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Being There Together and the Future of Connected Presence

Abstract

Research on virtual environments has provided insights into the experience of presence (or being there) and copresence (being there together). Several dimensions of this experience, including the realism of the environment and of the avatar embodiment, have been investigated. At the same time, research on a number of new media has begun to use concepts that are similar to copresence—such as mutual awareness, connected presence, and engagement. Since digital environments can be reconfigured and combined easily, and since an increasing number of such environments are used to connect people in their everyday lives, it is useful to think about the various modalities of connected presence as a continuum—with shared virtual environments in which people are fully immersed as an end-state. This paper proposes a model for the different modalities of connected presence whereby research on shared virtual environments can be modeled as approaching this end-state. It is argued that this model can improve our understanding both of the uses of shared virtual environments and of their future development among a variety of media for "being there together." This paves the way for integrating research on shared virtual environments with research on other new media.

1 Shared Virtual Environments as an End-State

Shared virtual environments (SVEs) have made it possible for people to experience being there together in the same computer-generated space. The experiences of presence in a virtual environment and copresence with other people have been explicated in a number of studies. At the same time, a number of studies of new media technologies have begun to use concepts of presence and copresence and related concepts—such as awareness, engagement, and the like. These media include mobile telephones, instant messaging, and online games. The main aim of this paper is to relate research on virtual environments to research on new media and to ask, what can we learn about SVEs from other new media, and vice versa?

A useful way to do this is to think of SVEs as an end-state—a purely mediated relationship in which the user of SVE technology experiences copresence with others in a fully immersive environment. Various technologies are now available whereby users and environments are represented to each other in fully immersive displays, either in the form of computer-generated embodiments and scenes, or in the form of the 3D video capture of people and scenes. Despite current technical limitations, these immersive displays represent an end-state in the sense that—barring direct sensory input into the brain (in the manner of science fiction novels such as William Gibson's *Neuromancer* and Neal Stephenson's *Snow Crash*)—synthetic environments for being there to-

Presence, *Vol. 15, No. 4, August 2006,* 000-000

gether that are displayed to the users' senses cannot be developed further than fully immersive VEs. Nevertheless, even these fully immersive SVEs will, like other new media, have certain possibilities and constraints. It is argued here that relating these possibilities and constraints of SVEs to other media will provide us with a better understanding of technologies for being there together and their potential future uses.

SVEs and other new media can be seen as varying on three dimensions: presence, copresence, and the extent of one's connected presence (the term "connected presence" was coined by Licoppe (2004); this concept will be explained in the following section). The third dimension, as we shall see, captures a number of different elements, but the main reason for this dimension is that we not only want to know about presence and copresence in abstract terms (the experiential state of the user at a particular point in time), but also in terms of the actual *extent* to which our relationships are mediated in this way. This yields a connected presence cube (see Figure 1 in the next section).

The next section of this paper will elaborate the connected presence cube. Section 3 will give an overview of the relevant findings about presence, copresence, and connected presence. Section 4 builds towards a comparison of SVEs with other media in relation to these three dimensions. The concluding section, finally, spells out the lessons we can learn from an integrated model of connected presence and how these can inform the design of SVEs.

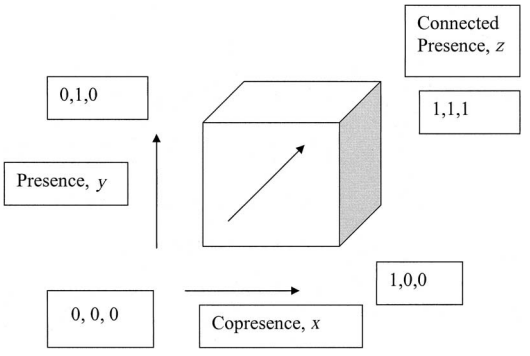

Figure 1. *The connected presence cube.*

2 Presence, Copresence, and Connected Presence

Research on VEs has produced a range of studies about presence and to a lesser extent about copresence. There are still debates about how to define and measure presence and copresence. Here it is not necessary to go into these debates in detail (for an overview, see Scheumie, van der Straaten, Krijn, & van der Mast, 2001). It is, however, important to provide a precise definition of SVEs which will allow us to compare it with other media: virtual environments provide "the user(s) with the sensory experience of being in a place other than the one you are physically in, and being able to interact with that place," or simply being there (Ellis, 1995; Schroeder, 2002a). Copresence can then be defined as being there together.

Previous models of VEs have identified a number of dimensions for single-user VEs. So, for example, Sheridan (1992), Zeltzer (1992), Steuer (1992), and Heeter (1992), focusing on spatial presence (or in Steuer's case, vividness) and interactivity. These models did *not,* however, include copresence (though Heeter briefly mentions social presence), or being there together with another person. At most, as in Zelter's (1992) model, they include agents or 'actors.' In this paper, in contrast, only shared VEs that afford a sense of copresence with real, noncolocated other people will be considered.

Shared VEs have three dimensions (*x,y,z*), which can be represented as being related to each other (see Figure 1). On all three dimensions, we can take the individual's presence in a real physical environment and a face-to-face encounter as our starting point (0,0,0). On the first dimension, being in physical world is at one end of the *y* axis and having a sense of being there (alone) in a purely media-generated place is at the other end of the end (0,1,0). This dimension is discussed in virtual environments research under the rubric of presence or being there. On this dimension, highly immersive environments such as Cave-type environments (Cruz-Neira, Sandin, & DeFanti, 1993) are at the top end of the *y* axis (0,1,0), but simulators and IMAX screens also pro-

F1

vide the user with the experience of being there (though with limited possibilities for interacting with the environment).

On the second dimension, again with our point of departure face-to-face encounters in the physical world at one end, the other end consists of mediated relations with persons whom we encounter only virtually (1,0,0). In virtual environments research, this is called copresence, but it could equally be called being there together. Telephones minimally provide us with this sense, though they lack the spatial component (not entirely, as we shall see), with instant messaging providing more of a spatial sense of copresence. So these two technologies are somewhere along the continuum of copresence, with the telephone providing some experience of copresence (>1,0,0) and instant messaging a somewhat spatial experience of copresence (>1,>1,0).

