

9 "Being there" and the Role of Presence Technology

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Abstract. This paper uses the metaphor of "being there" to differentiate two basic modes of mediated presence. "'Being' there" refers to presence in a remote environment through sensory extension, and "being 'there'" refers to presence in a virtual environment through sensory simulation. In "'being' there," users believe that they are in contact with a real, albeit remote, environment, and their sense of "being there" is affected by the perceptual fidelity they receive. In "being 'there,'" on the other hand, users feel present in an environment simulated by a presence medium in the form of a mental model, and their sense of "being there" is affected by the realism of the simulation they perceive. The merging of "'being' there" and "being 'there'" constitutes a synthetic environment that combines both remote and virtual presence. A main argument of this paper is that telecommunications technology is useful for producing remote presence, and presence technology is useful for creating virtual presence. While the former seeks to make what is not (locally) present, the latter seeks to make what is not present seem present.

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9.1 Introduction

The issue of sense of presence is an issue of the relationship between sense and presence, and the issue of presence is an issue of "being there" [1]. "Being there" is a metaphor, referring to presence in an environment other than where one's body is. In the literal sense of the word, therefore, "being there" is impossible because nobody can be here and there at the same time.

To get there from here, one needs to relocate one's body in space and time through locomotion, yet as soon as one gets there, what was once "here" will become "there." Thus, at any given point in time, a person can only be "here" - a place that is within his or her immediate sensory reaches. In that regard, it is legitimate to say, "I'm going there," "I'll be there," "I was there," or "I've been there," but it does not make sense to say, "I'm there."

However, in a figurative sense, "being there" is possible in at least two different ways: through (a) sensory extension or (b) sensory simulation. Sensory extension changes the "being" of a person by electronically extending the reaches of the person's natural senses such that he or she is able to experience a remote environment without physically being there.

Sensory simulation, on the other hand, brings the "there" here to a person by presenting him or her, through sense manipulation, with an experience similar to the one obtained from an actual encounter. For purposes of differentiation, "'being' there" will be used to refer to presence in a remote environment through sensory extension, and "being 'there'" to presence in a virtual environment through sensory simulation.

"'Being' there" is in a way analogous to telepresence and "being 'there'" to virtual presence, except that the concepts of "telepresence" and "virtual presence" have been conflated in the existing presence literature.

Telepresence has been used to refer to the experience "common to both teleoperation and virtual environments" [2, 3], and virtual presence to either presence in a virtual environment (e.g., the feeling of being present in the scene created by a movie) or virtual presence in a remote environment (e.g., the impression of being together with remote interlocutors) [4, 5].

This conflation is unfortunate because it has led to the attempts to develop measures of presence assumed to be applicable to both remote and virtual environments.

In this paper I will use the metaphor of "being there" to show that the distinction between "'being' there" (i.e., being in a remote actual environment) and "being 'there'" (i.e., being in a perceived virtual environment) is an important one. Awareness of this distinction will help us understand the differences in users' purpose and expectations for presence between the two modes of "being there"; consequently, it will help us develop mode-specific measures of presence to improve the sensitivity of our measurement.

Finally, this distinction will help us delineate the role of what has come to be known as the presence technologies.

The remainder of the paper will be divided into four sections. The first two sections will focus on the two basic modes of presence - "'being' there" and "being 'there'" - respectively. In each section I will first define the mode of presence, then examine users' purpose and expectations for presence, and finally look at the implications for measurement. The third section will be devoted to the discussion of the synthetic environment that combines both "'being' there" and "being 'there'" in a shared space. In the last section I will briefly consider the roles presence technology plays in the above three situations.

9.2 "'Being' There"

"'Being' there" is a situation in which one reaches a remote environment by means of sensory extension [6, 7]. This definition calls for an explication of the meanings of "remote environments" and "sensory extension."

9.2.1 *Remote environments*

An environment is defined here as a physical space containing objects, events, and people. An environment becomes remote when it is beyond the reaches of naked human senses. Schutz and Luckmann, two well-known phenomenologists, divide the world we live in into two sectors based on the range of human sensory reach [8]. At any given point in time, a human individual is located at a given place in space, which serves as the zero-point of the individual's system of coordinates. Starting from that zero point, the area that is immediately accessible to the individual's naked senses is termed the "world within reach" and the rest of the area is termed the "world beyond reach." A remote environment is a place that is beyond the reaches of natural human senses.

Human sensory perceptions vary in their range of reach, with gustatory and tactual senses having a short distance and optical and auditory senses a much longer stretch. Although there are individual variations, people's perceptual ranges are essentially the same, determined by the biological makeup of human sensory organs. "Under-reach" is a predicament that can be remedied by a corrective device, such as eyeglasses and hearing aids. Natural human senses, including those aided by corrective devices, define the range beyond which human individuals lose direct perceptual contact with their surroundings.

