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„How good is “VR for Good”? Examining Virtual Reality as
a medium for social attitude and behavior change“

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1 General introduction

In the second decade of the 21st century, social attitudes seem to be particularly fragile: trust in news media is fluctuating (Strömbäck et al., 2020); populism is on the rise (Moffitt, 2016); most countries see meteoric inflation (Lopez, 2022); and climate catastrophes are increasingly putting populations worldwide at risk (Harvey, 2019). In this complex socio-political environment, people turn to new media technologies such as the Internet, social media, and blogs to mobilize and spread awareness about social issues, with the Arab Spring and #Metoo being prominent examples (Milan, 2013). While the usage of new technologies comes with inherent complexities like the spread of fake news (Naeem et al., 2021), algorithmically enhanced polarization (Van Bavel et al., 2021), and surveillance capitalism (Zuboff, 2015), media innovations appear to be embedded in an overall utopian narrative in which they are expected to provide the answers to our time's most pressing matters (Dickel & Schrape, 2017).

Perhaps one of the most emblematic emerging media technologies heralded to incite social change is Virtual Reality (VR): an artificially simulated space users can tap into by strapping on a Head Mounted Display (HMD) (Sutherland, 1968; Steuer, 1992; Heim, 1993). Sophisticated hardware and software generate a “mathematical wonderland” (Sutherland, 1965, p. 506) in front of users' eyes, in which they can “escape from the confines of the physical world” (Biocca & Levy, 1995, p.7) by creating three-dimensional worlds, owning different bodies and interacting with virtual others. Like never before, users can now transport themselves to distant places (Ma, 2019), witness different cultures (Guttentag, 2010), and even walk in somebody else's shoes (Jones & Dawkins, 2018). Thus, the idea that VR can be used as a tool for persuasive civic and political communication emerged: an idea commonly referred to as “*VR for Good*” (Meta, n.d.).

Applications of this idea clearly exist: For instance, the UK government announced funding opportunities for VR projects that will help local businesses and farmers who were negatively affected by the COVID-19 pandemic (Mari, 2020). The United Nations, an international organization established to drive and maintain global governance (Mingst et al., 2017), invests in VR interventions with “the potential to vastly enhance the organization's ability to reach and assist children in its programme countries in key areas such as health, education and training” (UNICEF, n.d.). In the US, a presidential candidate used VR to share their campaign in a more immersive way (virtualitylab.com, 2015). Spanning from spherical 360-degree videos to fully immersive environments, VR appears

to have sparked the interest of multiple actors interested in social impact (Foxman et al., 2021); yet the literature lacks a comprehensive evaluation of effects across different contexts, ranging from laboratory studies to real-life applications. This research gap is particularly problematic in view of the rising interest in the *metaverse*, a unified virtual reality wherein users can co-exist and interact (Mystakidis, 2022), but whose effects on users are hitherto unknown. Because the metaverse is still in its infancy (Richter, 2022), it is critical that communication scholars provide practitioners and policymakers with early information about if, how and why VR experiences can potentially change users' attitudes and behaviors.

These questions can be understood as issues of persuasion (Holbert & Tchernev, 2013). Because VR comes with certain distinct technological affordances, such as tracking level, field of view and stereoscopy (Cummings & Bailenson, 2015), communication science has been particularly interested in how the medium's channel produces persuasive outcomes (e.g., Herrera et al., 2018; Filter et al., 2020). Here, substantial research has been revolving around the question: Are identical contents more persuasive in VR than in less immersive modalities? (Ma, 2019). To some extent, this assumption echoes McLuhan, as it implies that "it is the medium that shapes and controls the scale and form of human association and action" (McLuhan & Carson, 2003, pp. 230-231). However, while some studies find that VR can evoke attitudinal and behavioral change more effectively than, for example, video or text (Herrera et al., 2018), there is surprisingly little consensus about why this might be the case. The theoretical explanations for empirically established effects differ from study to study (e.g., Breves & Schramm, 2021; Ahn et al., 2016), making it difficult to locate what it is about VR that makes it persuasive. This leads scholars to "reinvent the wheel" both theoretically and methodologically for each empirical investigation, which in turn hampers the comparability and interpretation of extant media effects and overall, the progress in the field.

Given the disparity between the growing interest in "VR for Good" and the growing unclarity about its persuasive influence, it is essential to take a step back and systematically re-assess the extent to which this emerging medium can make users think and behave differently toward issues of broader social significance. To this end, this dissertation project offers a starting point by investigating whether, how and why VR may change social attitudes and behaviors in three separate empirical studies. Together, they draw a fuller picture of the effectiveness of "VR for Good"; a picture that does not reveal a

prosociality machine, but rather a complex synthesis of technological, situational and psychological elements that answer the question: How *good* is “VR for Good”?

1.1 Research goals and main contributions

The goal of this dissertation is to investigate how effective “VR for Good” is in terms of its potential to positively affect social attitudes and behavior. In particular, I aim to answer the question: **How effective is VR in producing positive effects on social attitudes and behavior?** To do so, I follow the three primary ways to study VR from a social science perspective by Fox et al. (2009): Firstly, I investigate whether VR as a *media object* can evoke social attitude and behavior change. Secondly, I explore how it is used as a real-life *application* for awareness and fundraising. Thirdly, I look at VR as a *method* to study attitudinal and behavioral change. By synthesizing these three approaches, this dissertation seeks to fully capture the breadth of “VR for Good” and illuminate whether, how and why it might be effective.

The dissertation sets out to investigate *whether* VR as a *media object* produces attitudinal change. Over the last decades, media effects research has been posing this question by drawing on different research designs that vary in types of VR, contents and attitudinal measures. Within the literature the results are mixed, with some studies yielding significant effect sizes (Herrera et al., 2018) and others not finding empirical evidence for a meaningful relationship (Ahn et al., 2013). As a result, extant conflicting findings make it difficult to clearly assess whether “VR for Good” is effective in the first place.

Further, scholars rely on different theories of persuasion to explain their results, which in turn hampers the isolation of relevant components that potentially factor into occurring effects. For example, some scholars rely on medium-specific theories (Grigorovici, 2003) and theories surrounding VR’s immersive modality (Kandaurova & Lee, 2019) to link found effects to its media richness (see Media Richness Theory, Daft & Lengel, 1986). Ahn (2021) focuses on VR’s capacity to provide embodied experiences, which resemble first-hand experiences and are therefore potentially more persuasive than secondhand events. Other studies (e.g., Hasler et al., 2017; Aitamurto et al., 2018) pay attention to the role of perspective-taking and argue that it is seeing the world through the eyes of another that makes VR persuasive. While each of these factors may play an important role in individual studies, it remains unclear whether, on average, they contribute to VR’s persuasiveness as communication technology.

Taken together, to fully understand how good “VR for Good” is in changing social attitudes and behavior, I argue that it is essential to first evaluate whether there is in fact an overall significant effect of VR treatments on attitudinal constructs. For that, the dissertation poses its first principal research question:

RQ1: To what extent does VR overall evoke social attitude and behavior change?

To answer its first research question, the dissertation synthesizes the extant experimental literature on VR and social attitude change and estimates average effect sizes through means of a meta-analysis with systematic review (Rosenthal & DiMatteo, 2001). In doing so, it offers a fuller picture of the literature that the field hitherto lacked. Moreover, it provides more definitive answers about the role of media richness (Daft & Lengel, 1986), sense of embodiment (Kilteni et al., 2012) and perspective-taking (Davis, 1994) than previous individual studies. Thus, the first principal research question clarifies whether VR as a medium object does influence social attitudes and behavior, and hence builds the thesis’s foundation for a better assessment of “VR for Good.”

A next step in understanding the complex influence of VR on social attitudes and behavior is an in-depth exploration of *how* such an effect might occur. To garner sufficient depth of information, the thesis explores its usage as *application* for the third sector and draws upon practitioners’ interpretative, process and technical expertise (Bogner et al., 2009) about how “VR for Good” can influence attitudes in real-life settings. Applications of “VR for Good” can be data rich sources about VR’s persuasiveness, and may provide new insights about the motives and mechanisms that drive its effectiveness. This is because, naturally, the cases of applied “VR for Good” vary regarding contents, settings and users, which in turn can point to new relevant variables that, so far, have been overlooked in the research. For instance, consider these two recent examples: On the one hand, the human rights organization Amnesty International used VR to communicate the situation of the Syrian War in the context of a street fundraising campaign in the United Kingdom; on the other hand, the humanitarian aid organization charity:water used it at a black tie fundraising event at the Metropolitan Museum of Art in the United States (Green, 2018). Despite both organizations using VR as an application for fundraising, the contents, users and contexts differ largely. By meaningfully comparing multiple cases of applied “VR for Good,” I argue that one can better understand (a) why VR is used to influence social attitudes and behavior in real-life settings, (b) how narrative and immersive elements are implemented to induce effects and (c) to what extent it is effective.

Yet, to date, this area remains understudied. The investigations of applied “VR for Good” focus primarily on its ethical challenges rather than its motives, mechanisms and outcomes. For example, Nash (2017) criticizes the immoral distance that such applications create between the user and the depicted populations, while Nakamura (2020) argues that they bear the risk of evoking feelings of toxic empathy. Aside from these critical examinations, however, there is no available evidence about why the third sector specifically chooses VR as a medium for attitudinal change, how they do it and whether it is actually effective.

To help close this research gap, the thesis poses its second principal research question:

RQ2: How is VR used as an application for social attitude and behavior change?

For its second research question, the dissertation garners insights from practitioners involved in the conception, commission and/or dissemination of VR contents for charitable purposes in a series of standardized open-ended expert interviews (Bogner et al., 2009). In doing so, it complements the results of the first research question with in-depth qualitative information that shines light onto the motivations, mechanisms and outcomes of VR usage for attitude and behavior change in real-life settings. It identifies the factors that enhance the effectiveness of applied “VR for Good”, which future scholars can test in the context of controlled laboratory research. Moreover, it elucidates the storytelling techniques that make for effective “VR for Good” applications, and thus contributes to the literature on VR as a medium for nonfiction communication (McRoberts, 2017; Rose, 2018; Bevan et al., 2019). To summarize, the second research question examines how complex and layered the effects of applied “VR for Good” are, and points to hitherto unexplored factors that might enhance this effectiveness.

Finally, for its third research question, the dissertation seeks to zoom in to the underlying mechanisms of VR-induced attitudinal change. For that it builds upon its first two research questions as well as extant empirical literature, and focuses on the role of virtual social actors. As previously discussed in regard to the first research question, VR technology provides the possibility to interact with virtual others in a vivid and sensory rich way; to embody a virtual self; and to adopt somebody else’s virtual first-person perspective. In the context of the second research question, the depiction of virtual others in applied “VR for Good” can potentially increase (Milk, 2015) or suppress (Nakamura, 2020) positive attitudinal change, depending on their depiction. In addition, VR scholars

Yoo and Drumwright (2018) refer to virtual others as *the* facilitator of VR-induced prosocial outcomes. Given its importance both for the thesis's previous research questions and the overall VR literature, the dissertation's final research question delves into the role of social presence (Lee, 2004) to gain a more complete understanding of the effectiveness of "VR for Good."

The concept of social presence stems from Social Presence Theory (Short et al., 1976), according to which the immediacy and intimacy to social actors in human-computer interaction have a persuasive effect on users. Social presence is a well-established predictor of prosocial outcomes within the traditional behavior research (Short et al., 1976; Lee et al., 2006; Whitty, 2008; Felnhofer et al., 2018), particularly because seeing the suffering of others tends to induce liking, empathy and in turn, helping intention (Batson et al., 1989). Accordingly, some VR studies have connected social presence to social attitude and behavioral change in several studies (e.g., Ma, 2019; Pimentel et al., 2021). This is because VR's immersive quality makes virtual others appear more 'there' than less immersive media (e.g., two-dimension screen), which increases users' willingness to help them with prosocial behavior; for instance, in the form of willingness to donate (e.g., Yoo & Drumwright, 2018; Kandaurova & Lee, 2019). However, as Pimentel et al. (2021) point out, exstant findings inform more about the role of immersive modality and less about the isolated role of social presence.

For this reason, the thesis seeks to investigate if specifically social presence is the underlying mechanism that explains *why* "VR for Good" motivates users to change their social attitudes and behaviors. For that, the dissertation poses its third research question: **RQ3: Is social presence the underlying mechanism that motivates the attitudinal effects of VR?**

To answer this question, the thesis implements a behavioral laboratory experiment with a mixed methods approach. For the social presence manipulation, the dissertation proposes a novel technique that artificially removes social actors from a 360-degree VR environment through means of software. With this process, it provides an innovative way for social presence manipulation that is more efficient and cost-effective than previous efforts (Pimentel et al., 2021). For its behavioral measure, it refines prior work (Martingano et al., 2022) by implementing a research design with improved external validity that helps to draw more generalizable conclusions about the effectiveness of "VR for Good." By adding a qualitative measure to assess users' behavioral motivations, the thesis adds further

nuance to its quantitative findings and integrates numerical and narrative data into a better assessment of the role of social presence.

Overall, this dissertation investigates the concept of “VR for Good” at the intersection of media psychology, human computer interaction and science and technology. By posing three separate research questions, it explores the influence of VR on social attitudes and behaviors from multiple perspectives, which together draw a much-needed landscape of the effectiveness of “VR for Good.” Thus, the thesis contributes to the critical discourse about the opportunities and limitations of VR technology in regard to prosocial outcomes, and paves the way for future scholarly efforts.

1.2 Overview of manuscripts compiled in this thesis

This cumulative dissertation consists of three original research articles that address the thesis’s principal research questions. The articles have been written in collaboration with co-authors (Study 1, Study 2) and by the author alone (Study 3). All three studies have been submitted to peer-reviewed international journals, out of which Study 1 has been published.

Study 1 (status: published)

Nikolaou, A., Schwabe, A., & Boomgaarden, H. (2022). Changing social attitudes with virtual reality: a systematic review and meta-analysis. *Annals of the International Communication Association*, 1-32. <https://doi.org/10.1080/23808985.2022.2064324>

Study 2 (status: submitted)

Nikolaou, A. Boomgaarden, H. & Lecheler, S. VR nonfiction storytelling for the third sector: Motivations, mechanisms and outcomes. *Frontiers in Virtual Reality*.

Study 3 (status: submitted) Nikolaou, A. When the “empathy machine” fails: A mixed methods experiment about social presence in VR and charitable behavior. *Media Psychology*.

2 Theoretical framework

2.1 What is the good in “VR for Good” about?

In Sherman and Judkins' (1992) eponymous book, the authors discuss whether VR technology offers both glimpses of Heaven and visions of Hell, specifically because its distinct affordances allow humans to create and destroy worlds, beings and objects; in other words, 'to play God' (pp. 126-127). This idea captures the dystopian fears and utopian hopes that surrounded VR in the early 1990's (Robins, 1995). Yet strong reactions to novel media is not a new phenomenon; new technologies have been sparking outrage and excitement as far back as Ancient Greece (Bowman, 2015). Mass media technologies like radio and television, for example, were met with critical caution by media scholars in the aftermath of the Second World War (Lazarsfeld, 1947). While moral reactions seem to be inherent to the emergence of novel technologies throughout media history, they can become problematic when they steer scientific effort into research questions that conform with the sentiment of the time (Elson & Ferguson, 2013, as cited in Bowman, 2015); for example, fear of a media technology can determine whether to study its negative over its positive effects. In contrast, a positive stance toward a new medium may lay fertile ground for research on its positive effects. To understand how and why VR— social attitude change became a relevant research subject for the Social Sciences, it is essential to discuss the social, political and economic context in which VR was popularized in the first place.

VR began to carve its way into the consumer market in the mid 2010s, when *Meta* (then *Facebook*) acquired the small Silicon Valley VR start-up Oculus with the larger vision of making VR mainstream (Dredge, 2014). At this point in time, Silicon Valley was the producer and exporter of a substantial techno deterministic narrative, according to which civilizational and environmental crises can only be addressed with technical solutions (Sereni, 2021). This sentiment factors into what Dickel and Schrape (2017) define as media utopianism: a logic in which novel media and information technologies *per se* drive social change (Dickel & Schrape, 2017). In contrast to traditional social utopias, where the change of the social order begets social transformation, media utopias expect technology itself to serve as the disruptive force that will transform the economic, political and social status quo (Dickel & Schrape, 2017). For example, 3D printing was expected to transform means of production by moving machines from factories into homes, and Web 2.0 was heralded to democratize the public discourse by transforming

passive citizens into active producers of information (Dickel & Schrape, 2017). While up to the mid 2010s, VR was commonly linked to training and education (Mazuryk & Gervautz, 1996), it soon was discursively constructed as a technology that will drive social change. VR was to be the ‘empathy machine’ society needed (Milk, 2015).

The term empathy machine was first used by film director Chris Milk in his 2015 TED Talk, where he described it as a device through which “we become more compassionate, we become more empathetic, we become more connected, and ultimately we become more human” (Milk, 2015). In line with this logic, Oculus by Meta launched the “VR for Good” initiative, with the goal to promote VR applications with pro-social and educational character (Meta, n.d.). Beyond this initiative, “VR for Good” became a popular umbrella term for nonfiction VR videos produced for prosocial purposes, such as awareness- and fundraising in the third sector. Similar to the cases of 3D printing and Web 2.0, VR is introduced as a technology surrounded by expectations of social transformation— which Rose (2018) describes as the ‘hype, and hope’ around VR for nonfiction communication. Importantly, VR emerges as an empathy machine at a time in which trust in traditional media (Gronke & Cook, 2007) and traditional institutions (Hudson, 2006) is on the decline. In contrast, novel media technologies such as social media appear to be attractive tools for civic mobilization and engagement (Warren et al., 2014). Against this background, Social Science began to examine VR as another novel technology that can potentially re-instill civic and political interest.

Particularly in communication science, an increasing number of scholars pay attention to the ways in which VR experiences change how users think and behave toward social problems. This strand of research is interested in how VR can evoke attitudinal change, with attitude typically understood as evaluative judgements, such as beliefs, opinions, and behavioral responses (Oskamp & Schultz, 2005) toward topics of broader social significance; for example, environmental issues (e.g., Ahn et al., 2016; Breves & Heber, 2020) racism, (e.g., Groom et al., 2009; Patané et al., 2020), sexism (Steinfeld, 2020) and political conflict (Hasler et al., 2017). Prominent journals devote special sections to the prosocial effects of VR, for example, *New Media and Society*’s special issue titled *Virtual Reality for Pro-Social Attitude Change* (Volume 23 Issue 8, August 2021). In parallel, a growing body of critical research (e.g., Hassan, 2019; Nakamura, 2020) pays attention to VR’s aspirational claims of social change, and points at the ethical challenges of “VR for Good.”

In summary, this thesis explores “VR for Good” as an idea born within the context of a media utopianist logic, where novel media technologies are expected to re-instill much needed civic, political and environmental attitudes. Media utopias, however, tend to decontextualize and overgeneralize their effects (Dickel & Schrape, 2017). Therefore, what is needed is a systematic examination of whether, how and why “VR for Good” might be as good as it claims.

2.2 Immersion as a key determinant of VR technology

To understand the influence of VR on social attitudes and behavior, it is necessary to first draw a clear conceptualization of VR technology. Here, it is helpful to refer to one of the most central concepts within the literature: *immersion* (e.g., Pausch et al., 1997; Bowman & McMahan, 2007). Immersion is a technology’s quality to create “inclusive, extensive, surrounding and vivid illusion of reality to the senses of a human participant” (Slater & Wilbur, 1997, p.4). VR can be conceived as a highly immersive medium, because its technological affordances (e.g., tracking level, field of view and stereoscopy; for a review, see Cummings & Bailenson, 2015) create the sensory illusion of a 360-degree mediated space while simultaneously excluding physical reality from users’ field of view. This conceptualization helps to draw a meaningful differentiation between VR technology and other media. Text, for example, might have an immersive *effect* if readers feel absorbed by the narrative (Douglas & Hargadon, 2000), but it is not an immersive technology *per se*. For that reason, the construct of immersion is valuable for this dissertation as it allows it to examine technology-specific effects separately from narrative influences (e.g., narrative engagement; see Busselle & Bilandzic, 2009).

One potential mechanism through which VR experiences affect social attitudes is a change in cognitive information processing (Breves, 2021). Because of its immersive technological quality, VR’s field of view mediates more data points than other media. This means that users can collect information by looking up and down, left and right, in front and behind them. As a result, they tend to explore the 360-degree environment around them and shift their attention to different focal points (Newton & Soukup, 2016). Early evidence suggests that the immersive presentation of contents can lead to less focused attention, recognition and cued recall of information (Barreda-Ángeles et al., 2020). This has led to the assumption that VR technology may impact users’ ability to engage in

cognitive elaboration and critical thinking: as one study found, weak argumentation appears more persuasive when presented in VR (Breves, 2021).

This may lie in the activation of another mechanism, that is, affective information processing (Grigorovici, 2003). Grigorovici (2003) theorized that, because VR increases users' arousal and affect by placing them into a virtual world, they become less aware of the persuasive message and in turn, more susceptible to it. Indeed, Breves (2021) found that VR technology pushes users to engage with the message heuristically, or in other words, less reflectively and resourcefully. According to Grigorovici (2003), VR's capacity to enhance heuristic information processing is what makes it highly persuasive.

However, it is important to mention that traditional media also impact information processing to a certain extent (Entman, 1989; Lang, 1999). For the study of "VR for Good", it is therefore essential to also discuss an underlying psychological phenomenon that is located at the heart of the VR literature: *presence* (Lee, 2004).

2.3 Presence as the persuasive core of immersion

Presence is a psychological phenomenon that describes the feeling of 'being there' in the mediated environment (Grigorovici, 2003; Lee, 2004). It is elicited through immersion, the medium's quality to present a vivid mediated environment while shutting out physical reality (Slater & Wilbur, 1997; Cummings & Bailenson, 2015). In other words, the combination of certain HMD-specific immersive affordances such as tracking level, field of view, and stereoscopy make users feel like they are present within the constructed world (Cummings & Bailenson, 2015). Depending on the VR contents, scholars have identified different types of presence. This dissertation relies on Lee's (2004) tripartite typology of (1) physical presence, (2) self-presence, and (3) social presence.

Physical presence is "a psychological state in which virtual (para-authentic or artificial) physical objects are experienced as actual physical objects in either sensory or nonsensory ways" (Lee, 2004, p.44). Physical presence, or spatial presence (Breves, 2021), refers to the sense of presence that corresponds to the users' perception of their virtual location. While some scholars have argued that presence also occurs during the usage of less immersive media like television (Lombard et al., 2000), it is widely considered a phenomenon inherent to VR technology itself (Steuer, 1992). Many definitions of VR do

include the term, for example Steuer's (1992) definition of VR as "a real or simulated environment in which a perceiver experiences telepresence" (p.37).

Evidence suggests that physical presence can move attitudes toward the wanted outcome. For example, physical presence during a VR video about the negative environmental impact of meat consumption can decrease users' interest in eating meat themselves, especially in comparison to users who saw the same contents in a two-dimensional video (Fonseca & Kraus, 2016). Another study (Breves & Schramm, 2021) found that physical presence in VR is superior to video in inciting behavioral intentions concerning distant environmental issues, and linked their findings to Construal Level Theory (CLT; Trope & Liberman, 2010) to explain this effect. According to CLT, 'being there' in VR can reduce the psychological distance to complex issues such as climate change (Kalyanaraman & Bailenson, 2020; Breves & Schramm, 2021). This way, abstract mental construal becomes more tangible and is easier to access and reflect upon when forming an attitude (Trope & Liberman, 2010). By "being there" physically as an individual, complex and abstract topics might become easier to grasp and in turn, to reconsider for this individual.

The second type of presence is *self-presence*, which is the experience of the virtual self as real self in sensory or non-sensory ways (Lee, 2004). This means that for users to feel self-presence, a virtual body is not required per se; a first-person viewpoint or interacting with virtual people can suffice (Lee, 2004). While a small number of studies has linked self-presence in VR to persuasive outcomes (Adachi et al., 2020; Song et al., 2020), most attitude research focuses on a related concept referred to as embodiment. Sense of Embodiment describes a combination of sense of self-location, sense of agency, and sense of body ownership (Kiltner et al., 2012), and therefore expands the concept of self-presence by adding a virtual body that users own and control. Because VR allows users to embody different avatars, much attention has been paid to the influence of body-swaps (Peck et al., 2020) and embodied cognition (Yee et al., 2009) on attitudes. For example, users who embody tall avatars in a negotiation behave more confidently than users who embody shorter avatars (Yee et al., 2009). Other studies have found that the embodiment of different races (e.g., Salmanowitz, 2018; Banakou et al., 2020) and genders (Steinfeld, 2020) can decrease respective biases. Thus, while there is little knowledge of how self-presence affects users, there is empirical evidence for a significant influence of embodiment on social attitudes and behaviors.

Social presence, the third type of presence, is “a psychological state in which virtual (para-authentic or artificial) social actors are experienced as actual social actors in either sensory or nonsensory ways” (Lee, 2004, p.43). Social presence can be measured by the extent to which users perceive virtual actors as real and sentient (Bailenson et al., 2003). Social presence in VR corresponds with the ideas around Social Presence Theory (Short et al., 1976), where the proximity to virtual social actors establishes the intimacy and immediacy needed to evoke persuasive communication. In line with this notion, emerging literature of empirical studies has found a link between heightened feelings of social presence in VR and attitudinal change, with authors describing it as “the psychological mechanism that closes the social and psychological distance between affluent potential donors and the beneficiaries of nonprofit fundraising” (Yoo & Drumwright, 2018, p.21). This notion is based on the assumption that in VR, the three-dimensional and/or life-sized representations of vulnerable populations (e.g., refugees) tend to feel more real and sentient than their flat counterparts on a two-dimensional screen, which in turn makes users more likely to change their attitudes and behavior to help them (Kandaurova & Lee, 2019). Previous studies have also found that the mediating influence of empathy (Pimentel et al., 2021) and guilt, responsibility, and social exclusion (Kandaurova & Lee, 2019) can enhance the persuasive influence of social presence on attitudes.

Taken together, the concept of presence seems to lie at the core of extant attitudinal change research, which makes it critical for this dissertation. The thesis particularly accounts for social presence, because its influence on behavioral outcomes such as donation (Pimentel et al., 2021) corresponds with the idea of “VR for Good” being a tool for actual social change. However, Hartmann et al. (2015) argue that multiple questions about presence in general remain unanswered, specifically how it occurs, how long it lasts and how it influences users. For that, it is critical to take a closer look at other factors that might drive users’ susceptibility to “VR for Good.”

2.4 Susceptibility to “VR for Good”

To fully understand the influence of “VR for Good”, it is imperative to consider that traditional communication research suggests that media do not affect everyone, everywhere, every time. A long tradition of media effects susceptibility scholarship has pointed at factors that exert persuasion beyond the medium’s control (McDonald, 2004;

Holbert & Tchernev, 2013), such as message, source, content, or recipients themselves (McGuire, 1989). Factors like users' predispositions, for example previous views and traits, can moderate the strength of the wanted attitude change, thus making some users more susceptible to the medium than others (Valkenburg & Peter, 2013). This dissertation assumes that users' predispositions exert a moderating influence on the effectiveness of "VR for Good" and focuses specifically on *issue-specific prior attitudes*.

Issue-specific attitudes can be resistant to change, especially when they are strong and of high importance (Judd & Krosnick, 1989; Krosnick et al., 1993). This is because strong attitudes are often tightly intertwined with other attitudinal, ideological and affective elements which factor into the individual's sense of identity (Howe & Krosnick, 2017). Individuals are prone to maintain consistency between these elements in order to avoid the distress caused by conflicting ideas (Festinger, 1957). Issue-specific attitudes can strengthen a main media effect if the information aligns with the individual's views, or weaken it, if it is attitude-incongruent (Valkenburg & Peter, 2013). Such is the case across different types of media, spanning from print and audio (Petty & Cacioppo, 1981) to television (Buijzen & Valkenburg, 2003).

Despite extant knowledge about the moderating influence of issue-specific prior attitudes in the context of traditional media effects, there is surprisingly little research regarding VR effects. So far, some studies have found that predispositional empathy and internal locus of control can increase users' sense of presence and immersion (Wallach et al., 2010; Shin, 2018), yet little attention has been paid on how such factors may affect the attitudinal outcome. Only Bujić et al. (2020) measured their participants' political ideology in their experimental study on VR effect on migration attitudes, but did not account for it in their analysis. This means that the susceptibility to the attitudinal effects of presence and its subtypes has been largely overlooked within the literature.

The dissertation aims to address this research gap by examining how prior issue-specific attitudes might influence the effectiveness of "VR for Good." For that, I draw on Valkenburg and Peter (2013) to investigate whether users with a positive previous attitude toward the issue will be more susceptible to the VR experience, whereas users with a negative previous attitude toward the issue will be more resistant to attitudinal change. In doing so, I aim to gain a better understanding of what motivates the attitudinal change of "VR for Good," hence complementing RQ3 as outlined in Chapter 1.1.

2.5 Overall framework

In sum, the dissertation is concerned with whether, how and why “VR for Good” may facilitate attitudinal and behavioral change. For that, it examines “VR for Good” through three research lenses as discussed by Fox et al. (2009): Firstly, as a medium object with a unique capacity for immersion, embodiment and perspective-taking; secondly, as an application for immersive awareness-raising and fundraising; and thirdly, as a method to test if social presence, in combination with a users’ prior attitudes, may serve as the facilitator of “for good” outcomes. Together, these three perspectives provide a clearer and empirically supported answer to the question: How *good* is “VR for Good?”