"Completely" mediated relationships then constitute a third dimension (the *z* axis). This is the *extent* to which one's relationships are mediated through environments in which presence and copresence are experienced. This dimension has several subcomponents: the affordances or constraints of the mediation, the extent to which one's relationships with others are *exclusively* mediated in this way, and third and finally the extent of time spent in these mediated encounters compared with one's face-to-face relationships. Together these constitute connected presence or the extent to which being there together is mediated. Once we add this third dimension, some everyday technologies like the telephone will receive a much higher value for this dimension (0,>1,>1) than SVE systems which typically have a low value for this dimension.

2.1 The End-State of SVEs and the Third Dimension

These three dimensions allow us to picture SVEs with completely immersive networked VR systems—systems in which the user exclusively has a sense of being there with others—as an end-state. This end-state is one in which users would live entirely inside immersive virtual worlds (1,1,1), and this allows us to plot all experiences of connected presence as approximations towards this end-state (see Figure 2). F2

Before we elaborate and compare these experiences further, however, three points need to be made about Figure 2: Of course it is true that all forms of mediated environments only complement—and do not replace—physical, face-to-face environments and relationships. Here, however, the focus is on *mediated* relationships. The balance between mediated relationships and face-to-face relationships in the physical world will be discussed below. The point of envisioning living together in virtual worlds is that—as we shall see—this will provide a useful model to think about and study SVEs and other media.

Another problem is that this plotting exercise is highly imperfect: the extent to which people experience a sense of being there with others in, say, telephone conversations, online chat rooms, and different types of virtual reality systems will vary considerably according to context. A further problem is that it is visually difficult to represent the three subcomponents of connected presence that have just been identified. This is especially true of the extent of time spent in these environments, though one solution would be to plot volumes with various sizes for each individual and situate the different media properly in relation to each other in the 3D space of the cube. (In other words, the solution is to make a proper 3D image in which the media were located in relation to each other in 3D rather than 2D as here and the shadow behind the boxes in Figure 2 would represent the three subcomponents of connected presence in terms of volume.) In fact, with enough scope for visual complexity, it would be possible to map the nature and extent of each person's mediated relationships in their entirety. Such an exhaustive and complex elaboration can be left for another occasion. Here, we can focus on how the three dimensions (and three subcomponents) allow us to make some useful initial comparisons.

Being there together in different SVEs will vary considerably on the first two dimensions. One reason to go beyond these two dimensions and add comparisons on the third dimension is that the end-state of the first two dimensions (remembering that this is a single point in time) will be influenced by the third; in other words,

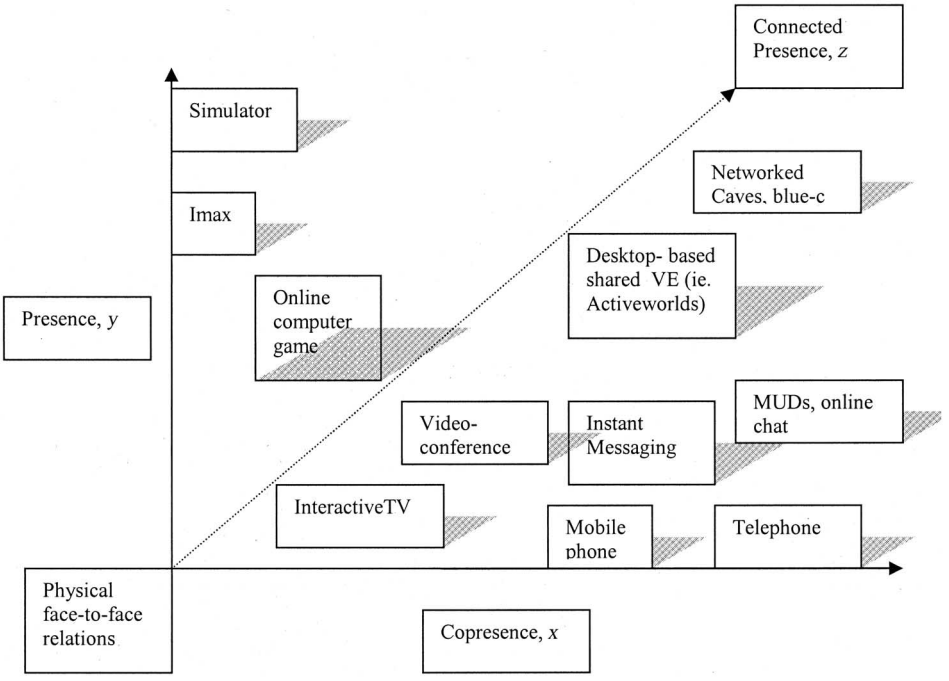

Figure 2. *Presence, copresence, and connected presence in different media for being there together.*

presence and copresence will be affected by the extent of experience with the medium.

Some brief examples can illustrate this point: One is that users must learn to cope with the other person's avatar—sometimes it is easy to walk through another person, at other times users will maintain interpersonal distance to a similar extent as in face-to-face encounters. This depends on the type of SVE system used (see the comparison of three systems in Becker & Mark, 2002) but also, in immersive SVEs, on the stage of the task people are in, or how habituated to interacting with an avatar they have become (Steed, Spante, Heldal, Axelsson, & Schroeder, 2003). Presence and copresence are thus affected in this case by connected presence—whether one maintains a conventional face-to-face distance from another avatar or walks through them is bound to influence the experience of being there in the environment and being there together and interacting with the other avatar. Another example from the same immersive SVE trial is that users point out objects to the other person with an untracked arm or they lean in to hear the person even when there is no spatial sound; yet at other times, they use the devices appropriately (Steed et al. 2003). Again, this depends on the amount of time they have spent on the task and how used to the system they have become.

