What Do We Mean When We Say "Presence"?

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Abstract

Characterizations of presence are many and various. The first part of this article applies philosophical and psychological lenses to three common descriptions: Presence as (or as following from) "the suspension of disbelief", presence as the "illusion of nonmediation", and presence as "(the feeling of) being there". These construals of presence—the assumptions and commitments they make—are compared with one another; their plausibility and utility appraised. The second, shorter part of the article is not so much interested in definitions as distinctions that may help us ask better questions moving forwards. We briefly consider the role of attention in presence, whether, when, or how presence is "binary", and whether it is helpful to speak of presence in unmediated physical reality. A recurring theme throughout the article is whether a given understanding of presence (mis)construes the mind as monolithic: That is, as uniformly rational and consciously accessible. In closing, we suggest that researchers specify precisely

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what type of presence they're referring to whenever the concept is evoked, and that states such as involvement, absorption, and engagement (etc.) be kept conceptually separate from presence, since they speak to "higher" cognitive functioning than simply feeling self-located in virtual environments, and indeed need not presuppose placeness or spatiality at all.

1. Introduction

In 2022, *PRESENCE* marks its 30th anniversary as a home for research into, and discussion about, virtual reality (VR) and its users. Much has been written about what it is like to experience VR, with a particular focus on the phenomenon of presence, which is most commonly conceived as an illusory sense of being located in a place other than one's actual, physical environment. In this article, we apply philosophical and psychological lenses to three perennially popular descriptions or definitions of presence: (1) "[T]he suspension of disbelief" (Coleridge, 1817 cf. Walton 1980; Murray, 1997/2016; 2012; Carroll et al., 2011), (2) the "illusion of nonmediation" (Lombard & Ditton, 1997; ISPR, 2000), and (3) the feeling of "being there" (Minsky, 1980; Heeter, 1992; Clark, 2001; IJsselsteijn & Riva, 2003). We address what is implicit in each of these construals of presence, weighing them against one another as well as considering each in relation to attention, whether presence is implied to be automatic and/or binary, and whether a given description mischaracterizes the mind as monolithic. In the end, we do not seek to redefine or introduce a new conception of presence (per the advice of Lombard & Jones, 2015). We do, however, identify ideas associated with the study of presence that seem to us useful, and others that seem less so. Researchers must be aware that constructs like attention and belief may span or transcend any division we might posit—or fail to posit—between penetrable thoughts and experiences on the one hand, and subpersonal (that is, *not consciously*

accessible) perceptual processes, cognitions, and feelings on the other. We suggest that like the mind itself, the nebulous mental state known as presence has aspects that cannot be probed or shaped by the will and, separately, aspects that can. Accordingly, in line with others' observations and recommendations (e.g., Skarbez et al., 2017; Hartmann & Hofer, 2022), we suggest that the specific experience of *spatial* presence or place illusion in VR—a primarily if not purely perceptual illusion—is broadly insulated from "higher" factors like (un)enjoyment or appraisals as to a virtual environment's (im)plausibility. In other words, things that can helpfully be considered presence can be distinguished from things that are separable from it—for instance, engagement (Brown & Cairns, 2004; Schoenau-Fog, 2011), absorption (Agarwal & Karahanna, 2000), involvement (Vorderer 1993; Klimmt & Vorderer 2003; Calleja, 2011), engrossment (Brown & Cairns, 2004; Wilcox-Netepczuk, 2013), enjoyment (Vorderer & Hartmann, 2009), immersion (Murray, 1997/2016; Brown & Cairns, 2004; Ermi & Mäyrä, 2005; Calleja, 2011; 2014), or flow (Csíkszentmihályi, 1990)—along the lines of what is off-limits versus what is susceptible to conscious influence. It's possible to be deliberately disinterested in a VR environment, but it's harder (if not impossible) to wilfully cease to feel as if one's physical body is in some sense located there. As a matter of course, we suggest that researchers specify precisely what definition or subtype of presence they subscribe to whenever the concept is applied. This is perhaps especially relevant when choosing an instrument or instruments to measure presence—different measures presuppose different definitions.

2. Unpacking presence

Presence is perhaps the defining feature of VR experiences: This journal did not acquire its name by accident. More than any other representational technology, VR enables its users to experience

a different "reality"—real or imagined; past, present, or future. That said, there remains widespread disagreement and confusion as to the exact meaning of the term "presence".[1] In a recent survey, Skarbez, Brooks, and Whitton (2017) catalog the various usages and definitions of presence, identifying the two prevailing meanings as "being there" and "nonmediation". In the former, the defining characteristic of presence is that one feels as if one is inside the environment depicted via the VR system. In the latter, a defining characteristic is that one fails to consciously acknowledge the mediating technology as part of the experience (see also ISPR, 2000). There are other definitions of presence that do not cleanly map to either of these categories, including a "psychological focus on direct perceptual processing" (Waterworth & Waterworth, 2001), "an illusory (false) perception that the simulator is the simulated" (Stoffregen et al., 2003), "a psychological state in which virtual…objects are experienced as real objects in either sensory or non-sensory ways" (Lee, 2004), and "the sense of feeling real" (Parola, Johnson, & West, 2016). We itemize these definitions (and ignore others) not with the goal of arguing for One True Definition of Presence. Rather, we explore them to show how different definitions of presence—which rely on varying and often unstated assumptions—give rise to different questions and issues concerning how we conceive of cognition and the embodied mind, several of which we unpack in the following sections. Let's begin, then, with the concept of (dis)belief, and whether or how its "suspension" might produce or be seen as tantamount to presence experiences.

2.1. Belief and the suspension of disbelief

[1] For an essay addressing the problematic proliferation or subdivision of presence concepts, see Lombard & Jones, 2015. For an example of how even presence scholars can become so muddled by presence-adjacent concepts that keywords are mis-defined in the opening sentences of an article that's meant to offer clarification, see Berkman & Akan, 2019.

The idea that spatial presence could be related to a "suspension of disbelief" was prominent in early presence research. This is stated perhaps most clearly by Slater and Usoh, who entertain that presence may entail a VR user's "(suspension of dis-)belief that they are in a world other than where their real bodies are located" (Slater & Usoh, 1993a, p. 1), and the possibility that presence "involves the commitment of the person's entire neurology to the 'suspension of disbelief' that they are 'somewhere else'[,] rather than where their…body really is" (Slater & Usoh, 1993b, pp. 95–96).[2] Of course, the phrase "willing suspension of disbelief" predates VR by almost two centuries, and is first used by Samuel Taylor Coleridge (1817/1984, p. 216), who muses that readers must suspend disbelief when engaging with his lyrical, quasi-narrative poetry. Aesthetician Kendall Walton (1980) has since argued in relation to audiovisual fictions that the suspension of disbelief cannot satisfactorily characterize audiences' relationships with films or film-worlds, since on his understanding of "belief", *truly believing* that a locomotive is about to burst through a movie screen would elicit fully-fledged, lifelike motor programs such as diving out of the way. (The urban legend that viewers did indeed do this at the premiere of the Lumière brothers' *L'arrivée d'un train en gare de La Ciotat* (1896) is roundly regarded as apocryphal. See Bolter, Engberg, & MacIntyre, 2021.) More recently, digital narrative researcher Janet Murray (1997/2016; 2012) has written that presence in VR does not so much hinge on the *suspension* of *dis*belief as the *active creation* of belief.[3] Murray's view, which inverts Coleridge's formulation, questionably presupposes that presence is a state that can or must be consciously worked towards and effortfully achieved, as opposed to one that is automatically "bootstrapped" when a

[2] Slater has written extensively on the concept of presence over the course of his distinguished career, and later writings have not referred to the suspension of disbelief. See Slater, 2009 for his most recent extensive treatment of the topic, or Slater, 2018 for a brief overview.