The dissertation focuses on this specific issue in an effort to help close two critical research gaps within the literature. Firstly, as a prominent research strand within communication science, the study of media effects seeks to untangle how media technologies elicit persuasive outcomes depending on factors such as the medium’s modality; and although much is known about the role of textual and audiovisual modality (Appiah, 2006), there is no clear, systematic and comprehensive assessment of the highly immersive modality that comes with VR. At the time of writing, existing knowledge of VR effects is constituted of individual empirical investigations (e.g., Hasler et al., 2017; Ma, 2019), theoretical reflections (Hassan, 2019) and hopeful discourse (Foxman et al., 2021), none of which provide definitive conclusions about the concepts, variables and effects at play. This is a major barrier for theory building in media effects literature, which I seek to tackle by providing a more comprehensive and systematic assessment of “VR for Good”.

Secondly, from a science and technology perspective, the question about VR’s prosocial impact feeds into a broader critical discourse on digital media utopias. As Dickel and Schrape (2017) argue, the promises of digital media utopias are often inflated; yet individual studies (e.g., Pimentel et al., 2021; Breves & Schramm, 2021) do suggest that VR may have an important influence on citizens’ attitudes toward civic, political and environmental matters. In a sociopolitical context where emerging media technologies are narratively constructed as the bearers of social change (Sereni, 2021), and both political and institutions show strong support for the advancement of VR (Kastrenakes & Heath, 2021; European Commission, 2022), it is essential to empirically investigate the aspirational claims of the media utopian logic that surrounds this technology.

3 Methods

3.1 Overall methods

Each of the thesis's research inquiries is addressed in a separate study, which implements a methodology appropriate to the data source needed to answer the question. The insights generated from separate methodologies are finally welded into a cohesive conclusion about the effectiveness of "VR for Good," hence providing a fuller picture of the phenomenon of interest.

In particular, each research question is matched with a methodology that suits its nature and needs. For example, the thesis's first research question is a question of correlation, as it is concerned with patterns of numerical relationships. It can thus be answered best with a systematic quantitative investigation (Watson, 2015). Further, the second research question is a question of practical insights, perspectives and meanings, and therefore requires a deductive and qualitative approach (Maxwell, 2013). Finally, the third research question is a question of causation and motivation, which requires a combination of both quantitative and qualitative data to be answered sufficiently (Jogulu & Pansiri, 2011).

Multi-method approaches can benefit doctoral projects because they help the researcher to assess the phenomenon of interest through different perspectives, and in turn, arrive at better informed conclusions (Jogulu & Pansiri, 2011). For example, if the aim of the dissertation is to produce more complete knowledge about a novel phenomenon, researchers may opt for the implementation of both qualitative *and* quantitative methods in order to both produce *and* confirm new findings that can be added to the extant literature (Jogulu & Pansiri, 2011). In contrast, single-method research is advantageous when the research aim is to delve deep into one specific variable, or a relationship between specific variables; however, by focusing on one element, single-method research bears the risk of overlooking other components that might be relevant for the phenomenon investigated (Onwuegbuzie & Leech, 2005). In the case of the present doctoral project, the overarching aim is to answer *How effective is VR in producing positive effects on social attitudes and behavior?* If the dissertation would rely specifically upon survey measures, for example, its conclusions about the effectiveness of "VR for Good" would be based exclusively upon correlations, but it would lack the causal underpinning of an experiment or the deeper understanding of a qualitative exploration. As a result, its findings would not suffice to

fully answer the thesis's overarching research aim. Consequently, I argue that a multi-method dissertation can better assess the media effects of "VR for Good" than a single-method approach.

In the following section, I elaborate on the method chosen per research question.

Study 1 examines the first research question, namely to what extent VR treatments can influence users' social attitudes and behaviors (RQ1). To answer this question, I need to estimate typical effect sizes and strengths of association between VR treatments and attitudinal outcomes, as well as potential moderating influences. An appropriate method to do so is a systematic literature review with meta-analysis, where the effect sizes of extant primary studies are combined into an overall estimation and contextualized in a thorough qualitative discussion (Rosenthal & DiMatteo, 2001).

In a meta-analysis, the variables and effects of interest are assessed in a systematic way by following six fundamental steps (Rosenthal & DiMatteo, 2001): Firstly, dependent and independent measures are clearly operationalized; secondly, they are systematically searched for within the extant literature; thirdly, effect size variability is examined informally; fourthly, extant effect sizes are combined in a statistical procedure using measures of central tendency; fifthly, the significance level of the indices of central tendency are examined; and sixthly, and last, the importance of the obtained effect size is evaluated. Through this procedure, scholars can identify the average effect of treatments on the variable of interest, and observe important patterns and tendencies at play.

There are multiple advantages of implementing a meta-analysis to answer the thesis's first research question. For example, the average effect size obtained from the combination of multiple separate studies can serve as an accurate and credible indicator for whether VR interventions indeed influence social attitudes, regardless of the type of attitude (e.g., environmental or political) and the research design of each individual study. In this way, a meta-analysis provides a more conclusive answer about the effectiveness of "VR for Good" than a single experiment. Further, through its systematic and rigorous procedure, a meta-analysis provides a protocolled and replicable way to generate new insights, thus enhancing the study's validity, paving the way for related future investigations and facilitating theory development (Rosenthal & DiMatteo, 2001).

Meta-analyses also come with certain shortcomings that need to be addressed. Rosenthal and DiMatteo (2001) argue that the sampled studies can be biased, given that database searches can oftentimes be incomplete; they can also differ in research designs

and quality; and sometimes one study may include multiple effect sizes that are not independent of each other. In conclusion, a meta-analysis is only as good as its search procedure and the studies it includes. For this reason, it is essential that each step of a meta-analysis is carefully documented.

Moreover, it is beneficial to add a systematic narrative review of the included studies to the meta-analytic findings (Crowther et al., 2010). This helps to contextualize the results in relation to each study's characteristics, such as research design, participant sampling and measures. Furthermore, a narrative literature review may allow theoretical and methodological patterns to emerge, which can explain possible variations within the meta-analytic findings.

In conclusion, the question of whether VR can overall influence social attitudes and behaviors (RQ1) can be answered best by means of a systematic review with meta-analysis, for which it is implemented in Study 1 of the thesis.

Study 2 explores the thesis's second research question, namely how VR is used by practitioners to influence social attitudes and behaviors. The information needed to answer this question lies in the practitioners' lived experience and can take the form of memories, ideas and concepts rather than numbers, which makes a qualitative methodology more suitable than a quantitative one. To retrieve this type of information, the study implements qualitative standardized open-ended expert interviews and draws upon practitioners' narrative responses as a data source (Bogner et al., 2009).

To ensure that the interviews are conducted in a systematic and standardized way, I follow a reconstructive approach as suggested by Reich and Barnoy (2020). This approach bears advantages, especially because experts are guided to recall and reconstruct every step of the process of interest, ranging from the conception, production, dissemination and evaluation of "VR for Good." Practitioners are asked identical questions regardless of their specific VR video, which in turn helps draw abstract patterns and conclusions that inform the research question. Because the interviews were conducted via the video conferencing tool Zoom, it was possible to ask questions about the use of immersive and narrative elements while playing the VR video, making it easier for practitioners to point at the specific features and better elaborate on their importance.

For the analysis, I chose Charmaz's (2006) constructivist approach of grounded theory. Charmaz's (2006) strategy is advantageous for qualitative data analysis because its purpose is to abstract the data into coherent research categories and theories. This means

that after an initial round of coding, the data is continuously coded in a more focused way until broader concepts emerge. These concepts can then feed into larger frameworks that might be valuable for further theory-building and hypothesis-testing.

This methodology comes with certain weaknesses regarding its replicability. Although the questions remained similar across interviews, Charmaz's (2006) constructivist view acknowledges the researchers' subjectivity in the process of data collection and analysis, which in turn hampers their replicability to a certain extent. For example, the data collection process is a product of the conversation between two people, which means that interpersonal and intangible conversation dynamics may affect how the interview unfolds. If in the future a different scholar seeks to repeat the study, their conversation with the interview partner may be governed by different dynamics, which in turn will affect the data collection. Furthermore, the data analysis is also influenced by a certain level of subjectivity, given that the researcher identifies and prioritizes information depending on their expertise and background (Charmaz, 2006). This, however, is a common complexity within qualitative research. Charmaz's (2006) framework acknowledges this issue, and stresses the importance of a protocolled and transparent data collection and analysis process.

For Study 2, qualitative standardized open-ended expert interviews are an appropriate methodology not only to retrieve the information needed to understand how practitioners use VR for immersive awareness and fundraising, but also to expand the numerical findings from the quantitative inquiry in Study 1 with novel research categories.

Study 3 finally investigates the thesis's third research question, namely why it may be social presence that motivates the attitudinal and behavioral effect of "VR for Good." The third research question is hence a question of causation, as it investigates if it is the feeling of social presence in HMD-based 360-degree VR that produces donation behavior. Randomized laboratory experiments are perhaps the most appropriate method to establish causality in social science research, because they help to isolate and test the causal effects of specific variables in a controlled environment (Iyengar, 2011).

For Study 3, a laboratory experiment comes with several strengths. Firstly, it can provide direct empirical evidence for the causal effect of one manipulated component if all other elements are kept constant; by manipulating social presence, Study 3 can test if there is a causal effect on the wanted outcome. In addition to the main effect, experimental designs can also test for moderation effects (Iyengar, 2011). This is particularly interesting

for the third research question, given that it seeks to account for the moderating influence of issue-specific prior attitudes as outlined in Chapter 2.4. Furthermore, experiments allow for the investigation of behavioral outcomes, for example, by the use of a cover story. Since the third research question is concerned with behavioral outcomes in the form of donations, a laboratory experiment can help build the setting in which to observe such an outcome.

Moreover, a laboratory experiment can be combined with another methodology so as to add more depth to the numerical results. To gain a better understanding of why social presence may motivate the effects of “VR for Good,” Study 3 adds a qualitative measure by asking participants’ to explain the motivation underlying their behavior in a post-stimulus open-ended question. Qualitative responses can thus provide information-rich data that explain the experiments’ quantitative findings. This integrative approach enhances the overall assessment of social presence and its effects and gives a more nuanced answer to the thesis’s third research question.

However, controlled experiments cannot fully inform whether social presence is facilitating the outcomes of “VR for Good” in settings outside of the laboratory. This raises the question of ecological validity; a “question of whether an effect (and its underlying processes) that has been demonstrated in one research setting would be obtained in other settings, with different research participants and different research procedures” (Brewer, 2000, p. 10). This means that Study 3 cannot apply its findings about the attitudinal effect of social presence to real-life environments. For that, the thesis synthesizes the practical insights gained from expert interviews in Study 2 with the observations made in Study 3 to draw more definite conclusions about how VR influences behavior.

By combining quantitative and qualitative methodology, Study 3 adds empirical evidence for the causal mechanisms that produce the attitudinal effects of “VR for Good.” As a result, its findings complement the results of Studies 1 and 2.

In sum, the dissertation project implements three different methodologies so as to weave quantitative and qualitative findings into a comprehensive evaluation of the effectiveness of “VR for Good.” Through means of systematic review with meta-analysis (Rosenthal & DiMatteo, 2001), standardized open-ended expert interviews (Bogner et al., 2009), and a randomized laboratory experiment (Iyengar, 2011) with a mixed methods approach, it illuminates the phenomenon of interest from different data sources, and adds a much-needed clearer assessment of “VR for Good” to the literature.

3.2 Research during a pandemic

It is important to reflect upon the context in which the dissertation project was conducted, namely the COVID-19 pandemic. As Dennis and Waterhouse (2020) argue, the role of political institutions during the pandemic as well as unemployment rates, austerity measures and social isolation may have short- and long-term influence on scholars, their research designs and study participants. In this section, I seek to outline two ways in which the COVID-19 pandemic impacted the realization of this dissertation project, and in turn, the replicability of its findings.

Firstly, the interviews for Study 2 were not conducted face-to-face due to travel restrictions and local lockdowns. Face-to-face interviewing is typically viewed as the gold standard for qualitative data-collection, in particular because the synchronicity of time and place allows for the interview partners to assess the others' voice, intonation and body language, which can provide additional data points to the verbal information (Opdenakker, 2006). Methodological alternatives to face-to-face interviews can be telephone, text based (asynchronous or synchronous) and remote video interviews (Gruber et al., 2021). The latter can mediate both visual and acoustic cues synchronously, making it more similar to face-to-face and hence more suitable for the aims of Study 2.

Video conferencing comes with inherent advantages and disadvantages to face-to-face interviews. Benefits of remote video interviews are convenience, accessibility, and timesaving as no travel arrangements are required (Gray et al., 2020). Consequently, more international practitioners can be included in the research design, which increases the number of diverse experiences, perspectives and insights and in turn, enhances the data richness of the study. A shortcoming of remote video interviews is that it cannot mediate social cues as accurately as face-to-face. These, however, are essential to relationship building, which is a central part of qualitative data collection and interpretation (Tietel, 2000). This means that the decision to conduct the interviews with an online conferencing tool may have impacted the relationship building between interviewer and interviewee, but also enhanced the data's diversity through the availability of international practitioners.

Secondly, Study 3 was impacted by local health safety guidelines regarding COVID-19, which required numerous process changes to the experimental research design. A detailed hygiene concept was put in place so as to ensure participants' wellbeing and health on site including regular use of disinfectant, appropriate social distancing, and the use of *FFP2* standard masks. The concept was based on the protocol for reducing

COVID-19 transmission risk in EEG research by Simmons and Luck (2020) and was adapted to the needs of the study.

While these factors enhanced the safety of the experimental procedure, they also altered it in a significant way. For example, participants were required to wear a mask under the HMD so as to minimize the risk of a potential infection. This might have evoked feelings of unease, which perhaps distracted users from the VR contents, thus impacting information processing and in turn, the persuasive effect. Alternatively, participants may have felt particularly safe due to the implemented measures. Because strong feelings of safety toward personnel can increase the individual's trust toward them (e.g., Conchie & Donald, 2008; Auer et al., 2014), it is likely that feelings of safety enhanced the cover story's credibility and as a result, the persuasive effect. Therefore, it is difficult to arrive at conclusions about how the applied safety measures influenced the data collection process of Study 3.

To summarize, the research designs of Studies 2 and 3 were adapted to the context in which they were conducted. For Study 2, this meant that remote video was used as a replacement to face-to-face interviews; this may have hampered relationship building during the conversation, but made it possible to include insights from international practitioners. For Study 3, the implementation of health safety guidelines perhaps influenced how comfortable participants felt during the experimental procedure, which potentially affected the wanted behavioral outcome. Future scholars should take these factors into account when comparing Studies 2 and 3 to related studies.



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RESEARCH ARTICLE



Changing social attitudes with virtual reality: a systematic review and meta-analysis

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ABSTRACT

Although it has been shown that Virtual Reality (VR) can positively impact political, civic and environmental views, the question of whether and how VR influences social attitudes more effectively than less immersive conditions has been a subject of debate. To address this question, this article provides a systematic review with meta-analysis of social attitude research in VR by examining 50 separate findings from 39 studies. We find that VR influences social attitudes significantly more than non-immersive interventions, while embodiment has no moderation effect. Further, outgroup VR perspective-taking fosters positive social attitudes more effectively than ingroup VR perspective-taking. Findings are categorized according to social attitude object and discussed in the light of emerging challenges and opportunities for VR attitude research.

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Introduction

The advent of Virtual Reality (VR), once predicted to challenge our definitions of communication and its effects (Biocca & Levy, 1995), has now led to a surge of scholarly interest in how and why VR interventions may change social attitudes toward social matters (Aitamurto et al., 2021). Virtual Reality pioneer Jaron Lanier noted that ‘the most important thing about a technology is how it changes people’ (Lanier, 2011, p. 4) and, in light of the current discourse on the Metaverse and the future of human existence in virtual spaces (e.g. Zuckerman, 2021), this question is timely for both scholars and practitioners. The purpose of this study is to investigate how VR changes the ways we think and behave toward social attitude objects by systematically reviewing and summarizing extant empirical evidence that addresses this question.

Over recent decades, researchers have been investigating how VR experiences evoke social attitude change, often posing similar questions and finding differing outcomes. Further, the variety of theoretical and methodological approaches make it difficult to identify common trends that could help accelerate progress in the field. A meta-analytic review of the research can contribute to providing a more accurate estimate of the effect investigated as well as a holistic picture of the literature and, thereby, point toward new research directions (Rosenthal & DiMatteo, 2001).

Given the above, the aims of this contribution are twofold. First, we systematically review relevant studies according to social attitude objects and identify current challenges and opportunities in their approaches. Second, we follow the quantitative procedures of a meta-analysis (Rosenthal, 1991; Rosenthal & DiMatteo, 2001) to test whether VR treatments are more effective for changing social

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attitudes than traditional media. To gain a better understanding of the effect of interest, we further examine the variables embodiment and perspective-taking in the literature.

Related work

Social attitudes

The topic of media-induced attitude change has a long research tradition in Communication Science and Social Psychology (Petty & Briñol, 2010); simply defining what an attitude actually is has occupied theorists for decades (cf. Oskamp & Schultz, 2005). Originally used to describe a person's physical posture, the term 'attitude' now commonly refers to a 'posture of the mind' (Oskamp & Schultz, 2005, p. 8) toward an attitude object. The most prominent approaches to defining attitude include the ABC model, whereby attitudes consist of affective, behavioral, and cognitive components (e.g. Ellis, 1962), and Fishbein and Ajzen's view (1975) of attitude as an exclusively affective construct that indicates favorability. We rely on the definition by Oskamp and Schultz (2005), who viewed attitudes as 'a summary of all of a person's evaluative beliefs/opinions about, affective reactions toward, and behavioral responses to an attitude object' (p. 14). This definitional approach entails beliefs that are value judgments about an object; stereotypes, namely general beliefs about social groups; opinions, defined as evaluations with a narrower scope; affective reactions (e.g. liking or disliking); and behavior toward attitude objects.

Such objects may be as simple as consumer products or as complex as topics of broad societal relevance, for example, climate change, racial bias, or discrimination against minorities. In the latter case, objects are commonly referred to as 'social attitudes' (e.g. Campbell & Stanley, 1963; Haddock & Zanna, 1999). Social attitudes are vital for democratic processes as they serve as driving factors for voting propensity (Boonen et al., 2014), public service motivation (Taylor, 2010), and support for democracy (Stevens et al., 2006). Therefore, the processes by which they change and the reasons for such changes are central to the literature (Briñol & Petty, 2010). One line of this research investigates the influence that media exert on social attitudes, from mass television, radio (Petty et al., 2008), and social media (Bail et al., 2018) to emerging technologies like Virtual Reality (Kalyanaraman & Bailenson, 2020).

Virtual reality as a medium for communicating social issues

Virtual Reality has been defined as 'a real or simulated environment in which a perceiver experiences telepresence' (Steuer, 1992, p. 78). Telepresence, frequently referred to as spatial presence or presence, describes the feeling of being there within the mediated reality (Slater & Wilbur, 1997; Lee, 2004). Presence can be induced by specific hardware, namely head-mounted displays, computers, and headphones (Steuer, 1992), and enhanced through immersive features such as increased levels of user-tracking, stereoscopic visuals, and wide fields of view of display (Cumings & Bailenson, 2016). With immersive technology, users feel as though they are present within mediated realities that range from spherically filmed 360-degree videos to fully immersive virtual environments (IVEs). Experiencing the feeling of being present in VR has potential value for the communication of social and political concerns, given that these tend to be perceived as psychologically distant: first, their immediate consequences may lie in a temporal distance (e.g. climate change); secondly, they may lie in a spatial distance (e.g. migration); or thirdly, they may not directly affect one's in-group (e.g. aging for younger populations). Scholars have argued that VR might decrease users' psychological distance in relation to such abstract mental construals (Kalyanaraman & Bailenson, 2020), thus transforming distant attitude objects into near ones. This conversion is key for changing social attitudes because attitudes toward psychologically near objects are more likely to change than those toward distant ones (Trobe & Liberman, 2010).

Other approaches have examined the role of social presence, that is the feeling of being there together with mediated others (Lee, 2004). Avatars or agents may exert social influence on users, specifically when the interaction is perceived as realistic and relevant (Blascovich et al., 2002). Furthermore, socially present characters are more likely to induce empathy (Schutte & Stilić, 2017) and, in turn, drive attitude change toward vulnerable groups (Herrera et al., 2018). Another distinct subtype of presence is self-presence, which is the subjective experience of the virtual self as the actual self (Lee, 2004). Self-presence depends on the degree of connection users feel to the virtual self's emotions, identity, and physical body (Ratan & Hasler, 2010). Because presence and its subtypes are often associated with persuasive outcomes in regard to commercial products (Lombard & Snyder-Dutch, 2001), researchers have shown a growing interest in its potential effects on social attitudes.

One of the main approaches in this line of research is to test how varying levels of immersive modality affect attitudinal measures. This body of literature is aligned with media richness theory (Daft & Lengel, 1986), the overarching hypothesis being that the richer the immersive modalities of the medium, the greater its persuasive effect on social attitudes. Such empirical investigations often compare VR to traditional media, for example, text or two-dimensional video, whereby some studies have identified significant effects (e.g. Ahn et al., 2014), while others have not (e.g. Ma, 2020).

A meta-analytic review of empirical studies may help explain such inconsistencies by drawing a more accurate and precise effect estimation based on the accumulation of separate findings (Rosenthal & DiMatteo, 2001). In addition, a synthesis of the literature can inform scholars about patterns in the theory and methodology of immersive modality effects research. Such an analysis would provide scholars and practitioners with a better understanding of the immersive technology needed to yield attitudinal change, and in turn, help generate new hypotheses. Moreover, in the event that challenges in extant designs are identified, a systematic review could help future researchers to address and overcome these shortcomings. For the purpose of our meta-analysis, we pose our first prediction:

H1: VR interventions will lead to more positive attitudes than less immersive media conditions.

Embodied experiences

Studies that compare social attitude effects on the basis of their immersive modality often use embodied experiences as VR treatment (Ahn et al., 2014). Embodiment requires the visual representation of the virtual self, manifested from virtual representations of hands (e.g. Heeter, 1992) to full-body avatars (Kilteni et al., 2012). When users experience a sense of ownership toward the virtual body, agency over its movement, and a feeling of intention over its location, they tend to experience a sense of embodiment (Kilteni et al., 2012). However, these additional variables make it difficult to compare embodied VR to print or 2D video because the treatments differ in regard to not only their immersiveness but also the sense of embodiment they evoke.

The literature shows a general consensus that embodiment can yield significant persuasive outcomes. Previous work has argued that, because of the illusion of control over the mediated environment, users tend to become susceptible to subliminal persuasive messages (Sundar, 2008). Further, embodied experiences can be considered more direct and personal than second-hand events and are, thereby, more likely to have a stronger influence on attitudes (Ahn, 2021). Moreover, significant effort has been made to investigate the effects of embodiment on body, identity, and attitudes. Yee and Bailenson (2007) coined the term 'Proteus effect' to describe how users internalize features of the avatar they embody. For instance, the embodiment of an avatar that is tall elicits more confident behavior than the embodiment of a short avatar (Yee & Bailenson, 2007).

Because literature offers evidence of a positive impact of embodied experiences on attitudes, we suspect that embodied treatments outperform non-embodied treatments when compared with

traditional media. A moderation analysis may clarify this assumption by providing a more precise effect estimate. Therefore, we state our second hypothesis:

H2: Sense of embodiment will positively moderate the relation between VR intervention and attitude.

Perspective-taking

Embodiment in IVEs, as well as the spherical viewfield in 360-degree VR, can create the illusion of seeing the world through the eyes of another. VR technology thus eliminates the need to mentally construct a different viewpoint by programming it into the user's visual field. According to traditional perspective-taking scholarship, the perception of the world through another's eyes shifts the visual focus to the external environment; as a result, individuals begin to think about the other's behavior based not on ascribed dispositional traits but on situational factors (Jones & Nisbett, 1987). Situational rather than dispositional information-processing, in turn, elicits feelings of sympathy (Batson et al., 1989) or congeniality toward the person whose perspective is taken (Davis, 1994).

Frequently, these approaches compare the effect of the first-person perspective (1PP) on in-group and out-group biases. For this, specific social markers such as race or gender are used to categorize subjects into an in-group and then test how an out-group 1PP in VR affects their attitudes toward the out-group. Mental out-group perspective-taking has been consistently linked to reductions in racial bias (Todd et al., 2011), a decrease in out-group stereotypes (Vescio et al., 2003), and improved social functioning in general (Davis, 1983). Naturally, a significant amount of scholarly effort has been made to examine how 1PP in VR affects attitudinal constructs (e.g. Aitamurto et al., 2018). However, it is unclear whether outcomes from mental 1PP research can be related to virtual experiences. The reason is that mental 1PP depends on important additional factors like mentalizing skills (Frith & Frith, 2006), which, in the case of VR 1PP, are not needed to put oneself in another's shoes. To test whether current perspective-taking and attitude literature in VR aligns with mental perspective-taking research by means of a meta-analysis, we hypothesize:

H3: Out-group 1PP in VR will affect social attitudes more positively than in-group 1PP in VR.

Methodological considerations in VR attitude research

Our meta-analytic review addresses the hypotheses stated above while additionally accounting for factors relating to the experimental designs. This is because the findings from attitude change experiments can be context-sensitive (Holbrook, 2011).

One relevant factor is sampling. For example, student samples might be threatened by social desirability bias to a larger extent than other populations when the study is undertaken by familiar research staff. Further, sampling can determine the level of familiarity with VR and, thus, account for novelty effects that might influence levels of flow with the mediated contents (Tokunaga, 2013). Presence can also be affected by familiarity with (Lachlan & Krcmar, 2011) and trust in VR (Salanitri et al., 2016). Regarding other sampling demographics, there is no conclusive evidence about the influence of gender (Felnhofer et al., 2012; Felnhofer et al., 2014; Giannopoulos et al., 2008; Kothgassner et al., 2013) or age (Corriveau Lecavalier et al., 2020).

Closely related to sampling, monetary compensation for participation is another factor we seek to consider. High incentives for participation can increase perceived risk of participation (Cryder et al., 2010) or attract subjects with different personality traits (Hsieh & Kocielnik, 2016), thus resulting in a systematic sampling bias. For example, low income populations might be more attracted to a study that offers monetary compensation than high-income populations, yet the attitude measure might be income-dependent (e.g. willingness to donate). A common alternative to monetary compensation for student subjects can be course credit; however, there is mixed evidence about the effect of payment vs. course credit on task performance (Brase et al., 2006; Kvaløy et al., 2015).

Another methodological issue that warrants discussion is duration of treatment. On the one hand, the comparability of different immersive modalities might be hampered by differing exposure times. For instance, a VR condition can last 5 minutes because it is bound to the duration of the video; however, the text condition depends on the subject's rate of reading, i.e. how quickly or slowly he or she reads. As a result, exposure time across treatments may vary, thus adding an extra differential factor to the independent–dependent variable relationship. On the other hand, long durations of exposure to VR treatments may produce feelings of cybersickness (Kennedy et al., 2000), which can, in turn, decrease levels of presence (Weech et al., 2019) and thus interfere with the outcomes. Further, it is also possible that longer exposure increases a sense of presence or engagement with the message and, thereby, the potential for attitudinal change.

We account for these three factors—sampling, incentives, and duration of treatment—in the review of the literature in order to provide a nuanced understanding of found effects. Given the lack of sufficient evidence to state hypotheses, we formulate a more general research question:

RQ: How are the experimental design factors of sampling, compensation, and duration of treatment considered in the extant literature?

Materials and method

The first step is the identification of relevant literature. The search for the review and meta-analysis was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A collection of relevant literature was extracted by completing keyword searches of the databases that publish research related to Communication and Virtual Environments, namely Web of Science, Mass Media Complete, and PsycInfo; the IEEE conference proceedings; and the ACM Digital Library as well as Google Scholar. The search terms applied to the full text included a combination of 'virtual', 'immersive', 'virtual reality', 'immersive virtual environments', 'HMD', '360VR', 'experiment', 'attitude', 'bias', 'opinion' and 'belief'.

We included studies that (1) were published in a peer-reviewed journal, a conference proceeding, a dissertation or pre-print; (2) measured an attitude toward a social object as a dependent variable; (3) collected empirical data in an experimental research design with random treatment assignment; (4) included one experimental condition in which an HMD was used; and (5) reported an effect size adequate for the aims of the review and meta-analysis. After identifying relevant studies, we searched for additional work in their reference lists. Based on this process (Figure 1), we identified 39 studies with 50 separate research findings and a total of 4,210 subjects (Table 1).

The final data pool was coded by two authors trained in a specific coding scheme that included detailed guidelines for the definition of each variable. Coded variables included study details (participants' demographics, sample type, participation incentive); aspects of the dependent variable (e.g. attitude type, measurement, effect sizes pre- and post-stimulus); presence measurements; aspects of the VR experience (e.g. sense of embodiment, perspective-taking); moderator variables; and additional conditions and technological affordances of the VR experience (duration of stay in minutes, HMD, tracking, audio). After specific coding intervals, the authors compared their results and discussed each coding step thoroughly to reach consensus on the ascribed values.