9.2.2 *Sensory extension*

However, the "world within reach" can be expanded by extending the natural ranges of human perceptions. The extension of human senses is made possible through technological mediation.

The telephone, for example, simultaneously extends human oral and aural channels across distances so that people half a world apart can talk to each other in real time, and radio telescopes extend the range of human vision far beyond Earth, enabling people to receive signals from galaxies million light-years away. The remote environment reached by extended human perceptions is termed the "world within mediated reach" [9].

Depending on whether the technological mediation allows for interaction between the user and the remote environment, "'being' there" can be further divided into two subtypes: telepresence and telecopresence [10]. Telepresence is a form of non-interactive or one-way remote presence, as it only enables people on one side of the operation to extend their sensory reaches to the other side. "Being there" through devices like telescopes, radio and television falls into this category. Telecopresence, on the other hand, is a form of interactive or two-way remote presence, which allows people on both sides to extend their sensory reaches to each other. Examples of telecopresence include interpersonal communications over the telephone, by email or via the IRC.

9.2.3 *Actual contact through mediated communication*

Users' perception of "'being' there" is determined by, among other things, users' purpose for remote presence and their expectations for the roles played by communications technology.

The main purpose of remote presence is to contact or communicate with the world beyond immediate reach. The "there" to be reached is a real physical environment, which could be an in-service nuclear reactor behind the observation window, an orbiting satellite in space, a cruising ship at sea, or a teleconference participant in another continent. The technologies used for this purpose are expected to perform two major roles: (a) to provide a communication channel that permits the flow of information to and from the remote site, and (b) to provide an interface that allows users to send and receive information through that channel. The same communication channel can be fitted with different interfaces to create different types of remote presence. For example, a telephone line can be used to support both the voice phone and the videophone, which results in two different forms of interpersonal telecommunication.

It is important to point out that, although users expect communications technology to provide them with a communication linkage to the remote environment, they do not expect the technology to provide the *content* of communication. The content of communication is expected instead to come from the users themselves and/or from the remote environment the users are communicating with. Of course, in a way, the medium used to deliver a message is itself a message [11], which interacts with the message it carries to affect the experience of the users. Nonetheless, this does not give communications service providers any excuse to meddle in the contents of the messages they are asked to deliver. In other words, even though the experience is technologically mediated, users of telecommunications media expect genuine contact with a remote environment.

9.2.4 *Level of perceptual fidelity*

An important factor that affects the experience of "'being' there" is perceptual fidelity, namely, users' ability to perceive a remote environment in the same way they perceive a proximal environment. In a proximal environment where one is physically located, one's perceptual contact with the environment is immediate and direct. Such unmediated contact produces perceptions of highest fidelity, which one normally accepts without further doubt. Expressions like "seeing is believing" attest to this point.

However, the fidelity of one's perception of a remote environment is always compromised because of technological mediation, and the extent to which it is compromised depends on the quality of the communications medium one uses. Astonishing technological improvement in perceptual fidelity has been achieved in many areas of telecommunications. For example, the auditory fidelity of the telephone has been improved so much that a person who is actually thousands miles away sounds, over the phone, like someone nearby high definition television produces visual images so sharp that you think you are physically co-present with the people shown on the screen.

Perceptual fidelity, however, is not the same as perceptual richness [12], which is determined by the number of sensory channels involved. The more sense organs a communicational activity engages, the perceptually richer the communication becomes. In the study of human interaction, perceptual richness is also called level of embodiment, which ranges from "total body communication" [13] in a face-to-face situation to fully disembodied contact in chat-room exchanges. While perceptual fidelity is always preferred in remote presence, the same thing cannot be said about perceptual richness, for many online users choose to minimize embodiment in order to maintain anonymity.

Contrary to what some people may think, perceptual realism is irrelevant in the situation of "'being' there" because people in remote presence assume that they are in contact with real environments. This assumption may turn out to be false, though, but so long as users believe

that the assumption is correct, the remote environment remains real to them. Consider text-based online chatting. The reason why people write so engagingly even though they cannot see each other is because they believe that they are in contact with real human beings. Their sense of remote presence will shatter, however, the moment they discover that the faceless others are in fact computer programs like ELIZA [14] capable of mimicking human conversation. This suggests that the sense of "'being' there" is not related to perceptual realism, but to users' belief in the authenticity of their presence in a real, though remote, environment.