[3] Murray uses the term *immersion*—not presence—to describe feeling present in a virtual environment. This usage predominates outside the VR literature (e.g., in game studies), while many "native" VR researchers prefer to reserve the term immersion to describe the technological capabilities of a VR system. This confusion has been addressed by Lombard et al. (2000) and Skarbez, Brooks, & Whitton (2017).

representation is sufficiently rich in spatial cues to sustain illusions of being navigable or "real" (Wirth et al., 2007; Hartmann et al., 2015; Hartmann & Hofer, 2022). Thus, while it's possible that none of the above-mentioned authors would say that suspending disbelief or actively creating belief is identical with presence, all would agree that an absence of scepticism towards a mediated environment is conducive if not prerequisite to imagining, perceiving, or experiencing it as real or persuasive.

Inspired by the enduring legacy of "the suspension of disbelief", we briefly consider the following questions: What *is* belief in relation to presence in VR? When or in what ways is "belief" at the perceptual level productive of belief at the propositional level? Is presence in VR willingly, deliberately, or actively sought and obtained? And do our answers to these questions tally with facts about the mind? A sensible entry point to this discussion is via the forecited Waltonian position.

For Walton, as for the International Society of Presence Research (ISPR, 2000), having an emotional reaction to fiction is a kind of presence experience. It's reckoned that in order to have a tearful response to the tragic fate of Anna Karenina or an awed reaction to the deductive finesse of Sherlock Holmes, readers or viewers must *believe* that those people are or were real despite consciously and rationally *knowing* that they never lived. Philosophers call this the "paradox of fiction" (Radford and Weston, 1975; Eco, 2011). Noël Carroll (1990) similarly describes our tendency to shriek at—but not to physically flee from—movie monsters as a "paradox of the heart". In both cases, the putative paradox is that we react to virtual and/or fictional entities *as if* real despite knowing—and, if asked, *believing*—that they are not. The paradox is easily resolved by acknowledging that conscious and rational beliefs are not necessary for affective or emotional reactions, especially to fictional or virtual events or environments. By

way of example, it can be shown how low-level cognitions and feelings produced by the impenetrable operations of perceptual and emotional systems should not be confused with propositional beliefs or "beliefs proper"—that is, informed, conscious, and rational attitudes about states of affairs in the world. Let's consider the differences.

When I stand at the edge of a precipice in VR, as in the famous pit demo (Meehan, 2001; Blascovich & Bailenson, 2011) or *Richie's Plank Experience* (Toast Ltd., 2016), my visual system tells me that I am dangerously close to a sheer drop, as inferred from the VR's provision of rich and lifelike spatial information. I may sweat, shake, and swear at the apparent prospect of falling fifty stories onto the street below despite consciously and rationally *knowing*—indeed, believing—that I am safely stood just an inch off the floor in a VR lab somewhere. Here, belief proper is clearly not necessary to induce a sense of presence in VR, since my belief—that is, my conscious, rational, accessible knowledge—that I am *not* at risk of dying is insufficient to attenuate my autonomic response to the illusory threat. Perception (here, primarily vision) trumps belief proper, with the illusory depth cues of VR effortlessly activating the "quick and dirty processing pathway" (Carroll et al., 2011 paraphrasing LeDoux, 1998, p. 164) that excites my fearful reaction. This reaction, which happens automatically and is relatively immune to the influence of cognition, can be extremely hard to quiet. The amygdala is activated directly, and the kinds of "reality status evaluation" (Qian, 2000; Grodal, 2009) that might otherwise allow me to apply the cool, tempering influence of rationality (and hence let me feel less fearful of the illusory danger) are circumvented by the urgency of my innate survival instincts—in this case, avoiding falling (E. J. Gibson & Walk, 1960; J. J. Gibson, 1979). It goes without saying that such an experience implies spatial presence in VR: I feel scared *because* parts of my subpersonal mind are telling me that "I'm standing on a precipice", and the fact that I do indeed feel scared

will likely further reinforce my sense of being "there". No suspension or active creation of attitudes is necessary to experience presence in VR so-described, which in this case is concomitant with my reacting to features of the environment as if they were physical. I do not need to willingly or effortfully suspend *dis*belief, since the "bottom-up", brute perceptual representation is more than sufficient to dupe the parts of my perceptual and nervous systems that are anterior to belief proper.

This example hints at how scholars have moved beyond the paradox of fiction as applied to audiovisual media like film or VR (see Frome, 2006; Carroll et al., 2011; van de Mosselaer, 2018; Tavinor, 2021). Jonathan Frome points out that "[s]ince reality-status is a global appraisal, we cannot speak of local [perceptual] subsystems appraising things as real or not" (Frome, 2006, p. 15). In other words, belief as to whether or not something is "real" cannot be helpfully conceived as happening in vision or audition alone or in combination. Carroll and colleagues similarly conclude that "[e]motions are…non-cognitive appraisals that provoke physiological changes and behavioral tendencies. Emotions do not require beliefs...in order to explode[,] so the paradox [of fiction] dissolves" (Carroll et al., 2011, p. 39). From here we can suggest that while spatial presence is not itself an emotion, it may well be a different type of "non-cognitive appraisal" or "cognitive feeling" (Schubert, 2009) that is, under certain conditions, just as inalterable as our body-based reactions to apparent dangers like falling through a glass-bottomed bridge or being attacked by captive predators at a zoo (Gendler, 2008; 2019). Further identifying what kind(s) of "belief" emerge bottom-up, from perception, and separating it or them from higher, more consciously accessible kinds of belief lets us further show that the willing suspension of disbelief is not a necessary, credible, or explanatorily powerful component of presence experiences in VR.

Werner Wirth and colleagues (2007) present a fine-grained process model of the formation of spatial presence experiences. Their two-step account integrates both media factors (e.g., a technology's "immersive" features) and user factors (i.e., trait and state variables). Crucially, the model acknowledges that we do not have direct access to the virtual environments in which we may or may not feel present, but rather *mentally model* environments based on the range and fidelity of spatial cues and/or information provided by the system. It is therefore our continuously updated mental models of both physical and virtual environments in which we feel present—we've simply become accustomed to speaking, behaving, and theorizing as if we have direct, unfettered, and infallible access to physical and virtual reality. (See Biocca, 2002; 2003, Schubert & Crusius, 2002. See also ISPR, 2000, §2, which states that "[a]ll experience of the physical world is mediated by the human senses and complex perceptual processes".) Media that are low in immersiveness, such as photographs, place the "work" of constructing a "spatial situation model" on the user or viewer. Photographs provide static, monoscopic perspectives on spatial scenes, so viewers engage in (largely unconscious) mental modelling to extrapolate what is out of frame, or what the depicted space might look like from another angle. Highly immersive media like modern-day VR systems, meanwhile, do all the work of updating the representation for us, so our spatial mental model of the virtual environment is rarely at odds with our exploratory perceptual behaviors. Wirth et al. hold that once a media user has constructed a sufficiently detailed spatial situation model (which may take mere fractions of a second in VR), the model is subject to automatic and unconscious "perceptual hypothesis tests" (Bruner & Postman, 1949) which determine whether the environment captured in and by the mental model is consistent, stable, and hence convincing enough to be taken as one's "primary egocentric

reference frame" (Riecke & Heyde, 2002)—that is, one's environment. Let's quickly illustrate how this happens by way of a thought experiment-like vignette.

