (e.g., in online profiles), and how to learn mechanisms for coping with stress (e.g., in therapy in VR). For example, the second survey shows that people use virtual spaces (e.g., SNS) to obtain feelings of comfort and satisfaction (e.g., by watching something funny, looking at photos to reminisce pleasurable moments, etc.) (Georgieva, 2016). Of course, similar activities can induce similar effects in real life (e.g., watching kids in the park or remembering pleasant memory). However, the effect of the immersiveness of the virtual strengthens the influence of these experiences.

Responses showed that people utilize virtual spaces to imagine and construct a better or an ideal self as a way to retell their life story (Georgieva, 2011a). Different side of the idealized image projection is the search for constant gratification through the approval from peers online. The virtual spaces can be connected with addictive behavior of receiving pleasure triggered by constant checking of profile, seeking attention, expecting positive reactions, etc. It might be difficult to define the healthy limits of the virtual spaces since they tend to elicit positive emotions quite easily and more effectively compared to similar actions in real life. However, the same features of the virtual spaces could be utilized successfully in the treatment of traumatic disorders in VR therapy. The fact that virtual spaces represent fast-reward non-realistic imagery points that they could be considered carefully as providing false beliefs. For example, research confirms that games can be seen "as having a positive effect on the relationship of people who play the same games" (Ghuman and Griffiths, 2012, p.14). Conversely, different research shows a correlation between the increase in aggression and the decrease in prosocial behavior in result of violent video games play (Anderson et al., 2010).

This twofold effect of the virtual spaces shows that they offer easier to manipulate medium for creation of different narratives. The medium where people recreate their self-image offers more options, immersiveness and efficacy compared to the real space. Then, virtual spaces and VR in particular can be utilized for important cases when impact on the person immersed in them is necessary, namely in more "serious games" (Susi et al., 2007) like training or treatment.

Trauma, Treatment, and Narrative

Considering the concept of reality as a narrative construct, Schechtman sees human brains as narrative-generating machines where the selves play the role of protagonists in the narratives they generate (Schechtman, 2011). If then we look upon trauma it can appear as an interruption in a narrative and it seems plausible to look for ways to explain and accept the trauma into a newly created narrative plot. Such process of creating a new story line can be facilitated by VR where people tend to play with identity construction as discussed here. Then, it would be plausible to claim that retelling the current or forming a new story in VR could be effective method for recovery from PTSD and similar disorders marked with a sudden change of person's narrative. This is aided by VR as imaginative medium for story-telling which also offers flexibility for altering the storyline according to patient's needs with the advance of the treatment. Therefore, in accordance with Schechtman's concept it should be possible to create stories about our "selves" through experience in the virtual as we "weave different subplots into a single narrative" (Schechtman, 2012, p.343). It is possible to imagine that a view upon one's life story as a linear happening could facilitate detaching from the extremes and help return to reality even though performed in VR. Seeing unpleasant events as a form of simulation or as a story one can re-view could possibly help to gain the control in a situation that resembles the real events and also presents a different standpoint and added possibilities in front of the patient.

Let us explore a study on resilience (Bauer and Bonanno, 2001) which defends the idea that self-efficacy works for reducing prolonged suffering after traumatic events (e.g., loss of relatives) and aiding people's coping abilities. The study presents findings for cases when negative self-talk and devaluation of self-worth impose negative effect not only on behavioral characteristics level but also on the level that constitutes the characteristics of the self. This shows that traumatic experience damages the self-narrative. On the other hand, when someone manages to construct a narrative around the idea of self-efficacy this helps redirecting negative influence from the self to the outside factors (e.g., people causing suffering or "fate").

The researchers mention that accepting the idea that one "can do" something has a beneficial effect on overall health resulting from the fact that it directly relates to the creation of self-perceptions about "control, mastery, abilities, and skills" (ibid., p. 425). If this concept is applied the idea of VR treatment of traumatic disorders it could support the idea that the virtual spaces give some security as well as freedom to practice experiences and build skills (e.g., in games). Then, through the process of transfer of experience the simulated practice, when tried and replicated in real life, appears as already acquired. This process happens during exposure therapy in VR when the experience of thoughts or narratives could help the person to internalize the simulated experience as happening in his or her own narrative and develop better coping abilities regarding the traumatic feelings which arise as sensations (e.g., increased heartbeat, palm sweating, etc.). Moreover, with repetition and gradual increase of the level of realism the simulated experience would become part of one's own abilities and can result in coping actions transferred in the real environments. With this, healthier behavioral results can be achieved as a long-term treatment outcome.