Dependent variable

Social attitude. This variable considers attitudinal measures defined as evaluative beliefs, opinions, affective reactions, and behavioral measures (Oskamp & Schultz, 2005) toward an attitude object of broader public relevance (Haddock & Zanna, 1999). Examples include abstract objects, such as the environment and migration, as well as narrower objects, such as policies or social groups. To

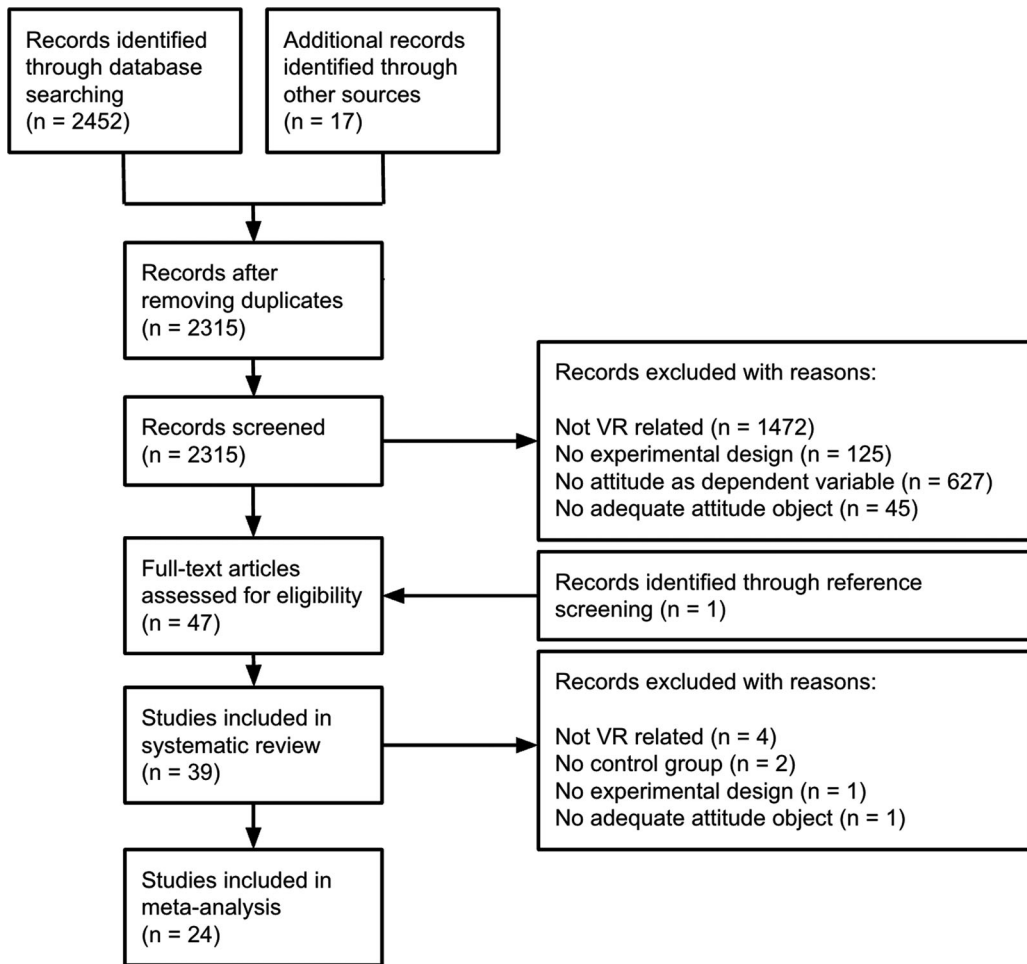


Figure 1. PRISMA Flowchart of study selection for review and meta-analysis (Moher et al., 2015)

ascertain internal validity, we restricted the search to studies that explicitly labeled their dependent variable as attitude and that employed at least one self-report or behavioral measure of that attitude. Thus, we excluded conceptually different constructs like empathy, which describes ‘the capacity to share and understand emotional states of others in reference to oneself’ (Decety & Moriguchi, 2007, p. 22). Attitude research related to marketing, advertising, and brand communication was excluded as the attitude objects did not match the research objectives.

Independent variables

VR interventions. For purposes of internal validity, we restricted the definition of VR interventions to experiences facilitated by the use of a Head Mounted Display, thus ensuring that immersive factors such as field of view, field of regard, display size and resolution, stereoscopy, rendering, realism, frame rate, and refresh rate (Bowman & McMahan, 2007) were within the same range. Interventions induced by less immersive devices, for example Google Cardboard, were excluded. In addition to fully immersive VR, we included studies that used 360VR as it realistically conveys an external environment that can be experienced on multiple axes (Huang et al., 2017).

Virtual 1PP. Virtual 1PP refers to the experience of the external environment from the first-person perspective of a person other than oneself. Subcodes included *in-group 1PP*, when the assigned

Table 1. Summary of studies.

Reference & Location	Sample	Conditions & Duration	Presence Measure	Attitude Measure	Compensation	Attitudinal Outcome
Environment Ahn et al., 2014 Study 1 US	N = 47 61.7% females (μ age = 21.6 Student	Cutting a virtual tree in an IVE with embodied hands vs reading a print description; >2 min	none	Self-report: Ten items from the Environmental Action Internal Control Index (Smith-Sebasto & Fortner, 1994) Behavioral: Number of napkins used to clean up water	na	No significant differences of treatment effect on self-reported locus of control Participants in the IVE condition used significantly fewer napkins compared to participants in the print condition.
Ahn et al., 2014 Study 2 US	N = 60 75% females (μ age = 20.32 Student	Cutting a virtual tree in an IVE with embodied hands vs reading a print description vs 2D video > 2 minutes; duration not reported	none	Self-report: Environmental behavioral intention; Environmental locus of control; Success in recycling-relevant behaviors at Time 2	na	Subjects in IVE reported significantly environmental locus of control, environmental behavior
Ahn et al., 2016 Study 1 US	N = 49 55.1% females (μ age = 20.4 Student	IVE cow avatar embodiment vs 2D video; duration not reported	Five item interval scale adapted from Bailenson et al.'s Spatial Presence Scale (2005)	Self-report: Inclusion of nature in self (INS; Schultz, 2001)	na	Participants in the IVE condition perceived significantly higher inclusion of self in nature than participants in the video condition
Ahn et al., 2016 Study 2 US	N = 53 50.94% females (μ age = 21.2 Student	IVE coral avatar embodiment with haptic feedback vs 2D video; duration not reported	Five item interval scale adapted from Bailenson et al.'s Spatial Presence Scale (2005)	Self-report: Inclusion of nature in self (INS; Schultz, 2001); Issue involvement was measured with six 7-point bipolar items asking participants to evaluate how important, of concern, relevant, meaningful, of matter, and involving the issue of ocean acidification was to them	na	Differences in inclusion of self in nature for participants in the IVE condition and those in the video group approaching significance, with the direct effect weakening over Time 2. No significant difference between groups was found for issue involvement
Ahn et al., 2016 Study 3 US	N = 126 65.08% females (μ age = 20.1 Student	IVE coral avatar embodiment with haptic feedback vs 2D video; duration not reported	Five item interval scale adapted from Bailenson et al.'s Spatial Presence Scale (2005)	Self-report inclusion of nature in self (INS; Schultz, 2001); Issue involvement was measured with six 7-point bipolar items asking participants to rate how important, of concern, relevant, meaningful, of matter, and involving the issue of ocean acidification was to them	na	No significant differences in inclusion of self in nature between conditions



Bailey et al., 2015 US	N = 70 47,1% females (μ age = 18,4 Student, Communication and Introduction to the Humanities class	IVE vividness (avatar-coal, coal) x personalization (personal sign, impersonal sign) during virtual shower; 6 min	na	Water amount and temperature during task	Course credit	Participants exposed to vivid messages used cooler water compared with not vivid messages. Personalization had no significant effect.
Breves & Heber, 2020 DE	N = 56 42,8% females (μ age = 30,18 Half student, faculty members, distant acquaintances of researcher	Video about nature in 360VR vs 2D video; 11 min	Spatial Presence Experience Scale (Hartmann et al., 2016)	Self-report: commitment to environment (CTE) scale, Davis et al. (2009)	Course credit for students	The immersive nature video was more likely to elicit feelings of connection to nature than the regular nature video
Breves & Schramm, 2021 DE	N = 112 86,6% females (μ age = 22,04 Half student, faculty members, distant acquaintances of researcher	Video about the negative environmental consequences of mono- cropping in agricultural practices in 360VR vs 2D; 4 min		Self-report: personal relevance of the environmental (Ahn et al., 2016); pro- environmental behavioral intentions (Toomey & Domroese, 2013)	Course credit or a small amount of money (10 EUR) for students	No significant main effect of condition
Filter et al., 2020 DE	N = 50 72% females (μ age = 23,76 Student	Video about wolves in their natural habitat in 360VR vs 2D video; 3:36 min	Spatial Presence Experience Scale (Hartmann et al., 2016)	Self-report: Attitudes towards wolves, based on attitudes toward wildlife by Kaczynsky et al. (2004)	none	No significant main effect of condition
Fonseca & Kraus, 2016 DK	N = 64 42,19% females age = 19-53 University environment	Video about meat consumption and its environmental effects in 360VR vs 360 video on tablet vs 360 control video	PQ (3 items)	Self-reported attitudes toward meat consumption Behavioral: Post-stimulus choice experiment, whereby subjects could choose between a snack with or without meat	na	Significant effect on self- reported attitudes; no effect on behavior.
Pimentel et al., 2018 US	N = 20 55% females (μ age = 14,95 Highschool students	IVE interaction with small vs large penguin; 5 min	none	Self-report: environmental threat perception (Leiserowitz, 2006; O'Connor et al., 1999); likelihood of pro- environmental behavioral intentions (e.g. donating money, volunteering, following social media pages)	none	Small sized penguins had a significant effect on attitudes, and perceived threat than large sized ones; no effect on behavioral intentions
Pimentel & Kalyanaraman,	N = 60 na% females	IVE visit at virtual sea turtle hospital, one vs many victim	Spatial presence (Harms & Biocca, 2004)	Self-report: environmentalism (Gatersleben et al., 2002);	5 USD	Participants in the single victim condition donated

(Continued)

Table 1. Continued.

Reference & Location	Sample	Conditions & Duration	Presence Measure	Attitude Measure	Compensation	Attitudinal Outcome
2021 Study 1 US	(μ age = 20,97		Spatial presence (Sundar et al., 2017)	behavioral intentions (e.g. likelihood of donating money)		more towards sea turtle conservation than those in the many victim condition.
Pimentel & Kalyanaraman, 2021	N = 98 75.5% females (μ age = 20,63	IVE (visuomotor synchrony: yes/no) x 2 (visuotactile synchrony: yes/no); 2-5 min	Spatial presence (Harms & Biocca, 2004) Spatial presence (Sundar et al., 2017)	Self-report: environmentalism (Gatersleben et al., 2002); behavioral intentions (e.g. likelihood of donating money); threat perceptions; inclusion of self in nature	Course credit	Embodiment increases the salience of the threats to the group, which contributes to charitable giving intentions
2021 Study 2 US						
Pimentel & Kalyanaraman, 2021	N = 90 43.3% females (μ age = 18,95 Museum visitors	IVE victims: self vs one other vs seven others (yes/no)	none	Self-report: single item measure of perceived extinction, imagining winning 5USD and then rating donation amount	na	No effect on dependent measures
Pimentel & Kalyanaraman, 2021	N = 25 88% females (μ age = 18,95 Student	IVE victims: number (one vs many) x species (similar vs different); 2-5 min		Self-report: environmentalism (Gatersleben et al., 2002); threat perceptions; inclusion of self in nature; behavioral intentions (e.g. likelihood of donating money)	5USD	No effect on perceived extinction and threat perceptions. Donation intention was higher for the one-victim condition than the many-victim condition. The effect was reversed when victims were of different species
Markowitz et al., 2018	N = 47 highschool students 61.7% females age = 18-28 (Median = 20) Prior experience with VR (over 90%) student, Department of Communication's research participant pool	IVE coral embodiment vs scuba diver embodiment; 6,5 min	Nine items by the authors	Self-report: New Ecological Paradigm Scale (Dunlap et al., 2000)	Course credit	No significant effect of condition
2018 Study 2 US						
Markowitz et al., 2018	N = 43 55.81% females Student	IVE swimming by using physical arm movements as gestures vs swimming by using a joystick; >3 min	Five items about the degree to which participants felt surrounded by the virtual environment.	Self-report: New Ecological Paradigm Scale (Dunlap et al., 2000)	Course credit	
2018 Study 4 US						



Racial Bias Banakou et al., 2016 Study 1 ES	N = 60 100% females (μ age = 21,9 University environment	IVE White vs Black embodiment while performing Tai Chi movements with Asian avatar teacher; 10 min	none	Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	15–20 EUR	Black embodiment reduced the degree of bias but did not change bias to non-bias
Banakou et al., 2016 Study 2 ES	N = 30 100% females (μ age = 21,9 University environment	IVE White while performing Tai Chi movements with European avatar teacher; 10 min	none	Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	15–20 EUR	No effect of teacher appearance
Banakou et al., 2020 ES	N = 92 100% females (μ age = 21,8 Caucasian/White; University environment	IVE BodyType (White, Black) x Crowd (Negative, Neutral, Positive); 35 min	One item on a Likert Scale from –3 (strongly disagree) to 3 (strongly agree) (I felt I was in the middle of a crossroad with people walking by)	Self-report: attitude to Blacks scale (Brigham, 1993) Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	15 EUR	No significant effect of conditions on self-reported attitudes Neutral crowd condition: IAT decrease with Black embodiment and increase with White embodiment Positive crowd condition: IAT decrease with Black embodiment Negative crowd condition: IAT increase with Black embodiment Increase in IAT for Black avatar embodiment
Groom et al., 2009 US	N = 98 60,2% females (μ age not reported 46,94% White 21,43% Asian 16,33% African American 7,14% Hispanic 8,16% Other; Student	IVE Black vs White avatar embodiment during job interview	none	Self-report: Racial Argument Scale (RAS) (Saucier & Miller, 2003) and portions of the Modern Racism (MRS) scale (McConahay, 1986) Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	Class credit or payment	
Hasler et al., 2017 ES	N = 32 100% females Caucasian/White Student	IVE Black vs White avatar embodiment during interaction with White and Black virtual character (different sessions,	none	Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	na	No effect of condition on IAT

(Continued)

Table 1. Continued.

Reference & Location	Sample	Conditions & Duration	Presence Measure	Attitude Measure	Compensation	Attitudinal Outcome
Maloney, 2018 US	N = 14 0% females Caucasian/White University and surrounding environment	counterbalanced order); 6 min IVE Black vs White avatar embodiment during shooting task	iGroup Questionnaire (Schubert, 2003)	Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	na	IAT decrease in White avatar condition
Patané et al., 2020 FR	N = 40 67.5% females (μ age = 25.8 Caucasian/White	IVE Black avatar embodiment during cooperative vs non- cooperative interaction with Black virtual character; 9 min	none	Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	na	IAT decrease in cooperative condition
Peck et al., 2013 US	N = 60 100% females age = EL: 23 $\pm$ 5, ED: 25 $\pm$ 7, ND: 20 $\pm$ 3, EA: 21 $\pm$ 1 Student	IVE Embodied-Light-Skinned (EL) avatar vs Embodied- Dark-Skinned (ED) vs Non- Embodied Dark-Skinned (ND) vs Embodied-Allen- Skinned (EA); subjects first explored and viewed their virtual body in front of a mirror, then were approached by 6 light and 6 dark-skinned avatars; 11.5 min	none	Self-report: explicit racial bias (Avenanti et al., 2010) adapted for Spain Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	na	IAT decrease in Embodied- Dark-Skinned condition
Salmanowitz, 2018 US	N = 92 50% females (μ age = 28 university environment, 51% from Psychology department participant's tool, 49% from the local community	IVE Embodied VR/Black Defendant vs Embodied VR/ White Defendant vs Sham (not embodied) VR/Black Defendant vs Sham VR/ White Defendant; 5 min	Custom (7 items)	Self-report: Symbolic Racism Scale (SRS) (Henry & Sears, 2002) Racial bias Implicit Association Test (IAT) (Greenwald et al., 1998)	na	No effect of condition on explicit attitudes; IAT decrease in embodied groups and favorable rating of mock legal case in comparison to Sham groups



Gender Bias Altamurto et al., 2018 US	N = 67 58% females 67% of sample were aged 25–34 University	Video about gender inequality in 360VR vs 180VR vs 2D video; 10 min	Space presence and Social presence (Ahn et al., 2013; Oh et al., 2016)	Self-report: attitudes toward gender inequality; responsibility to address gender inequality (personal, community's, employer's and government's); willingness to take action against gender equality	Voluntarily or 25 Amazon gift card	No effect of condition on attitudes or willingness to take action; Significant effect on personal responsibility
Fox & Bailenson, 2020 US	N = 83 48,19% females (μ age = 20,82 38,6% White 24,1% Asian/Asian- American 13,3% Black/African/ African-American 10,8% Latino/Latina/ Hispanic 13,3% multiracial Convenience sample, university environment	IVE 2 Dress (suggestive vs conservative) x 2 Gaze (high vs. low); <1 min	Custom (12 items)	Self-report: Rape Myth Acceptance scale (RMAS; Burt, 1980); Two subscales from The Ambivalent Sexism Inventory (ASI; Glick & Fiske, 1996): Hostile Sexism (HS) and the Benevolent Sexism (BS)	Course credit or 10 USD	Increase in sexism and greater rape myth acceptance in the suggestive dressing x high gaze condition
Fox et al., 2013 US	N = 86 100% females (μ age = 21,16 53,5% White/Caucasian 24,4% Asian/Asian- American 7% Black/African/ African- American 7% Latina/o/Hispanic 2,3% Multiracial 5,8% Other Student	IVE embodiment of Sexualized Self vs Sexualized Other vs Nonsexualized Self vs Nonsexualized Other	Custom (12 items) based on Fox & Bailenson (2009), Price & Anderson (2007)	Rape Myth Acceptance scale (RMAS; Burt, 1980)	Course credit or 15USD	Increase in rape myth acceptance particularly in the Sexualized Self condition
Gonzalez- Liencres et al., 2020 ES	N = 32 0% females age = 18-64 ES	IVE female first-person perspective vs observer during verbal abuse by male virtual character; 5,5 min	none	Gender bias Implicit Association Test (IAT) (Greenwald et al., 1998)	10 EUR	No effect of condition

(Continued)

Table 1. Continued.

Reference & Location	Sample	Conditions & Duration	Presence Measure	Attitude Measure	Compensation	Attitudinal Outcome
Lopez et al., 2019 US	N = 24 0% females (μ age = 29.8 White/Caucasian Students, University staff and members of the general public	IVE male vs female embodiment during Tai Chi exercise; 13 min	na	Gender bias Implicit Association Test (IAT) (Greenwald et al., 1998)	25 USD	Increase in IAT for female embodiment group
	N = 73 64% females (μ age = 24 students	Video about sexual harrasment at the workplace in vs 2D video vs print; 5 min	na	Self-report; Sexual Harassment Attitude Scale (Mazer & Pervial, 1989) and the Ambivalent Sexism Inventory scale (Glick & Fiske, 2018)	Monetary compensation	Decrease in negative attitudes through interaction effect of gender (men), method of consumption (immersive), and assessment of the effectiveness and emotionality of the content
Homelessness Herrera et al., 2018 Study 1 US	N = 117 64.1% females (μ age = 22.94 28% White/Caucasian 6% Hispanic 6.8% Indian 41.8% Asian 6.8% African American 11.1% Multiracial University environment	IVE first-person perspective of being homeless vs text- based perspective-taking; 15 min	Adapted social presence scale, 6 items (Nowak & Biocca, 2003)	Self-report: attitudes toward the homeless (Batson et al., 1997) Behavioral: Agreement with proposition that supports affordable housing; signing petition for this proposition; donation question; letter writing to elected officials about the issue of homelessness; agreement with proposition about supportive initiatives	100USD Amazon gift card for completing the four parts of the study	No significant effect of condition on self-reported attitudes at T0, but significant effect of VR condition over the course of eight weeks No effect of condition on agreement with proposition or donation amount Increase in positive letter writing and petition signing for VR group
Herrera et al., 2018 Study 2 US	N = 439 56.9% females (μ age = 29.2 48% White 20% Asian 9% Multiracial 6% Indian 5% African American 2% Middle Eastern 1% Native American 7% Hispanic 1% declined to answer;	IVE first-person perspective of being homeless vs interactive 2D perspective- taking vs text-based perspective-taking vs informative text; 15 min	Adapted social presence scale, 6 items (Nowak & Biocca, 2003)	Behavioral: Agreement with proposition that supports affordable housing; signing petition for this proposition; donation question	Course credit or a 100USD Amazon gift card	VR condition increased support for proposition and petition signing significantly more than other treatments No effect of condition on donation amount

students and recruitment at schools, museums and senior citizen centers							
Ageism							
Banakou et al., 2018 ES	N = 30 0% females University environment	IVE Einstein embodiment vs normal adult embodiment during a numeric exercise; 10-12 min	na	Age bias Implicit Association Test (IAT) (Greenwald et al., 1998)	15 EUR	Decrease in age bias for Einstein embodiment group	
Oh et al., 2016 Study 1 US	N = 148 64.19% females (μage = 21.03) 43.2% White 31.8% Asian 10.8% Latino 7.4% Black 6.8% reported another ethnicity	Low threat article about the elderly vs high threat article x IVE elderly avatar embodiment with perspective-taking instructions vs mental perspective-taking vs control	non	Kogan's Attitudes towards Older People Scale (KOP) (Kogan, 1961) (sixteen items)	na	No significant effect of on ageism	
Oh et al., 2016 Study 2 US	N = 84 54.76% females age < 35 53.57% White 11.90% Asian 8.33% Latino 13.10% Black 13.10% reported another ethnicity	Low threat interaction with virtual elderly avatars during a ball game vs. high threat interaction x IVE elderly avatar embodiment with perspective-taking instructions vs mental perspective-taking vs control	non	Future intentions to communicate with the elderly.	na	No significant effect of on ageism	
Yee & Bailenson, 2007 US	Student N = 48 50% females	IVE embodied elderly avatar vs embodied young adult during interaction with confederate	non	Self-report: attitudes towards the elderly; Word association task; ambiguous story task (Levy, 1996)	Course credit	No effect of condition on attitudes or ambiguous story; Increase of positive words associated to the elderly for the elderly embodiment group.	
Physical impairment							
Ahn et al., 2013 Study 1 US	N = 44 54.55% females (μage = 22.57) Student	IVE being colorblind vs imagining being colorblind; 5 min	na	Self-report: Attitude Toward Disabled Persons Survey (Yuker et al., 1966) Behavioral: Number of completed tasks	na	Positive but non-significant effect of condition	

(Continued)



Table 1. Continued.

Reference & Location	Sample	Conditions & Duration	Presence Measure	Attitude Measure	Compensation	Attitudinal Outcome
Ahn et al., 2013 Study 2 US	N = 97 54.64% females (μ age = 21.59 Student	IVE being colorblind vs imagining being colorblind	adapted from Bailenson & Yee, 2007; Nowak & Biocca, 2003; Witmer & Singer, 1998 (5 items)	Self-report: Attitude Toward Disabled Persons Survey (Yuker et al., 1966) Behavioral: Seconds invested in helping; number of words written to help identify the problematic areas of a website	na	Positive but non-significant effect of condition
Ahn et al., 2013 Study 3 US	N = 57 61.4% females (μ age = 22.54 School	IVE being colorblind vs imagining being colorblind; 5 min	na	Behavioral: Seconds invested in helping; number of words written to help identify the problematic areas of a website	na	Significant effect of condition, IVE group spent significantly more time helping the colorblind person and also wrote significantly more words to help compared to participants in the perspective-taking condition Decrease in bias for the IVE treatment, no interaction effects
Chowdhury et al., 2021 US	N = 71 39.44% females (μ age = 20.3 Student	Two (IVE vs desktop) x two interface (gamepad vs wheelchair); 30-35 min	PIFF ²	Implicit Association Test (IAT), (Greenwald et al., 1998)	none	
Migration & Human rights Kim, 2009 US	N = 105 52.38% females (μ age = 23.46 45.7% White 5.7% Black/African American 1.9% Hispanic/Latino 44.8% Asian/ Pacific Islander 1.9% Prefer not to disclose Student	Video about Syrian refugees crossing the Mediterranean sea in IVE vs 2D video; 7 min	TPI Social and Spatial Presence	Self-report: Scale by Telhami (2014) on 'American attitudes on refugees from the middle east' Behavioral intention; donation interest	na	IVE increased social and spatial presence, which in turn increased positive attitudes



Ma, 2020 US	N = 216 54.6% females (μ age = 19.42 53.2% White 22.2% Asian 12.5% Black or African American 8.8% Hispanics 3.2% other racial backgrounds Students from participation pool	Video about the fight against malaria in Tanzania in 360VR vs 2D; 7 min	TPI Social and Spatial Presence	Self-report: Attitudes toward helping people who need protection from malaria and willingness to help (Peng et al., 2010)	na	No effect on attitudes or willingness to help.
Bujić et al., 2020 FI	N = 87 females 2:1 ratio (μ age = 26.38 26.4% Finnish 10.3% Chinese 9.2% Spanish 9.2% Russian 5.7% Vietnamese	Video about Syrian refugees and war in 360VR vs 2D vs text; 7 min	na	Self-report: abridged version of the Human Rights Questionnaire (Diaz-Veizades et al. 1995)	Movie tickets	No significant effect difference between 360VR and 2D conditions
Bias against minorities Chen et al., 2021 Study 1 SG	N = 77 42.5% females (μ age = 24.28 University environment	IVE minority embodiment experiencing workplace aggression x perspective- taking instructions (affective vs cognitive)	na	Feeling thermometers measuring favorability	5 SGD	Increase in ingroup bias for both instruction groups
Chen et al., 2021 Study 2 SG	N = 73 53.42% females (μ age = 24.51 University environment	Witnessing workplace aggression against minority x perspective-taking instructions (affective vs cognitive)	Self presence (Ratan & Hasler, 2010)	Feeling thermometers measuring favorability	5 SGD	Increase in ingroup bias for both instruction groups
Intergroup Conflict Hasler et al., 2017 IL	N = 55 72.73% females (μ age = 23.86 Israeli Student	Video from Palestinian couple's perspective during interaction with Israeli soldier in 360VR vs in 2D	none	Self-report: moral evaluation of the soldiers' actions	Course credit	Subjects in the 360VR condition judged the soldiers' actions as significantly less justified and less moral than the 2D group

(Continued)

Table 1. Continued.

Reference & Location	Sample	Conditions & Duration	Presence Measure	Attitude Measure	Compensation	Attitudinal Outcome
Bullying McEvoy et al., 2016 US	N = 78 67.95% females (μ age = 19.74 Student	Witnessing bullying in 360VR vs witnessing bullying in VR where avatars wear clothes with the university's logo vs 2D	none	Self-report: attitudes toward bullies and bullying victims (Batson et al., 1997); attitudes toward bullying (Swearer et al., 2008); future anticipated bystander intervention behavior in bullying situations (Banyard et al., 2007)	none	No effects of media condition on measures
Mental health Kalyanaraman et al., 2010 US	N = 112 60.71% females (μ age = 22.25 University environment, psychology research	Virtual simulation of schizophrenia vs a written empathy-set induction of schizophrenia vs a combination of both the simulation and written empathy conditions vs a control; 4.5 min	none	Self-report: adapted scale based on Attitudes towards people with AIDS (Batson et al., 1997)	Course credit or 20 USD	Increase in positive attitudes for the combined treatment group
Vaccine Skepticism Nowak et al., 2020	N = 171 67.3% females age = 18-49	Story in IVE vs 2D vs electronic pamphlet; 5 min	Yes, not specified	Self-report: community immunity beliefs (Nowak et al., 2020)	30 USD	Significant effects of VR treatment on attitudes through higher presence scores

Note: Following abbreviations were used in the 'Presence Measurement' column: Witmer & Singer's Presence Questionnaire (PQ), Presence Involvement Flow Framework (PIFF2), Temple Presence Inventory developed by Lombard, Ditton and Weinstein (2009) (TPI).

experimental treatment aligned with a subject's in-group (e.g. a male subject assigned to male 1PP), and *out-group 1PP*, when the treatment provided the subject with the perspective of an out-group member (e.g. a male subject assigned to female 1PP). In-group and out-group had to be clearly defined by the study to be included.

Moderator variable

Sense of Embodiment. Studies in this code category included an embodied experience as experimental treatment whereby users experienced (1) a sense of self-location (first-person perspective overlaps with position of artificial body's eyes), (2) a sense of agency (motoric and visual correlation, being in control of global motor control), and (3) a sense of body ownership (visibility of a virtual body, enhanced synchrony of bodily movements), hence, taken together, a Sense of Embodiment (Kilteni et al., 2012). For this category, in-text descriptions, screenshots, and videos were used for the coding. When no information except for the treatment contents (e.g. title of video) was provided, online searches helped gather the material.