Imagine donning a VR headset and a pair of noise-cancelling headphones. Instead of perceiving a virtual environment as you normally would, you encounter a totally grey, "Ganzfeld"-like visual field: The kind of null stimulus deployed in sensory deprivation experiments. Wherever you attempt to look, you see uniform nothingness—no spatial information whatsoever. You also hear nothing. Ignoring for the meantime your other perceptual abilities (such as proprioception, a.k.a. kinesthesia), you cannot mentally model your environment: There is nothing to model. You cannot feel present in the representation since there is no "there" in which you might experience the feeling of *being*. Now imagine that gradually, you start to discern faint shapes; features; details, as if a heavy fog were very slowly lifting. Perhaps it's just a hazy horizon line at first—something to differentiate ground from sky. Before you know it (and without intending it), you notice that the "fog" has cleared enough for you to be able to perceive a distinct spatial layout, and you suddenly feel as if the virtual environment is where you *are*. Of course, as with any mediated spatial presence experience, you still *know* that you're not really "there", since the "there" isn't a physical place. But nevertheless, on Wirth et al.'s view, what has happened is that your mental model—your spatial situation model of the VR environment—reached a threshold where it became sufficiently rich in spatial information to pass an unconscious and automatic perceptual hypothesis test ("*Is this where I am? It must be.*"), thereby being accepted as your primary reference frame for egocentric perception and action.

Yet a mental model of a virtual environment that has passed an automatic and unconscious perceptual hypothesis test is no more constitutive of "belief" than is our sense that the Sun encircles the Earth: We're well aware that looks can be deceiving. Contrary to the old adage,

then, seeing is not believing. And belief—or the suspension of *dis*belief—is not a necessary dimension of presence in VR. Seeing can be supportive of believing, but belief is not undergirded by perception alone: Knowledge is the superordinate, determining factor. One can *feel* on a subpersonal, sensorimotor level as though a virtual environment is conducive to acting (Waterworth & Riva, 2014; Damasio, 1999), and one may relish acting and feeling present in VR despite *knowing*, at the back of one's mind, that one is not corporeally "there". The mere perception of affordances (J. J. Gibson, 1979; Norman, 1988/2013)—particularly negative affordances like falling or being mauled (Grabarczyk & Pokropski, 2016; Murphy, 2017; 2021; Tavinor, 2021)—may galvanize the sense of presence in VR, ensuring that users prioritize realistic survival behaviors over actively doubting the virtual representation, "just in case". But suspending disbelief—or, following Murray, *creating* belief—is practically irrelevant to experiences of spatial presence in VR. Imagination is surely central to feeling present in the environments elegantly rendered by verbal alchemists like Coleridge, and imagining oneself as, say, an astronaut may enhance one's enjoyment of a VR simulation that depicts such a scenario. But as far as visual perception and spatial reference frames are concerned, VR takes care of the imaginative, effortful part for us.

To summarise this section, the suspension of disbelief and/or the active creation of belief are neither synonymous with presence nor prerequisite to feeling self-located in the environments depicted via contemporary VR systems. Suspending disbelief or actively imagining oneself in a literary or filmed environment may be conducive to those representations' sense of reality, and suspending critical judgments surely supports enjoyment or involvement in VR. But one cannot,

it seems, deploy one's intellect to make 6DoF[4] ("room-scale"), stereoscopic representations of space seem any less space-like.

2.2. The illusion of nonmediation

Our second recurring definition of presence is that it is, or involves, the (or an) illusion of nonmediation. To our knowledge, Lombard and Ditton (1997) were the first to apply the phrase, noting that presence's many manifestations can be united under the banner of the/a "perceptual illusion of nonmediation" (Lombard & Ditton, 1997, *passim*). This is also a key component of presence as defined by the International Society for Presence Research (ISPR, 2000). According to their broad but long-standing concept explication statement, presence is

> "a psychological state or subjective perception in which even though part or all of an individual's current experience is generated by…human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience. Except in the most extreme cases, the individual can indicate correctly that [they are] using the technology, but at *some level* and to *some degree*, [their] perceptions overlook that knowledge[,] and objects, events, entities, and environments are perceived as if the technology was not involved in the experience."
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> (ISPR, 2000, §1 – emphases original)

One way to unpack this precise yet permissive definition is to ask: Under what conditions is it possible to experience illusions of nonmediation in audiovisual forms that are less immersive than modern-day VR systems (e.g., film, TV, etc.), and does the quality of experience differ in kind, or only in degree? There are many imaginal media, each with strengths and weaknesses in

[4] Six degrees of combined rotational and translational freedom.

their ability to depict a consistent and convincing world. However, they all share one vital characteristic: The worlds they depict—let's flatten the landscape by calling them all "virtual" worlds[5]—are perceived in tandem with unmediated reality. We'll soon see that this claim extends to VR, too, but first let's concentrate on the "virtual" worlds represented in and by older, less immersive media.

One experiences the Shire not just as a place of low, rolling hills between the River Brandywine and the Far Downs, but as words and illustrations on the pages of a book held in one's hands. One experiences Tatooine not only as a desert planet orbiting twin suns, but as a moving image on a projection screen in a darkened theater. In any such media, the perceptual illusion of nonmediation is not possible in a sustained, robust way due to the lack of sensory immersion (isolation) and the absence of positional (i.e., perspectival or head-)tracking underscoring the "dual" nature of the experience. The illusion of nonmediation *is in some sense still possible* in film- or TV-viewing, but is hard to engender and is all too easily dissipated. One may, from time to time, experience a cinema screen or an AI chatbot as "a large open window" or "a social entity" respectively, as suggested by Lombard and Ditton (1997). But in the end, one cannot escape medium-as-medium, artwork-as-artefact (Tan, 1996; Frome, 2006), or one's own "media awareness" (Hartmann & Hofer, 2022).[6] This argument, however, demands a distinction between perceptual and cognitive illusions, and a brief acknowledgment of how they may interact in presence experiences cued by flat screen and other non-VR media.

[5] Here, we use the term "virtual" not in its ontological capacity, but in the dictionary-definitional sense of "almost or nearly as described, but not completely".

[6] Incidentally, by suggesting that conversations with chatbots hinge on *perceptual* illusions of non-mediation, Lombard and Ditton contravene their own definition: Perceiving disembodied AI agents as humanlike is rather a cognitive illusion. This will become clearer momentarily.

Richard Gregory (1966) suggests that perceptual illusions are best typified by optical illusions. Mirages caused by "heat haze", stereograms, or stereoscopic media like the *View-Master* all leverage "raw" physiological optics. Cognitive illusions, meanwhile, primarily exploit top-down heuristics and/or conceptual knowledge. An example is the size-weight illusion: "[A] *smaller* object feels heavier than a *larger* object of the same weight" (Gregory, 1966, p. 197 – italics original; Kentridge, 2014). This is because life teaches us to *expect* larger objects to weigh more than smaller ones: We're "surprised" by the heft of smaller object, and tend to overestimate its weight accordingly. Despite that the size–weight illusion also involves a multimodal perceptual element, duping vision and proprioception or kinaesthesia alike (the object's mass "pushes" against one's joints, tendons, and musculature), the size-weight illusion is predominantly cognitive; not perceptual.