Then, it can be said that the treatment of traumatic experiences can be aided by the narrative self-recreation in VR as a powerful

and immersive story-telling tool which aids the efforts for eliciting perceived coping. The purpose of the treatment in VR is to help the people who have lost the meaning (explanation) of their life stories, as often happening in PTSD cases. However, it is not plausible to offer creation of any kind of story since the narrative must be an intelligible story of a person's life presented in a relevant way. Hence, the design of the treatment should consider the healthy possibilities for the creation of a new or restructured life story for trauma patients. The reconstruction of the person's life story should happen through a process beginning with learning new ways of seeing one's story, then by memorizing this new narrative (through reconstruction), and finally through acting on it (repetition in VR setting) so that the person undergoing treatment could obtain the ability to intertwine his or her life story in the common narrative he or she is taking part in. With the narrative concept it is possible to retell one's story while practicing acceptance of such new meaning. As Schechtman proposes "pronouncements about what will happen next give him reasons to follow the course he has announced" (Schechtman, 2011, p.401). In this sense, the trauma could be integrated as an episode with special meaning rather than a major break in the person's narrative.

One way to defend the efficacy of VR is to see it as presenting possibility of controlling the "quality, intensity, duration, and frequency of exposure" (Morina et al., 2015). Compared to other forms of exposure therapy such as *in vivo* or imaginal exposure VR allows gradual, controlled, safe, and immersive experience in a realistic story-telling environment. In addition, a consideration of the idea that most stories have somewhat meaningful ending or at least an esthetically elaborated closure (as in movies for example) could help the therapy design in order to support the striving to improve one's life story.

However, considering that the narrative capacity is important evolutionary developmental milestone (Schechtman, 2011) then trauma itself could be considered as having similar purpose. Narrative as part of the autobiographical memory develops the sense of being extended over time and separated from the others authors with their own narratives. In Schechtman's words, "when a person is faced with what almost anyone would see as clear evidence of an anomaly in her narrative she either correct it or explain why it is not really anomalous" (Schechtman, 2012, p. 336). It seems natural that healthy people seek explanations for traumatic events. Still, severe PTSD cases show people who are unable to find ways to integrate trauma and reconstruct their narrative. Therefore, in order to reduce the cognitive disturbance and foster a perspective for recreating the self-narrative it is possible to employ treatment in VR as a ground for new experiences.

CONTRIBUTION AND CONCLUSION

Analyzing and understanding the role and the possibilities in front of VR could help finding its best application as a new scientific tool influencing humankind in various ways. Introducing the correlations of trauma and narrative self-creation in virtual spaces can be used in the context of therapy for cases such as PTSD. In this sense, the contribution of this research could be sought in the proposal for narrative perspective onto the overall and unified concept of traumatic experience and reality perception as a proposal for healing of the self in the virtual.

Considering VR as a successful method for treating traumatic disorders such as PTSD can provide insights about the effects of VR on human mind. Moreover, the explanation of trauma in the prism of self-narrative could be utilized in the therapeutic design and its application to different health problems. In addition, the explanation of the transfer of experience from the VR to real life can connect to the ideas about reality perception and the way people create their life narrative. Finally, this could lead to more options in front of the people who would like to reconstruct their life story in a healthier way.

AUTHOR CONTRIBUTIONS

IG designed the work; acquired, analyzed, and interpreted of data for the work; and wrote the manuscript.

ACKNOWLEDGMENTS

This study is based on the author's doctoral dissertation (Georgieva, 2017).

REFERENCES

Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., et al. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: a meta-analytic review. *Psychol. Bull.* 136, 151–173. doi:10.1037/a0018251

Bauer, J. J., and Bonanno, G. A. (2001). I can, I do, I am: the narrative differentiation of self-efficacy and other self-evaluations while adapting to bereavement. *J. Res. Pers.* 35, 424–448. doi:10.1006/jrpe.2001.2323

Behm-Morawitz, E. (2013). Mirrored selves: the influence of self-presence in a virtual world on health, appearance, and well-being. *Comput. Hum. Behav.* 29, 119–128. doi:10.1016/j.chb.2012.07.023

Bouchard, S., Baus, O., Bernier, F., and McCreary, D. R. (2010). Selection of key stressors to develop virtual environments for practicing stress management skills with military personnel prior to deployment. *Cyberpsychol. Behav. Soc. Netw.* 13, 83–94. doi:10.1089/cyber.2009.0336

Bruck, S., and Watters, P. A. (2009). Cybersickness and anxiety during simulated motion: implications for VRET. *Annu. Rev. Cyber Ther. Telemed.* 7, 169–173.

Chalmers, D. (2005). "The matrix as metaphysics," in *Philosophers Explore the Matrix*, ed. C. Grau (Oxford, UK: Oxford University Press), 132–176.

Chalmers, D. (2015). *David Chalmers: Spatial Experience and Virtual Reality. [Video Title]*. Available at: https://www.youtube.com/watch?v=IN0X0qmc8Lw

Cooper, R. (2011). *Alter Ego: Portraits of Gamers Next to Their Avatars*. Available at: https://www.brainpickings.org/2011/12/14/alter-ego-robbie-cooper/

Floridi, L. (2012). Technologies of the Self. *Philos. Technol.* 25, 271–273.