Statistical analysis and procedure for meta-analysis

For the quantitative synthesis and graphical presentation, we used the R packages *metafor* (Viechtbauer, 2010) and *metaviz* (Kossmeier et al., 2019). To ensure comparability of the studies included in the meta-analyses, we included only the effect sizes regarding post-treatment measurements the first time they were collected (therefore, no effects were measured over time), self-reported and implicit attitudes (therefore, no intent or behavioral data), and when participants received the same content (therefore, no unrelated control conditions). In cases in which more than one effect size within a sample was eligible to be included in the meta-analysis, we summarized those effects by calculating the mean (Borenstein et al., 2009).

We performed two separate meta-analyses for our independent variables, IVE interventions and virtual perspective-taking. Due to the diversity of the studies, we used a random-effects model with the Hedges' estimator to conduct the meta-analyses because the Hedges estimator is mainly unbiased in the case of meta-analyses with few effect sizes and a heterogeneous sampling variance (Viechtbauer, 2010). To investigate the effect size of heterogeneity, we calculated I^2 , τ^2 , and Q and used a Baujat plot to identify studies that contribute disproportionately to the overall heterogeneity and the summary effect size. We excluded two samples (Banakou et al., 2020, positive condition; Lopez et al., 2019) from the second meta-analysis due to irregularities in the Baujat plot. Additionally, we conducted a leave-one-out sensitivity analysis to examine whether any study would change the summary effect size if not included within the meta-analyses. Further, we checked for indications of a publication bias using Egger's regression test. To analyze the effect of the sense of embodiment, we calculated a moderator analysis (mixed-effects model) with 'sense of embodiment' as the moderator on the effect of VR interventions.

Review of the literature

We discuss the identified studies using the attitude object categories that emerged in our review of the literature.

Environment. A considerable number of empirical investigations ($n = 17$) explored VR exposure effects on environmental attitudes and attitude-expressive behavior. In terms of VR contents, small-sized animals and single-victim narratives (e.g. one turtle) enhanced feelings of environmental threat, conservation intentions, and small donations significantly more than large-sized animals and multiple-victim narratives did (Pimentel et al., 2018; Pimentel & Kalyanaram, 2021-Studies 1 and 4). Embodiment studies yielded mixed results. The visual representation mattered in some studies, wherein human and large-animal embodiments resulted in larger effects than other species

embodiments (Ahn et al., 2016). Further, one study found that the vividness of the VR contents can lead to more water-saving behaviors (Bailey et al., 2015). Studies that compared the effects of varying immersive modality often found that VR outperformed less immersive treatments in eliciting attitudinal change, for example, use of paper and recycling intentions (Ahn et al., 2014), self-reported commitment to the environment (Ahn et al., 2016; Breves & Heber, 2020), and likelihood of engaging in gardening and talking about environmental issues with friends (Breves & Schramm, 2021).

Overall, it merits discussion that the investigated effects align with the low-cost hypothesis, according to which environmental behavior related to low costs and minor inconveniences (e.g. recycling, water-saving) is more likely to change than high-cost objects (e.g. no airplane flights, no car in the household) (Diekmann & Preisendörfer, 2003). Only one study investigated VR effects on a more high-cost environmental attitudinal object, namely not eating meat for environmental reasons (Fonseca & Kraus, 2016), and found no significant effect. The authors showed that, although subjects in the VR condition reported higher intentions of reducing meat consumption for environmental reasons than subjects in the 2D condition, both groups chose a meat option in a post-treatment behavioral measurement. Considering that most studies found VR effects on low-cost environmental behavior, it is possible that the nature of the measured object moderates found effect sizes. It may be theoretically relevant to further explore the extent to which low- and high-cost environmental behavior is influenced differently by VR treatments.

Racial bias. Several studies have reported that the embodiment of a Black avatar reduces racial bias in White subjects (e.g. Salmanowitz, 2018). These effects are most consistently observed when the avatar is placed in a neutral-to-positive social context, for example, athletic exercises (Peck et al., 2013) and cooperative tasks (Patané et al., 2020). In contrast, Black embodiment in a negative social context can increase racial bias for White subjects, for example, when placed in a negative crowd (Banakou et al., 2020) or in a job interview (Groom et al., 2009). Scholars have argued that hostile situations interfere with the ownership of the virtual body and, thus, prevent the formation of a positive relation to the avatar (Banakou et al., 2020). Moreover, Maloney (2018) found that White avatar embodiment during a gun shooting exercise can decrease IAT scores more than black avatar embodiment, and linked this finding to potential social desirability effects as the researcher conducting the study was Black. Further, we reviewed the avatar images, which were available in all the identified studies. Here, it is critical to note that the 'Black' avatars resembled the 'White' avatars but with a tanned or darker complexion. Specific characteristics, for example, Black hair textures, were not addressed in the studies except for one (Banakou et al., 2020). The visual representation of avatar-based racial identity should be taken into consideration in future work.

Gender bias. Several studies examined how VR experiences affect gender bias. One group of studies found that the embodiment of sexualized female avatars can activate stereotypes (Fox & Bailenson, 2009; Fox et al., 2013). Stereotype activation was also observed by Lopez et al. (2019), who found that female embodiment during a sports exercise increased implicit gender attitudes in comparison to male embodiment. The other group of studies examined how VR exposure can influence attitudes toward sexual harassment. Steinfeld (2020) showed that men who experienced workplace harassment from a woman's viewpoint in VR changed their views on the matter, particularly when the issue felt emotional to them. Feeling for the male character also moderated VR effects on gender inequality attitudes in another study (Aitamurto et al., 2018). These findings point to the importance of individual and contextual factors that need to be further explored.

Homelessness. One study (Herrera et al., 2018) found positive effects on attitudes toward homelessness in two consecutive experiments. In their first empirical investigation, VR fostered more positive attitudes and behaviors compared to text-based narrative perspective-taking. Most significantly, the effect declined to a smaller degree for the VR group over the course of eight weeks. In a second experiment, VR elicited greater support for affordable housing than perspective-taking via a text-based narrative and a 2D video. Considering that a long research tradition has been discussing attitudes toward homelessness as a multifaceted construct, it is worth exploring how VR treatments affect its various components such as indifference, hostility, annoyance, revulsion, and curiosity (Bahr, 1973).

Ageism. A small number of studies explored how interaction with or the embodiment of elderly avatars affects ageism among users. Similar to research on racial bias, we found that positive social context yielded larger effects. For example, elderly avatar embodiment during a friendly interaction with a confederate increased positive associations with the elderly in contrast to young avatar embodiment, even though there was no direct effect on self-reported attitudes. (Yee & Bailenson, 2007). It might also be possible that the embodiment of an elderly figure associated with positive social characteristics such as wisdom and success can contribute to reducing ageism; one study found that an Einstein embodiment scored significantly lower levels of implicit ageism in comparison to the embodiment of an unknown adult (Banakou et al., 2018). Further, positive feedback during task execution suppressed ageism in subjects who embodied an elderly avatar, while negative or neutral reactions reinforced hostile ageism (Tsao et al., 2020). Likewise, Oh et al. (2016) demonstrated that subjects who felt excluded by elderly avatars during a virtual ball game showed increased ageism, regardless of the perspective-taking exercise that followed. However, playing games with the elderly might not be an ecologically valid behavioral measure for ageism reduction. For this, more research is necessary to test potential VR effects on forms of ageism occurring in real-world settings, for example, age discrimination in the workplace (Rupp et al., 2006).

Physical impairment. Two studies measured effects on attitudes toward physical impairments. Ahn et al. (2013) compared mentalizing to being virtually color-blind, finding mixed results in three consecutive experiments. In two investigations, no conclusive attitudinal and behavioral effect was found; however, a third experiment with improved believability showed that subjects who experienced color-blind vision in an IVE demonstrated twice as much helping behavior than subjects who imagined being color-blind. In another study, experiencing how it feels to be in a wheelchair in VR decreased implicit bias toward people with disabilities more effectively than the gamepad and desktop condition (Chowdhury et al., 2021).

Migration, human rights, and humanitarian aid. In comparison to video, Kim (2019) found that VR can induce levels of telepresence and social presence, which in turn factored into more positive attitudes toward and more donations for Syrian refugees. Another study found that both the VR and the 2D treatment outperformed text in eliciting positive attitudes toward human rights (Bujčić et al., 2020). More research is needed on factors that might moderate these effects, for instance the role of geographical location (Czaika & Di Lillo, 2018). Further, Ma (2020) did not find a significant main effect of 360VR on self-reported attitudes or willingness to help Tanzanian populations in their fight against malaria; however, it indirectly affected spatial presence, transportation, counterarguing, and, eventually, favorable attitudes. Given that the stimulus was released by the United Nations Foundation to promote support in the fight against malaria, future studies should explore the effectiveness of VR use by non-governmental and non-profit organizations.

Biases against minorities. In two empirical investigations, Chen et al. (2021) compared whether cognitive or affective perspective-taking instructions would affect biases against minorities. In the VR video, subjects either embodied a migrant worker who experiences aggression at the workplace in 1PP (experiment one), or they observed the interaction in 3PP (experiment two). Regardless of instructions and perspective, both studies found that in-group biases increased after VR exposure. In other words, subjects perceived their in-group as more negative rather than their out-group as positive.

Intergroup conflict. One study showed that, when Israeli subjects adopted a Palestinian's perspective in 360VR, feelings of dehumanization and threat toward Palestinians could decrease (Hasler et al., 2017). Similar effects were found in a second measurement five months after the VR treatment. While one study does not suffice to draw conclusions, these early findings point to the practical implications of VR experiences on real-world intergroup conflict perception.

Bullying. McEvoy et al. (2016) studied VR as a tool for bullying prevention and found no significant effect of media condition on the perception of the school's responsibility to address bullying or on attitudes toward bullying and future bystander behavior intention. On the contrary, more subjects who watched the video in 2D reported perceiving school bullying as a problem than participants in the VR condition. Consistent with literature on the relation of immersive affordances and presence

(Cummings & Bailenson, 2016), subjects in a subsequent focus group reported that a higher degree of realism, interactivity, and prominent customization would have affected their responses.

Mental health. Kalyanaraman et al. (2010) conducted research to determine whether experiencing how it feels to suffer from schizophrenia affects users' attitudes toward the condition differently than a written empathy condition or both treatments combined. The combined condition outperformed the others; however, in contrast to the desired effect, the VR-only condition increased social distance. Thus the authors suggested that such simulations should be used with caution (Kalyanaraman et al., 2010).

Vaccine skepticism. One study found that feelings of presence in VR mediated the belief that the flu vaccination can help protect other members of the community, particularly in contrast to video, tablet, and text (Nowak et al., 2020). However, considering the COVID-19 pandemic and the vaccine debate it sparked, such empirical investigations need to be replicated in order to reach conclusive results.

Summary of review sample

Regarding our final research question about the role of sampling, compensation, and duration of treatment, we identified several challenges and opportunities in the reviewed studies. To begin with, samples were commonly not controlled for familiarity with VR technology. Although a few investigations tested whether subjects were familiar with VR (e.g. Markowitz et al., 2018-Study 2; Tsao et al., 2020; Breves & Schramm, 2021), precise numeric estimates or scales were not included. This observation is surprising, particularly given that studies often reported that novelty effects might have affected the measured outcomes (e.g. Pimentel et al., 2018; Bujić et al., 2020; Filter et al., 2020). The lack of novelty control is especially critical in studies that compared the effects of VR to less immersive yet familiar media. In other words, it is likely that, in some of the reviewed studies, one experimental group was assigned a medium they have known for decades (e.g. video), whereas the other group was assigned a medium they had potentially never encountered before. For this reason, it is crucial to pretest familiarity with VR and to account for it in the analyses, particularly because novel experiences can increase interest in the object and excitement about its applications (Izard, 1977).

Concerning studies that compared out-group 1PP to in-group 1PP, only one or two social demographic characteristics were used as sampling criteria; for example, Banakou and colleagues (2020) included Caucasian female subjects to test for the effects of Black female avatar embodiment on racial bias. Other information that might factor into feelings of social identity, for example, age or socioeconomic status, were not used as inclusion criteria. Thus, subjects shared one or two in-groups but potentially differed in others. This trend emerges across the reviewed in-group–out-group attitude literature and makes it difficult to draw definitive conclusions. A more precise approach could be to determine a certain level of homogeneity of potential in-groups, for example, age, race, and socioeconomic status, in order to isolate the causal effect of the manipulated out-group variable (e.g. gender).

Further, because studies mostly used university-environment samples, it is difficult to determine whether social desirability had an impact on effect sizes. More empirical research with non-student samples is needed to reach conclusive answers. This also applies to the level of education and political orientation. Only two studies controlled for political inclination. Here, one study noted that only 10.3% reported being conservative (Bujić et al., 2020), while in the other study, subjects with a left-wing orientation scored higher levels of empathy and perspective-taking tendencies than participants with a right-wing orientation. These two early cases indicate that the analysis of prior political attitudes might be a valuable source of information for the causal isolation of found effects.

Concerning compensation, studies commonly offered either course credit (for student samples) or monetary compensation in the form of gift cards or direct financial incentives. These ranged from 5 SGD (= 3, 72 US dollars) to 25 dollars, regardless of the duration of treatment. Subjects assigned to the VR condition received the same compensation as subjects in other groups. We could not identify any specific reasoning that determined the amount of compensation given to participants. Given that most of the identified studies were conducted in overwhelmingly WEIRD nations (i.e.

Western Industrialized Rich Democratic; Henrich et al., 2010) with predominantly White, young, well-educated samples, it would be valuable if future studies were to examine how compensation levels vary across time, location, and population.

Finally, we found that, when a time specification was given, VR treatments lasted 7 minutes on average (min: 0.82 min; max: 35 min). It must be noted, however, that some studies reported the total amount of time subjects were immersed in the virtual world, while others reported the duration of the specific treatment task excluding preparation and instruction time. VR interventions naturally did not differ in duration from 2D interventions because the same stimulus video was used (e.g. Fonseca & Kraus, 2016). However, when compared to print treatments, the VR experience was often longer than the reading of the text. For example, one study reported that ‘the entire experiment lasted between 20 and 30 min, depending on the treatment, as the text article did not necessarily require the allocated 7 min to read’ (Buić et al., 2020, p. 1413). To avoid interfering effects resulting from varying exposure time, future work should consider keeping treatment times consistent. Further, some studies referred to cybersickness as reason to exclude subjects from the study (e.g. Breves & Schramm, 2020). We could not identify a relevant role of cybersickness in regards to outcomes.

Taken together, the roles of sampling, compensation, and duration of treatment need to be explored further to gain a more precise causal isolation of main effects.

Meta-Analysis findings

Vr vs. less immersive conditions

We conducted a meta-analysis for which we summarized the effects of 24 samples with a total of 1,878 subjects. The main meta-analytic results suggest that across studies, VR interventions had a

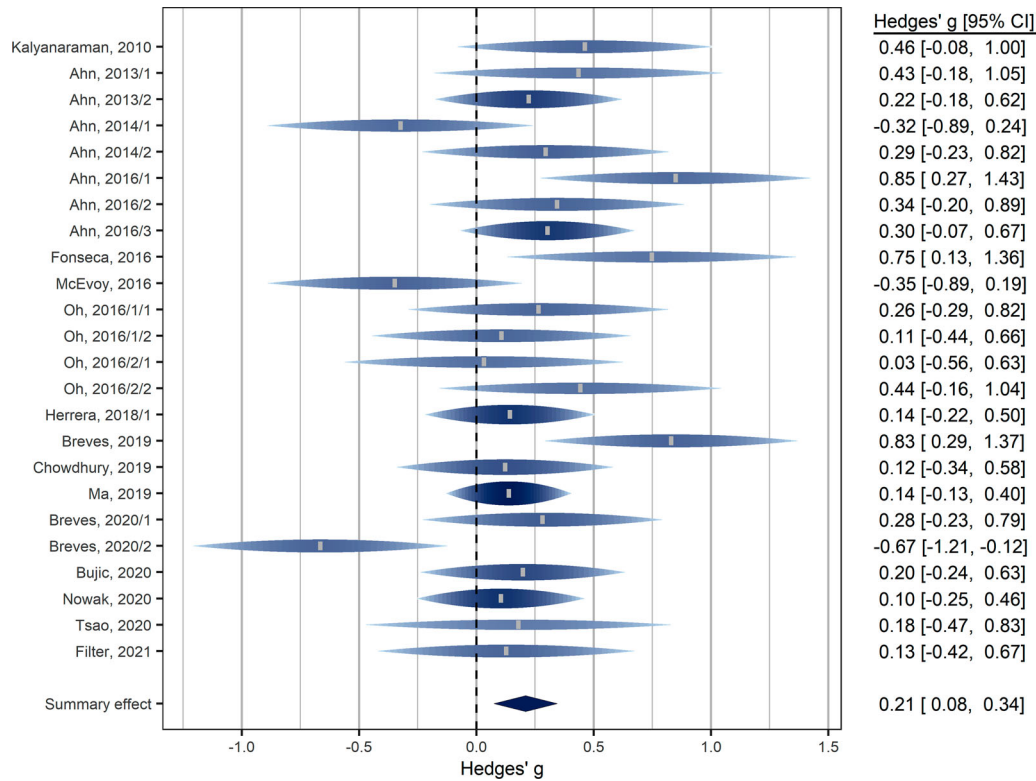


Figure 2. Rainforest plot depicting results of meta-analysis comparing effect sizes by VR interventions to effect sizes caused by less immersive experimental conditions

significantly stronger positive effect on attitudes than traditional media interventions (Hedges' $g = 0.21, p < .01, 95\% \text{ CI } [0.08; 0.34], I^2 = 45.00\%, \tau^2 (\text{SE}) = 0.05 (0.04), Q(23) = 34.35, p = .06$), confirming the assumption stated in the literature. Even though the heterogeneity was moderate, the Baujat plot did not indicate a single study with a strong influence on the overall result and overall heterogeneity, and the leave-one-out sensitivity analysis did not flag any study that would change the summary effect size a lot if it were left out. Further, Egger's regression test did not indicate a publication bias ($t(22) = 0.69, p = .50$). H1 was supported. Effect sizes and the summary effect size are shown in the rainforest plot (Figure 2).

Sense of embodiment as moderator

A moderation analysis was employed to provide information about whether a sense of embodiment influences the overall effect of VR interventions on attitudes. Contrary to our expectations, a sense of embodiment did not impact the effectiveness of VR on the dependent variable across studies (see Figure 3). The moderator analysis showed that the average true effect does not significantly differ over the two conditions ($QM(1) = 0.06, p = .80$). H2 was not supported.

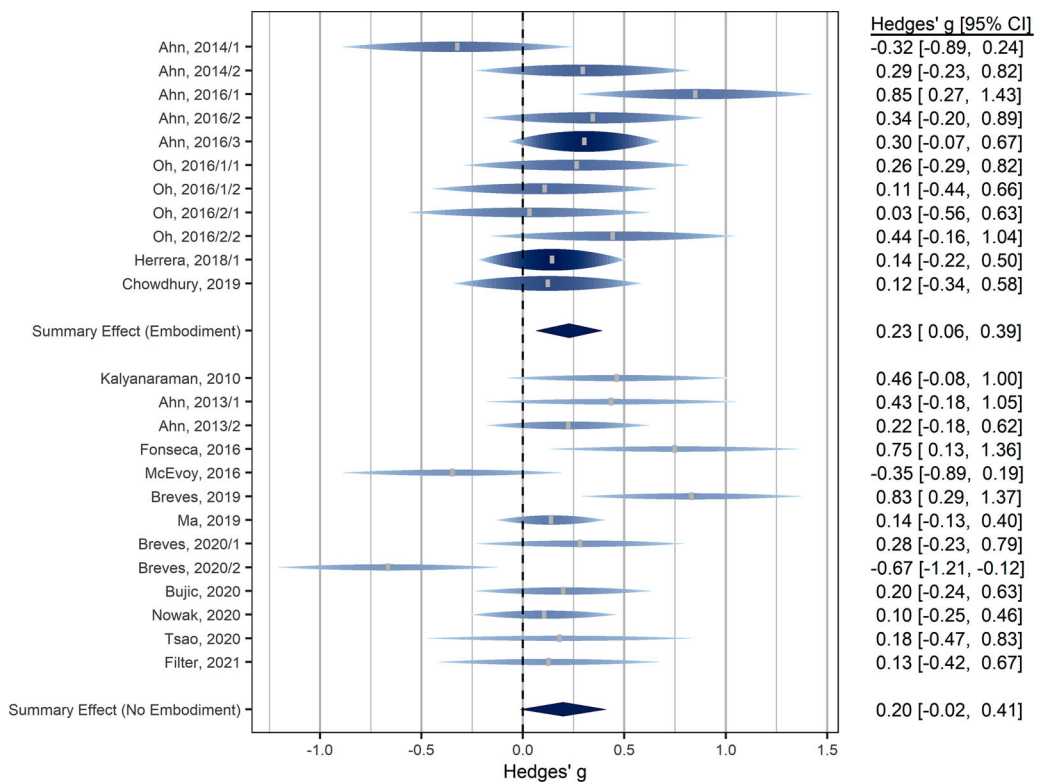


Figure 3. Rainforest plot depicting moderation analysis results of comparison between effect sizes related to VR interventions providing sense of embodiment and not providing sense of embodiment

Outgroup 1PP vs ingroup 1PP

Finally, we compared the effect sizes of in-group vs. out-group 1PP in VR. We used nine independent samples with a total of 411 participants. The results indicate a positive effect of out-group perspective-taking on prejudicial attitudes (Hedges' $g = 0.54, p < .001, 95\% \text{ CI } [0.28; 0.81], I^2 = 42.83\%, \tau^2 (\text{SE}) = 0.07 (0.09), Q(8) = 12.72, p = .12$) (Figure 4). Neither sensitivity analysis nor the Baujat plot revealed any other

than the earlier described irregularities. Most of the included studies used an implicit instrument to measure attitude (IAT, Greenwald et al., 1998) and an interactive IVE. Only one study (Hasson et al., 2019) used a questionnaire to measure attitude and a 360-degree video as IVE. However, the sensitivity analysis did not reveal a significant difference in the summary effect had this study been excluded. Therefore, we decided to include this study in the analysis. Further, Egger's regression test was not significant ($t(7) = 1.98, p = .08$). Overall, consistent with prior literature, seeing the virtual world through the eyes of an out-group member did foster more positive attitudes toward the out-group than adapting the in-group's perspective. H3 was supported.

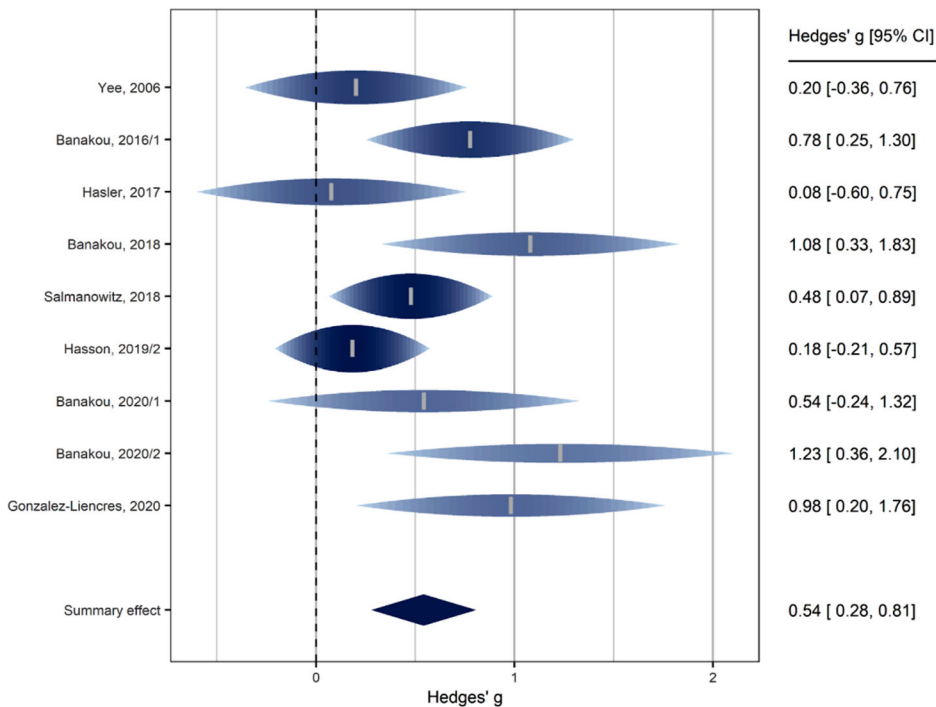


Figure 4. Rainforest plot depicting results of a meta-analysis comparing effect sizes related to virtual ingroup-perspective taking and virtual outgroup-perspective taking. A positive effect size equals a more positive attitude after outgroup 1PP than ingroup 1PP.

Discussion

In this contribution, we provide an overview and meta-analysis of experimental research on the effect of VR interventions on social attitudes. First, we find that an increased immersive modality tends to yield greater attitudinal effects as VR outperformed print, 2D video, and oral narration treatments in the reviewed studies. VR elicited larger degrees of attitudinal change regardless of whether these were measured with self-reports, behavioral intention, or actual behavior in the literature. This finding can inform both media-richness researchers and practitioners about VR's potential to influence certain types of attitudes, namely those directed toward social objects like climate change, racial biases, or intergroup conflicts.

However, this conclusion must be read with caution. From a theoretical perspective, most studies identified presence as the phenomenon that explains why VR outcomes are greater than traditional media effects while neglecting other possible theoretical explanations. This applies both to studies that measured actual levels of presence (e.g. Kim, 2019) and those that made a mere theoretical reference to its concept (e.g. Kalyanaraman et al., 2010). The assumption that telepresence, social

presence or self-presence have a direct effect on attitudinal constructs requires further empirical investigation, ideally in experimental settings that maintain consistent levels of immersion, embodiment, or duration of treatment while manipulating exclusively the presence subtype of interest. Moreover, increased attention should be given to moderators and mediators, for instance, novelty effects (Tokunaga, 2013), feelings of interest or excitement (Izards, 1977), or political inclinations (e.g. Patané et al., 2020), before a causal relation between presence and social attitudes can be drawn. Further, homogeneity of age, race, and level of education in the pooled studies may have suppressed critical information that might have been obtained with a more diverse sample. Taken together, further efforts in theory and methodology are needed to reach conclusive answers about VR's persuasive effect on social attitudes.

Secondly, we find that embodied VR experiences did not outperform non-embodied VR experiences in evoking larger effects compared to less immersive media. This finding stands in contrast to the literature, wherein embodiment is linked to persuasive outcomes because of its capacity to provide direct experiences (Ahn, 2021) and facilitate embodied cognition (Yee & Bailenson, 2009). We suspect that future analyses with a larger pool can confirm a moderating effect, as single studies (e.g. Banakou et al., 2018) reported successful embodied cognition, which indicates that a sense of embodiment can alter users' self-identity and their behavior. Another explanation may lie in the novelty of embodiment, which potentially shifts the user's attention away from the message contents, thus suppressing the desired effect. It is also possible that 360VR suffices to elicit attitudinal effects toward social issues. Moreover, 360VR videos can feature objects, humans, and events with photographic and behavioral realism, both of which contribute to visual realism and the overall media experience (Harris et al., 2009). For instance, viewing a spherical film of a refugee camp in 360VR might evoke a similar attitudinal change toward migration as a fully immersive, embodied experience. This assumption might be relevant for scholars and practitioners interested in the efficacy of 360VR experiences, especially given the high costs that come with IVEs.

Thirdly, our analysis indicates that, across studies, out-group 1PP was more effective in suppressing bias and negative attitudes than in-group 1PP. This finding aligns with prior literature on mental perspective-taking and corresponds with the notion that fundamental cognitive processes observable in real life also occur in VR (Sheridan, 1999). We suggest that scholars further explore the nuanced effects of virtual out-group perspective-taking, for instance, meta-stereotype activation (Vorauer & Sasaki, 2009). This is particularly important, given the backfire effects found in some of the studies (Groom et al., 2009; Lopez et al., 2019). Beyond their theoretical implications, it should be stressed that studies like that of Hasson et al. (2019) illustrate the potential of virtual out-group 1PP to impact deeply ingrained patterns of social attitudes. By enabling citizens to witness the consequences of violent intergroup conflict from the other's perspective, VR experiences can potentially contribute to a shift in the public perception of complex historical and political disputes.

While the aforementioned findings contribute to understanding the current state of the art, our study has several limitations. Due to internal validity purposes and the need for a clear selection criterion, we included only studies that explicitly defined an attitude as a dependent variable. Thereby, we excluded work that tackled related constructs but did not refer to them as attitudinal (e.g. Kandaurova & Lee, 2019). Doing so limited the final pool of relevant literature, yet it permitted a fruitful comparison across findings. Further, the effect sizes that powered our meta-analysis are comparable on the basis of treatment medium but not measure. The aim of the analysis was to detect whether the effect sizes generated by VR interventions overall differed from those generated by less immersive interventions, regardless of the type of attitude. The same applies to the moderating role of sense of embodiment and the difference between virtual in-group vs. out-group 1PP. It is, therefore, important to stress that the identified studies explored different types of attitudes and assessed them with varying measures. Heterogeneity tests, however, allowed for a robust ground for comparison, and therefore, we hope that the trends we observe in our analysis are of a general nature.