Now; when I read *The Hobbit*, my cerebral activity of world-building, prompted by words on the page and maybe maps in the book's front matter, is foremost a cognitive activity. My attention and other cognitive resources (working memory, etc.) are dedicated to juggling facts about, and fleshing out mental images of, characters, locations, events, and so on. Accordingly, I may "forget" that I am sat in a room reading a book, and thus experience a fragile and fleeting sense of presence in Bilbo Baggins' home—likely an epiphenomenal by-product of not having the attentional inclination or resources left over to perform perceptual or cognitive acts that would otherwise undermine my imaginative presence. (For example, attending to a ticking clock, the sound of birdsong, or self-reflection/mind-wandering. See Vaage, 2009; Hanich, 2019.) Any sense of presence I experience in Tolkien's Shire (cf. its depiction in film) is therefore a *cognitive* illusion that is minimally contingent upon (A) attention, (B) trait absorption, and (C) my ability to conjure up vivid mental imagery (Wirth et al., 2007). It is also a somewhat effortful

activity, as with Murray's aforementioned "active creation of belief". But interestingly, presence experiences in written fiction are explicitly excluded by Lombard and Ditton's definition of presence as the *perceptual* illusion of nonmediation, yet *not* excluded by the ISPR definition of presence in which "perception" seemingly refers to both sensory perception and, separately, thinking about things.

When I feel present in or on *Star Wars*' Tatooine (as depicted in film), this is foremost a perceptual illusion, albeit a more effortful and less robust one than VR can provide. Ed Tan points out that film-viewing is supported by an effect also observed in the perception of painted pictures or photographs: The camera's "monocular perspective", he writes, "draws the beholder in a position that is defined in relation to an imaginary space behind the window formed by the picture plane and the frame' (Tan, 1996, p. 52). This is the same perspectival quirk that makes it appear as if a portrait sitter's eyes follow us around the room. But given that cinema screens do not encompass the viewer's visual field; that "movie vision" is usually monoscopic; that the cinematic camera is not coupled to audience members' heads; that sound is not dynamically spatialized, I must keep my sense organs and cognitive attention intentionally directed towards both the screen and a film narrative's situational meaning in order to be perceptually *or* cognitively engaged by the movie and its plot at all. What does this mean for how we experience illusions of nonmediation in VR?

At first blush, it seems theoretically possible to design a "fully" immersive VR system—presumably one replete with all manner of exotic peripherals for various modalities—such that the only sensory information available to users is provided by the display(s), and there is no environmental context to betray that the medium is, in fact, a medium. Would an absolute illusion of nonmediation be sustainable in this case? We argue that despite the epistemic

authority of perception likely insisting that a representation produced by such a system *looks* and *sounds*; maybe even *feels*, *smells*, and *tastes* "real enough", it would still be possible to perceptually experience medium-as-medium owing to the top-down cognitive influence of knowledge brought to bear on sensation. Not only would this hypothetical VR system's various tactile and olfactory displays have to mimic reality excellently; they'd also need to be intangible and weightless, since the feeling of having a haptic glove strapped to one's hand or forearm can just as easily steal attention away from the representation, no matter how verisimilar or perceptually realistic the device's output is.

Even the mere recollection of having entered VR can, if dwelt upon, repel or suppress cognitive (and to a lesser extent, perceptual) illusions of nonmediation. Grant Tavinor describes a "sadistic" thought experiment in which an unwitting test subject is drugged, kidnapped, and placed without realizing it inside "a very elaborate and convincing kind of aircraft simulator, perhaps involving actors playing the roles of passengers and flight crew" (Tavinor, 2009, p. 135). The unlucky individual is then told by phoney air traffic controllers that they must singlehandedly land the plane or face certain death. Most people would panic, experiencing an authentic form of fear predicated on the belief that they're in peril. If we again take the individual's emotion to be indicative of their sense of presence in the artificial scenario—that is, their throughgoing but mistaken sense that the space and situation are genuine—we can speculate that their fear would be significantly diminished if the previously-incapacitated fake flight attendants all yelled, "surprise!" in unison, and explained the nature of the conspiracy, reassuring the victim that they're not in danger. If the imitation aircraft then accurately simulated a nosedive or tailspin *after* the hoax was revealed, most individuals would probably still experience *some* kind of fear owing to the fact that the imitation aircraft is lurching violently

around, and since the view out of the windows would still be perceptually convincing. But, given the knowledge this *is* in fact a simulation after all, the illusion of nonmediation's cognitive component would be diminished, and doubt therefore cast upon the situation's perceptual aspects. Outside of thought experiments, of course, there aren't really any ways to put people in VR without them realizing or recalling it. Thus, even an experience of a "perfect" VR system—so long as we know that we're using it—can be colored by a kind of knowledge or way of seeing things that works against the perceptual illusion of nonmediation.

Along similar lines, Skarbez, Smith, and Whitton argue that nothing short of a "Matrix-like VR"—that is, a "perfect" brain-computer interface—would be able to avoid such sensory conflicts between the virtual and the physical worlds. Presumably, such a system would hijack and misinform the nervous system such that the user (or victim) really believes that they're physically moving their limbs (running, jumping, etc.) despite being immobile; apparently asleep. Indeed, as an aside, we can speculate that this is plausibly how or why dreams feel so real: They consist in embodied, modal simulations of sensory experiences that are approximate enough, in our state of un- or semi-consciousness, to pass for authentic experiences of waking life upon groggy reflection (see Wilson, 2002; Barsalou, 2008).

We believe that at least two distinctions are needed for "the illusion of nonmediation" to figure meaningfully into a definition or conception of presence. First, as mentioned, it must be clearly stated whether the medium in question (and the resulting presence experience) functions primarily by perceptual means, or by cognitively effortful activity on the part of the user, viewer, player, or participant. Most media experiences involve a blend of both, but the more the medium or representation s(t)imulates perception, the less imaginative work must be done by the user. Second, it should be acknowledged that attention is not synonymous with where one's sense

organs are pointed, despite that looking and seeing or listening and hearing do often imply concerted acts of attendance. For instance, I might find myself nominally looking at the screen while "watching" a movie in a theater, yet realize that my cognitive attention has been so rapt by the argument playing out between the young couple sat in front of me that I've not taken the film's events on-board. The same can happen in headset-based VR: I *see* and *hear* the virtual environment, as there is nowhere else to look, and I cannot close my ears. But I'm not necessarily attending mentally to what's happening there. Instead, I might be thinking about how desperately I need to visit the bathroom, or what to cook for dinner. In such cases, psychologists would insist that attention *is* being dedicated to the screen-image or media presentation, as there *can be no* perception of the visual world without cognitive attention directed towards our continually and continuously updated mental models of an external reality (Mack & Rock, 1998).[7] Being aware of anything at all necessitates that some minimal attention is paid to one's internal or external environment. But, as we shall see in the next section, presence experiences in VR may not be a simple case of directing one's attention "there" so as not to be distracted by "here".