Similar phenomena can be identified for other new media. For example, people can treat places at the other end of a mobile phone conversation as if they were sharing the remote space—as when they gesture to the other person even though the gesture cannot be seen (Ling, 2004). Or again, instant messaging (IM) can, with routine use, create the sense of the other person's copresence in the sense that people will treat IM as a shared space in which people can step in and out of each other's awareness (this is described further in Section 3.3).

Another example is when, in networked immersive projection technology (IPT) systems, people use their bodies as a reference point in interacting with objects when they do spatial tasks together, using both verbal and nonverbal communication to do so. They need more verbal communication in networked desktop sys-

tems for the same task because they need to describe in words where they would otherwise have used gestures and their bodies (Heldal, Steed, et al., 2005). Again, this takes getting used to in both cases. Notice again that people also do this in mobile phone conversations, for example giving an indication of their location to let their partner know how they are coping with the space around them (Ling, 2004). Or, to take a nonspatial example, the absence of eye gaze to indicate who one is speaking to can be compensated for in both telephone and SVE situations by means of words (or in SVE's also by gestures, see Brown & Bell, 2006).

2.2 Two End-States of Being There Together

SVE technologies range from immersive projection technology systems or IPTs (also known as Cave-type displays) and head mounted displays to desktop systems. Two types of technologies currently occupy the furthest points on the dimensions of presence and copresence (1,1,0): Networked IPT systems that display computer-generated avatars and spaces, and environments that allow users to share the same 3D video space with video avatars (blue-c is currently the only example of the latter, see Gross et al., 2003).

The difference between video 3D environments (essentially holographic videoconferencing systems) versus computer-generated 3D environments is important for the discussion to follow and need to be clearly distinguished: Both are end-states of noncolocated people completely immersed in mediated communication environments interacting with each other, but they have quite different capabilities: video environments *capture* the appearance of real users and real places, while virtual environments *generate* user representations (avatars) and virtual places or spaces. The two technologies also allow the user to *do* different things: video environments are realistic and are constrained by this realism, virtual environments allow manipulation but they do not capture real scenes. The two environments therefore represent two quite *different* end-states—even though *both* are on the same top right hand corner in Figure 1 terms of presence and copresence (1,1,0).

To appreciate the difference between these two immersive VEs, picture your body (and those of others), as well as the real place around you, captured by cameras and reproduced in full—and now add the fact that, although this capturing has been done digitally, the digital environment of 3D video images is designed such that objects (including people) can only behave according to the laws of the physical world. In other words, this is a 3D videoconferencing scenario in which the space around the users is included.

Now picture, by contrast, your body controlling a computer-generated avatar along with other such avatars in a computer-generated environment—the appearance and behaviors of which are unconstrained by real-world laws (for example, flying around together, or picking up objects without weight or gravity). Note that the difference between the two scenarios is not just realism, but also what control is exercised over one's body—is it captured or tracked?—and over the environment—are objects captured or can they be manipulated? The Rubik's cube task, for example, which involves collaboratively putting together cubes that are suspended in space and that snap together (described in Steed et al., 2003), would be impossible to implement in a video-captured environment.

In fact, the two end-state scenarios may be mixed in practice—for example, capturing the user on video but putting them into a computer-generated environment, or putting a computer-generated avatar into a video-captured environment—but in their pure forms they are quite different.

If they are fully realized in the way described here, they are also, as mentioned earlier, the furthest possible extensions of technologies for being there together or of shared synthetic environments—since no conceivable system could go beyond providing a more fully immersive experience of being there together. (Perhaps, again, neurophysiological mind-melding is conceivable, but this falls outside the definition of *displays* for the senses.) Mixed or augmented reality devices, where the user is partly inside a VE and partly engages with the physical world, will constitute approximations to these two ideal end-states.

3 Findings about Different Types of Presence in SVEs

Before discussing some findings that are relevant to the connected presence cube about the different types of presence, it is important to emphasize that the experience of presence is a sensory one—primarily visual and also audio (and sometimes haptic). This is important because there are debates about whether media that do not afford sensory experiences of another place or person—a book, say, or a text-based MUD—can be discussed in the same context as VEs (see the discussion in Klimmt & Vorderer, 2003). This is ruled out by the definition of VEs given earlier: unless the experience is a sensory one, one based on perception of a place or person via our sensory apparatus, the experience mediated by books and the like is excluded. Thus a complete end-state will provide an environment for being there together for *all* the senses, but since sensory inputs and outputs apart from vision, sound, and haptics (such as smell and taste) are rather remote, we can concentrate on the audio-visual environments that are currently available.

It can also be mentioned that there will be individual differences in the experience on all three dimensions. Some of these have been explored in research, especially for spatial presence (for a recent discussion, see Jurnet, Carvallo, Beciu, & Maldonado, 2005). These are bound to affect the people's experience of SVEs in profound ways on all three dimensions, but apart from presence, the research is still at a very early stage, and so it is too early to summarize and draw out general lessons about these differences.

3.1 Findings about Presence in VEs

Against this background, we can turn to some of the findings of presence research. One aspect of presence that has been studied extensively is the difference between desktop and immersive virtual environments and technology. The point here is not to review the findings about presence related to these two types of systems, but simply to note that a number of factors affect presence. And although the various factors interrelate and it is therefore difficult to generalize, there are clearly higher and lower degrees of presence and it is therefore possible to place different technologies on the presence dimension in Figures 1 and 2. (Note that "higher" and "lower" are imprecise—it would be more correct to speak of scores or scales on the *y* axis—but for our purposes it is sufficient to talk about higher and lower, and this will also apply to copresence. A different way to think about presence is that different technologies and their uses provide different degrees of absence or removedness from the physical world.) Fully immersive environments will be ranked close to an experience of being there (0,1,0) and desktop environments less so (0,>1,0), but there is considerable variation between the two (see Lessiter, Freeman, Keogh, & Davidoff, 2001; Slater, Sadagic, Usoh, & Schroeder, 2000; Heldal, Schroeder, et al. 2005). It has also been argued that there may be trade-offs between the different factors affecting presence (for example, that performing a task and high degree of spatial presence may conflict with each other), and some research has begun to identify these in different scenarios (Ellis, 1996). There may also be trade-offs between presence and copresence (Spante, Heldal, Axelsson, & Schroeder, 2003). Various findings and issues related to presence also come under copresence, to which we can turn next.