In sum, our analysis of extant literature finds that VR affects attitudes toward social issues significantly more than less immersive interventions. With some areas of human experience and

connection potentially migrating to virtual spaces over the next decades (Li, 2022), it is critical for scholarship to explore beyond main effects and further investigate how, and why, VR can influence the ways we think and act in the physical world.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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5 Study 2: VR nonfiction storytelling for the third sector: Motivations, mechanisms and outcomes.

Nikolaou, A. Boomgaarden, H. & Lecheler, S. VR nonfiction storytelling for the third sector: Motivations, mechanisms and outcomes. *Frontiers in Virtual Reality*. (submitted)

Abstract

As Virtual Reality (VR) emerges as a novel medium for nonfiction storytelling, so do questions of factuality, objectivity and subjectivity of contents. This article explores the challenges and opportunities of VR nonfiction by zooming in into its implementation for third sector applications, also referred to as “VR for Good”. Drawing upon reconstructive interviews with international practitioners involved in the creation and dissemination of “VR for Good”, it provides an in-depth exploration of why nonfiction VR is used for compelling storytelling in the third sector, how specific narrative and immersive elements are implemented, and finally, whether it is effective. The results show that “VR for Good” faces a similar challenge to other forms of nonfiction VR storytelling: a fundamental conflict between objectivity and subjectivity, which results in a persuasive, yet imprecise event representation. We conceptualize this pattern into a unified theoretical model of subjectivity construction in nonfiction VR, and discuss it in the context of real-life best practices for “VR for Good” storytelling.

Keywords: nonfiction, virtual reality, 360VR, storytelling, organizations, fundraising

Introduction

With its capacity to immerse users into distant real or synthesized environments (Steuer, 1992), Virtual Reality (VR) has unlocked new pathways for nonfiction storytelling over recent years. Often referred to as Virtual Reality nonfiction (VRNF; e.g., Evan & Green, 2018), this genre encompasses a wide range of storytelling forms that seek to mediate real-world affairs, ranging from documentaries to journalism to fundraising communication (Rose, 2018). While these forms of VRNF may vary, they share a common core: the practitioner’s wish to immerse users into stories about real-world events that are both compelling and factual, often with the aspiration to induce affective, cognitive and behavioral change (McRoberts, 2017). The idea that VR can be used as a medium for the impactful communication of social matters is commonly referred to as “VR for Good” (Meta, n.d.).

“VR for Good” gained public momentum when Director Chris Milk announced VR as the “ultimate empathy machine” in his 2015 TED Talk. With *Clouds over Sidra*, a film about the Syrian Refugee crisis produced in partnership with the UN and Samsung, as his reference point, Milk argued that unlike any other traditional medium VR “connects humans to other humans in a profound way” and “has the potential to actually change the world” (Milk, 2015). These claims drew in industries that have been increasingly open to adopting new media for nonfiction storytelling (Flew, 2008; Seo et al., 2019): news media (Aitamurto, 2018; Mabrook, 2021) and intergovernmental and non- governmental organizations (INGOs). Thus for journalists and fundraisers alike, VR emerged as a nonfiction medium heralded to instill empathy (De la Peña et al., 2010) and promote prosocial behavior (Green, 2018).

While VRNF is surrounded by hopeful enthusiasm about its potential prosocial impact (Rose, 2018), it also raises questions that are innate to traditional nonfiction storytelling. How do filmmakers chronicle matters of broader social significance? What are the trade-offs between truthful communication and audience engagement? In an effort to address these issues, immersive journalism research (Aitamurto, 2018; Mabrook, 2021; Goutier et al., 2021) suggests that VRNF pushes practitioners to manipulate contents in order to maintain journalistic accuracy, while simultaneously compromising objectivity. In addition, they find that VR's spherical field of view promotes self exploration, and as a result, "each viewer composes a unique narrative of the story, which can give rise to myriad connotations" (Aitamurto, p.10, 2018). Furthermore, the depiction of vulnerable populations raises several ethical concerns, as they can reinforce stereotypes and thus cultivate toxic empathy and 'othering' in VR users (Nash, 2017; Nakamura, 2020). Taken together, VRNF in the form of immersive journalism appears to create several normative challenges that originate in the clash between objectivity and subjectivity.

Yet to date, it is unclear whether our insights of VRNF in the form of immersive journalism apply to the genre of VRNF in general. This means that questions of objectivity/subjectivity and ethical representation might be specific to immersive journalism, but less relevant for other types of VR nonfiction storytelling. It is plausible that different filmmakers' motivations result in different immersive storytelling strategies and, in turn, lead to different outcomes. As a result, scholars potentially overlook critical ideas, variables and concepts, thus producing a growing gap within the literature. Alternatively, it is also plausible that the issues within immersive journalism co-occur across different forms of VRNF, which would enhance the robustness of previous findings and contribute to unified theory-building. To gain more complete knowledge of VRNF as an overall phenomenon, what is needed is to further explore its different forms and combine the gained insights in a systematic way.

To help close this research gap, this study focuses on VRNF in the form of third sector applications. In particular, it explores *why* INGOs adopt VR as a nonfiction storytelling medium, *how* they use it and *whether* its implementation is *successful* in regards to their goals. Together, these three questions draw a fuller picture of the motivations, mechanisms and outcomes of VRNF for the third sector, and point at its current opportunities and challenges. After analyzing the results in relation to the available VRNF literature, we identify fundamental similarities between INGO communication in VR and immersive journalism, and propose an overarching theoretical model through which VRNF can be studied in a more comprehensive and standardized way.

1.1 Why VR nonfiction for the third sector?

Traditionally, INGOs utilize nonfiction storytelling to communicate real-life events that transpire on the ground in an effort to drive advocacy, charity and fundraising, community service to public education campaigns (Dimitrov, 2008). To do so, INGOs have been increasingly expanding their focus from print and television to digital audiovisual media, for example websites, videocasts, podcasts and blogs (Seo et al., 2019). Given that VR media technology is often discussed in regards to its prosocial impact within scholarly and public discourses (Foxman et al., 2021), more and more INGOs have been using VR videos to increase interest in an issue, raise petitions and generate donations for charitable causes (Green, 2018). As media technology, Virtual Reality comes with a highly immersive technological quality that creates an "inclusive, extensive, surrounding and vivid illusion of reality to the senses of a human participant" (Slater & Wilbur, 1997, p.4). For example, VR 360VR is a panoramic video filmed with a 360° camera and stitched into

3D geometry to elicit a feeling of realism, depth and spatial presence (Bryson, 2013). In addition, immersive virtual environments (IVEs) are programmed environments where users can have a sense of location, ownership and agency over their virtual body (Kilteni et al., 2012). Depending on the type of VR, INGOs can thus communicate humanitarian and environmental problems in a more immersive way than with traditional media.

Yet besides the notion that contents are mediated with higher immersion, there is little knowledge about why INGOs specifically select VR for nonfiction storytelling. Possible motivations may lie in VR's unique capacity to induce spatial or physical presence, "a psychological state in which the virtuality of experience is unnoticed" (Lee, 2004, p. 32). This means that VR experiences create the illusion that there is no distance between the user and the projected contents (Lelyveld, 2015), or in other words, that they are physically inside of the virtual environment. Physical presence can therefore decrease the individual's psychological distance, and in turn change their attitudes toward complex matters, such as environmental protection (Breves & Schramm, 2021). This is because psychologically distant, yet hazardous issues such as climate change can be perceived as more concrete through direct experience rather than description (Weber, 2006). Thus, INGOs may be incentivized by VR's potential to narrow the perceived distance between potential donors and remote events.

Furthermore, it is possible that INGOs are interested in the feeling of social presence, where users perceive virtual actors as real and sentient (Lee, 2004). This concept may be particularly relevant, because when users feel high levels of social presence, they are more likely to feel empathy, responsibility and willingness to donate and volunteer (Kandaurova & Lee, 2019). Social presence has therefore been described as "the psychological mechanism that closes the social and psychological distance between affluent potential donors and the beneficiaries of nonprofit fundraising" (Yoo & Drumwright, 2018, p.21). The explanation for such effects may lie in traditional social presence theory, according to which the immediacy and intimacy of social actors in human-computer interaction has a persuasive influence on users (Short et al., 1976). Thus, social presence can potentially help INGOs feature the populations they seek to support in a more realistic way than with text or two-dimensional video.

Moreover, VR technology can evoke feelings of self presence, described as the experience of the virtual self as the actual self (Lee, 2004). Through embodying a different self, for instance when a male user embodies a female virtual self, then the user can experience how it feels to be in somebody else's shoes and thus, develop more positive attitudes toward the embodied group (Steinfeld, 2020). Related studies have found similar positive effects: Banakou et al. (2016) showed that when White users embody a Black avatar, their racial bias tends to decrease. In a later study, they found that when young users embody Einstein, their attitudes toward the elderly become more positive (Banakou et al., 2018). INGOs might be interested to harvest VR's capacity to induce self presence in order to put users into the shoes of the vulnerable populations they advocate for.

While in theory, physical presence, social presence and self-presence might incentivize INGOs to use VR as a storytelling medium, there is no empirical evidence in the literature to support this assumption. Alternative explanations might lie in an assumed positive effect of technological innovations in general, or, in spill-over effects from other forms of VRNF. Immersive journalism research, for example, indicates that some journalists select VR because its spherical field of view shares more information points than other media and in turn, presents the news story with more detail and accuracy (Aitamurto, 2018). Other journalists use VR to increase emotional engagement, attract younger audiences and enhance cognitive effects such as understanding and recall (Goutier et al., 2021). What is missing in the literature is a more strategic as well as operative view

on the process of employing VR for third sector communication. To clarify these strategies and operatives, we pose our first question:

(RQ1) What motivates INGOs to choose VRNF storytelling?

1.2 Potential storytelling elements for third sector VR

With the multitude of new technological possibilities that VR offers, it also provides numerous new techniques and directions for storytelling (Bucher, 2017). Immersive journalism, for instance, is driven by the components of technology, narration and interaction (De Bruin et al., 2020). This means that the story is built around the medium's immersive technological affordances, the role of the user (e.g., observer or participant) and the degree of interactivity with the virtual environment (Goutier et al., 2021). Yet the focus on these elements can come at a cost: Practitioners are forced to compromise accuracy and objectivity to exploit VR's technological affordances, which in turn makes it difficult to uphold their traditional journalistic values (Aitamurto, 2018; Goutier et al., 2021). Thus, while VR offers novel storytelling possibilities, it also raises the question how to balance out innovation and traditional values.

The elements implemented in VRNF for the third sector have not yet received similar attention; as a starting point, it is helpful to consider the factors that make for compelling traditional fundraising communication according to Das et al. (2008): message evidence, that is, the presentation of statistical or narrative proof of the issue; message framing; “the decision to focus on the positive consequences of donating or the negative consequences of not donating” (p.162); and goal attainment, the presentation of positive outcomes. All three can be enhanced through VR's capacities for dynamic and participatory narration (Aylett & Louchart, 2003). For example, early evidence suggests that seeing the positive outcomes of one's environmental actions in VR can increase the individual's feelings of environmental efficacy (Ahn et al., 2014). Therefore, it is plausible that the elements that make for compelling INGO storytelling in traditional media also occur in VR.

However, it is critical to mention that traditional strategies may also backfire in VR storytelling. ‘Poverty porn’, for instance, has been a recurring term within the INGO literature and describes the voyeuristic exploitation of poverty and the objectification of its victims (Deloffre & Schmitz, 2019). In VR, such depictions can reinforce othering and objectification (Nash, 2017). Moreover, Nakamura (2020) argues that “VR for Good” is often produced by White producers which can reinforce cultural and racial stereotypes and as a result, cultivate toxic empathy (Nakamura, 2020). These emerging discussions about the normative complexities of VRNF in the third sector point at a need for a more systematic evaluation of how it is implemented.

Therefore, we seek to explore the immersive and narrative features of INGO VR communication and identify relevant storytelling patterns for the overall VRNF literature. Thus, we pose the question:

(RQ2) How do INGOs integrate immersive and narrative affordances in NFVR storytelling?

1.3 Is VR nonfiction effective for INGOs?

All forms of storytelling aim at a certain outcome; from providing a descriptive picture of reality to entertainment to persuasion (Booker, 2005). The outcome, therefore, provides the information needed to better evaluate and interpret the storytelling form, and in turn, completes the overall examination of the phenomenon of interest. For the exploration of

VRNF in the third sector it is thus essential to also understand the extent to which its implementation was effective for the INGOs.

While the goals of INGOs can range from advocacy to fundraising to educational campaigns, a general wanted outcome is positive social change (Dimitrov, 2008). Within the available literature, laboratory experiments have found empirical evidence for a positive effect of VR experiences on different forms of social change, for example petition signing for social causes (Herrera et al., 2018) and willingness to donate to humanitarian aid (Kim, 2019; Ma, 2019; Pimentel et al., 2021). Across studies, the effect of VR on social attitudes and behavior is significantly larger than the effect of traditional media (e.g., text, two-dimensional video), as a meta-analysis showed (Nikolaou et al., 2022). Following these observations, it appears that the outcomes of VRNF for INGOs should be overall positive.

However, findings from laboratory research may not accurately depict real-life effects. Experiment participants may alter their responses to align with what is culturally expected, which means that found effects may be threatened by social desirability bias (Paulhus & Vazire, 2007). Furthermore, participants may not have the skills or resources required to participate in the behavior that the researcher is interested in, for example volunteering or donating to a cause (Miller & Krosnick, 2004). In other words, attitudinal change tested in a laboratory setting may not correspond with real life effects, as there might be external, yet relevant, factors that experimental research does not account for.

By investigating the effectiveness of INGO VR cases, we seek to derive novel insights from naturally occurring processes, add new variables to the available literature and overall, merge motivations, mechanisms and outcomes into a bigger picture of INGO VR communication. Therefore, we ask:

(RQ3) How effective is the use of VRNF storytelling for INGOs?

2 Materials and methods

The data needed to answer the study's three research questions lies in the practitioners' lived experiences, memories and ideas. To retrieve this type of qualitative information, the study follows Bogner et al. (2009) and implements qualitative standardized open-ended expert interviews to collect the practitioners' technical, process and interpretive knowledge. Methodologically, the interview questions adopt a reconstructive approach (Reich & Barnoy, 2020) which guides interviewees to recall the process of interest, ranging from the conception, production, dissemination and evaluation. Thus, practitioners are asked identical questions regardless of the specific VR case, which in turn helps to distill abstract patterns and observations that inform the study's research questions.

The interviews were not conducted face-to-face due to COVID-19 related travel restrictions and local lockdowns; instead, the study relied on interviews via video conferencing. Video conferencing has several advantages and disadvantages to face-to-face interviews. For instance, video conferencing does not mediate social cues, such as gestures and micro-expressions, as accurately as face-to-face interviews, which may hamper the essential relationship building between interviewer and interviewee (Tietel, 2000). However, video conferencing can be more convenient, accessible and time-saving (Gray et al., 2020), which in turn makes it easier to include more international practitioners in the research design and enhance the sample's diversity and data richness.

Most importantly, video conferencing helped gather more detailed information for research question two, which is concerned with the use of immersive and narrative features. Here, interviewees were asked to answer the respective set of questions by screensharing the VR video and explaining the immersive and narrative elements used per

scene. All interviews used screen sharing, with the exception of two due to copyright and availability issues.

In sum, the study implemented a qualitative exploration by conducting standardized open-ended expert interviews (Bogner et al., 2009) with a reconstructive approach (Reich & Barnoy, 2020) through video conferencing.

2.1 Sample

We chose purposive sampling in order to identify actors within a sampled population who meet specific criteria of inclusion (Ritchie et al., 2013). Criteria of eligibility for inclusion were occupation in the Non-Profit (Leverty, 2008) and/or Non- Governmental or Inter-Governmental (Berg, 2009) sector, or in the immersive media production sector or in a marketing agency and at least one experience in the conception, commission and/or production of VR videos that were employed by INGOs. Data was collected up until theoretical saturation had been reached (Charmaz, 2006).

In total, 15 practitioners from seven countries were interviewed, from the United States (4), Australia (3), the United Kingdom (3), the Netherlands (2), Germany (1), Spain (1) and Switzerland (1). They represented NGOs (8), media studios (4), IGOs (2) and one marketing agency (1). Practitioners' occupations ranged from higher to senior levels, including Producers (4), Communication Leads (4), Founders and CEOs (3), Project Manager (2) and Directors (2). The VR videos related to were 360° VR (11), 360° VR and IVE within the same campaign (2), IVE (1) and immersive 180° VR (1). Issues tackled ranged from environment (4), animal rights (2), financial aid (2), human rights (2), medical research (2), humanitarian aid (1), medical aid (1) and poverty reduction (1).

2.2 Procedure

The interviews were conducted in February and March 2021. Interview duration ranged from 50 to 120 minutes. Interviews were conducted in English, with the exception of one interview which was conducted in German. Interviewees were thoroughly briefed about research objectives, anonymity protection and data storage prior to the interview. Declared consent prior to the interview was required. Contents of the interview were transcribed verbatim by one author and identifying information (e.g., interviewee name, organization name, project name, film shoot location name) was deleted.

2.3 Interview guidelines

To better prepare the interview questions, the VR videos were viewed two times by the interviewer in a HMD (Oculus Rift) to fully experience the video as it was intended. Interviewees were asked about their experience with VR for INGO communication in four blocks of questions. The first block regarded the initial phase of production preparation, idea conception and expectations. The second block asked questions about the use of immersive (realism, vividness, embodiment, agency) and narrative (storyline, characters, perspectives, mood, voice over, text and/or animation overlays, framing) features. Here, the video was screenshared to better point at the specific elements. For comparability purposes, the questions focused on the video's first scene, scenes with characters (approx. 4-6), and the final scene. Afterwards, the third block posed questions about the dissemination of the VR video, feedback and metrics, and the evaluation of its effectiveness in regards to its goal. Finally, the fourth block asked interviewees about their views on VR's potential, limitations and future opportunities for the INGO sector.

2.4 Data analysis

Interviews were analyzed following Charmaz' (2006) analytical framework for grounded theory. After initial line-by-line coding, a second round of focused coding helped identify the most significant and frequent factors (Charmaz, 2006). Then, thematic entities were organized around two major categories through axial coding (Strauss, 1987). Axes and categories were finally diagrammed according to scope and direction, in order to visualize sequences and relationships (Charmaz, 2006). For the analysis, we used the coding software MAXQDA.

3 Results

3.1 Motivations

Practitioners reported that they utilized VR in order to fully present the reality crises to users. When asked why specifically VR was suitable for such an aim, two main motivators resurfaced across interviews: VR's capacity to help users "to see it with their own eyes" and "to hear it from them" (RQ1).

Firstly, practitioners expected that VR can place users into the here and now of an accurate simulation of spatiotemporal evidence, for example refugee camps, slaughterhouses or endangered forests. In contrast to other media, practitioners expected that VR can thus push users "to see it with their own eyes" instead of receiving the evidence in the form of abstract information. Users witnessing the evidence is of particular importance for INGOs in a twofold way: On the one hand, it minimizes the intermediary role of the INGO. One practitioner explained this argument as follows: "You don't need to tell them this is all endangered and now you have to do this and that. That is actually unnecessary (...) You just put them there and let them stand around there and they will come away with a whole new appreciation for what it really means to keep these environments preserved and protected" (2). On the other hand, it compels users to develop familiarity with, and in turn interest in, the location. "They feel like they have really visited that place. Then naturally they're going to be more connected to it." (2). Thus, "to see it with their own eyes" contributes to full reality presentation in that it transforms message evidence from mediation into witnessing.

Secondly, practitioners implemented VR so that the message evidence could be delivered virtually by the affected population instead of the INGO. Users are given the opportunity "to hear it from them", which can enhance the message's factuality and credibility. For example, when the source of message evidence is a virtual person who narrates their lived experience, interviewees expect that the information will be most likely perceived as factually correct and trustworthy. As one interviewee described it, "You almost can interact or you feel like you're interacting with the person in a more meaningful way. We wanted to transport decision makers and others into the camps to actually directly hear from the refugees, what *they* had gone through, what *they're* feeling now and what *they* want to happen." (emphasis appeared in the original text) (15). Again, "to hear it from them" enhances full reality presentation by transforming message evidence from mediation into testimony.

Taken together, practitioners reported that "to see it with their own eyes" and "to hear it from them" in VR can contribute to a complete and naturalistic representation of crises. As a result, VR eliminates the need for message evidence mediation, in that it converts mediation into witnessing and testimony.

3.2 Mechanisms

To maximize the concepts “to see it with their own eyes” and “to hear it from them”, practitioners focus on four factors: vividness, authenticity, relatability and agency (RQ2).

3.2.1 Vividness

To enhance the experience of “seeing in with their own eyes”, practitioners attempted to design the experience as vivid as possible. For this, large focus laid on immersive features such as image quality, spatial audio and stereoscopy. “If you just sat there looking forward, you might as well be watching TV. We wanted to create, as near as possible, the experience of being there, actually being there.” (13). Practitioners explained that multisensory stimulation was central for an increase of vividness. For example, one practitioner inserted thermal and motion cues to the VR experience to increase vividness. In cases of 360° VR, where multisensory stimulation is limited, practitioners used the voiceover to pair visual cues with olfactory ones, by hinting at specific smells.

Interestingly, practitioners reported that a consequence of vividness was the deliberate exclusion of graphic material (e.g., fights, blood, screams). One explanation lies in the risk of harming users’ well-being, as VR cuts users off from physical reality and thus creates an “intimate” media experience. Violating this intimate experience by inducing disturbance and fear would potentially impact users’ mental and emotional state, a moral cost practitioners were not willing to pay: “When you're placed into a scene and you see something like that happening right in front of you, it's actually too much, you're putting your audience into too much of an intense situation.”(2) Another explanation for the exclusion of disturbing material on the grounds of vividness lies in the negative impact on intended persuasive outcomes. Practitioners expressed concern about the deterring effects of fear, which would discourage users from further support. As one practitioner reported, “We want to reach people, not scare them. Sometimes we want to provoke them to get into a thought process and into change, but we don’t want to scare them away. Fear would result in rejection, and we don’t want rejection, we want acceptance of our topics.”(6).

We observe that the differentiation between vivid and graphic contents results in a somewhat biased representation. The inclusion of vividness and the exclusion of graphicness interferes with the overarching goal of unmediated reality presentation, for which VR was utilized in the first place. As a result, what users “see with their own eyes” are crises absent of violence, hurt and suffering.

3.2.2 Authenticity

A driving component of character representation that re-emerged across interviews was authenticity, operationalized by practitioners as naturalness, non-orchestration and being oneself. We identify two separate subcategories for authenticity of socially present characters, namely the authenticity of message contents (i.e., what is shown/said) and authenticity of message delivery (i.e., how it is shown/said). Regarding the authenticity of message contents, spoken word material was not scripted or altered, primarily in an effort to outbalance previous conversations about negative framing and poverty porn. “Their stories should be told in their words, because if we take their story away from them, then we're taking away their agency and their ability for self-determination.” (13). For this aim, practitioners commonly implemented rigorous procedures including briefing, not scripting interviews, seeking approval of contents after the filming and using original voice overs. Moreover, authenticity of message contents was expected to enhance persuasive outcomes: “Doing VR was to bring across to decision-makers what the lived reality of these refugees was. And so we felt that having it directly in their own voices, rather than having a voice over artists do it, was more compelling.” (15)

In contrast to the authenticity of message contents, authenticity of message delivery was designed specifically for the users' experience. For example, filmed individuals were commonly instructed to sit in front of a 360° camera and narrate contents in a natural manner, thus simulating an authentic conversation with the user. Practitioners justified the orchestration of authentic message delivery with its importance for heightened social presence. "So we filmed them in 360 and we have that person that is speaking directly to you, or at least that is the impression that you should get." (10).

Overall, we find that it is the eye of the viewer that determines how the message is delivered, while the filmed individual maintains control over what is said in the message. Yet, the orchestration of authentic message delivery contradicts the overarching aim of full reality presentation. For example, an individual can narrate an authentic experience, while being instructed to do so in a non-authentic position that he or she would otherwise not choose. Therefore, what users "hear from them" is authentic information, but "what they see with their own eyes" is a product of orchestration.

3.2.3 Relatability

Both in the case of "to see it with their own eyes" and "to hear it from them", practitioners framed the "it" as relatable to the user's own lived experiences. "We wanted them to feel like, I know this person, this is my mother. This is my sister. This is my friend. I know the story." (9). By centering storylines around activities and roles which are common across cultural contexts (e.g., playing with friends) and species (e.g., the role of motherhood), practitioners attempt to highlight intergroup similarities, which then serve as the basis for social proximity, empathetic concern, and, eventually, helping intention. "If you looked inward, you can say, I have a woman in my life, too. I want to make sure that they're not discriminated. And it goes back to that same ideology of if you're not okay with it happening here, do your part to make sure it's not happening there." (9).

Some practitioners reported that relatability drove the design of the entire concept of the video. "The concept was home and that idea of identity, and that's a concept that anyone can relate to, right? Like, no matter who you are, home is special." (5). Others deliberately selected scenes for their relatability, and often paired it with goal attainment. Such efforts depicted relatable activities that the affected individuals enjoyed thanks to donors' financial support:

"I think it's important if you're asking for support that you show the positive impacts of that, because you want people to be able to feel good about what they're doing, it's positive reinforcement of that behavior. So it was great to show her at school, playing football with friends, those were all really positive and powerful ones. And they were also ones that were easier for people to relate to in terms of parallels with their own life. Because everyone has a memory of sitting at school and putting their hand up." (14).

However, the prevalent focus on relatability implies the conscious selection of relatable topics over unfamiliar ones. One interviewee described this phenomenon as follows: "We wanted them to be situations that the majority of people would have an experience of, so they weren't excluding kind of portions of people, and that it was relatable to many people." (4). As a result, peculiar or too specific elements lose importance and are excluded from further filmmaking decisions. What users "see with their own eyes" are therefore scenes selected specifically for their relatability, not an accurate depiction of a possibly unfamiliar reality. Again, this interferes with the overall goal of naturalistic message evidence depiction.

3.2.4 Agency

Practitioners reported to deliberately design for high agency, so as to increase the sense of “to see it with their own eyes”. Agency was described as the capacity to inspect the VR environment from every direction and to freely focus on individual elements: “I want people to control the environment in the goggles to the utmost extent” (1). In particular, VR was produced in a way that manoeuvres users into inspecting the virtual environment from every angle. For example, the use of immersive audio was expected to force users to turn their head to different sound sources, while text overlay aimed at directing users attention to multiple positions (e.g., to look down, up, left, right). Practitioners explained that agency enhances self-exploration of the environment, and in turn, improves the users’ understanding of the message evidence. “You yourself can understand how the situation is instead of someone telling you, instead of someone saying: This is the location where somebody lives and we filmed only one corner of it” (3).

In an effort to design for high agency environments, however, practitioners faced the challenge of guiding users’ viewing field towards central events. “If you’re really paying attention, then it makes a lot of sense. That was a challenge in itself because it’s 360, people could be looking at the other way. That’s why we use audio to make sure that we direct people into the right scene.” (5). Despite strategies to circumvent the problem, practitioners reported little control over users’ focus on their product. The simultaneous focus on vividness significantly complicated the matter, with stimuli rich environments increasing self-exploration and intuitive reactions, but decreasing control over users’ focus.

Other interviewees evaluated users’ freedom of focus as an inherently positive, not negative outcome of agency. “Virtual reality allows viewers to focus on the thing that is important to them, and sort of see the things that maybe interests them the most or shocks them the most so that everybody gets the most powerful experience (3)”. According to this reasoning, the personalization of experience in VR resembles physical reality, and outweighs the cost of overlooking important information.

To summarize, practitioners reported focusing on the factors vividness, authenticity, relatability and agency so as to enhance the experiences of “to see it with their own eyes” and “to hear it from them”. However, their implementation contradicts the overall motivation to depict reality in an unmediated and naturalistic way. Thus, our findings for RQ2 appear to contradict the findings for RQ1.

3.3 Outcomes

Our final aim was to explore the effectiveness of VR use for INGOs. Practitioners explained that spatiotemporal and social context is decisive for the effectiveness of VR INGO campaigns, specifically the factors controlled setting, sufficient time and prior interest in the issue (RQ3).

Practitioners reported that face-to-face fundraising efforts to increase donations, petitions and sign-ups with VR were largely unsuccessful. To wear technology that cuts individuals off physical reality for several minutes, thus forcing them to stop other activities, was perceived as invasive by the broader public and, in turn, suppressed wanted outcomes. “Apparently people on the street didn’t really want to stop for a stranger and have their hearing and their vision compromised for about five minutes with their belongings and their bags.” (12). Further, several practitioners attributed their campaigns’ ineffectiveness to VR’s flattening hype. “After all these years, we know, or it seems, that attention to VR is fading away.” (10). As a result, the more familiar people were with VR, the less interest they showed in engaging with the INGO VR stations on site.

In contrast, practitioners reported that when implemented in manageable settings, for example meetings with significant donors (e.g., private, corporate, political), interest groups and at staff trainings, VR did elicit affective responses and sparked more engaging conversations than other means of communication.

“Our major gift officers throughout the country will each have one, if they're visiting with a major donor to have them take part in the experience. So even though it was intended to be a tool in the face-to-face canvassing campaign, we did use it in other more event-based, one-on-one small group settings.” (12).

Overall, successful implementation was attributed to prior interest in the matter, to sufficient time for briefing and conversation and to an undisturbed setting that prevented from interruption.