2.3. "Being there"

Perhaps the most common usage of presence is to refer to the sense or feeling of "being there" (Minsky, 1980; Heeter, 1992; Zahorik & Jenison, 1998; IJsselsteijn & Riva, 2003). "There" is suggested by Daniel Dennett (1978) as involving one's visual viewpoint: I consider myself to be located at the place from which I perceive the world (IJsselsteijn & Riva, 2003). Philosophers

[7] In formal terms, we can say that cognitive attention is necessary but not singly sufficient for the perception of external stimuli: Perceptual attention, or "readying" one's sense organs, is necessary too. Inversely, the presence of external stimuli—even when salient—is neither necessary nor sufficient for cognitive attention. I might open the refrigerator and point my eyeballs directly at the thing I seek, yet not "see" or register it because, despite some minimal and automatic perceptual attention being paid, I'm mentally (cognitively) attending to something else entirely.

like Andy Clark (2001) would add that all perception is in service of action, so "being" presupposes effective "doing", which is consistent with Marvin Minsky's (1980) early application of "being there" to presence in the context of robotic teleoperations. Similarly, Witmer and Singer's conception of "being there" is exclusive to mediated representations insofar they define presence as "the subjective experience of being in one place or environment…*when one is physically situated in another*" (Witmer & Singer, 1998, p. 225 – emphasis added). Prima facie, then, this gives us two possible places to "be". It is generally assumed that "there" is a remote or virtual space displayed to the user via appropriate technologies, while its apparent polar opposite, "here", is the user's local environment in physical reality. It was once the case that presence researchers—particularly those coming from systems engineering as opposed to human factors—held that one can, at a given moment, feel present "here" or "there", but not in both places, in-between, or somewhere else (Biocca, 2002; 2003; Schubert & Crusius, 2002). In some instances, this bipolar conception of "where" we can "be" during VR exposures is founded upon the incorrect, largely implicit assumption that we have unfettered access to the world via our sense organs.

In its strongest form, proponents of this ontological position—known as direct or "naïve" realism in philosophy of mind—hold that we perceive the world objectively, which is essentially to suggest that perception is infallible; that incoming sense data, if they are accepted as existing at all (e.g., J. J. Gibson, 1979 cf. Stoffregen et al., 2017), cannot be consistently, incorrectly assembled into percepts that constitute sustained illusions (bar, for instance, hallucinations). The opposite of direct realism is a position that we've already gestured towards, albeit not named, in Section 2.1. As explained with reference to Wirth et al.'s process model of the formation of spatial presence experiences, when we are exposed to novel environments, we rapidly and

involuntarily assemble a spatial situation model of wherever we seem to find ourselves. Arguably, this applies not only to external environments, but to all that is physical—even our own bodies. Without evoking Cartesian dualism, then, we can say that our phenomenal experience of the world and of our own somatic activity is had *indirectly* via the "first-order mediation" (ISPR, 2000) of mental models like spatial situation models (Wirth et al. 2007) or interoceptive "maps" like the body schema (Gallagher, 1985; de Vignemont et al., 2021), both of which are subserved by *and themselves support* subpersonal sensorimotor processes.

While empirical VR researchers may seldom need take these facts into account in their operationalizations of presence, the idea that we do not have direct access to reality—that we can misperceive "there", conflate "there" with "here", or feel present in our own mental imagery space (which is neither "here" nor "there")—has been noted previously, and has considerable epistemic import. We explore this line of thinking in the following subsection.

2.3.1. Biocca's three-pole model of presence

In a conference paper that has been largely overlooked, Frank Biocca (2003) presents what he calls a "three-pole model of presence shifts". He argues that one can feel present not only in virtual or physical spaces, but also in what he calls mental imagery space. We have already alluded to this idea in our earlier description of feeling imaginatively present in the Shire when reading a book like *The Hobbit*. Biocca furthermore argues that while one's sense of spatial presence tends to "gravitate" toward one of the three poles, "cues from other spaces…may be merged, or distort, or conflict [with] properties of the user's mental model" (Biocca, 2003, p. 6). In other words, spatial presence conceived as such is no longer binary, nor even ternary: It is a continuously valued linear combination of the vectors defined by the poles. I may be

successfully performing a simple motor task in VR but simultaneously allocating attention to the feeling of the real carpet under my feet; the chilly draught coming into the room; the sound of a car alarm outside. Depending on a number of unspecifiable factors, I may erroneously integrate and/or attribute some or all of these sensations (in)to my perception of the virtual environment, which may reinforce my sense of being "there" in VR. This would cause me to gravitate towards the Virtual Space pole.

Alternatively, I may attend to the carpet, draught, or car alarm as supportive of a spatial situation model of the physical world that is at odds with my VR experience. If I concentrate on *where* the carpet's edge lies, *where* the draught is coming from, or *where* the car whose alarm is sounding is located, I may gravitate towards the Physical Space pole instead of experiencing presence in either the Virtual Space or my subjective Mental Imagery Space.

In VR exposures, the role of Mental Imagery Space is less immediately clear. As suggested earlier, it seems unlikely that my Mental Imagery Space would differ much from what is presented via the VR system's displays: As long as I am not suffering some significant sensory impairment or hallucinatory episode, I should perceive and experience the virtual spatial environment more or less as rendered and intended. In book-reading, of course, I've far more latitude to misinterpret and/or incorrectly reconstruct the author's description of a space, and hence to feel imaginatively present somewhere that is neither the author's intended "virtual" space nor my physical environment, but rather a reconstituted mental imagery space that *I* consider a Hobbit house despite it resembling neither Tolkien's descriptions nor cinematic depictions. Somewhat surprisingly, this can happen in visual media, too. Performing an online image search for "Seinfeld apartment map" or "Friends apartment map" may yield floor plans that depart markedly from what occasional viewers of the respective series might have visualized

given the limited number of camera angles deployed in a given episode.[8] The relationship between Virtual Space and Mental Imagery space in the context of how we experience televised sets like sitcom apartments, then, is that the Virtual Space—the space as we're *meant* to reconstruct it—is significantly shaped by the means of mediation; in this case, camerawork and editing designed to hide the fact sitcom apartment interiors and exteriors are rarely a single cohesive set; a continuous space.

Biocca's three-pole model is valuable partly because it theoretically unifies presence experiences in and across literary, audiovisual, and interactive media, and partly for its ontological accuracy: Everything gets mentally modelled "on the way in"; in the process of sensation transmuting into perception. As noted, we needn't much appeal to Mental Imagery Space in explaining VR, since the likelihood that our perceptions of the environment will differ from what's shown and heard inside the headset (the Virtual Space) is low. Yet acknowledging that presence shifts are not quite as simple as "there" versus "here" is, as we've argued, philosophically important. In the following short subsection, we suggest that while Biocca does acknowledge that sensations can be (correctly or erroneously) attributed to different poles, and thereby be (mis)taken to reinforce or undercut one's experience of "there", it seems increasingly implausible to suggest that frequent VR users do not experience some hybridity or division of presence.