3.2 Findings about Copresence in SVEs

If we turn to the second dimension, there are far fewer studies comparing different SVEs in terms of copresence, and fewer still with highly immersive environments. And apart from demonstration and experimental uses, few have examined immersive SVEs for longer periods; the study of Steed et al. (2003) with just over three hours and two persons in networked IPTs is the most long-term study in immersive SVEs (in other words, this is the study with the highest values for *x* and *y* which also extends into *z*). These environments, immersive or non-immersive, are nevertheless very engaging in terms of interpersonal interaction, and one of the main questions in current research is how the various conditions of immersiveness influence social interaction

(see the review in Garau, 2003). Recent research on copresence can in fact be seen as an extension of earlier research about social presence in the 1970s (Short, Williams, & Christie, 1976; for comparisons of copresence and social presence, see Garau, 2003), which compared videoconferencing with other media (telephones) and with face-to-face meetings.

Biocca, Harms, and Burgoon (2003) have provided a review of the various definitions and measures of social presence, but their definition of social presence is much broader than would fit the definition of VEs used here: Their criteria for social presence, for example, includes phenomena apart from displays to the senses such as "'read[ing] minds' in both people and things" (Biocca et al. 2003, p. 474). It also includes experiences where the other with whom one experiences presence can be an agent or other media-generated human-like appearance (for example, para-social interaction with a film character). Copresence, however, is described as a more tightly defined subset of this phenomenon whereby people need to have a sensory experience of sharing the same space with someone else (Biocca et al., pp. 463–464). This limits copresence to face-to-face experiences or experiences in which two (human) users *both* share the space and the sensory experience of each other (this also corresponds to Schroeder's 2002b strict definition of copresence). Biocca et al., (p. 463), however, say that such restrictive definition is binary and unproblematic in a way that they regard as unhelpful, though their wider concept of social presence, as we have just seen, includes many phenomena outside the definition of VEs and thus outside of the connected presence cube.

Different measures of copresence and social presence (reviewed in Biocca et al., 2003; Bailenson et al., 2005) have drawbacks: self-report measures are subjective, but any objective (behavioral or psychophysiological) measures will also be problematic since they will not reveal what people feel or how they interpret the presence of another. Obviously a combination of methods will provide the most well-rounded understanding and/or explanation of this phenomenon.

As mentioned earlier, there are several aspects of interpersonal relations on this second dimension that are important. Garau (2006), for example, has shown that people are more responsive to and experience a higher level of copresence when interacting with behaviorally more responsive agents (agents that display human-like behaviors) in immersive environments. She also showed that people are more responsive to and perceive the quality of communication as being improved when interacting with an inferred eye gaze avatar (an avatar for which a life-like eye gaze is generated using a computer program) than with a random eye gaze avatar in a variety of conditions (seeing the avatar on a screen, and in an immersive virtual environment).

A number of other factors influencing copresence have been studied in the context of other media technologies, but in the case of SVEs, there are several that apply specifically to this technology. These include the nonverbal communication of the avatar, avatar appearance and behavior, and the extent to which people exercise control over the graphical environment and its features. Again, without going into the findings in this area in detail, it will suffice to say that here, too, there is a great deal of variation in the extent to which people experience being there together in different SVE settings, and much of this will depend on the appearance of the other person and the environment and the control the technology or the environment affords. The key point about locating copresence on the second dimension in this case is that although immersive SVEs like networked IPT systems will generally rate more highly in terms of copresence than desktop systems (see Spante et al., 2003), the factors affecting copresence are much more complex than those affecting presence (Schroeder, 2002b). To give just one example: a highly immersive environment with a nonrealistic avatar may afford no more copresence than a nonimmersive desktop one (and less than one with a realistic avatar).

3.3 Some Findings about Connected Presence in Everyday Life

So far, we have considered various SVEs in terms of presence and copresence. What if we now compare the nature of being there together, not from the point of view of high-end systems and their affordances, but from the perspective of how users experience being

there together in their everyday lives? Here we need to turn to non-VE technologies since SVEs, apart from online gaming (discussed below) have not been used in extensive or routine ways for being there together.

It will be useful to give two examples of forms of mediation that can be conceptualized as having an affinity to, or being comparable to, SVEs. This will show that, although the end-state presented here may seem far-off at the moment, it is important to anticipate the factors shaping connected presence as they develop towards more immersiveness and share its features.

To do this, we need to relax the definition of presence and copresence based on sensory perception and broaden it to a wider sense of being there together. Thus presence does not need to be immersive if we shift from a sensory experience of being in another place to having a *sense* of being in another place. Similarly, copresence will only require that people that have a *sense* that others are there with them. If we take this broader view of presence and copresence, it becomes possible to discuss some everyday uses of communication technologies that do not meet the strict definition—but which, as we shall see in a moment, researchers have nevertheless associated with these concepts.

The two examples are Nardi, Whitaker, and Bradner's (2000) analysis of instant messaging (IM) and Licoppe's (2004) study of mobile phones (including short message services or SMS). They argue that these technologies—in different ways—provide a persistent link between people that gives them a sense of being there together with the other. (Another example, similar to Licoppe's, are young Japanese mobile email users, see Ito and Okabe, 2005, especially pages 264–266.) They also suggest that the uses of these two technologies are not primarily for information exchange or for individual communication acts. Instead, they are used, in the Nardi et al. study, for what they call "outeraction," which is defined as "communicative processes · · · in which people *reach out* to others in patently social ways" (p. 79). Similarly, mobile phones, according to Licoppe, are used for "'connected' presence · · · in which the (physically) absent party renders himself or herself present by multiplying mediated communication gestures up to the point where copresent interactions and mediated communication seem woven into a seamless web" (Licoppe, 2004). In other words, in both cases, the technology is used expressively as opposed to instrumentally and to indicate a state of mutual availability or awareness.