Galea, S., Nandi, A., and Vlahov, D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiol. Rev.* 27, 78–91. doi:10.1093/epirev/mxi003

Georgieva, I. (2011a). *Questionnaire about Your Online (Internet) Activity*. Available at: https://www.surveymonkey.com/r/JVRQBYY; https://www.surveymonkey.com/r/JCG5K9K; https://www.surveymonkey.com/r/JCHDBK7; https://www.surveymonkey.com/r/JJKNHGR

Georgieva, I. (2011b). The similarity between the virtual and the real self — how the virtual self can help the real self. *Stud. Health Technol. Inform.* 167, 20–25.

Georgieva, I. (2016). *Online Life and Experiences in Virtual Spaces*. Available at: https://www.surveymonkey.com/r/SCFYNBB

Georgieva, I. (2017). *Philosophical Consideration of the Treatment of Posttraumatic Stress Disorder in Virtual Reality: Trauma and Formation of Self-Narrative in Virtual Reality Context*. Unpublished dissertation, The University of Tokyo, Tokyo, Japan.

Ghuman, D., and Griffiths, M. D. (2012). A cross-genre study of online gaming: player demographics, motivation for play, and social interactions among players. *Int. J. Cyber Behav. Psychol. Learn.* 2, 13–29. doi:10.4018/ijcbpl.2012010102

Grigorovici, D. (2003). "Persuasive effects of presence in immersive virtual environments," in *Being There: Concepts, Effects and Measurement of User Presence in Synthetic Environments*, eds G. Riva, F. Davide, and W. A. Ijsselsteijn (Amsterdam, Netherlands: IOS Press), 191–207.

Harwood, J., Dooley, J. J., Scott, A. J., and Joiner, R. (2014). Constantly connected – the effects of smart-devices on mental health. *Comput. Hum. Behav.* 34, 267–272. doi:10.1016/j.chb.2014.02.006

Heim, M. (1993). *The Metaphysics of Virtual Reality*. New York: Oxford University Press.

Jin, A. S.-A. (2012). The virtual malleable self and the virtual identity discrepancy model: investigative frameworks for virtual possible selves and others in avatar-based identity construction and social interaction. *Comput. Hum. Behav.* 28, 2160–2168. doi:10.1016/j.chb.2012.06.022

Kim, Y., and Shyam Sundar, S. (2012). Visualizing ideal self vs. actual self through avatars: impact on preventive health outcomes. *Comput. Hum. Behav.* 28, 1356–1364. doi:10.1016/j.chb.2012.02.021

Kosinski, M., Stillwell, D., and Graepel, T. (2013). Private traits and attributes are predictable from digital records of human behavior. *Proc. Natl. Acad. Sci. U.S.A.* 110, 5802–5805. doi:10.1073/pnas.1218772110

Kramer, A. D. I., Guillory, J. E., and Hancock, J. T. (2014). Experimental evidence of massive-scale emotional contagion through social networks. *Proc. Natl. Acad. Sci. U.S.A.* 111, 8788–8790. doi:10.1073/pnas.1320040111

Linares, K., Subrahmanyam, K., Cheng, R., and Guan, S.-S. A. (2011). A second life within second life: are virtual world users creating new selves and new lives? *Int. J. Cyber Behav. Psychol. Learn.* 1, 50–71. doi:10.4018/ijcbpl.2011070104

MacIntyre, A. (2013). *After Virtue*. London, UK: Bloomsbury Academic.

Maercker, A., and Perkonigg, A. (2013). Applying an international perspective in defining PTSD and related disorders: comment on Friedman (2013). *J. Trauma Stress* 26, 560–562. doi:10.1002/jts.21852

Mantovani, G., and Riva, G. (1999). "Real" presence: how different ontologies generate different criteria for presence, telepresence, and virtual presence. *Presence Teleoper. Virtual Environ.* 8, 540–550. doi:10.1162/105474699566459

McCreery, M. P., Krach, S. K., Schrader, P. J., and Boone, R. (2012). Defining the virtual self: personality, behavior, and the psychology of embodiment. *Comput. Hum. Behav.* 28, 976–983. doi:10.1016/j.chb.2011.12.019

McCreery, M. P., Schrader, P. G., Krach, S. K., and Boone, R. (2013). A sense of self: the role of presence in virtual environments. *Comput. Hum. Behav.* 29, 1635–1640. doi:10.1016/j.chb.2013.02.002

Mitchell, P., Parsons, S., and Leonard, A. (2007). Using virtual environments for teaching social understanding to 6 adolescents with autistic spectrum disorders. *J. Autism Dev. Disord.* 37, 589–600. doi:10.1007/s10803-006-0189-8