[8] Indeed, the *Seinfeld* apartment is an "impossible" space: Fans have pointed out that Jerry's kitchenette would intersect with the hallway outside. Thus, *Seinfeld*'s Virtual Space (i.e., the fictional apartment that we're meant to imagine) is continuous despite the show's set or scenic elements being *dis*continuous, meaning any attempted walkthrough of the physical set depicting Jerry's tenement would reveal its interior and its exterior to be unconnected—a fact we're not meant to pick up on. Thanks to Reviewer 2 for pointing this out. See also Suma et al. 2012 and Fisher et al. 2017 for treatments of impossible space(s) in relation to VR specifically.

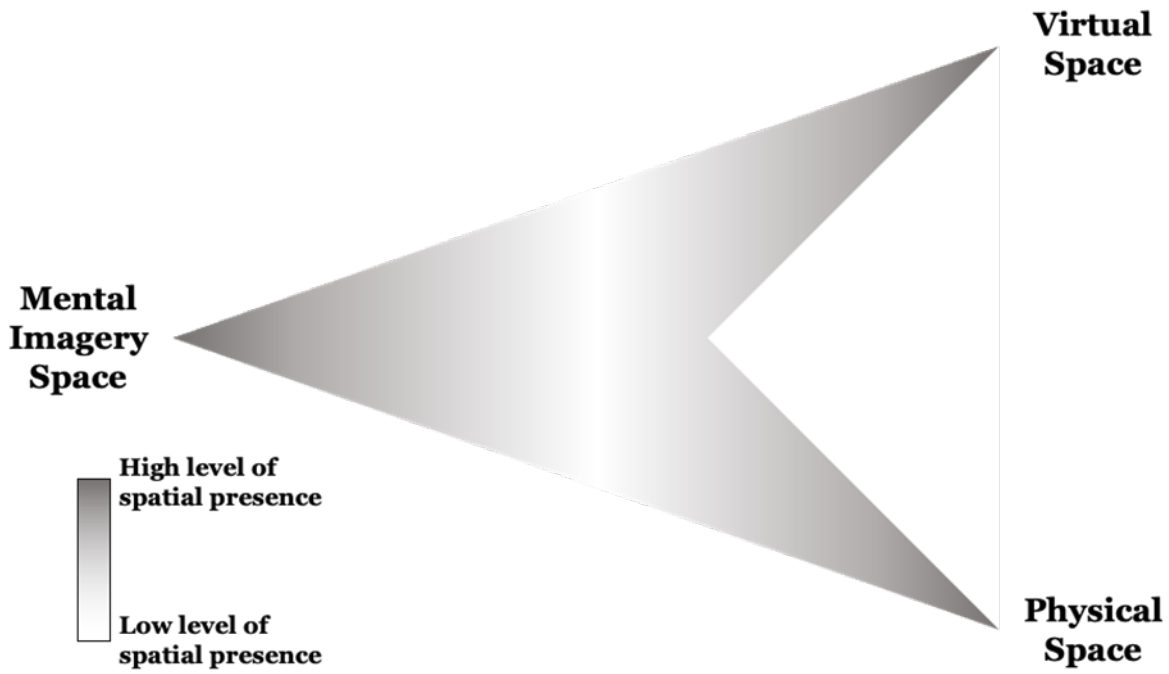

Figure 1: Biocca's three-pole model of presence shifts, adapted from Biocca, 2003. Note the "notch" between the Physical Space and Mental Space poles: Biocca seems not to have believed that it was possible to be simultaneously present in physical and virtual spaces.

2.3.2. A slight modification to Biocca's three-pole model

Despite endorsing Biocca's model of spatial presence, we would like to propose a modest modification informed by experiment and experience. Specifically, we feel that the deltoid "notch" in the right-hand side of Figure 1—implying that one cannot experience spatial presence simultaneously in virtual and physical space(s)—is unnecessary and even misleading. Consider the work of Spagnolli and Gamberini (2002), who describe users' experience of the "hybridity of virtual environments"—that is, the fact that virtual experiences are simultaneously and indeed *always* both physical and virtual. A virtual floor cannot support a VR user's bodyweight (or anything physical at all, for that matter), meaning sensations reported via our feet and legs are always indicative of physical reality, yet are liable to be integrated into our experience of the

virtual world whether we dedicate conscious attention to them or not. Or consider the following scenario; an experience shared by many VR developers. One can don a head-worn device and observe or effect changes in the virtual world while simultaneously sitting at a desk and typing in the physical world, on a keyboard with no virtual representation. We believe it would be inaccurate to say that such a developer is "leaving" the physical world and "entering" the virtual world, or vice versa. Rather, they are present (i.e., perceiving and acting, either literally or by way of embodied simulation) in three "worlds" simultaneously: "Here", "there", and a likely-hybrid mental model comprising elements of both, which may not be consciously explorable, but which must surely inform behavior. Perceptually, mentally, and motorically, users shift their attention and intention between these three domains (which are perhaps experienced as only two) as necessary.

With this tentative recommendation voiced, we can zoom in on the question of attention, among other things.

3. Cross-cutting questions

Across the previous sections, we addressed some of the issues arising from three of the most common conceptions of what it means to be present in a virtual environment. These were, in short, (1) that presence is the result of an active process of believing or suspending disbelief, (2) that presence results from a failure to notice an intervening medium, and (3) that presence occurs when one feels located in the depicted virtual space or place. In this less lengthy section, we consider several issues relating to presence that are independent of specific definitions. They are (A) the relationship between presence and attention, (B) the "binary" nature of presence, and (C)

whether the concept of presence is only meaningful in relation to the experience of mediated environments.

3.1 The role(s) of attention in presence experiences

We now discuss the role that attention can, does, or must play in presence experiences. Amusingly, attention is every bit as slippery a concept as presence. The science of attention has uncovered many facts about the massively multifaceted collection of phenomena we call attention, yet the label itself alludes to so manifold and variegated a thing—tasks, demands, abilities, brain regions, cognitive modules or architectures, reflexes, volitional behaviors, deficits, experiences—that it's almost impossible to say what attention *is*, exactly. Indeed, in just a over century, psychology has gone from William James' infamously deflationary assertion that "[e]very one knows what attention is" (James, 1890, p. 403) to Bernard Hommel and colleagues' well-supported provocation that "[n]o one knows what attention is" (Hommel et al., 2019.). (See also Anderson, 2011: "There is no such [unitary] thing as attention".)

Many authors have argued that attention—often subsumed under other constructs such as involvement, absorption, or engagement, all of which imply some minimally conscious or effortful cognition—is necessary if not sufficient for presence. (For prominent examples, see Draper, Kaber, & Usher, 1998; Witmer & Singer, 1998; Vorderer et al, 2004.) Others have argued that this is not the case, pointing out that it's possible to feel physically present but not cognitively or affectively engaged (as in cases of boredom or "zoning out" in faculty meetings, or even during boring VR experiences), or that one can be cognitively engaged yet not feel spatially present (as when reading a book). (See also Slater, 2004 or Cummings & Bailenson, 2016.) The shortcoming with both these lines of reasoning is their failure to distinguish, at the

very least, between perceptual attention, which can be (but is often not) allocated volitionally, and cognitive attention, which (as we suggested towards the end of Section 2.2, in line with James) can be voluntarily dedicated to things quite separate from one's immediate perceptual environment.