4 Discussion

This study addresses a central research gap within current literature on VRNF storytelling, namely its application for communication purposes by intergovernmental and non-governmental organizations. Our results show that VR is adopted by INGOs in order to render an unmediated, factual and complete picture of crises, the premise being that VR can help users see the events and hear the victims' stories on their own. These concepts can be linked to physical and social presence respectively. Further, we identify four factors that are deployed in order to enhance physical and social presence: vividness, authenticity, relatability and agency. Moreover, we observe that their implementation interferes with the overarching motivation of unmediated and naturalistic reality presentation, in that the contents are not objective, but rather a product of immersive and narrative features, which in turn can be viewed from a multitude of different perspectives depending on users' agency.

The observed clash between motivations and mechanisms in VRNF for the third sector aligns with the normative paradox of immersive journalism: The motivation to achieve high objectivity and accuracy through VR's spherical view is contradicted by the manipulation of contents and users' freedom of focus to inspect the environment from the perspective they wish to (Aitamurto, 2018). To describe this observation, Mabrook (2021) suggests the term 'journalist-induced subjectivity' for the manipulation of contents through the producer, and 'user-induced subjectivity' for the individual perception of contents through users' agency. We argue that the results from immersive journalism research intersect with our findings from VRNF for INGOs in three points. Firstly, the starting point of both VRNF genres lies in the motivation to objectively present what transpires on the ground. Secondly, the mechanisms implemented to enhance the VR experience results in the exclusion of factual contents. Thirdly, VR's technical capacity for agency enforces the subjective experience of the final product. This pattern suggests that a contradiction between objectivity and subjectivity may be prevalent across different forms of VRNF, irrespective of field.

We believe our findings point towards a potential two-step *model of subjective reality construction* in VRNF. The model would describe the reality alteration processes that emerge when contents are orchestrated in an effort to enhance the naturalistic presentation of information in VRNF. These efforts result in the construction of two consecutive subjective realities, whereby we describe the first one as *synthetic* (i.e., artificially construed by practitioners' decisions), and the second as *organic* (i.e., users'

natural response to the spherical environment). In this section, we elaborate on the proposed model and its benefits for VRNF research.

Synthetic subjective reality occurs when practitioners merge contents into a coherent VRNF product in accordance with specific subjective factors. Chronologically, it is the first step in our model, the rationale being that first the VR video, then its experience. The term synthetic refers to the immersive and narrative factors that drive the design, film, production and post-production, and in turn, synthesize objective reality into a subjective media product. We define it as subjective insofar it is an outcome of subjective factors, such as practitioners' goals, views and aesthetics. These factors can vary depending on the field of VRNF. In the case of the present study, the synthetic subjective reality for INGO VR is constructed by the factors vividness, authenticity and relatability, which synthesize the reality of crises as absent of violence, naturalness and otherness. Similar factors have been identified by Nash (2017), in particular the euphemization of humanitarian tragedy for the VR users' wellbeing and entertainment, as well as the users' self-projection onto the outgroup. For immersive journalism, it is the focus on presence and authenticity that drives journalists to manipulate VR materials (Aitamurto, 2018). The synthesis of a subjective reality is therefore intrinsically tied to the production of nonfiction VR contents. Therefore, it can serve as an umbrella term for the VR media product that practitioners' create according to subjective factors.

Organic subjective reality then occurs in the form of users' natural response to the mediated, spherical environment. Whereas television viewers are bound to the area of their screen, VR users can self-explore the external environment according to their subjective wishes and intuitions. When they strap on the VR goggles, their reactions to the external environment can be arbitrary, as an intuitive response to a specific stimulus, or conscious, as a result of deliberate decision-making. Consequently, the practitioners' product can *only* be experienced subjectively, analogous to physical reality. We therefore use the term organic specifically because users respond to the environment in a natural way, moved by their own agency, and unaffected by the practitioners' intentions. For example, if a user wishes to explore the mediated floor beneath her, she has the agency to do so, even though practitioners' might have placed virtual actors right in front of her. Similarly, one user can intuitively react to a specific sound contrary to practitioners' intentions. As a result, users construct a distinct subjective reality on their own terms.

In the following, we visualize the hypothesized two-step model of subjective reality construction according to the findings about VRNF in the third sector (Fig1.).

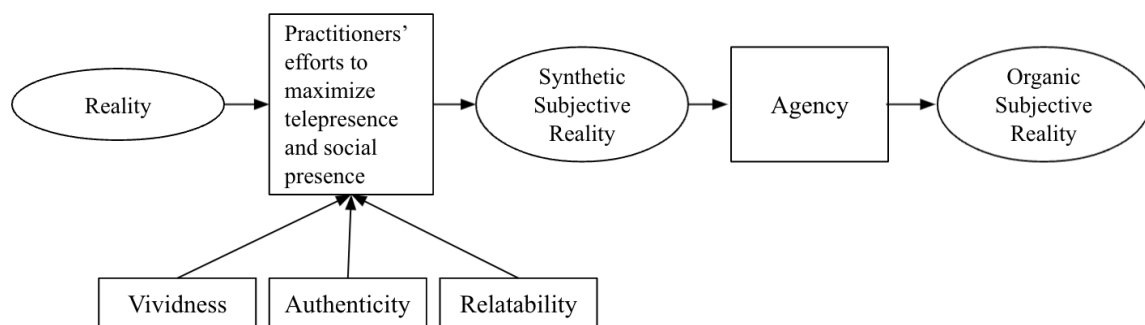


Figure 1. Diagrammed Two-Step Model of Subjective Reality Construction

Our model would offer a broad, yet structured lens through which future scholars can study different fields of nonfiction VR storytelling. By adding a chronological

structure, it isolates the product's from the users' subjectivity, and allows for their separate exploration across research strands.

Finally, to return to the last research question, we find that VR can serve as an effective medium for INGO storytelling under certain conditions. According to our analysis, VR is neither the panacea to INGO practitioners' challenges, nor the ultimate empathy machine as popularly labeled within the public and scholarly discourse (Foxman et al., 2021). Decisive external factors, specifically controlled environments, sufficient time for the experience and prior interest in the issue, can enhance wanted outcomes and thus create a deeper understanding of complex issues. To grant a transparent and ethical VRNF story, practitioners should refer to the measures identified in the present study, namely briefing, not scripting interviews, seeking approval of contents after filming and using original voice overs. Together, these measures and factors may contribute to the creation of compelling and fair VRNF in the third sector.

While this study offers a better understanding of INGO VR communication, there are a few limitations that need to be addressed. One concerns the diversity of interviewees. The practitioners we interviewed were located primarily in the Global North, while the environmental and social issues they dealt with were largely concentrated in the Global South. Thus, their answers might be grounded in a Global North positioning. To ensure larger variability of perspective, future studies should include a more diverse group of interviewees with INGO VR experience. Another limitation regards the type of VR that the majority of the practitioners' had experience with, that is 360° VR. This may be tied to the monetary costs of VR productions, which are lower for 360° VR than for immersive virtual environments. As a consequence, our findings do not entail concepts such as self presence, embodiment and avatar or agent interaction.

5 Conclusion

Nonfiction VR storytelling seems to appeal to third sector practitioners because of its capacity to mediate events in a more realistic and complete way, yet its implementation results in the presentation of subjective contents which are then viewed by users in their own, subjective terms. As a result, VRNF in the third sector is more subjective than it is objective. Furthermore, its influence depends primarily on predispositional (prior interest in the topic) and situational (sufficient time and space for the VR experience) factors, which challenges the popular notion that VR is an empathy machine with social impact per se (Foxman et al., 2021).

Overall, we argue that the observed processes are similar to processes in immersive journalism, and propose a model that helps to analyze the reality alteration steps within VRNF in a unified way. This model opens the conversation about the subjective construction of factual information in VRNF, and allows for a systematic exploration of its storytelling potential. Future research can test and expand the suggested model by examining the different factors that drive subjectivity across different forms of VRNF. Such efforts can pivot the current techno-utopian VR discourse (Rose, 2018) into a more nuanced theoretical and empirical investigation of VR as a medium for nonfiction storytelling.

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6 Study 3: When the “empathy machine” fails: A mixed methods experiment about social presence in VR and charitable behavior

Nikolaou, A. When the “empathy machine” fails: A mixed methods experiment about social presence in VR and charitable behavior. *Media Psychology*. (submitted)

Despite the heated debate whether Virtual Reality (VR) is an ‘empathy machine’ that drives prosociality, the empirical evidence is ambiguous, especially because of the lack of behavioral data. Therefore, this pre-registered study conducts a between-subjects experiment (N = 104) that merges quantitative, behavioral and qualitative data into a fuller picture. In particular, it investigates (1) whether it is the presence of virtual actors that influences charitable giving, (2) how pre-existing attitudes toward these actors moderate this effect and (3) why social presence might motivate donation behavior. To do so, it is the first to manipulate the presence of actors in 360 degree VR by means of computer software. The study finds that there is no evidence for a significant effect of social presence or prior attitudes on charitable giving, and that donations are driven by predispositional factors that lie beyond the technology’s control. Moreover, participants’ responses to the stimulus were largely rational rather than emotional. Overall, the article suggests that the current empathy-machine focused research narrative might be inflated, and that communication science scholars would benefit from a less normative approach to VR’s media effects.

Keywords: 360 video; Virtual Reality; experiment; social presence; charitable giving

Theoretical Background

Evoking prosocial behavior through social presence in VR

How can media technologies facilitate prosocial behavior? This fundamental question has been investigated by media effects scholars from multiple fields, ranging from television and radio (van Leeuwen & Wiepking, 2013) and social media (Saxton & Wang, 2013) to video games (Prot et al., 2013). In general, to be motivated to increase another’s welfare, one needs to be aware that the other is in need in the first place (Bekkers & Wiepking, 2010). Therefore, the inclusion of social cues in computer-mediated

communications, such as facial expressions, posture and vocal tone are decisive elements that can help the individual notice, comprehend and respond to the others' state (Short et al., 1976). The mere presence of mediated others can thus have an overall positive impact on users: they respond with higher cognitive presence (Lee, 2006) and higher psychological involvement (Felnhofer et al., 2018), and can even form meaningful interpersonal relationships with the virtual other (Whitty, 2008).

Scholars have found that social presence in VR, that is, when virtual actors feel real and sentient to the user (Bailenson et al., 2003), can evoke various forms of prosocial behavior, such as willingness to engage in charitable giving (e.g., Yoo & Drumwright, 2018). For example, when users view a 360 degree VR video about a humanitarian crisis, the technology's spherical field of view makes the people appear as if they were there, which in turn pushes the users to help them and support them (Ma, 2019). Positive findings from individual studies (e.g., Pimentel et al., 2018; Kandaurova & Lee, 2019) have fed into both popular and scholarly discourses arguing that VR is an 'empathy machine' that can mechanize concern for vulnerable others and thus incite prosocial behavior (Foxman et al., 2021). The aspirational term 'empathy machine' was first coined by director Chris Milk, who in 2015 presented his 360 degree VR documentary "Clouds over Sidra" in partnership with Samsung and the United Nations on the TED Talk platform. In this Talk, he refers to VR's capacity to place users into the same virtual room with vulnerable others as a way to help them understand, empathize and become more supportive (Milk, 2015). In contrast to less immersive media, social presence in 360 degree VR has therefore been described as "the psychological mechanism that closes the social and psychological distance between affluent potential donors and the beneficiaries of nonprofit fundraising" (Yoo & Drumwright, 2018, p.21).

Thus, a common methodological choice to test for the effects of VR on prosocial behavior is a modality comparison between social presence in 360 degree VR and a less immersive medium, for example two-dimensional video (e.g., Kandaurova & Lee, 2019). Found effects are then attributed to the higher social presence levels in VR (Yoo & Drumwright, 2018; Kandaurova & Lee, 2019; Ma, 2019). While modality comparisons inform about the importance of immersive quality, they are not particularly adequate to draw causal conclusions about the role of social presence. As Pimentel et al. (2021) argue, immersive modality comparisons are particularly problematic in that they hamper the precise isolation of social presence, because additional dimensions (e.g., technological immersion or general feelings of presence) may interfere with the social presence—prosocial outcome relationship. This is because VR and less immersive media differ in multiple other factors besides social presence, for example feelings of spatial presence (Breves & Heber, 2020), as well as recall, recognition and focused attention (Barreda-Ángeles et al., 2020). It is therefore plausible that found effects are linked to differences in general immersion or differences in information processing, and that social presence per se is not the causal facilitator of prosocial outcomes. As a result, we know very little about firstly, whether it is social presence that induces prosocial behavior, and secondly, what the underlying psychological mechanisms that motivate such outcomes might be.

To solve this problem, a small handful of studies have focused on the role of social actors. For example, Steed et al. (2018) manipulated the gaze of virtual representations of refugees and found that, when users felt like they were being looked at, they were more interested in the issue of migration than when they were not looked at. In a different approach, Pimentel et al. (2021) manipulated the presence of actors by filming two separate 360 degree videos, one with actors and without, and demonstrated that the video with actors elicited larger levels of social presence, and donation intention. Considering

that in traditional prosocial behavior literature, it is the victim, their appearance and others' perception of them that drives helping (Batson, 2011), it is plausible that it is the presence of the virtual actors that facilitates social presence in the first place, and in turn, prosocial outcomes.

Thus, I propose the following hypothesis:

H1. Social presence in VR will increase charitable giving more than no social presence in VR.

The moderating influence of prior attitudes

Are all users susceptible to media effects? To answer this question, scholars typically investigate conditional, or indirect effects (see Valkenburg & Peter, 2013, for a review of media effects research). Because of VR's popular label as an empathy machine (Milk, 2015), most studies focus on the indirect role of users' emotional response states, namely "all affectively valenced reactions to media content (i.e., the message, the story line, and the vicarious affective reactions to characters)" (Valkenburg & Peter, 2013, p.228). Such are empathy (Pimentel et al., 2021); guilt and feelings of responsibility (Kandaurova & Lee, 2019); transportation and identification (Ma, 2019); and message engagement, enjoyment and involvement (Buić et al., 2020). Altogether, these studies share the notion that it is the VR experience that induces emotional appraisal, which in turn, influences the decision to help (for a more elaborate account on this relationship, see So et al., 2015).

The focus on VR-induced emotional appraisal, however, means that the role of conditional effects is still substantially overlooked. Conditional effects can alter the direction or strength of an effect (Valkenburg & Peter, 2013). In the traditional prosocial behavior research, for instance, helping behavior is more pronounced if it aligns with the individual's political views (Lee et al., 2018). Similarly, sympathy toward the victim tends to increase helping (Beechler, 2011), while antipathy tends to discourage it (Batson et al., 2005). Thus, pre-existing attitudes toward the actors may make the effect of social

presence conditional: strong for users with positive attitudes, and weak for users with negative ones.

Examining pre-existing attitudes as moderators can therefore test the main effect more accurately. Further, it can help illuminate the role of cognition for VR effects, and thus expand the literature's current focus on VR-induced emotion. Thus, I hypothesize:

H2a. Prior positive attitudes towards refugees will strengthen the social presence-charitable giving relationship.

H2b. Prior negative attitudes towards refugees will weaken the social presence-charitable giving relationship.

Exploring the motivation to donate

So far, I have argued that charitable giving following 360 degree VR experiences might be driven primarily by the feeling that the vulnerable populations presented appear real and sentient, and that such a main effect might be moderated by users' prior attitudes toward the issue. Yet to gain a more complete understanding of the prosocial outcome, it is essential to zoom into the underlying psychological factors that promote charitable giving in general.

Overall, Bekkers and Wiepking (2010) identify eight motivators within the philanthropy literature: awareness of the others' need; solicitation; costs and benefits of the donation; reputation, or in other words, the donations' social consequences for the donor; psychological benefits, such as improvement of the donor's self-image; value compatibility with the donation cause; and a heightened feeling of efficacy. They also highlight altruism as a potential factor, that is the self-less concern for the beneficiaries wellbeing (Andreoni, 2006). When, however, the motivation for an altruistic action is to benefit the donor, for instance when they seek to feel self-pride after a prosocial activity, then donors can be referred to as egoists, or 'impure altruists' (Andreoni, 1990). Another egoistic motivation for charitable giving can be found in Batson's (2011) tension reduction

model, according to which the suffering of others causes distress which the individual needs to tackle so as to reduce one's own discomfort. Altogether, there are well-established motivators for charitable giving in the extant research, which individually or combined may explain what it is about social presence in 360 degree VR that might promote donation behavior. For instance, it is plausible that feelings of social presence enhances users' awareness of the actors' needs; or, it is also possible that social presence increases the distress of seeing others suffering, which in turn motivates VR users to act prosocially.

To date, however, little attention has been paid to the underlying motivations of VR users' donation behavior. Scholars have found evidence that empathy can enhance the main effect of social presence on prosocial outcomes (Kandaurova & Lee, 2019; Pimentel et al., 2021), yet conceptually, empathy can be connected to several of the aforementioned motivations: For example, individuals with an empathetic self-image tend to engage in more charitable behavior (Bekkers, 2006). Moreover, regular engagement in selfless acts reinforces a selfless identity, and in turn, increases prosocial behavior (Piliavin & Callero, 1991). In contrast, very high levels of empathy can backfire and cause apathy and disinterest in the issue, also referred to as 'compassion fatigue' (Ledoux, 2015). Given the multiple interpretations of how empathy might relate to charitable giving, it is essential to take a step back and openly examine donors' motivations.

Therefore, I seek to explore users' thoughts, responses and interpretations of their donation behavior (Monroe et al., 1990, as cited in Khalil, 2004). In doing so, I can capture the meaning they ascribe to their charitable giving, and better assess the influence of social presence on their behavior. To provide further qualitative nuance to the study's quantitative findings (Creswell, 2014), I thus pose the exploratory research question:

(RQ) How does social presence lead to the motivation to engage in charitable giving?

Materials and methods

To answer the hypotheses and research question, I conducted a randomized laboratory experiment with a between-subjects design with a single factor (social presence) with two levels (presence of social actors, absence of social actors) and a post stimulus behavioral measure by using a cover story. I preregistered the hypotheses, research design and analysis plan at [osf.io](https://osf.io/jmt93/)¹². Participants were provided informed consent, and the study was approved by the Institutional Review Board of the faculty (ID 20210720_60). It adheres to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans.

Participants

To detect a medium sized main effect, a power analysis for a two-group comparison (using the R pwr package), with power set at 0.8, p set at 0.05 and d set at 0.6, yielded that a sample size of 45 persons per group is needed. I based the estimated effect size on prior social presence and donation research (Kandaurova & Lee, 2019). Thus, the target sample size was 90 participants. To account for potential drop out, I attempted to recruit up to 130 participants.

Subjects were recruited via advertisements at university facilities, stores, coworking spaces, activity associations (e.g., sports, arts), virtual reality gaming spaces and online via social media. Inclusion criteria were: a. legal age, b. German on a mother-tongue level, and c. physical and mental health (no psychoactive medication, no proneness to nausea or epilepsy). Subjects received 10 EUR compensation.

¹ To access the anonymized preregistrations, please visit https://osf.io/jmt93/?view_only=964d394d0f4a434aab1814e273291daa

² In the preregistration, we refer to attitudes toward migration as a moderating variable. This is due to a translation error.

Overall, 105 people participated in the study. One case was removed from the sample because the participant did not complete the post behavioral measure survey. Thus, a total of 104 people (67 female, 36 male and 1 non-binary), between the ages of 18 and 55 years ($M = 24.86$, $SD = 5.82$) partook in the study. 84% reported to be students, 9% full time employed, 4% part time employed, 4% self-employed and 4% unemployed.

Materials and apparatus

I used the video “eXodus”³, a 2016 documentary about Syrian refugees living in a camp in Moussa Taleb, Lebanon. In the video, a narrator firstly explains the conditions under which refugees fled from Syria to Lebanon while the camp is shown in bird’s eye view. Secondly, users find themselves inside of a camp tent, where a woman describes her escape and struggles for survival. She is accompanied by a female interviewer. Thirdly, users are placed outside of the tent in front of a young boy, who explains his nightmares about Syria and his plans for the future. For a transcript (translated from German into English) see supplemental material.

To manipulate social presence, a professional multimedia production used the software Nuke to remove all visible people from the video. The voice over, content and environment remained identical. The process yielded two videos: one where people were present (original) and one where people were absent (manipulated) (see Figure 1). For the head mounted display I used the Oculus Quest 2 (1832x1920 pixels per eye) with built-in speakers for positional audio.

Pilot Study

To test for effective stimulus manipulation and to examine whether the used materials appear credible, a pilot study was conducted with a sample ($N = 10$) of 7 men

³ eXodus (2016). <https://www.youtube.com/watch?v=AORQZ03tbJU&t=122s>

and 3 women aged 25-34 ($M = 28.4$; $SD = 2.5$) from the university environment.

Feedback about the study process and its materials was also collected.

Manipulation check social presence. Social presence was measured via a 5-item (Cronbachs' $\alpha = 0.71$), 7-point Likert-scale from -3 to 3 (Social Presence Survey (SPS), Bailenson et al., 2003). The items measured participants' level of agreement with the statements "I perceived that I am in the presence of another person in the room with me," "I feel that the people are watching me and are aware of my presence", "The thought that the people are not people crossed my mind often," "The people appeared to be sentient, conscious, and alive to me," "I perceived the people as being only computerized images, not as real people". Presence of social actors induced significantly higher levels of social presence ($M = 1.68$, $SD = 0.7$) than absence of social actors ($M = -.32$, $SD = 1.4$), $t(10) = 2.78$; $p = 0.02$) in an independent samples t-test.

Quality of VR stimuli. No significant differences in stimulus quality were detected via an independent samples t-test between presence of social actors ($M = 3.53$, $SD = .38$) and absence of social actors ($M = 3.46$, $SD = .29$) , $t(10) = .309$, $p = .766$). Quality of stimulus was tested with an index entailing the items professionalism, quality and credibility on a 4-point scale.

Other materials. For the experimental procedure (see below) an NGO poster and donation bin were needed so as to test for donation behavior. In order to avoid pretreatment effects, I chose to fabricate a fictitious NGO instead of using an existing one. To test whether the NGO name, logo and overall appearance is perceived as credible by participants, two different poster versions with identical information but different designs were created (see Figure 2). In both posters, no people were visible so as to ensure that

Relevant actors were present only in one of the VR conditions. The posters were shown to the participants of the pilot study in a randomized order. A paired samples t-test

revealed no significant differences in quality, professionalism, credibility, and capacity to potentially generate donations between the two posters (all $ps > 0.5$). Subjects also reported that both posters appear as if they belonged to existing organizations in a feedback round after the pilot study. Therefore, the poster with the higher means was selected (Figure 2).

Procedure

Each participant completed a pre-questionnaire that measured familiarity with VR and prior attitudes toward refugees. Participants were then randomly assigned via random.org to one of the two VR conditions, namely presence of social actors and absence of social actors. Figure 1 illustrates the viewpoint of the participant in each condition. After viewing the VR video, participants filled out a post-questionnaire that asked whether they saw people in the video, their levels of social presence and sociodemographics. Then, they received the participation compensation of 10,- (5 EUR bill, 2x2 EUR coins and 1 EUR coin) in an envelope. The envelope was closed, but not sealed. Participants were then thanked for their participation and led to the second experimental room, labeled as “community room”, under the premise that they should remain there until possible cybersickness symptoms wear off. Participants had consented to do so when signing informed consent at the beginning of the study. They had also handed their mobile phones to the researcher, because they were told this will help avoid distractions during the study. Thus, participants entered the second experimental room without their mobile phones and willing to wait until the researcher returns to check on their wellbeing.

The second experimental room mimicked a community room (Figure 3). There was an armchair, a coffee table, a reading lamp, two chairs, beverages, and University posters about COVID-19 measures. Next to the armchair, which was intended for the participant, hung a poster from a fictitious NGO calling for donations for refugees in Vienna, and below it, a donation bin. The donation bin was made out of opal glass (semi-transparent)

and included a small amount of coins, so as to mimic previous donations and appear more credible (Jacob et al., 2018).

After seven minutes⁴, the researcher returned to the community room. Participants were debriefed about the aims of the study, the use of the cover story, the role of the second experimental room and the fictitiousness of the NGO. Participants received their mobile phones back. In case they donated (a part) of the compensation into the donation bin during their waiting time, they were returned the money. Finally, each participant received a final questionnaire that asked about the amount of their donation, and the reason why they did or did not donate.

Measures

Manipulation check

Social presence. For the main study, I used the same scale as in the pilot study (Social Presence Survey (SPS), Bailenson et al., 2003). ($M = 0.67$; $SD = 1.21$).

Dependent variables

Donation behavior. Scholars often measure behavior by means of self-reported intention (e.g., Kandaurova & Lee, 2019). This can be problematic in three ways: (1) intention and behavior are different theoretical concepts that require different measures, while their relation is a matter of ongoing debate within the research (Sheeran, 2002); (2) self-report measures of prosociality intention can threaten the validity of results, as the topic accentuates subjects' tendency to give socially desirable and acceptable answers (Maccoby & Maccoby, 1954). And (3) measures of intention refer to money in an abstract, non-

⁴ At preregistration, ten minutes were planned; however, several test trials with faculty staff indicated feelings of confusion from eight minutes onward, therefore the waiting time was set to seven minutes.

tangible way (e.g., potential lottery winnings in the future; Nelson et al., 2020), which in turn may decrease its perceived value in comparison to when subjects actually see and touch it (Peck & Shuh, 2009), and in general, own it (Kahneman et al., 1990). Because the aim of this study was to assess behavior, I measured how much of the compensation participants' would donate to a fictitious cause. Subjects were asked to answer the question "Please state how much of your participation compensation you donated" by entering the donated amount as a number in a text field ($M = 0.96$; $SD = 2.82$).

Donation reason. Participants were asked to answer the question "Please describe in your own words, how come you did or did not donate" by typing their response in an open text-field. Answers to the open-ended question were coded with the software MAXQDA according to the four steps suggested by Mayring (2003): material collection, descriptive analysis, category and subcategory selection, and material analysis. The data was mapped into four groups according to condition and outcome (social presence & donation; social presence & no donation; no social presence & donation; no social presence & no donation) and then compared on the grounds of code co-occurrences.

Moderator variable: prior attitude toward refugees

Attitude toward refugees was measured using five adapted items (1,2,4,5,7) from The Symbolic Racism 2000 Scale (Henry & Sears, 2002) (Cronbachs' $\alpha = 0.73$). Participants were asked to report their agreement with or evaluation of the statements "If refugees would only try harder in Austria they could be just as well off as Austrians," Germans, Italians, Croatians and many other minorities overcame prejudice and worked their way up. Refugees should do the same," "How much of the social tension that exists in Austria today do you think refugees are responsible for creating?," "How much discrimination against refugees do you feel there is in Austria today?," "Over the past few years, refugees

have gotten less than they deserve”. Higher scores indicated more negative attitudes toward refugees ($M = 1.9$; $SD = 0.5$).

Control variables

Age (metric), gender (‘female’, ‘male’, ‘non-binary’, ‘no answer’) and occupation (‘student’, ‘full-time employed’, ‘part-time employed’, ‘self-occupied’, ‘unemployed’, ‘in pension’) were also assessed. Further, familiarity with VR was measured on a 5-point scale (Cronbachs’ $\alpha = 0.91$) entailing the items “How often have you used VR with an HMD?” (0, 1-3, 4-6, 7-9, more than 10), “How would you rate your experience with VR with an HMD)” (‘no experience at all’, ‘very inexperienced’, ‘inexperienced’, ‘experienced’, ‘very experienced’) and “How would you evaluate your know-how of VR with an HMD” (‘no know-how at all’, ‘very low’, ‘low’, ‘high’, ‘very high’). An image of an HMD was included in the questionnaire for clarification. Higher scores meant higher familiarity ($M = 1.07$; $SD = 0.95$).

Results

Randomization and manipulation check (exploratory analysis)

I run an ANCOVA to control for differences between the two groups in regards to age, occupation, gender, and familiarity with VR. No significant differences in age, occupation, and gender were found (all $p > .05$). Despite using a randomization software, the group with social presence scored higher in prior familiarity with VR than the group without social presence ($p = .00$). To test how this influenced the manipulation check, I ran a multiple linear regression with presence of social actors and familiarity with VR as independent variables, and social presence as dependent variable. Presence of social actors had a significant influence on feelings of social presence ($p = .00$), whereas familiarity with VR had no effect ($p > 0.5$). An independent samples t test showed that the video with people evoked a larger sense of social presence ($M = 1.3$, $SD = 0.7$) than the video without people ($M = 0.01$; $SD = 1.24$), $t(102) = -6.36$, $p < .00$). Taken together, subjects in the

group with visible actors felt more social presence than in the group without people, regardless of their prior familiarity with VR. The manipulation check of social presence was successful.

Hypotheses testing

Donation behavior. There was no significant main effect of presence of social actors ($M = 1,4$; $SD = 3,5$) and absence of social actors ($M = 0.51$; $SD = 1,8$) on donation amount; $t(102) = -1.615$, $p < .10$. H1 was not supported.