9.3 "Being 'There'"

"Being 'there'" is a situation in which one feels present in a virtual environment created by a presence medium through sensory simulation [15, 16]. Again, it is necessary to explicate the concepts of "virtual environment," "presence medium," and "sensory simulation" before users' needs and expectations for virtual presence can be meaningfully examined.

9.3.1 Virtual environment

A virtual environment is a "mental model" [17] that represents a physical environment. It is true that an actual environment also generates a perceptual model in the minds of the perceivers. The difference, however, lies in the origins of these models. In the case of the actual environment, the mental model is generated by the physical environment the model represents, whereas in the case of the virtual environment, the mental model is generated by a presence medium (i.e., a sense stimulus) to represent a physical environment that may or may not exist.

In other words, an actual environment is a physical environment coupled with a perceptual model that is generated by and represents the physical environment, and a virtual environment is a perceptual model generated by a presence medium that is different from the physical environment the model represents.

Consider the example of a person shopping for a car. Suppose that there is a real car on display at a local dealer's show room. The person walks into the room, looks at the design and color of the car, gets into the car, examines its interior, feels the wheel, the chair, and the brakes - the person is obviously in the actual environment of the car. Suppose that the person is now looking at the pictures of a car on a dealer's website. These pictures show the exterior as well as the interior of the car. There are also written descriptions of the car that go with the pictures. The person in this situation is virtually present with the car. The pictures are sense stimuli used to generate a mental model of the car that is not physically present at the time.

The mental model of the car is therefore a virtual environment in which the real car is felt present.

9.3.2 Sensory simulation

In "being 'there'", the "there" is a virtual environment or a mental model that is created by sense stimuli rather than the real environment the mental model represents. A sense stimulus is in this case a presence medium which is used to make what is not present seem present. A presence medium can take physical, electronic, or verbal forms. Physical presence media, such as paintings, artificial plants, dolls, and performing arts, simulate the sensation of encountering a real object by presenting a substitute that physically resembles the object.

Electronic presence media, such as audio products, video games, and movies, evoke the feeling of presence in an environment by electronically reproducing the environment. And verbal presence media, such as oral stories and written novels, create the mental imagery of an occurring event through verbal descriptions. In all of these instances, the content of a presence medium presents a missing physical environment in the minds of the medium users.

A simple form of a presence medium is a single stimulus medium, which generates a mental model by affecting only one sensory channel. A picture, for example, affects the visual sense, and an audio tape the auditory sense. Many presence media are, in fact, designed to influence more than one sensory channel. A television program stimulates both auditory and visual senses, and a video game involves auditory, visual, and tactile senses. It is generally believed that the more senses a presence medium affects, the more vivid the resulting virtual environment becomes [18]. An even more effective approach is to fully immerse a user's senses in a simulated environment by isolating the user's sensory contact from the real world by using a head-mounted display, a body suit, data gloves, and other virtual reality tools.

9.3.3 Entertainment and training through virtual encounters

What is then the purpose of being "there" in an environment that one knows is not real? There are at least two main reasons for that: entertainment and training. In the case of entertainment, people seek to experience for fun something that they cannot or usually do not encounter in the real world. A science fiction novel, a haunted house, a simulation flight, or a virtual space expedition -- it is not difficult to imagine how much fun these simulated experiences can bring to both children and adults. Another reason for "being 'there'" in a virtual environment is to reduce the risks of injury, death, and/or other losses that could occur in the real world while engaging in certain activities, such as learning how to fly an aircraft or drive an automobile.

Unlike in "'being' there", where users expect the communications technology to create only the communication linkage (i.e., tools to get there) and not the communication content (i.e., what is there to be experienced), in "being 'there'", users expect the presence technology to create both the presence medium (i.e., tools to get "there") and the medium content (i.e., what is "there" to be experienced). In other words, while the content of sensory experience comes from real environments in remote presence, it comes from the presence media in virtual presence. This difference is crucial for understanding users' presence expectations in virtual environments. First, users are aware that they are present in an artificial environment contrived by presence technologists to simulate a certain experience. Second, users are willing to suspend disbelief in order to let the simulation take effect.

This is probably one of the reasons why many adults still enjoy reading storybooks and watching animated movies even though the images presented there do not always look real.

Third, users understand that what happens in a virtual environment has no real-life consequences.

9.3.4 Level of perceptual realism

Perceptual realism is an important factor contributing to the sense of presence in "being 'there'."

Perceptual realism refers to the perceived resemblance between simulated and real-world experiences. In general, users expect a virtual environment to be life-like. For example, they would want the animated pictures of people to look like people; the artificial trees to look like trees; and the plot of a story to be realistically plausible. However, realism in a virtual

environment is often perceptually fractured: an experience may be more real to some senses but less real to other senses. A black and white drawing may look real in terms of patterns but not in terms of colors; a cartoonist bird that chirps may sound real, but may not look real; and a play that may seem real in all aspects, but takes place merely on a stage. Many users have learned to tolerate such perceptual fracturing by focusing only on the targeted sensory areas and ignoring the rest.