Note that, apart from relaxing the requirement of sensory experience for presence and copresence, we also need to shift the emphasis from the experience of individual encounters to the maintenance of relationships. What Nardi et al. (2000) and Licoppe (2004) nevertheless find, interestingly, is that the subjects themselves talk about the experience of these relationships in the language of presence and copresence, so that presence and copresence does not just mean that people have an imagined sense of being there or being there together, as, for example, in fiction or in text-based MUDs, but (as we shall see) talk about their experience in terms of sensory experience.

Let us look at these two forms of connected presence more closely. Nardi et al. (2000) studied IM in two work organizations (a telecommunications company and an internet company) and found that "intermittent instant messages were thought to be more immersive and to give more of a sense of a shared space than · · · email exchanges" (p. 84). This made IM "similar to the 'virtual shared office'" (p. 84) that has been demonstrated with open videoconferencing links. IM is used expressively in this setting in the sense that it creates what they call "awareness moments" whereby people feel that the other person shares the same space. They note that IM is typically used in conjunction with other communication technologies and with face-to-face meetings, such that one can speak of different "communication zones" which "delimit a virtual 'space'" (p. 86), or rather several such spaces that people step into and out of (to use their terminology).

IM thus supports different relationships with each other and, despite limited awareness, provides a better link between users than email because users have the option to use it or not to use it in conjunction with other modes of communication, and because it affords symmetrical opportunities to all users (unlike say, a phone or face-to-face conversation in which the addressee *must* respond if they are available, or an email

exchange in which the sender cannot be sure if the addressee is present for reply). Put differently, IM allows users more control inasmuch as both parties have the possibility to make themselves unavailable. For videoconferencing, in contrast, it has been argued that one reason why this technology has not been as popular as expected is that people either have to take themselves at a set time to a particular videoconferencing room—or if the videophone is in their office or home, they *have* to be available for a visual engagement. (Moreover, on a practical level, videotelephony often has technical problems, whereas IM is a comparatively robust technology.)

Interestingly, similar issues about shared spaces and availability arise in the quite different context of mobile phones studied by Licoppe (2004). Licoppe's research, unlike that of Nardi et al. (2000) focuses on the private or nonwork use of communication technologies and it is based on user logs and interviews. He contrasts the "connected management of relationships" or "connected presence" via mobile phones and SMS with the "conversational mode" of communication via stationary telephones: conversations via stationary telephones are typically longer conversations that take the form of a routine ritual with distant others to affirm a bond. Mobile phone use (including SMS) by contrast is typically short and the content does not matter as much as the fact that one affirms one's availability to the other or that one is thinking about the other. Licoppe describes this as a "connected" or also a "phatic" (conveying general sociability as opposed to specific meaning) mode of communication. This mode may be irregular, but it continuously affirms the relationship and becomes part of managing one's relationship with a few close people over a set of proliferating media. And again, as in the case of IM, mobile phone messages often lead to interactions via other media or face-to-face.

What we can see in the cases of IM and mobile phones/SMS then are media with little media richness and little immersiveness or ability to interact in a powerfully immersive way. Nevertheless, these communication technologies can in some way be regarded as yielding more of a sense of being there together than stationary telephony, videoconferencing, shared virtual spaces, or face-to-face meetings. The reasons in both cases are that participants have more control (including over where they are), more flexibility (possibility to switch media, multiple modes at the same time), more permanence (the channel can be kept open), and more awareness (one can have several users in one's field of vision in IM), all of which map onto the three dimensions in the connected presence cube in Figure 1 and Figure 2 (Licoppe uses connected presence in the broader sense of connected sociability—roughly, the second and third dimension—whereas the connected presence cube foregrounds the first dimension, arguably the most important for VEs in the definition used here).

Clearly from the point of view of the human senses, completely immersive and all-surrounding environments with full representations of oneself and other users are the richest possible medium (though in the two end-state varieties—immersive videoconferencing and immersive computer-generated environments—discussed earlier). It is also possible to envisage mixed modes apart from the extremes of rich and poor modes. There may, for example, be socially rich but sensorially poor modes, and vice versa. Or it is possible that different modalities could be used in combination at different times to maintain different states of connected presence or being there together. Nevertheless, all of these will fit into the connected presence cube—as long as we remember that the connected presence (z) dimension consists of a number of elements (again, time, number of relationships, and immediacy or exclusivity). In the case of IM and mobile phones/SMS, the sense of presence may be quite low (the y axis), but the technology will rate highly on the x axis and goes a long way on the z axis for many of the users in Licoppe's (2004) and Nardi et al.'s (2000) studies. For Licoppe and Nardi et al., presence is not so much being in another place per se, but continuously letting the other know your whereabouts and keeping updated on theirs. This continual awareness therefore shades into copresence, but also has elements of colocation or presence.

At this point we can make some comparisons between these two media for being there together. One is that in IM there is an avatar presence while mobile phones maintain availability without avatars (though this may change with the increasing availability of images on mo-

bile phones in addition to voice and text). On the other hand, IM maintains this connection with only a small list of users, whereas mobile phones allow connectedness with a larger group—at least in theory. In practice, as Licoppe (2004) shows, regular mobile/SMS contact is with a small group, and IM lists can be long. IM thus has more copresence, more constancy, and is less interruptive, whereas mobile phones/SMS are more accessible, flexible, and (to adapt a point made by Sallnas 2004 in her comparison of text-only and voice SVEs) voice presents a copresence reality check. Finally both can convey a sense of presence if the location or place of the sender or receiver is disclosed via sound (and image for IM).