Exploratory analysis. To control for interfering familiarity effects, a multiple linear regression was conducted with presence of social actors and familiarity with VR as independent variables, and donation behavior as dependent variable. No significant effect of prior familiarity was found ($p > .05$). I further tested for meaningful differences that relate to the stated hypothesis. Results show a tendency in the mean differences (Figure 4). In the treatment with actors present, more participants ($N=15$ of 53) donated more money ($\Sigma=74,35$) than subjects in the treatment with actors absent ($N=6$ of 51; $\Sigma=26,3$).

Moderation Analysis. To test H2a and H2b, the PROCESS macro in SPSS (Hayes, 2013) was used to conduct a simple linear moderation analysis (Model 1) with 5,000 resamples. The outcome variable was donation behavior, the predictor variable was social presence and the moderator variable was pre-existing attitudes toward refugees. No significant interaction between social presence and attitudes was found ($b = -.532$, $p = .62$). As can be seen in Figure 5, however, when attitudes toward refugees become more negative by one unit, the difference in donation amount between those in the high and the low social presence decreases by approx. 50 Cents. H2a and H2b were not supported.

Control variables. No meaningful differences in donation behavior were found in regards to age, gender, familiarity with VR and employment status.

How does social presence lead to the motivation to engage in charitable giving?

Differences per condition

The comparison of responses per donation behavior and treatment yielded one difference that merits discussion: a difference in *cognitive information processing*. This code describes users' capacity to freely recall the stimulus' contents (e.g., storyline, information about the character). Subjects who saw actors and donated freely recalled the information in the video's message; in contrast, subjects who did not see actors and did not donate reported comprehension difficulties and information overload. Consider the responses of (4) and (5):

“The VR-Video definitely made me donate. That, and that I received 10 EUR for viewing it. That made me feel like the people need the money more (especially the detailed story of the young mother and the loan, which she had to take to build the tent). I also want to note that I wouldn't have donated at all or only 1-2EUR, if I hadn't received money for the study participation.”

(4; social presence condition; 5EUR)

“The video didn't impact me much, because I was overwhelmed by the listening, and because I was watching without a point to focus my vision on, I had difficulties understanding and empathizing with what was being said.”

(5; no social presence condition)

Case (4) entails detailed information about one of the story's characters. In contrast, case (5) references difficulties in understanding the video's contents due to the lack of visual focus. The latter relates to the concept of information overload; an overarching explanatory category for not helping introduced by Batson (2011). In his work, Batson (2011)

references Milgram's urban overload hypothesis (1970), according to which city residents pay less attention to others' needs in order to cope with the abundance of information intake. One similarity between this literature and the case (5) is the information-loaded environment in which the individual finds themselves, which in turn may impact its information processing and as a result, their helping decision.

Differences per outcome

The response differences per condition (social presence - no social presence) were not pronounced enough to fully explain subjects' motivations to donate. Therefore I compared the responses per donation outcome (yes/no). The comparison yielded two main motivators: rational altruism and rational egoism.

Rational altruism. This code encapsulates explanations of donation behavior that stress the availability of resources alongside the desire to increase the victims' welfare. I refer to altruism as rational because it was not driven by affect (e.g., empathy, sympathy), but rather by a conscious cost/benefit calculation. Consider the following cases:

“I was simply given 10 Euros for 40 minutes of my time, and the donation box was just there. I briefly thought it might be related to the study, but I still donated in case it reaches the people. ”

(1; social presence condition; 6EUR)

“Because the video impacted me emotionally and because donating 5 Euros isn't a big loss to me. But I didn't donate all the money, because I didn't know the NGO and I wanted to buy myself a coffee with the rest.”

(2; no social presence condition; 5EUR)

In case (1), the respondent stresses how the availability of the compensation plus the

donation box, enhanced by the motivation to help, sums up to their decision to donate. Similarly, the participant in case (2) engages in a cost/benefits calculation and eventually decides to donate half of the compensation to help, and keep the rest to serve their self-interest. Notably, the reference to emotion (“the video impacted me emotionally”) serves as an input to a conscious reasoning process, rather than the direct cause of helping.

Rational egoism. In the non-donor groups, *rational egoism* emerged as the most frequent code. The code labels the motivation to donate in order to maximize one’s own benefit and not out of dislike for the victim. In other words, subjects were motivated to keep the compensation by sympathy for their own financial needs, not antipathy toward the victim. Take, for example, case (3):

“Despite seeing the poster and the donation box, I decided to not donate, because I am going to a small party tonight and I had planned in advance to buy a bottle of wine with that money”

(3; social presence condition)

Taken together, subjects’ explanations were more rational than affective, both for the donors (rational altruism) and the non-donors (rational egoism). Their responses align with rationalist approaches in moral psychology, according to which one reaches a moral conclusion based on reflection and reason rather than affect (e.g., Turiel, 1983). This stands against most previous research, which stresses the importance of affective arousal in response to 360 degree VR (see Ventura et al., 2020, for a meta-analytic review).

Qualitative findings are visualized in Figure 6.

Discussion

The purpose of this study was to examine and understand prosocial behavior under

conditions of social presence manipulation in VR experiences. By implementing a mixed methods experiment, the article merges much needed behavioral and qualitative into a bigger picture; a picture which points at VR's limited capacity to instill prosocial behavior. In this section, I analyze the study's contributions to the extant literature and highlight refinement opportunities for future scholarly efforts.

To date, this study is the first one to artificially remove visible actors to manipulate levels of social presence in 360 degree VR by means of software. In doing so, it provides empirical evidence for a direct link between the presence of actors and feelings of social presence. My approach thus confirms and extends previous work (Pimentel et al., 2021) by suggesting that the use of digital compositing applications for social presence manipulations circumvents the need to produce two separate VR videos, which tend to come with high costs and in turn, may hamper progress in the field. While the present approach comes with added costs, too, (e.g., collaboration with professional film editing services) it renders a more affordable option for social presence researchers, and can thus help accelerate future investigations of social presence effects.

Despite the successful manipulation of social presence, results show no significant effect on donation behavior (H1). In particular, only 21 out of 104 participants proactively donated (a portion of) their compensation to the charitable cause advertised in the second experiment room. This number is lower than in a pre-print by Martingano et al. (2021), where subjects were asked to voluntarily donate to UNICEF after finishing the study procedures. One possible explanation might be that for the present study, the advertised organization was fictitious so as to avoid pretreatment effects, thus evoking more distrust than a known organization and deterring potential donors. However, the successful use of fictitious organizations in previous charitable behavior literature (e.g., Tremblay-Boire &

Prakash, 2017) points at another explanation: the increased realism of the experimental environment. In Martingano et al. (2021), subjects were still in the premises of the laboratory when asked to donate; thus, the awareness of the experimental setting might have enhanced their donation behavior (Dickson & Roethlisberger, 2003). In the present design, subjects were told the study is officially over and were brought to wait in a different room labeled as ‘community room’, so as to separate the laboratory context from the behavioral stimulus. It is possible that the lack of monitoring decreased social desirability bias, thus yielding findings that are non significant but with increased external validity.

Further, contrary to expectations, prior attitudes toward the issue did not significantly influence participants’ donation behavior (H2a, H2b). However, there was an observable tendency that the more negatively subjects’ thought about refugees, the less they donated. A potential explanation for this result is that the effect is there, in line with previous work on attitude-compatible behavior (Valkenburg & Peter, 2013), but that the sample was not large enough for a successful moderation analysis; future research should aim for a larger sample size when testing for related moderation effects. For this study, however, the effect of pre-existing attitudes was not significant enough to explain why subjects chose to (not) engage in charitable giving. To answer this question, I turn to the qualitative analysis of their post-stimulus responses.

For both experimental conditions, the motivation to donate stemmed from a rational analysis of the costs and benefits of giving (a portion of) the compensation (RQ). Here, donors reported altruistic motivations, while non-donors had egoistic motivations. These motivations per se are not novel; on the contrary, they are well-established explanatory factors of charitable giving in the prosocial behavior literature (Bekkers &

Wiepking, 2010). Yet they are particularly novel in the context of the extant VR literature. This is because users' rational decision-making, paired with a lack of affective reactions, suggests that humanitarian communication in VR does not necessarily illicit emotional appraisal; which stands in stark contrast to the extant empathy-focused literature (Foxman et al., 2021; Sora-Domenjó, 2022). This means that the study finds no empirical evidence for VR being an empathy or donation machine, and that instead, prosocial outcomes after VR exposure depend on well researched human-related factors that are beyond the technology's control. Therefore, media psychology scholars interested in how VR influences prosociality would benefit from incorporating traditional concepts and theories (see Bekkers & Wiepking, 2010) into their work, instead of reinventing the wheel. Furthermore, VR media effects research needs a stronger focus on qualitative designs, which can illuminate users' thoughts and feelings better than self-report measures of empathy.

Although the difference in donation amount between the two conditions was not statistically significant, it is valuable to discuss why participants' in the social presence condition donated more, and more often, than in the no social presence condition. A plausible explanation for this trend might lie in the role of information processing. Donors in the social presence condition freely recalled the message's contents, while in contrast, non-donors in the no social presence condition reported information overload. Similarly, a previous study found that the omnidirectionality of 360 degree videos leads to heightened exploratory behavior, and difficulties in focused attention and recall (Barreda-Ángeles et al., 2020). Therefore I suspect that the presence of actors served as a visual focus which enhanced their information processing; as a result, users had more information available (e.g., receiver and cause of donation) to decide whether and how much they want to donate. In comparison, the absence of actors potentially increased exploratory behavior

which impeded information processing, thus limiting the information necessary to persuade users to donate. Taken together, I hypothesize that the social presence condition increased donation behavior not because of subjects' feelings of social presence, but rather, due to increased information processing. This assumption can be conceptualized in a classic mediation model where information processing mediates the effect of social presence on donation behavior. While this study points in this direction, more research is needed to support this hypothesis.

This study expands previous literature in several methodological and theoretical ways, yet it also comes with certain shortcomings. To begin with, the experimental groups differed significantly in prior familiarity with VR, despite the use of a randomizer software for treatment assignment. Therefore it is important to discuss the reliability and validity of findings in this context. Interestingly, the impaired randomization did not impact the experimental manipulation of interest; experienced users did not feel significantly more social presence than inexperienced ones. This result stands in contrast to previous work by Lachlan and Krcmar (2011), who found that past experience with interactive environments increases levels of general presence. One explanation for this finding may lie in other relevant components that factor into social presence, such as the photorealism of contents (Zibrek & McDonell, 2019). Future research should test the replicability of the study and opt for designs with improved randomization.

Moreover, the sample's attitudes toward the issue was overall positive which may have hampered moderation effects. This comes somewhat unexpected, considering the efforts to recruit a sample with varying sociopolitical views by advertising the study in diverse locations such as grocery stores, athletic centers, or on the street. That VR studies attract more liberal participants was also the case in Bujić et al. (2020). A possible

explanation for this might be that people who are interested to participate in studies about novel technologies may tend to be generally more open and curious about novel experiences, a personality trait which, within the literature, is frequent in left-wing orientation (Carney et al., 2008). Potential sampling biases in new media research should be investigated by future scholars, so as to gain a better assessment of how novelty influences found effects.

Another limitation of this study is related to the advertised monetary incentive, which potentially maximized subjects' self-interest in the compensation. The nature of incentives, particularly when charitable giving is the variable of interest, is unfortunately under investigated; this is because typically, studies about social presence effects on donation behavior employ course credit as incentive (e.g., Kandaurova & Lee, 2019). This pattern has implications about the generalizability of found outcomes, as it raises the question to what degree causal inferences can be made when empirical evidence is primarily drawn from student populations. Future studies should further explore sampling and compensation effects.

Further, I note a limitation to the choice made for the exclusion of emotional response state measures. This study did not collect information about participants' feelings toward contents or characters, in an effort to avoid priming them to helping behavior. For example, it did not measure levels of sympathy, which would potentially have informed about differences in issue perception and provided a more nuanced analysis. Future experiments should consider ways of including such measures while controlling for priming effects.

The present study contributes to the extant literature on social presence in VR in threefold way. Firstly, it provides empirical evidence that feelings of social presence in

360 degree VR depend on the presence of virtual actors, thus confirming previous work (Pimentel et al., 2021) and expanding it with a novel method for social presence manipulation through means of software. Secondly, it finds that neither social presence nor issue-specific prior attitudes toward the issue influence charitable giving; traditional predictors of charitable giving appear to play a much more important role, specifically people's rational altruism, egoism and information processing. Thus thirdly, the article suggests that emotional appraisal and empathy may not be the underlying psychological mechanisms that connect VR experiences with prosocial outcomes, and that more qualitative research on donors' reasoning is needed to better understand the role of rationality in their decision-making. Taken together, it provides a more precise, in-depth and ecologically valid assessment of whether, how and why social presence in 360 degree VR might evoke charitable giving. Overall, the study joins in the call to pivot from the 'empathy machine'-focused research narrative and instead, examine VR's media effects in a more systematic, and less normative, way (Sora-Domenjó, 2022).

Declaration of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Figures



Figure 1.



Figure 2.



Figure 3.

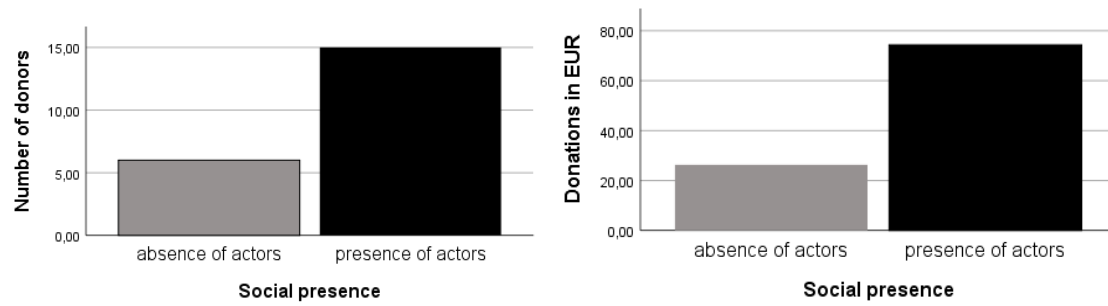


Figure 4.



Figure 5.

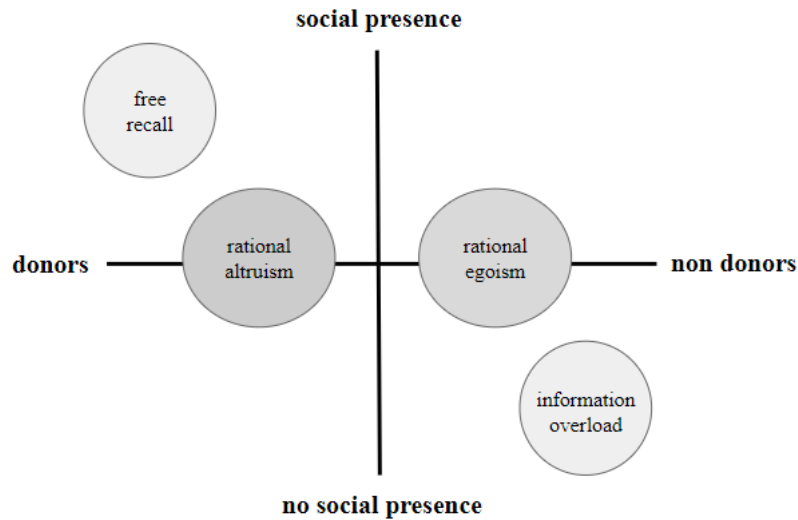


Figure 6.

Figure Captions

- Figure 1. Original stimulus with actors present (1) and edited stimulus with actors absent (2).
- Figure 2. Poster designed for the post stimulus behavioural measurement. Poster 1 was selected for the main study.
- Figure 3. Waiting room (left) and chair placed next to the donation poster and bin (right).
- Figure 4. Bar charts showing the number of donors (left) and sum of donations (right) per group.
- Figure 5. Visual representation of the moderation of the effect of social presence (X) on donation amount (Y) by attitudes toward refugees. Higher attitude scores indicate higher negativity toward refugees.
- Figure 6. Visual representation of code co-occurrences per condition and outcome.

7 General discussion

7.1 Summary of study findings and their contributions

This dissertation examines how effectively VR can influence attitudes and behaviors toward topics of broader social significance, an idea referred to as “VR for Good.” In particular, it draws a much-needed fuller picture of “VR for Good,” thus helping to close a research gap at the intersection of media psychology, human computer interaction and science and technology. It does so by posing three separate research questions: Firstly, a question of correlation: To what extent does VR overall evoke social attitude and behavior change? (RQ1); secondly, a qualitative question: How is VR used as an application for social attitude and behavior change? (RQ2); and thirdly, a question of causation: Is social presence the underlying mechanism that motivates the attitudinal effects of VR? (RQ3). Together, the three dissertation studies contribute to the evaluation of VR technology as a communication tool that can potentially move users to think and behave in ways that benefit the world around them.

The main finding of this thesis is that “VR for Good” is not effective per se in changing social attitudes and behavior, and that in turn, the discursive construction of VR technology as a prosociality machine is inaccurate. Instead, the persuasiveness of “VR for Good” is driven by factors such as channel (Study 1), context (Study 2), content (Studies 1 and 2) and the recipients themselves (Studies 2 and 3). By pointing out relevant factors other than VR technology, the dissertation joins in the call to demystify the ‘social change’-centered narrative around VR (Sora-Domenjó, 2022).

In this final chapter, I aggregate the results of all three studies, weld them into a cohesive conclusion and discuss their limitations. Building on the thesis’s main findings, I finally outline two future research directions for the study of “VR for Good” that may inform scholars, technologists and policy makers about VR’s strengths and weaknesses as a communication tool.

Study 1 investigates whether overall, VR as a medium object can evoke attitudinal and behavioral change. For that, it estimates an average effect size of VR treatments on social attitudes and behavior by synthesizing two decades of related empirical studies into a systematic review with meta-analysis (Rosenthal & DiMatteo, 2001). It sets out to test if there is a main effect of immersive modality on attitudinal constructs, building upon Media

Richness Theory (Daft & Lengel, 1986). In a second step, it investigates what it is about VR that produces persuasive outcomes, and focuses on two central concepts within the literature: the moderating influence of Sense of Embodiment, namely users' feeling of self-location, ownership and agency according to Kilteni et al. (2012), and first-person perspective-taking (1PPP) in accordance with perspective-taking theory (Batson et al., 1989; Davis, 1994). To contextualize found effects, it systematically reviews and categorizes the literature according to attitude object (e.g., attitudes toward the environment). Through this approach, Study 1 provides an informative summary of extant literature, and offers more definitive conclusions about whether VR can function as a persuasive communication tool in comparison to an individual study.

The analysis of 50 separate findings from 39 studies suggests that, on average, VR treatment evoked larger social attitude and behavior change than their less immersive counter treatments (e.g., video, text) across previous work. Importantly, this finding aligns and expands Media Richness Theory (Daft & Lengel, 1986), in that it provides empirical evidence for the persuasiveness of media rich modalities, which in turn informs about the theory's relevance in the context of emerging technologies. However, this finding must be read with caution given the methodological issues that Study 1 identified within the literature: differing treatment length (e.g., VR treatments are often longer than reading treatments), unclear operationalization or lacking measurement of the independent variable (e.g., presence), and design problems (e.g., the misrepresentation of Black avatars) hamper the comparability of effect sizes, making it difficult to attribute differences exclusively to VR's immersive modality. Future scholars concerned with comparisons of immersive modality should improve these three factors to better isolate the role of VR's media richness.

Furthermore, Study 1 finds no empirical support for a moderating effect of Sense of Embodiment. In particular, embodiment in VR did not enhance the medium's superiority in inducing larger attitude change than less immersive conditions. This stands in contrast to previous argumentations, according to which embodied experiences are more personal, and in turn, more persuasive (Ahn, 2021). A plausible explanation may be that having a sense of embodiment does not feel more direct or personal. Owning a body in an online game, for example, does not necessarily produce a feeling of connection between the player and the body; instead, it can serve merely as a vehicle for the user to move around the virtual space (Banks, 2015). Instead, it is factors like identification, relation, and interaction with the virtual self, as well as enjoyment and overall engagement that

create a more personal embodied experience within online games (Bowman & Banks, 2021). It is plausible that in VR, too, Sense of Embodiment is not in itself more persuasive, but needs to be combined with more psychological mechanisms to produce attitudinal outcomes. More research is needed to clarify such mechanisms.

Moreover, Study 1 shows that across different primary studies, adopting the outgroup's point of view has a larger impact on the user's attitudes in comparison to remaining in one's ingroup perspective; for example, when male users adopt a female's first-person perspective (Aitamurto et al., 2018). This might be because viewing the world through the eyes of another helps the individual think about the other's behavior as a result of situational and environmental factors rather than personal traits, which enhances understanding and sympathy (Jones & Nisbett, 1987; Davis, 1994). But Study 1 also indicates that outgroup first-person perspective-taking in VR does not have a universally persuasive effect: as the systematic review of the literature indicates, the effect can backfire when the VR experience reinforces stereotypes, or when its contents are unpleasant to the user (Groom et al., 2009; Banakou et al., 2020). This observation aligns with previous theoretical discussions about how "VR for Good" may lead to unwanted outcomes, such as othering (Nash, 2017) and toxic empathy (Nakamura, 2020). Thus, Study 1 provides both powerful numerical evidence for the persuasiveness of outgroup perspective taking for bias reduction, and the narrative analysis needed to fully understand the context in which this effect can occur.

Finally, it merits discussion that the majority of attitudinal and behavioral measures within the reviewed literature are low-cost situations. Low-cost situations describe minor inconveniences (e.g., recycling) which do not require a major shift in behaviors, habits or values in comparison to high-cost situations (e.g., no car in the household) (Stern, 1992). Low-cost objects are therefore more susceptible to change than high-cost objects (Diekmann & Preisendörfer, 2003). For Study 1, this means that the identified attitudinal effect of VR treatments might be smaller for high-cost situations. This is particularly interesting, given that most measures within the literature are self-reported willingness to engage in low-cost situations, for example intention to donate to a charitable cause (Kandaurova & Lee, 2019). As a result, it is unclear whether found effects on intention correspond with effects on actual behavior. By uncovering this systematic pattern, Study 1 suggests that what is needed is more research on both high-cost, and more externally valid attitudinal and behavioral measures.

Taken together, Study 1 is the first to provide aggregated evidence for the question of whether VR has a persuasive effect on social attitudes and behavior across individual studies. By combining a meta-analysis with a systematic review, it draws an essential landscape of extant effects that the literature was lacking. As a result, it can help scholars identify significant variables, theoretical and methodological patterns, as well as the literature's strengths and shortcomings. By finding evidence-based support for the importance of media richness and first person perspective-taking for VR induced attitudinal change, Study 1 contributes to theory development by bridging traditional concepts with novel media effects.

With Study 1 clarifying whether VR as a medium object has an overall persuasive effect on social attitudes and behaviors, **Study 2** expands on that finding by exploring its persuasiveness as application for real-life attitudinal change. Specifically, it examines how VR is used as an for immersive fundraising and awareness raising. Here, the thesis dives into the essence of “VR for Good” as a real-life application that is expected to increase users’ interest and participation in charitable causes of intergovernmental and nongovernmental organizations (as defined by Leverty, 2008; Berg, 2009). From a theoretical standpoint, the study elaborates on how the concepts of presence, social presence and self-presence (Lee, 2004) as well as well-established frameworks for effective fundraising (e.g., message framing, Das et al., 2008) may connect to immersive awareness and fundraising. However, the study refrains from formulating theory-based hypotheses that might narrow its exploratory approach and poses open research questions instead.

For that, Study 2 relies on data collected in standardized open-ended reconstructive expert interviews via remote video (Bogner et al., 2009; Reich & Barnoy, 2020). Following purposive sampling (Ritchie et al., 2013) I chose experts who met the criteria of inclusion: occupation in the non-profit (Leverty, 2008) and/or non- governmental or inter-governmental (Berg, 2009) sector, *or* in the immersive media production sector *or* in a marketing agency *and* at least one experience in the conception, commission and/or production of VR videos that were employed by intergovernmental and nongovernmental organizations. In addition to the standardized interview questions, Study 2 also implemented a guided film-analysis where the practitioners elaborated on the use of immersive and narrative features scene-by-scene while the VR video was screenshared by the video conferencing tool. Through this approach, the study collected more in-depth details (e.g., camera angles; users’ viewpoint) about the deployed storytelling techniques.

All data was then analyzed following Charmaz's (2006) grounded theory framework, which enabled theory building through rigorous and repetitive coding.

The analysis of 15 interviews suggests that the benefits of using VR in the third sector are limited. Practitioners decide to implement VR so as to present events in a naturalistic and objective way, in the hope that users will see humanitarian and environmental catastrophes with their own eyes and learn about their impact from the affected populations. Yet this choice does not translate into tangible attitudinal and behavioral effects, for example an increase in sign-ups, petitions or donations. Especially in the context of street fundraising, VR use was largely unsuccessful according to the interviewed practitioners. In their professional experience, passers-by feel uncomfortable to strap on the VR goggles and shut out their physical surroundings, as it results in leaving their personal belongings unattended during the VR experience. Furthermore, some practitioners noted that the more familiar their audience was with VR in general, the less likely they were to use the VR experience provided by the street fundraisers; and given VR's growing popularity, it was difficult to identify individuals unfamiliar and interested to try it out. Overall, applied "VR for Good" did not yield the attitudinal and behavioral change that many practitioners expected.

However, Study 2 identifies a pattern for the successful implementation of "VR for Good": controlled settings with users who have prior issue-specific interest in the contents. Examples include meetings with private, corporate and political donors, interest groups and staff trainings. In these cases, users' prior interest in the issue was relatively high, which made them more motivated to explore the matter through a VR experience. Furthermore, controlled meetings provided sufficient time and space for in-depth conversation afterwards, which according to the analysis had a positive effect on the wanted outcome. Consequently, Study 2 suggests that the success of "VR for Good" in real-life applications does not depend exclusively on the medium's technology, but on additional contextual and predispositional factors.

Moreover, Study 2 shines light onto the underlying storytelling techniques of applied "VR for Good" in the third sector. In particular, it finds that the motivations to use VR conflict with the mechanisms deployed. Whereas the motivation to use VR lies in its capacity to present events in a naturalistic and objective way, the implemented mechanisms alter the contents according to certain criteria (vividness, authenticity, relatability) while users' agency creates a uniquely subjective experience of said contents. Eventually, users experience a subjective reality, constructed through filmmakers'

decisions and their own agency. A similar observation was made by immersive journalism scholars: Aitamurto (2018) notes that journalistic values like objectivity and accuracy are compromised by the manipulation of original contents, and users' freedom of focus. Mabrook (2021) suggests the term 'journalist-induced subjectivity' for the manipulation of contents through the producer, and 'user-induced subjectivity' for the individual perception of contents through users' agency. Study 2 expands this work by suggesting that this paradoxical phenomenon is inherent to nonfiction VR storytelling in general, and proposes a two-step model of subjective reality construction that illustrates how this paradox occurs.

The hypothesized model captures two separate consecutive processes of subjective reality construction that occur when practitioners produce nonfiction VR storytelling, for example for immersive journalism, documentaries or the third sector. In a first step, the events that objectively take place on the ground are constructed into a film product according to subjective criteria of inclusion and exclusion, of editing and cutting. In a second step, when users wear the HMD to view the VR contents, the medium's spherical view inherently promotes inspection according to the individual's interests and urges, in contrast to a two-dimensional screen, where the viewer's focus is bound to the medium's four frames. Due to VR users' agency, reality is constructed into a subjective experience for a second time. As a result, the final VR experience diverges from real-life events in a two-fold way. By proposing a model that captures these processes, Study 2 adds a valuable analytical tool to the literature, which can help future scholars to study and interpret VR nonfiction storytelling across different genres.

Furthermore, Study 2 contributes to the research by shining light on the ethical challenges that practitioners face when applying "VR for Good". Specifically the experts' focus on vividness, relatability and authenticity often leads to the misrepresentation of vulnerable populations. For example, non-Western refugees are shown to engage in sport activities that are relatable to the Western user in order to induce feelings of understanding, empathy and prosociality. The result, however, is that people are deprived of their otherness, as previously argued by Nash (2017). It becomes evident that immersive fundraising faces similar challenges as its non-immersive counterpart, for example the lack of guidelines for the use of images and messages (Pleues & Stuart, 2006). Here, Study 2 offers direction for a more ethical use of "VR for Good." by highlighting practitioners' best-practice-strategies (e.g., briefing actors, not scripting interviews, seeking approval of contents after the filming and using original voice overs).

To summarize, Study 2 finds that VR has a moderate persuasive influence on users' attitudes and behaviors in real-life settings. Moreover, it illuminates the primary motives (naturalistic depiction of contents), and mechanisms (vividness, relatability, authenticity, agency) of applied "VR for Good," and suggests a new theoretical framework for its analysis that expands previous work about VR nonfiction storytelling (Bevan et al., 2019).

The results of Studies 1 and 2 point to several factors that may be important for the effectiveness of "VR for Good": virtual actors, who can mediate the reality of social, political and environmental issues directly to the VR users (Study 2); users' prior issue-specific interest (Study 2); and how easy and convenient the attitude change is for the individual (Study 1). Building on these findings, **Study 3** investigates if feeling social presence toward virtual actors is why "VR for Good" might evoke attitudinal change, and focuses specifically on a more high-cost behavior while also accounting for the moderating influence of prior attitudes.