We believe that the key difference between these two positions—that is, whether or not attention is prerequisite to presence—is not their definition of presence, but their definition of attention. Attention can be likened or equated to "notice, thought, or interest". Yet even these have different connotations. One can *notice* something without taking *interest* in it. One can *attend* (for instance, visually or auditorily) without *paying concerted attention* (that is, without deliberately dedicating mental resources; see Watzl, 2017, p. 39). Attention in the former sense is predominantly tied to our sense organs, and is clearly integral to presence by any meaningful definition, while attention in the latter sense—as cognitive; as mental; as capable of being decoupled from "on-line" perception—seems not to be. Partly for convenience's sake and partly to follow philosophers (e.g., Wu, 2011), we will call the former *perceptual attention*, and the latter *cognitive attention* (though note that any such distinction à la faculty psychology risks painting an artificially tidy picture of the mind). An example of perceptual attention is *hearing* a car backfire behind you and automatically whirling around to *see* if the source of the sound heralds danger. Such a sequence of events can unfold without much conscious thought. An example of perceptual and cognitive attention working in tandem is studying a painting and taking note of its features, thus employing working memory and probably aesthetic judgement, too. And an example of cognitive attention working in relative isolation is closing one's eyes and effortfully sustaining a train of thought (see James, 1890, pp. 403–404). (Of course, this involves other kinds of cognition also.)

A VR user must at the very least *notice* a state of affairs—whether physical, virtual, or imaginary—in order to believe it, experience it, or locate themself within it. A thing must be not only perceptible, but *perceived*. And in order to be perceived, a thing must be subject to some minimal allocation of perceptual attention, even if fleeting and non-deliberate. Put plainly, one could not expect to feel present in a virtual environment if one's eyes are shut and ears are plugged, as we have previously demonstrated (again, toward the end of Section 2.2). Hence, it seems clear that "simple" perceptual attention is required to have an experience of presence in visual media: A spatial situation model of a visual scene cannot be assembled without some automatic or volitional allocation of perceptual attention to that scene (Wirth et al. 2007), and as soon as a VR user dons a contemporary HMD—assuming they have their eyes open—they're practically guaranteed to attend to, perceive, and feel present the virtual environment, with mere milliseconds lapsing between these events.

It seems to us less clear that cognitive attention is a requirement in spatial presence experiences. Let's first consider what's implied by cognitive attention, which some authors fold into the construct of involvement. Witmer and Singer define involvement as "a psychological state experienced as a consequence of *focusing* one's energy and attention on a *coherent set of stimuli or meaningfully related activities and events*" (Witmer & Singer, 1998, p. 227 – emphases added). Böcking and colleagues define involvement as "*intense cognitive engagement* with a media environment" (Böcking et al., 2004, p. 227 – emphasis added). And Wu notes that "conscious attention to what is perceived involves not just a way of perceptually locking on to a specific object. It is a way of cognitively locking on to it as well" (Wu, 2011, p. 93). All three descriptions suggest that attention can be more than just looking or listening. Yet there is no

universally or even “commonly” accepted definition of either cognitive attention or involvement (Klimmt & Vorderer, 2003, p. 348).

It remains an open question whether presence in virtual environments (VR in particular) is purely an effect of bottom-up perceptual attention, or whether it also requires higher, more conscious cognition to occur. It seems safest to say, “it depends”. If the chosen definition of presence is componential, implying higher-level cognitive processing, as in reality judgements (Grodal, 2009; Hartmann & Hofer, 2022) or plausibility illusions (Slater, 2009; Skarbez, 2016), then concerted cognitive attention is likely a strengthening factor (Wirth et al. 2007). This also holds, of course, when the medium in question demands effortful imagining, as in reading. For narrower definitions of presence—for example, those that refer specifically or exclusively to place illusion or spatial presence—simple perceptual attention likely suffices. Again: Anyone who works with VR will surely attest that it can be difficult if not impossible to fully convince oneself that one is *not*, in some subpersonal way, corporeally located in virtual environments displayed via 6DoF, stereoscopic HMDs. No matter how much you tell yourself, “I’m not here”, a runaway trolley or other hazard hurtling towards you in VR revivifies your spatial presence in the suddenly-attention-demanding scene. Regardless, the interplay of attention and presence merits further research. While the nature of the relationship remains as unclear as the concepts’ definitions in isolation, attention must be considered an important “conceptual bridge” (Klimmt & Vorderer, 2003) between feeling located in a virtual space on the one hand, and feeling engaged by or interested in what’s occurring there on the other.

3.2 The binary (or not) nature of presence

In previous sections, we alluded to the idea that presence is binary. This opinion remains dominant among the presence research community, with some notable examples including Wirth and colleagues (2007) ("we regard the state of Spatial Presence as binary (on/off)") and Slater (2009) ("[w]e suggest that [Place Illusion] should be treated as binary—it is a qual[e] associated with an illusion. Either you get the illusion or you do not—you cannot partially get a [perceptual] illusion"). It seems to us that the claim that spatial presence is binary can be interpreted in at least two ways, which we attempt to sketch here.

On one interpretation, both Slater and Wirth and colleagues would be arguing that the *experience* of spatial presence is binary; bipolar. That is, there is no situation in which one can experience partial or mixed presence (as we showed not to be plausible earlier, with reference to Biocca). Let's call this the "strong" binary conception of presence.

A more realistic and charitable interpretation is possible; that presence being binary means it is a "thresholdy" perceptual experience, even if one can ultimately feel presence in more than one (or two) places simultaneously. On this view, one *can* experience partial or mixed presence, but one will only behave *as if* one is really in the virtual or depicted environment if presence is above a certain threshold, which may be different for different users in different situations. We will call this the weak conception of binary presence.

As hinted in Section 2.3, we reject the strong conception of binary presence. That is, we believe that it is very much possible to have partial or mixed presence experiences, and that there may be at least three meaningful loci of presence—not just the "here" and "there" assumed by most authors and researchers. We thus endorse the weak conception of binary presence. It seems reasonable to suggest that one must be "minimally present" in an environment in order to be able

to act effectively there, and that this emergent property or phenomenon is easily identifiable when presence comes courtesy of primarily perceptual as opposed to cognitive illusions. For example, consider stereograms. In "solving" a stereogram, one moves one's eyes closer and further away from the image until correct focus is achieved and the 3D figure "pops out". This is what Slater is alluding to when he speaks of qualia. Now consider the analogous experience of wearing a 6DoF VR HMD and slowly pulling the visor away from one's face until light leaks in, the field of view becomes diminished, the lenses distort the screen-images, and spatial presence in the virtual environment is no longer felt. When one *very slowly* removes a VR HMD in such a manner, it becomes easy to identify the "threshold"; the point at which spatial presence's binary or "on/off" nature is noticeable. The question for theorists thus becomes a knotty metaphysical one. If spatial presence in virtual environments can in some sense be causally determined by key technological features (i.e., typically, 6DoF perspectival tracking and a stereoscopic display; Murphy, 2021; Tavinor, 2021 cf. Steuer, 1992), then does presence's binary, thresholdy quality speak of a difference in kind, or a difference in degree? Or we might ask; when does an incremental difference in degree (e.g., increasing the distance between one's eyes and the HMD) produce a phenomenal difference in kind (i.e., from feeling present to not-present or vice versa)? For empirical researchers and philosophers alike, this area of enquiry is ripe for further enquiry.

3.3 Presence in the real world

Many authors (e.g., Lombard & Ditton, 1997; Stoffregen et al., 2003; Slater, 2009) have explicitly argued that presence refers to a mistaken belief; that it only makes sense to speak of presence in relation to environments that we know to be mediated or "unreal".