4 Comparing Presence, Copresence, and Connected Presence in Different Media

4.1 Comparing Presence

Although presence has mainly been studied in the context of VR/VE research, some steps have been taken to compare SVEs with other media. Thus researchers have put technologies such as IMAX screens, 3D computer games, and other technologies on the same scale as VEs (Lessiter et al., 2001). Comparisons can also be made with presence in the real world (Nisenfeld, n.d.). Combining the results of Lessiter et al. with his own, Nisenfeld finds that the real world scores highest on spatial presence, with an IPT system scoring higher than a video game but lower than an IMAX screen. Interestingly, for engagement, which is one way of analyzing presence, a video game scores roughly the same on presence as an IPT in Lessiter et al.'s comparison. Still, as pointed out earlier, there is considerable debate about the appropriate ways to measure presence (Scheumie et al., 2001) and about comparing VEs with other media.

Another key factor to mention in connection with the presence scale is how much interaction is possible. Perhaps on Lessiter et al.'s (2001) measures, a passive experience like an IMAX movie provides a greater sense of (spatial) presence than IPTs (though this will depend on context and on the content), but an IPT in which objects can be manipulated provides more control over the environment. Interactivity and presence are clearly interrelated, but this relationship has not been subject to systematic research.

4.2 Comparing Copresence

For copresence, there are also a number of issues in SVEs that overlap with those in other technologies the audio quality and visual appearance of the other participants, for example, are also issues for videoconferences.

One factor that is obviously a key determinant of copresence in SVEs, as in face-to-face situations and in other media, is group size, or the number of avatars in encounters or social situations: the more avatars, the more one's focus of attention is divided, and the focus on any *one* other person's copresence may therefore be diminished (though there is no research on this topic for SVEs). Thus we could ask a similar question about, for example, one's online instant messaging contacts as can be asked about the number of avatars with whom we shared the same space in SVEs: namely, if there are more copresent participants, does their copresence become diluted? Another question that can be compared here is whether copresence is enhanced by having an image of the user: How does copresence vary with the realism of the user representation (Garau, 2006)?

4.3 Comparing Connected Presence

When it comes to connected presence, there are a number of overviews of the social psychology of mediated communication (for example, van Dijk, 1999, Chapter 8). Baym has reviewed the issues concerning online togetherness in her essay *Interpersonal Life Online* (Baym, 2002). She discusses issues such as communities, trust, and others in relation to the internet and text-based CMC generally. Even if online relationships are typically text-based, they can perhaps in one sense best be seen as the closest relative to connected presence in SVEs.

But at this stage in the comparison we need to distinguish between the three subdimensions of connected presence mentioned earlier: first, the extent to which

the relationship is mediated through an environment or the all-embracing nature of the mediation; second, the number of relationships that are mediated in this way; and third, the extent of time spent in these mediated encounters. At the same time, the three subdimensions are bound to be combined with presence and copresence in various ways.

4.3.1 Copresence and Interpersonal Relations. How immersive—or all-embracing—is the copresence of participants in different media? In fully immersive SVEs, the (graphical, visual) environment surrounds the interaction, and otherwise the audio conveys the communication between participants. This makes SVEs a medium that combines the features of other media that support copresence via voice (the telephone) or video- or computer-generated representations of the other person (videoconferencing, instant messaging) and include the environment in various forms.

Sallnas (2004) found, when measuring copresence in 3D SVEs and 2D web environments and with and without voice, and with and without a videoconferencing representation of the other person in addition to the avatar representation, that audio copresence overshadows the visual copresence of the other participant—or, as she also puts it, it provides more of a reality check of the other person. This is an important finding, but we know little (apart from this work on audio) about the weight of different modalities in conveying the copresence of the other person in different media. Still, even if visual copresence is overshadowed by audio copresence, it is clear that immersive and desktop SVEs *with* voice provide more immersive copresence than copresence in other media.

4.3.2 Immediacy versus Exclusivity of Mediated Relationships. For copresence and relationships, we can distinguish between online relations with strangers (or relations that are anonymous); against those that are complementary to face-to-face relations; and against those that are complementary to other forms of mediated relations with people. Purely online relationships with strangers have been much discussed (Baym, 2002), but for complementary relations, too, it may be necessary to distinguish between different degrees of complimentariness or exclusivity for the sake of analyzing connected presence.

If we combine the presence and copresence scales, we could ask: how far *removed* are the online relationships from face-to-face relationships? Put differently, the immediacy (or realism) of the other person will be captured not only by the extent to which sociability is mediated, but also by the strength of the presence with which other person(s) are experienced. From the individual's point of view then, relationships may be experienced as more and less immediate or direct depending on the spatial and copresence of the other participants combined, but also by the exclusivity of whether they also experience each other online or offline as an additional factor (Steed et al. 2003 examines this for immersive SVEs).

4.3.3 Time Spent in Mediated Relationships. For longer-term relationships in immersive SVEs, there are as yet not many findings, although for online games and nonimmersive social spaces, there is some research that bears on longer term uses (reviewed in Spante, 2004). SVEs for socializing—for maintaining social relationships or engaging in sociability as opposed to those for entertainment—have not yet come into very widespread use. One reason for including them here is that some people spend a considerable amount of time in SVEs, at least in online games and social spaces (Yee, 2006; Hudson-Smith, 2002), and so they will have a higher value for connected presence than other SVEs. A key finding here is Walther (Walther, 1996), who shows that even in online interaction that is lacking in many social cues, such as text-based computer-mediated communication, people still get to know each other, in some senses better than via face-to-face communication, but it takes them longer to do so (Walther calls these "hyperpersonal relationships").