Morina, N., Ijntema, H., Meyerbröker, K., and Emmelkamp, P. M. G. (2015). Can virtual reality exposure therapy gains be generalized to real-life? A meta-analysis of studies applying behavioral assessments. *Behav. Res. Ther.* 74, 18–24. doi:10.1016/j.brat.2015.08.010

Novick, L. F. (2005). Epidemiologic approaches to disasters: reducing our vulnerability. *Am. J. Epidemiol.* 162, 1–2. doi:10.1093/aje/kwi164

Riva, G., Raspelli, S., Algeri, D., Pallavicini, F., Gorini, A., Wiederhold, B. K., et al. (2010). Interreality in practice: bridging virtual and real worlds in the treatment of posttraumatic stress disorders. *Cyberpsychol. Behav. Soc. Netw.* 13, 55–65. doi:10.1089/cyber.2009.0320

Rizzo, A. S., Schultheis, M. T., and Rothbaum, B. O. (2002). "Ethical issues for the use of virtual reality in the psychological sciences," in *Ethical Issues Clin. Neuropsychol*, eds S. S. Bush and M. L. Drexler (Lisse, The Netherlands: Swets & Zeitlinger Publishers), 243–280.

Rodogno, R. (2012). Personal identity online. *Philos. Technol.* 25, 309–328. doi:10.1007/s13347-011-0020-0

Schechtman, M. (1996). "The narrative self-constitution view," in *The Constitution of Selves*, ed M. Schechtman (Ithaca, NY: Cornell University Press), 93–135.

Schechtman, M. (2011). "The narrative self," in *The Oxford Handbook of the Self*, ed. S. Gallagher (Oxford, United Kingdom: Oxford University Press), 394–418.

Schechtman, M. (2012). The story of my (second) life: virtual worlds and narrative identity. *Philos. Technol.* 25, 329–343. doi:10.1007/s13347-012-0062-y

Schoenfeld, D., and Yan, Z. (2012). Prevalence and correlates of Internet addiction in undergraduate students: assessing with two major measures. *Int. J. Cyber Behav. Psychol. Learn.* 2, 16–34. doi:10.4018/ijcbpl.2012040102

Steiner, P. (1993). On the Internet, nobody knows you're a dog. *The New Yorker* 69, 61.

Suh, A. (2013). The influence of self-discrepancy between the virtual and real selves in virtual communities. *Comput. Hum. Behav.* 29, 246–256. doi:10.1016/j.chb.2012.09.001

Susi, T., Johannesson, M., and Backlund, P. (2007). *Serious Games: An Overview. Technical Report HS-IKI-TR-07-001*. Sweden: School of Humanities and Informatics, University of Skövde.

Turkle, S. (1994). Constructions and reconstructions of self in virtual reality: playing in the MUDs. *Mind Cult. Activ.* 1, 158–167. doi:10.1080/10749039409524667

Turkle, S. (1995). *Life on the Screen: Identity in the Age of the Internet*. New York, NY: Simon & Schuster.

Turkle, S. (2005). *The Second Self: Computers and the Human Spirit*. Cambridge, MA: MIT Press.

Turkle, S. (2011). *Alone Together: Why We Expect More from Technology and Less from Ourselves*. New York, NY: Basic Books.

van Kokswijk, J. (2007). *Digital Ego: Social and Legal Aspects of Virtual Identity*. Delft, Netherlands: Eburon Publishers.

Waddell, T., Sundar, S., and Auriemma, J. (2015). Can customizing an avatar motivate exercise intentions and health behaviors among those with low health ideals? *Cyberpsychol. Behav. Soc. Netw.* 18, 687–690. doi:10.1089/cyber.2014.0356

Widyanto, L., and Griffiths, M. (2013). "An empirical study of problematic Internet use and self-esteem," in *Evolving Psychological and Educational Perspectives on Cyber Behavior*, ed. R. Zheng (Hersey, PA: Information Science Reference) 82–95.

Wiederhold, B. K., and Wiederhold, M. D. (2008). Virtual reality with fMRI: a breakthrough cognitive treatment tool. *Virtual Real.* 12, 259–267. doi:10.1007/s10055-008-0100-3

Zhou, S. X., and Leung, L. (2012). Gratification, loneliness, leisure boredom, and self-esteem as predictors of SNS-game addiction and usage pattern among Chinese college students. *Int. J. Cyber Behav. Psychol. Learn.* 2, 34–48. doi:10.4018/ijcbpl.2012100103

Zoladz, P. R., and Diamond, D. (2016). Psychosocial predator stress model of PTSD based on clinically relevant risk factors for trauma-induced psychopathology. *Posttrauma. Stress Disord. Neurobiol. Treat.* 125, 125–143. doi:10.1002/9781118356142.ch6

Conflict of Interest Statement: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.