We believe that definitions of presence that stipulatively require that the user's perception of the environment to be "false" are begging the question, because they assume that the equivalent "true" or "accurate" sensation is already well-defined. We argue that such a feeling is akin to the phenomenology of attention: While everyone may know what it is like to *feel* presence, to the best of our knowledge, no one has yet clearly defined the sensation. (Perhaps the closest is Schubert, 2009.) Without that foundational knowledge of what it feels like to simply *be* in space, such definitions fall apart. (Skarbez, Brooks, and Whitton (2017) recommended the term *placeness* for the roughly equivalent feeling of being in the real world, but do not sufficiently define or operationalize the term.)

We believe that a better understanding of placeness is required if a coherent theory of presence is to be developed. We acknowledge the difficulty of research in this area—after all, isn't placeness so-defined essentially normal conscious experience? Perhaps yes, so we propose that it can be investigated by looking at disruptions of normal conscious experience. Consider Timmins and Lombard's (2005) notion of "inverse presence", the experiences of persons with depersonalization–derealization or dissociative disorders, or James' proposed opposite of consciousness or concentration; "the…scatterbrained state which in French is called distraction" (James, 1890, p. 404). Presence in VR and in the real world (Waterworth & Riva, 2014) may be better understood by considering its or their opposites.

4. Conclusion

Frank Biocca reminds us that "[w]hile…virtual reality technology has brought the theoretical issue of presence to the fore, few…argue that the experience of presence suddenly emerged with the arrival of virtual reality" (Biocca, 1997, p. 19/2006, §5.2.1.1). Indeed, presence is by no

means exclusive to media experiences. In its widest sense, the word is tantamount to attentiveness: Presence *of mind*. Yet it also speaks of *placeness*, and of the very essence of *being*. Hence many agree that presence in VR and presence in unmediated physical reality have much in common, and decline to discriminate between virtual, remote, and physical environments at all, figuring mediated and unmediated presence as functionally identical; as having a common biological basis.

Giuseppe Riva and colleagues stress presence's evolutionary teleology when they write that "[it is] a neuropsychological phenomenon…whose goal is the control of agency…through the unconscious separation of both 'internal' and 'external', and 'self' and 'other'" (Riva et al., 2015, p. 76; see also Loomis, 1992). Framed this way, presence is a kind of selection mechanism or a monitoring system; a "sixth sense" (Slater, 2002) that continually provides feedback about an organism's internal state and external environment relative to its intentions, actions, and goals (J. J. Gibson, 1979; Biocca, 2015). This approach aims to remain agnostic as to the (im)materiality of an agent's surroundings by instead emphasizing how presence coheres in service of not just *being*- but *doing-in-the-world*, irrespective of whether that world is tangible (Zahorik & Jenison, 1998 following Heidegger, 1927; 1954; J. J. Gibson, 1979). According to this position, presence is a "global percept" resulting from "engagement and action of the sensorimotor system" (Biocca, 2015, p. 3) that emerges from and dovetails with the various strata of consciousness, some of which are accessible, others of which are impenetrable (Mantovani and Riva, 1999; Riva, 2009; Riva & Waterworth, 2014; J. Waterworth & Riva, 2014; Riva et al.. 2015; J. Waterworth et al., 2015 following Damasio, 1994; 1999). This line of philosophizing—part biocultural, part phenomenological—is plausible, and does not preclude any of the descriptions of definitions of presence that we have appraised in this article, or which

VR researchers routinely rely upon. Yet we believe that there are vital differences between presence seen this way and presence as tailored towards understanding VR's inherently synthetic nature.

In this article, we hope to have shown that belief—or the suspension of *dis*belief—is not a necessary component of presence experiences in VR. When a representation is sufficiently rich in spatial cues that remain consistent with our exploratory perceptual behaviors (what Slater calls a high number of "sensorimotor contingencies"; 2009), presence appears to take hold almost automatically; in a binary, thresholdy, "gestalt"-like manner (Slater, 2002). One can try to tell oneself, "I'm not really here", or "this isn't really happening", but that often doesn't make the subpersonal conviction that this *is* a place, and that I *am* here, driven bottom-up by perception, any less strong (Hartmann & Hofer, 2022). Suspending disbelief or forging some impetus to participate in the dramatic events of a virtual environment (Murray 1997/2016; 2012) likely entails what media scholars call engagement, involvement, engrossment, absorption, or simply enjoyment. But feeling *interested in* being in a virtual environment, we maintain, is categorically different from feeling self-located there.

As for whether presence involves the or a "perceptual illusion of nonmediation", we have suggested that spatial presence in VR, at least, centers on a "thresholdy" illusion. A sense of spatial presence in cinematic or videogame environments, meanwhile, is a far more effortful activity that few are able to dependably achieve at will. While we have not discussed social presence in this article, it is perhaps informative to note that encountering a lifelike virtual human face-to-face in VR would involve both perceptual *and* cognitive illusions: A virtual human entering one's intimate (peri)personal space mainly elicits feelings bottom-up, foregrounding perception, while the sense that an AI agent's utterances --are really being

produced by a conscious entity is rather a top-down cognitive illusion. Spatial presence in VR can be fairly described as a purely perceptual illusion of nonmediation, but if we want our definition of presence to be holistic, it may be necessary to acknowledge that higher factors are at play, too. Yet since the term "presence" is evidently already overloaded, we suggest that it is better to *not* use presence to refer to things that involve idiosyncratic interests or preferences, like whether a virtual environment designed for entertainment or aesthetic pleasure is neon or pastel-colored; serious or playful; realistic or cartoonish, and so on. Such details do not affect whether a virtual space is experienced *as* a space in which one can naturalistically act.

With reference to "being there", we have argued that experiences of virtual environments are always already hybrid; that it's not simply a case of "here" versus "there", but that we (more or less unconsciously) also occupy an internal mental imagery or modal simulation space when in VR, plausibly integrating sense data from virtual and physical stimuli into a hybrid model that lets us perceive and act effectively in two "places" at once.

The literature surrounding presence is rich and complex, bringing together both canonical knowledge and novel findings from computer scientists, philosophers, psychologists, media theorists, visual artists, and more. We feel that the collective endeavour of making sense of presence is rendered unnecessarily difficult by the proliferation of definitions and descriptions of the term (Lombard & Jones, 2015). In writing this article, we hope to have underscored at least one vital distinction: That the thing we call spatial presence in VR is a robust, fast and automatic, binary or thresholdy perceptual illusion that can persist in spite of wilful attempts to dissipate it through the application of top-down knowledge. Spatial presence assumes some minimal kind or degree or "simple" perceptual attention, but does not presuppose cognitive attention or the kinds of interest and involvement (etc.) scaffolded by conscious thought and shaped by personal

preference. By contrast, the phenomenal or psychological states variously referred to as engagement, absorption, involvement, engrossment, enjoyment, immersion, or flow *ought not to be* seen as identical with presence—or even analogous to it—since they do not necessarily have anything to do with placeness or spatiality,[9] are far more contingent upon the application or embrace of pro-attitudes, and are easily lost or dispelled.

[9] That is to say, engagement, absorption, involvement, enjoyment, or flow can all be experienced during "placeless" activities like solving mathematical formulae in one's head. To say that one feels "present" in such space-agnostic mental operations would be misleading.

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