If we consider communication technologies beyond SVEs, there are examples of people who spend a considerable amount of time every day in mediated relations with others or in (minimally) interactive spaces such as IM. The extent to which people spend a substantial part

of their day in SVEs is still limited, but if we think about those whose contact with others consists to a large extent in mediated relationships and who spend much of their day in this way, then this represents a sizable population. How this affects their relationships has been investigated in different contexts, but if we are interested in how these mediated relationships add up, an indicator of the aggregated mediatedness of our relationships, this remains (to my knowledge) to be investigated. Put differently, even if we can put different communication technologies on the scale of presence, copresence, and connected presence in relation to their approximation of the end-state in terms of their immediacy or exclusivity for a particular encounter, we are still far from being able to gauge their overall role, the total number and time spent in mediated presence relationships, or what Licoppe calls our "relational economy." (Licoppe points out, however, that insofar as the data are digital, they can easily be gathered and aggregated.)

A final question that can be raised about mediated relations in SVEs and other media such as instant messaging, phone, online computer games, and others, and which is related to interactivity, discussed earlier, is: what kind of affordances do these mediated relations have (Hutchby 2001)? How are relationships supported? Here we are close to where presence, copresence, and connected presence intersect, or to gauging how active or passive media are, since these affordances, or, in the case of SVEs, the degree of interaction (manipulating the environment and engaging with the other), are closely interrelated.

4.4 Connecting SVEs and Other Media

At this point we can compare some of the findings about connected presence in mobile phones/SMS and IM with SVEs. SVEs allow direct awareness whereas these other media allow lesser direct awareness and a less immediate sense of the availability of the other person. And whereas SVEs allow a shared *space,* IM and mobile phones/SMS support *relationships.* Finally, whereas copresence in SVEs is continuous, in IM and mobile phones/SMS relationships are maintained over certain stretches of time. In this wider sense then, SVEs as well as IM and mobile phones/SMS provide a shared communication space.

Licoppe therefore argues that our "entire relational economy · · · is 'reworked' every time by the redistribution of the technological scene on which interpersonal sociability is played out" (Licoppe, 2004, p. 142). He says that there is "evidence of a gradual shift in which communication technologies, instead of being used (however unsuccessfully) to compensate for the absence of our close ones, are exploited to provide a continuous pattern of mediated interactions that combine into 'connected relationships' in which the boundaries between absence and presence get blurred" (Licoppe, p. 135–136). This is a gradual—historical—shift, but one implication is that it could be more useful for the study of contemporary uses of communication technologies to gauge different communication technologies in relation to *each other*—to see a continuum between a fully immersed end-state of mediated relations and lesser ones as suggested in Figures 1 and 2—than to compare mediated copresence or connected presence with the baseline of face-to-face encounters.

It may also be possible to go further to imply, as Licoppe does, that the changing relational economy of being there together in these different modes may progressively devalue face-to-face relations (Licoppe, 2004, p. 154). In this vein, we can contrast the limited but technologically powerful uses of SVEs with the low tech but widespread and frequent or common uses of IM and mobile phones/SMS: the former are the furthest high/high point on both dimensions for Figure 1 for individual encounters, whereas the latter may be low/low, but they account for a much higher *volume* of being there together or connected presence. With the changing landscape of information and communication technologies, however, this balance will surely change.

It is thus important not simply to take face-to-face encounters and physical location as a point of departure. At the furthest extreme are virtual places that are completely immersive and where people have created the environments that they "inhabit" (Hudson-Smith, 2002). This is rare even for short periods as yet on the presence dimension, but it is an end-state that is approached on the copresence and connected presence

dimensions. An important point about the end-state—which has been made in relation to other, less immersive forms of being there together—is that there is no reason why mediated relationships or encounters should be regarded as less authentic or less engaging than face-to-face interaction.

There are some examples that approach this end-state to a lesser extent; for example high presence-generating technology that is low on interpersonal copresence because the relationships are defined by preassigned roles and activities and are therefore not interpersonal in the same sense as face-to-face encounters—such as highly realistic online computer games like Quake or Counterstrike. This is not to say that people cannot develop engaging relationships in online games (Axelsson & Regan, 2002), only that *in so far as* they make use of pre-assigned roles and activities, they do not provide for direct inter-personal relationships (it may be useful to think here of the face-to-face interaction between two theater actors that are in character). Apart from online gaming, it is difficult to think of *extensive* or long-lasting day-to-day uses of this type of highly immersive but low copresence technology or medium.

In other words, online games, which are highly engaging, nevertheless depend on identification with characters or on playing roles, and this means that interpersonal encounters between the people behind the avatars (and copresence in this sense) is downplayed. For this reason Marc Smith (personal communication) calls online gaming characters virtual puppets. The same considerations apply to presence in the situations described by Klimmt and Vorderer (2003) who include a wider range of phenomena than the definition of VEs here allows—reading books, watching films, playing single-person computer games, and the like: strong identification with narrative and with onscreen characters can, to be sure, lead to a strong sense of presence in the sense of engagement, but this is not a first person engagement of the senses with the environment—rather, it is an engagement of the imaginary identification with fictional characters.

In addition to the complementarity of online relations to face-to-face relations, and apart from the length of time spent, it is important to consider the number of people that one is interacting with: many communications media only support one-to-one or one-to-several two-way relationships (the exceptions include the shared spaces with many users that were just mentioned). Broadcast communication technologies fall outside of the scope of Figure 1, except perhaps for interactive uses or two-way uses of media such as interactive TV (Craven et al., 2000). Thus SVEs such as Activeworlds (Hudson-Smith, 2002) that are used as online social spaces provide an interesting example—lower than immersive SVEs on presence, but high on copresence—of approximations towards the end-state of inhabited copresence.