Study 3 implements a randomized between-subjects experiment with a mixed methods approach to gain a better assessment of why and how social presence might motivate users to act prosocially after "VR for Good" treatments. For the stimulus selection, it follows related studies (e.g., Kandaurova & Lee, 2019; Ma, 2019) and uses a 360 VR video about Syrian refugees as treatment. For the social presence manipulation, it introduces a novel methodological strategy by artificially removing visible social actors from the VR contents, which isolates the variable of social presence more precisely in comparison to previous studies (e.g., Yoo & Drumwright, 2018; Ma, 2019). To increase the outcome's ecological validity, Study 3 chose a behavioral measure, namely charitable giving, and implemented a cover story based on a fictitious organization asking for donations in the post-treatment waiting room. Thus, it complements previous work (Pimentel et al., 2021) that primarily focuses on self-report measures. Moreover, to gain a more nuanced understanding of the effect of social presence, Study 3 (a) tested for a potential moderation effect of issue-specific prior attitudes and (b) collected users' behavior motivations in a post-treatment qualitative measure.

The experiment (N = 104) yielded several novel insights, both confirming but also contradicting previous research. It finds that social presence can be successfully manipulated by removing visible actors through means of editing software, hence validating the study of Pimentel et al. (2021) while also presenting a new, effective and

more affordable methodological choice for future social presence research. However, social presence does not move users to donate significantly more than no social presence; neither does users' prior attitudes about the issue. Albeit non significant, it is important to note that the trends follow the predicted direction, as users in the social presence condition donated more than users in the no social presence condition, and secondly, the more negative users' prior attitudes were, the less they donated. These results indicate that there might be other variables at play that, so far, have been overlooked. A possible explanation might lie in a difference in information processing, as the qualitative analysis of participants' responses revealed. Donors who saw actors freely recalled information about the VR contents, whereas in contrast, non-donors who did not see actors reported feeling overwhelmed by the information. Research has shown that 360-degree VR can decrease recall, recognition and focused attention (Barreda-Ángeles et al., 2020); it might be possible that the presence of actors served as visual focus, which in turn enhanced information processing and decision making.

Most importantly, Study 3 indicates that the link between social presence in VR and helping them in the form of donations is driven less by emotions and more by reason. This becomes evident in view of the lack of affective reactions in users' qualitative responses, and the rational cost/benefit reasoning of their actions. This points to an important issue in extant "VR for Good" research, namely the question whether VR users' moral judgment is rationalist or emotive. Within the literature, the prevalent framework appears to be the social intuitionist model, which explains that psychological, cultural and social influences drive decisions (Haidt, 2001); hence the idea that VR is an empathy and prosociality machine. In contrast, not much attention is being paid to the rationalist model, according to which affect serves as an input that helps the users to arrive at a final rational conclusion (Haidt, 2001). Yet surprisingly, the study's results align with the rationalist model. It is unclear how generalizable this finding is; Study 3 is the first to implement a qualitative measure to a VR-attitude experiment with a cover story, and in turn, the first to uncover how users decide to donate after "VR for Good" exposure. More mixed methods research is needed to understand how users' moral values interact with the effects of social presence on prosocial behavior.

In sum, Study 3 elucidates the causal relationship between the presence of actors in 360VR and feelings of social presence, but also points at the complexities that surround its influence on prosocial outcomes. It informs the dissertation's previous studies (a) by confirming practitioners' reports of VR's limited capacity to evoke behavioral change

(Study 2), and (b) by pointing to potential issues of validity when measuring “VR for Good” outcomes, given that in the literature, these rely predominantly on self-report measures (Study 1).

Together, the three studies of the dissertation draw a fuller picture of whether, how and why “VR for Good” may evoke social attitude and behavior change. Through the thesis’s multi-method approach, this picture is informed from several data sources: the extant literature (Study 1), practitioners’ expertise (Study 2) and VR users’ behavior and explanations (Study 3). By welding these sources together into one coherent conclusion, it outlines a detailed picture of “VR for Good” that the research lacked. When zooming into this picture, the thesis provides novel and empirical-based insights that contribute to several theoretical and conceptual frameworks within communication science, especially media richness theory, perspective-taking, subjectivity construction in nonfiction storytelling and social presence theory. In the next session, I explicate the thesis’s main contributions and how they benefit the extant literature.

7.2 Overall contributions

7.2.1 The modest effect of “VR for Good”

The combination of the thesis’s three studies suggests that the effectiveness of “VR for Good” is relatively modest. While overall, contents have a larger persuasive effect when presented in VR than in less immersive treatments (Study 1), there is little evidence that the use of VR does evoke actual attitudinal and behavioral change in real-life settings (Study 2) or when imitating such with a cover story in the laboratory (Study 3). This disenchanting conclusion stands in stark contrast to academic and popular discourses, where VR is discussed as an impactful tool for social change (Foxman et al., 2021). It is plausible that the ‘hype, and hope’ (Rose, 2018) that surrounds VR is a result of its repetitive discussion as a prosociality or empathy machine, given that familiar ideas are often perceived as popular ones (Weaver et al., 2007). Another explanation may lie in the prevalent media utopian logic of our time, in which new technologies like VR are heralded as the bearer of the positive social change that democratic institutions should be responsible for (Dickel & Schrape, 2017). Yet the dissertation’s conclusion that VR is not a prosociality machine per se does not imply that as a medium, VR has no persuasive

capacity; its modest main effect can be enhanced by situational and contextual factors that need further attention by future practitioners and scholars alike.

For practitioners specifically, the thesis provides valuable information about how to enhance VR's effectiveness in an applied setting. For example, filmmakers, producers and advertisers interested in implementing "VR for Good" would benefit from accounting for sufficient time for briefing and debriefing to enhance the wanted outcome, as Study 2 of the thesis suggests. For example, using a VR video instead of a flyer can lead to larger persuasive outcomes at a meeting with large donors; however, it will be less effective when used for street fundraising, due to limited time and resources on site. By providing practical guidelines (e.g., briefing, not scripting interviews, seeking approval of contents after the filming and using original voice overs) as outlined in Chapter 6, the dissertation also contributes to a more efficient and ethical use of VR for applied immersive awareness and fundraising.

For scholars, the dissertation's conclusion about the modest persuasive effect of VR on social attitudes and behavior paves the way for future investigations into potential influencing factors. For example, research can further explore *message* related factors that have been previously linked with attitude change: for instance, how the message is framed (Bizer et al., 2010) and whether it presents both sides of the issue (Xu & Petty, 2022). Furthermore, *source* related variables such as source credibility (Luo et al., 2013) may strengthen the medium's main effect on attitudes. Considering that audiovisual evidence can enhance the content's credibility, typically referred to as "seeing is believing" (Wittenberg et al., 2021), it might be plausible that, similarly, "being there" is believing; here, scholars can further investigate the relationship between presence, credibility and attitude change in VR. Moreover, future studies would benefit from considering how *user* related variables interact with the main effect of "VR for Good" treatments; Wallach et al. (2010), for example, examined the role of the 'big five' personality traits for VR experiences. While this thesis finds no evidence for a moderating influence of issue-specific prior attitudes in Study 3, it remains a variable worth exploring; especially because in the traditional literature, prior attitudes tend to be a strong predictor of attitude change (Ness et al., 2017). Finally, Study 2 suggests that the setting can be important for the effectiveness of "VR for Good", which means that future studies can account for variables of *context*. Altogether, scholars would benefit from using this dissertation's findings as a starting point to better understand who is susceptible to the effects of VR, and when and why.

The dissertation's conclusion that "VR for Good" has a modest effect on social attitudes and behavior benefits practitioners and researchers who are interested in VR media effects and who seek to gain a fundamental understanding of its main effects in extant research, in applied form and in the laboratory.

7.2.2 Demystifying the prosociality machine

In his introduction of a "mix of attributes" approach to media effects research, Eveland (2003) notes:

"It often seems that each new technology that comes along produces a subset of researchers who believe that this medium "changes everything." Virtual reality, these researchers might argue, requires new theories and new concepts, which then require all new research" (p.407).

As this dissertation concludes, VR is not a separate media technology with a one-size-fits-all impact. Instead, it seems to be a variation of existing audiovisual media with a distinctly highly immersive technological quality. Taking Eveland's (2003) argument into account, the dissertation proposes that scholars would benefit from studying VR not with medium-specific theories, but rather through the lens of well-established theoretical frameworks within the literature. Thus, research would circumvent "reinventing the wheel" for each investigation and reach more accurate and comparable conclusions.

Consider how most extant research relies upon the VR-specific concept of presence and its subtypes to explain effects (e.g., Ahn et al., 2016; Markowitz et al., 2018; Kim, 2019). Yet as Hartmann et al. (2015) note, presence comes with several conceptual and empirical problems that, hitherto, remain unresolved: for example, whether it is a continuous process or a phenomenon that starts and ends abruptly; its connection with emotion and interactivity; and finally, its relationship with users' automatic and reflective processing. Therefore, scholars should not exclusively focus on presence when studying VR effects, and instead, explore other theoretical frameworks that may prove to be more standardized and robust. For example, VR scholars can consider using Eveland's (2003) six media attributes (interactivity, organization, control, channel, textuality, and content) to investigate the influence of VR on social attitudes. In doing so, we can gain a better

understanding of the VR elements that produce persuasive outcomes, and add theoretical depth to the extant literature.

The dissertation argues that what is needed is a pivot from VR's popular academic understanding as a medium that mechanically produces prosocial impact (Foxman et al., 2021) to a less normative conceptualization of VR as an audiovisual medium with multiple affordances and attributes. Such a shift would help examine VR in a more standardized and comprehensive way, and consequently accelerate the progress in the field.

7.2.3 Challenges in the measurement of “for good” outcomes

By investigating “VR for Good” from three different perspectives, the dissertation contributes to the literature by pointing at a fundamental problem of internal validity: Do scholars and practitioners indeed measure attitudinal and behavioral change?

Firstly, most of the extant research assesses “for good” outcomes with measures of self-reported attitude change, as Study 1 indicates. Yet self-reported attitude change can be biased, especially toward issues with high social desirability: for example environmental protection (Vesely & Klöckner, 2020), immigration support (Denney et al., 2020) and racial bias (Stocké, 2007) –altogether topics relevant to “VR for Good” studies. It is plausible that participants in “VR for Good” research overstate their support for certain issues due to social desirability bias, potentially skewing found effects. Also, given that the prosocial impact of VR is often discussed in popular discourses (Foxman et al., 2021), it is also likely that participants sense the experimenter's expectations, which in turn, may accentuate the potential of social desirability and as a result, can yield larger effect sizes than the less immersive treatments. Self-reported attitudinal change might not be a suitable measure of “VR for Good” outcomes, which raises the question whether found effects are even indicative of how users think, feel and behave after VR exposure.

Secondly, many studies (e.g., Kandaurova & Lee, 2019; Pimentel et al., 2021), including Study 3 in the present thesis, focus primarily on donation behavior as an indicator of persuasive “VR for Good” outcomes. This may be linked to the original idea of “VR for Good” as a collaboration between industry and the third sector (Meta, n.d.). For that, some studies rely on self-reported charitable intentions and refer to the donations in non-tangible and abstract ways, for example donating hypothetical lottery winnings (Nelson et al., 2020). Others, like Martingano et al. (2022) and Study 3 of this thesis, implement behavioral measures but find no significant effect. Similarly, Study 2 shows

that in an applied setting, VR interventions do not particularly increase donation behavior. Interestingly, the qualitative responses collected in Study 3 indicate that donation behavior is influenced by factors outside of the VR treatment, such as users' altruistic tendencies or their personal financial needs. This stands in line with previous work about how subjective the value of money can be for individuals (Raghubir, 2006). This means that a low-income individual may assign larger value to a relatively small donation, whereas a high-income person might perceive a relatively large donation as mediocre or small. Given these complexities, charitable giving may not be the most valid measure of attitudinal change after a "VR for Good" experience.

Taken together, the dissertation points at a significant research gap within the literature: the limited validity of self-reported attitudinal change and donation behavior as indicators of "for good" outcomes. Thus, the question emerges what other measures of civic interest and participation might be worth investigating. Here, the study by Herrera et al. (2018) may offer an interesting starting point for alternative methodological approaches. In their work, Herrera et al. (2018) combined self-reports and donation responses with a qualitative measure, where subjects were asked to write a letter to their elected officials about the topic of the VR treatment (homelessness); a linguistic analysis of the collected responses then traced for a persuasive effect. Moreover, they looked for long-term effects by testing two, four and eight weeks after the VR intervention. Both strategies, namely the implementation of qualitative measures that align with a common measure of civic participation, and longitudinal testing, may help to better assess social change after VR exposure.

The thesis hence expands the extant literature by pointing to an important limitation, namely the question of internal validity, which future scholars can address with novel methodological choices.

7.3 Limitations

The dissertation aimed to gain a better understanding of how good "VR for Good" is in changing attitudes and behaviors toward social issues. Despite its contributions to the study of VR effects, it has several limitations that merit discussion. In this section, I elaborate on the thesis's shortcomings and highlight refinement opportunities for future research.

Firstly, the operationalization of the thesis's central variable of interest, namely attitudinal and behavioral change, is very broad. Given that "VR for Good" encompasses VR projects that aspire to create positive social impact, it is difficult to clearly define what positive social impact exactly means. To overcome this problem, (1) I chose to focus specifically on attitudinal constructs and consequently excluded educational outcomes. To narrow down the definition of attitude, (2) I followed Oskamp and Schultz (2005), who describe attitudes as "a summary of all of a person's evaluative beliefs/opinions about, affective reactions toward, and behavioral responses to an attitude object" (p. 14). To better isolate the attitudinal object, (3) I focused specifically on persons, policies, topics and events of broader social relevance (e.g., Campbell & Stanley, 1963; Haddock & Zanna, 1999), which meant the exclusion of interpersonal attitudes toward, for example, family members. Despite this process, the variable of interest remains vague as it encompasses biases, beliefs, opinions and stereotypes, all of which have distinct conceptualizations and different susceptibility to media effects. Especially for Study 1, it would have been beneficial to clearly differentiate the types of attitudinal constructs and elaborate on them separately. This would have added more nuance to the review of the literature. Future efforts may consider this challenge and refine the current operationalization of social attitudinal change.

Secondly, the thesis focuses on HMD-worn VR, but does not differentiate between fully immersive and 360-degree VR. HMD-worn VR comes with affordances like update rate, tracking level, field of view and stereoscopy and in turn evokes a standardized sense of overall presence (Cummings & Bailenson, 2015). In turn, I excluded devices which do not have these affordances, like Google-Cardboard. However, HMD-worn VR can be both 360-degree VR and fully immersive VR, which are different mediated experiences and should be investigated separately to better assess nuanced effects. Overlooked factors, such as the photorealism in 360-degree VR or interactivity in fully immersive VR, might have played an important role that the thesis did not account for. For example, the influence of social presence in Study 3 might have been larger if users could have interacted with the virtual actors in a fully immersive environment, which was not possible in the chosen 360-degree VR stimulus. Future studies should aim for a clearer definition of what VR is, and what it is not, when examining its effects.

A third shortcoming concerns the time during which the dissertation was written, namely the global pandemic of COVID-19 between March 2020 and August 2022. This context may have influenced the dissertation's findings in a twofold way. To begin with,

the expert interviews for Study 2 took place in a time where people relied on digital technologies to maintain a positive professional and private life on an unprecedented level. This sudden dependence on digital media technologies might have impacted how experts evaluate virtual technologies such as VR, potentially highlighting its positive sides more than in a different historical context. In addition, Study 3 was conducted between lockdowns, with local health centers still facing rising infection numbers. This means that study participants partook despite potential health risks (e.g., exposure to COVID-19 in public transport when visiting the University premises), which implies a certain intrinsic motivation. Possible motivations might be strong interest to use VR technology, or heightened interest in the advertised monetary compensation. Both factors may have distorted found effects on donation behavior. Future studies should replicate the current research under different conditions, to avoid potential sampling shortcomings.

Furthermore, it is important to discuss that the dissertation predominantly focuses on the concepts of presence and social presence following Lee (2004), which disregards other content-related variables, like narrative engagement (e.g., liking the main characters) or cognitive involvement (e.g., focused attention). Yet such factors may play an essential role in attitudinal change. Bowman (2019) conceptualizes these factors as demands: cognitive, social, emotional and physical demands that vary in complexity depending on the user and the mediated environment. In a later study, Bowman et al. (2021) found that the more emotionally demanding the VR contents, the higher the feeling of social presence. It is therefore plausible that the operationalization of social presence as the perception of virtual others as real and sentient (Bailenson et al., 2003) in Study 3 did not suffice to explain the underlying emotional and social demands necessary to engage in prosocial behavior. Future research should explore VR effects that go beyond presence and its subcategories. Here, the interactivity-as-demand model (Bowman et al., 2021) can provide a helpful framework to guide such efforts.

Finally, a word needs to be said about the thesis's multi-method approach. To answer the overarching question, *How effective is VR in producing positive effects on social attitudes and behavior?* the dissertation poses three separate research questions of correlation, quality and causation so as to provide better informed conclusions. Each question was matched with an appropriate research method, namely a meta-analysis with systematic review for the question of correlation, standardized open-ended expert interviews for the question of quality and a mixed methods behavioral experiment for the question of causation (for the strengths and limitations of each methodology, please refer

to Chapter 3.1). While a multi-method approach may benefit the doctoral projects by capturing the phenomenon of interest in a more holistic way (Jogulu & Pansiri, 2011), it also comes with shortcomings. Multi-method approaches can drive the doctoral researcher to distribute the limited time across a variety of research designs, components and skills, thus hampering sophistication and innovation (Ahmed & Sil, 2012). Opting for a single-method approach instead would have helped the researcher to pay focused attention on one particular method and in turn, delve deeper into specific research components (Ahmed & Sil, 2012). This means that the implementation of three different methodologies comes with a trade-off between the breadth and depth of the gained data. While the thesis's multi-method approach helped to provide a fuller picture of the effectiveness of "VR for Good," more single-method research is needed to uncover the nuances underlying this picture.

Despite its shortcomings, the dissertation offers a valuable overview of "VR for Good" and lays fertile ground for more redefined and nuanced research about the ways in which VR technology affects how we think and behave towards topics of broader social significance.

8 Conclusion

The dissertation aims to dissect the effectiveness of “VR for Good” by investigating if, how and why it influences social attitudes and behavior. In three separate research articles, it (1) provides an important systematic meta-analytic overview of the literature and found effects; (2) garners novel insights about the motives, mechanisms and outcomes of applied immersive awareness and fundraising; and (3) reveals the complexities of VR-induced behavioral change. Overall, the dissertation finds that VR is not a prosociality machine per se, and points to the importance of content-related, contextual and predispositional variables, such as design choices, filmmakers’ motivations and users’ interpretations. In conclusion, the thesis suggests that the academic and popular discourses need to pivot from its current assumption that VR is a machine for prosocial impact (Foxman et al., 2021). Instead, scholars, technologists and policy-makers would benefit from conceiving VR as a variation of existing audiovisual media, whose ‘good’ effect may vary across users and contexts.

8.1 Future directions: What about the future of “VR for Good”?

Throughout this dissertation project, I have suggested that VR can be an effective tool for social attitude and behavioral change, but that there is no one-size-fits-all approach to how such an effect will occur. How good “VR for Good” is seems to depend on a multitude of hitherto unexplored external factors, some of which this dissertation has pointed to: message, context and users’ predispositions. These dimensions should be further investigated empirically and discussed theoretically by future scholars and technologists. Yet for that to happen, the literature needs to re-conceptualize its current understanding of “VR for Good.”

Up until now, nearly all of the published research that has explored “VR for Good,” (including the present thesis) has focused on a somewhat specific definition of ‘good’: a ‘good’ that encompasses primarily progressive social attitudes (e.g., minority rights) and serves conventionally good moral intentions (e.g., charitable behavior). However, looking back at the tradition of media effects studies, the nature of ‘good’ attitudinal outcomes varies (Borchers, 2013). For example, from a conservative perspective, ‘good’ attitudinal change can be understood as the strengthening of

conservative social attitudes. From an unethical stance, ‘good’ attitudinal change may be deception. What constitutes a ‘good’ attitudinal outcome is inherently tied to factors such as political ideology and morality, both of which can determine the medium’s message, the context in which it is viewed as well as its final recipient.

Looking at current predictions for the future of VR, it seems plausible that ideology and morality will have a front-row seat. This is because VR software and hardware will continue to become increasingly more affordable and easy to use (Economist, 2020), which in turn, may lead to a surge in the actors interested in VR and their interpretations of its use “for good.” Therefore, it is unlikely that “VR for Good” will remain an idea reserved exclusively for progressivism and good moral intentions, but rather expand across the political and ethical spectrum; and with it, its messages, contexts and recipients.

Thus, in closing, I argue that the question: *What about the future of “VR for Good?”* will revolve around two research directions: the conceptual expansion of ‘for good’ across the political and ethical spectrum. For each direction, I outline its relevance for communication science as well as the broader public. In doing so, I hope to offer a foundation for future VR scholars, practitioners and policymakers who are concerned with the technology’s opportunities, and challenges.

8.1.1 First direction: The expansion of “for good” across the political spectrum

Within the literature on VR and attitudinal change, the focus seems to tilt toward attitudes at the progressive end of the political spectrum. As Study 1 of the dissertation indicates, current research is interested in attitudinal objects like the rights of minorities, environmentalism, and altogether, the benefit of social change. These variables are commonly classified as progressive social attitudes (Kerlinger, 1984). In contrast, conservative social attitudes are rarely examined as dependent variables in the literature. Such variables would be attitudes toward the sanctity of private property, the importance of tradition and overall, the value of social stability (Kerlinger, 1984). Exploring this research gap in the future may yield several theoretical, methodological and practical benefits, as explained below.

To begin with, by investigating how VR experiences impact conservative social attitudes we can better evaluate our knowledge of VR effects in general. For instance, recall one of the main findings of the dissertation: VR treatments have a significant effect

on social attitudes in comparison to less immersive media treatments (Study 1). This finding, however, draws upon a synthesis of extant studies which focus primarily on progressive social attitude change. If the attitudinal effect is indeed causally related to the treatment's immersive modality, scholars should be able to trace a similar effect on all social attitudes, regardless of their political nature (progressive - conservative). For example, a video about the importance of traditional family structures should have a larger positive effect on conservative attitudes when shown in VR than on a tablet. Yet, to date, the research on this topic has not been established. Investigating conservative social attitude change would hence help clarify whether attitudinal effects are linked to VR's immersive modality, or other dimensions.

If there are variations in how VR influences conservative and progressive attitudes, communication science provides several well-established theoretical frameworks about the role of message, context and recipient to explain possible differences. Such are confirmation bias, the propensity to favor attitude-congruent information over attitude-incongruent information (Nickerson, 1998) and motivated reasoning, people's tendency for post-hoc reasoning to "to arrive at conclusions that they want to arrive" (Kunda, 1990, p. 480). By expanding the definition of "for good" effects across the political spectrum, scholars can connect traditional theories with novel media technologies so as to gain rich and nuanced insights about user susceptibility to VR effects.

Furthermore, understanding how VR experiences affect social attitudes across the political spectrum can yield valuable practical insights for polarization reduction work. Consider VR's unique capacity to provide perspective-taking experiences which help users understand the point of view of their political opponents (e.g., Hasler et al., 2017). Across studies, viewers' attitudes toward the "other" group tend to become more positive after seeing the world through their eyes, as Study 1 of the thesis finds. Anti-polarization organizations and educators can harvest this attribute to help progressives and conservatives alike visualize the 'other side' of an issue in a more tangible way, and potentially become more inclined to act prosocially. Effects may be stronger if the results of Study 2 of the thesis are considered, namely an undisturbed setting that prevents interruption, sufficient time for conversation and users' prior interest to engage with the topic.

8.1.2 Second direction: The expansion of “for good” across the ethical spectrum

Whether aiming for progressive or conservative attitudinal change, in both cases “VR for Good” conceptually remains a generally positive and ethical idea in which VR usage can contribute to society, albeit from different sides of the political spectrum. But the history of media is also a history of unethical media usage: books were used to spread both knowledge *and* propaganda; audiovisual media were used both to inform *and* to disinform (Soules, 2015; Jowett & O’Donnell, 2018). As tools of communication, media can be used for ethical and unethical communication purposes, and VR may face a similar path in the future.

What is ethical? Ethics can be understood as “prescriptive judgments of justice, rights, and welfare pertaining to how people ought to relate to each other” (Turiel, 1983, p. 3). What is right and wrong within a society may vary across cultural and historical context, but certain issues reappear in most cultures: fairness and injustice, wellbeing and suffering (Wainryb, 2006). Using media technology to deceive or to induce harm can be generally considered unethical. The individual’s morality, however, is further shaped by factors that go beyond society’s code of ethics; for example, neurobiological predisposition (Raine & Yang, 2006), childhood upbringing (Dahl & Killen, 2018) and ideology (Hatemi et al., 2019). What is morally ‘for good’ or not may therefore lie in the eye of the beholder, and so might “VR for Good.”

Here, communication research is well equipped to prophylactically investigate potential unethical uses of VR media technology. Examples are propaganda, deception, disinformation, and in general, user manipulation. Already some scholars have set out to explore whether VR contents appear credible (Kang et al., 2018) and trustworthy (Seymour et al., 2018). Moreover, efforts are being made to map future challenges and public policy recommendations regarding VR; for instance, mental health risks, escapism, privacy and manipulation concerns (Spiegel, 2018). Slater et al. (2020) also explicated the potentially harmful effects of VR’s superrealism, privacy and data issues, as well as psychological and social implications. These concerns are important, but they are discussed primarily in regard to VR gaming. Yet as a recent study showed, VR can serve as an effective tool for voter persuasion (Weber, 2022). Future scholars should not underestimate VR as a potential audiovisual tool for political communication and should investigate how it might be weaponized for unethical persuasive purposes.

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11 Abstract

Over the past two decades, the idea that Virtual Reality (VR) media technology can evoke prosocial impact has gained attention and enthusiasm within scholarly and public discourses; an idea commonly referred to as “VR for Good.” To test this conjecture, communication scientists are increasingly investigating the relationship between VR exposure and attitude change toward civic, political and environmental issues. To contribute to this strand of research, this cumulative dissertation is the first to draw upon multiple data sources to systematically investigate whether, how and why “VR for Good” might be effective in changing social attitudes and behavior. Methodologically, it consists of three empirical studies, namely a systematic review with meta-analysis, expert interviews and a mixed methods experiment. Together, the studies indicate that VR treatments have a modest effect on social attitudes due to the medium’s immersive modality, but at the same time, it has no ‘one-size-fits-all’ prosocial impact. On the contrary, the effectiveness of “VR for Good” can be enhanced or suppressed by factors that lie beyond the technology’s control, such as contextual and predispositional dimensions. In particular, the dissertation points at the importance of content-related, contextual and predispositional variables, such as design choices, VR filmmakers’ motivations and users’ interpretation for produced attitudinal change. So, overall, the dissertation concludes that VR is not a prosociality machine per se. Thus, future scholars would benefit from studying its attitudinal effects not through a normative, but rather a standardized lens.

12 Zusammenfassung

In den letzten zwei Jahrzehnten hat die Idee, dass Virtual Reality (VR) als Medientechnologie eine prosoziale Wirkung in User*Innen hervorrufen kann, Aufmerksamkeit und Begeisterung in wissenschaftlichen und öffentlichen Diskursen erlangt; eine Idee, die weithin als „VR for Good“ bezeichnet wird. Um diese Vermutung zu überprüfen, untersuchen Kommunikationswissenschaftler*Innen zunehmend die Beziehung zwischen VR-Erfahrungen und Einstellungsänderungen gegenüber sozialen, politischen und ökologischen Themen. Als Beitrag zu diesem Forschungsstrang greift diese kumulative Dissertation erstmals auf mehrere Datenquellen zurück, um systematisch zu untersuchen, ob, wie und warum „VR for Good“ bei der Veränderung sozialer Einstellungen und Verhaltensweisen wirksam sein könnte. Das Dissertationsprojekt besteht aus drei empirischen Studien, nämlich erstens, einer systematischen Übersicht und Metaanalyse der Literatur, zweitens, qualitative Interviews mit Expert*Innen aus dem Bereich „VR for Good“, und drittens, einem Mixed-Methods-Experiment. Zusammengefasst weisen die Studien darauf hin, dass VR-Erfahrungen aufgrund der immersiven Modalität des Mediums einen moderaten Effekt auf soziale Einstellungen haben, aber auch, dass VR keine allgemeingültige prosoziale Wirkung besitzt. Im Gegenteil, die Wirksamkeit von „VR for Good“ kann durch Faktoren verstärkt oder unterdrückt werden, die außerhalb der Kontrolle der Technologie liegen. Insbesondere weist die Dissertation auf die Rolle von inhaltsbezogenen, kontextuellen und prädispositionellen Variablen hin, wie etwa Designentscheidungen, Motivationen von VR Filmemacher*Innen und der Interpretationen der User*Innen. Insgesamt liefert die Dissertation empirische Belege dafür, dass die Beziehung zwischen VR und Einstellungsänderung sowohl innerhalb als auch außerhalb des Labors kompliziert ist. Sie stellt somit die Annahme in Frage, dass VR per se ein Instrument für gesellschaftlichen Wandel ist, und schließt sich dem Aufruf an, seine Effekte von einem nicht normativen Standpunkt aus zu erforschen, zu testen und zu erklären.