5 Shared Virtual Environments, the Multiple Modes of Connected Presence, and the Future of Mediated Relationships

SVEs can be compared to other environments for being there together, which raise issues pertaining to the immersiveness and interactivity of graphical plus audio environments (again, interfaces for the other senses could be discussed here, but interactive and immersive graphics with audio is the most common type of VE system and environment). Further, they allow us to compare an end-state of full and constant immersiveness with various other conditions of connected presence. SVEs can thus be used to investigate a range of communications conditions along the presence, copresence, and connected presence dimensions. The dual end-state scenario of SVEs represents a valuable research tool for the study of the role of (computer-) mediated communication in society. In addition, this end-state can be used to advance social science research, with experiments in SVEs that are difficult or impossible in face-to-face situations because various conditions of presence and copresence can be manipulated (Blascovich, 2002; Bailenson & Beall, 2006). ("Manipulating conditions" may bring to mind social psychology, but it needs to be remembered that all kinds of conditions can be manipulated in SVEs, such as the means by which users can contact each other, how they can shape the

built environment, etc.) In short, they offer a laboratory for studying face-to-face encounters and other media by allowing an array of conditions towards an end-state.

What brings all the issues around the different types of presence together into a coherent whole, from the point of view of taking mediated relationships rather than face-to-face encounters in the physical world as the baseline, is the focus of attention *inside* the environment (exclusively, away from the physical world and its face-to-face encounters), which consists of the forms of attention on the other person(s) or mutual focus on one side, and on the environment on the other. In other words, the focus can be on the relationship, or on the interaction with the environment (though of course interaction with the other person(s) is also a form of interaction).

There are bound to be environments that are rich in terms of the spatial environment, and poor in terms of affording the sense of another person (or persons) being there, and vice versa. Since the spatial component—being *there* and being *there* together which includes being able to navigate through and manipulate the environment (the presence or *y* dimension)—is arguably the most essential feature of VE technology, a critical area for future research will be to identify when this spatial component outweighs the communicative or interpersonal relationship part of SVEs (the *x* or copresence dimension), which centers on avatar appearance, eyegaze, and the like—or the other way around, when the communicative outweighs the spatial. In view of the model presented here, this is perhaps the most fundamental balance that SVEs need to achieve in order to provide connected presence successfully. So far, there is little research that directly addresses the topic of how the two dimensions are related, though many insights could be drawn out from existing research, and a research program could be designed that systematically examines whether the focus is on one or the other; and if there is a conflict between them or if they fit easily together. If SVEs of different types become more common, as can be expected, this is a key research priority.

In other words, the focus in the SVE is on seeing or hearing the environment and the other person(s), but the focus can also be on what you can *do* in the environment, and *do* there together—how people can interact with each other and with the environment. This notion of interaction, however, is still too passive for gauging connected presence. What is also needed is a more active notion of how relations can be maintained, or how they are enabled and constrained, in different media. Apart from the control over the immediate activity or what holds one's attention, we could ask about the extent to which people have control over the environment in different media or mediated environments—how much they can be modified, what control over their appearance users have, what level of interactivity the displays and tools provide, and the like (all these have already been discussed in passing.) In addition, we should add the depth of the relationships, which encompasses the extent in time and the immediacy or exclusivity, that these media afford for being there together and for making the environment one's own (combining all three subcomponents of the *z* dimension mentioned earlier).

Debates about our mediated relationships with others have arisen previously in relation to new media. Recently, the debate has been about whether the internet contributes to fewer offline relationships and the like (Baym, 2002). If we think in terms of copresence and connected presence, these debates can be put into a different perspective: it is not that purely mediated interpersonal relations should be seen as causing loneliness or being inferior to face-to-face relations and the like; rather, different media provide different possibilities for being there together in the changing landscape of interpersonal connected presence.

Relationships are thus shaped not only by the medium, but by its affordances. These affordances apply not just to the relationship with people, but also to relationships to the environment and our control over it. Even if, as mentioned earlier, our relations in these media technologies should be described in terms of areas rather than as points on the three axes in the two figures, certain technologies and their uses nevertheless remain clustered in particular areas in relation to each other. This is an obvious point, but one that is not often made (Hutchby, 2001, is an exception): different technologies provide different constraints and possibilities

for being there together, and if we put these on our three axes, we can begin to see what the futures of different media might look like.

This leads to what is perhaps the most comprehensive question that can be raised in relation to the intersection between the three dimensions of presence: Given that our relationship to the world is mediated by information and communication technology, what affordances, physical and social, do the various technologies for being there together provide? This is the question to which the end-state presented here can begin to give some interesting answers. The end-state of SVEs points to a particular form of the mediation of our physical and social worlds and particular forms of living in immersive virtual worlds. If, however, we do not take face-to-face relationships as a baseline but rather as approximations to this end-state, then we can ask: what do SVEs, in contrast with other less immersive relations, afford? How do the levels of immersiveness and togetherness compare with each other, rather than compared with face-to-face relations in the physical world?

Many SVEs provide a rich modality for being there together compared to other media and they offer more control. Yet, as we have seen, other media also provide a strong sense of mutual awareness and availability on an everyday basis. With the changing landscape of mediated relationships and new media technologies, the line between SVEs and other new media technologies (which often include images and sounds of the other person and of the environment) that are shared over interpersonal networks are becoming increasingly blurred. Hence a research program will be required that takes SVEs beyond the laboratory and early uses, and beyond online gaming and social spaces, and put being there together into the context of our multiple modes of connectedness in everyday settings.

The connected presence cube allows us to do this; to see individuals connected to others via various communication and interaction modalities, with face-to-face communication as only one among other possibilities. People are either immersed in the physical world or in the virtual world, stepping into and out of these constantly, and sometimes participating in several such worlds, limited only by the fact that sensory attention needs to be focused on a limited set of people and features of the environment, which makes multiple simultaneous channels (communicative multitasking) difficult. Increasing communications means that we are ever more continuously connected to others who are aware of our presence and copresence to a greater or lesser extent. If we think of the multiple devices for connected presence that we use constantly throughout the day, it is possible to see that we need to manage our accessibility, mutual awareness, and focus of attention continuously with different affordances (or constraints and possibilities) in different technologies for mediated interaction. The design of SVEs should therefore be informed by how best to combine different levels of presence, copresence, and connected presence in our everyday lives.

Acknowledgment

Thanks to a number of anonymous references for the presence 2005 conference and the journal presence for helpful comments.

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