Perceptual realism takes on a new meaning when users feel present in a virtual environment that lacks a real-world counterpart. What does it mean to say a visit to a haunted house or a virtual expedition to Mars seemed real? How can you tell whether your virtual experiences are real-life like or not when in fact you have no idea how the real-life thing will look and feel like? In these instances, perceptual realism is largely defined in terms of users' imaginations rather than their real-life experiences.

The sense of "being 'there'" is, therefore, dependent on more than just perceptual realism. In addition to users' willingness to suspend disbelief, users' knowledge, imagination, and enthusiasm in the activity all come into play in affecting their sense of presence in a virtual environment.

9.4 Synthetic Environments

The merging of "'being' there" and "being 'there'" in a single space gives rise to a synthetic environment in which a user simultaneously experiences remote presence and virtual presence [19].

Depending on where the presence medium is placed, two subtypes of synthetic environments can be delineated: (1) remote-local, and (2) remote-remote. A remote-local synthetic environment combines remote presence with proximate virtual presence, where users are in contact with an actual environment at distance and a virtual environment in close proximity. Examples: two individuals talking to each other over the phone while each holding a picture of the other; and an individual communicating in real time with a remote person through a locally situated robot representing the remote person [20]. A remote-remote synthetic environment combines remote presence with online virtual presence, where users are in contact with an actual environment and a virtual environment across distances at the same time. Examples: a group of electronically networked people text-chatting with one another using a graphic interface, with each being represented by a partially guided avatar [21]; and users of a tele-immersive system manipulating a simulated 3-D object in a shared virtual space [22].

The sense of presence resulting from being in a synthetic environment can be complicated. On the one hand, users expect to be in touch with real people and/or real objects in a remote but actual environment and, as such, authenticity and fidelity are important to them. On the other hand, users expect to receive outputs from virtual objects in a simulated environment created by presence technologists, in which case perceptual realism and users' own imaginations become crucial factors. There are times when users find it hard to keep these two sets of expectations separate in dealing with a mixed reality.

Consider the example of chatting online with your friend using semi-animated avatars. You cannot see your friend, but you believe she is there writing to you; and, although her avatar is smiling and blinking at you, you know it is a simulated object. In this case, the real and the virtual are not intertwined. However, consider another example: suppose you are taking a virtual-reality-enhanced roller-coaster ride with the remote friend through the Internet. You

feel you are moving at a tremendous speed on a curved railway, being turned upside down, and making sudden free falls. You hear your friend's screams, feel her tight grips, and see her panicked face.

You understand very well, though, this is a virtual ride, but you also know for sure that your friend is taking the same ride with you, and the screams, grips, and panic are real. In this situation, it is somewhat difficult for the users to separate the actual from the virtual and the real from the simulated, for the combination of live video outputs with graphical images, real audio streams with synthetic sounds, and real-time haptic feedback with simulated motions has succeeded in blending "'being' there" and "being 'there'" in the creation of a mixed reality.

9.5 The Role of Presence Technology

Presence technology is defined here as a collection of technologies that seek to create a perception of presence in an environment through sensory simulation. Sensory simulation can be accomplished in two different ways: (1) stimulating users' senses using external stimuli to create a desired sensory experience, (2) bypassing the sensory organs to stimulate directly the perceptual systems in the brain [23]. Either way, a sensation of being present in a particular environment can be created without actual presence in the environment. Presence technology has so far focused on the manipulation of senses using external stimuli.

Defined in this way, presence technology is different from the technology used to accomplish remote presence. The technology for remote presence is commonly known as the technology of telecommunications, which enables users to contact remote environments by means of electronically extending their sensory channels. More specifically, there are two major differences between these two sets of technologies. First, telecommunications technology makes what is not present present, whereas presence technology makes what is not present *seem* present. Remote presence is a form of actual presence, for the "there" in "'being' there" is a real environment. Through sensory extension, the technology makes a remote object accessible to the users. Virtual presence, on the other hand, is a form of perceived presence, which takes place only in the minds of the users. Through sensory simulation, the technology makes users feel that they are in touch with something real, but in reality that "something" does not exist. Second, while communications technology creates only the linkage for communication not the content of communication, presence technology creates both the presence medium and the content of the medium. In other words, in remote presence (e.g., flying a remote plane) the sensory outputs (the data) come from the actual environment (the plane) the users are in contact with through a technology (remote control), but in virtual presence (e.g., flying a virtual plane) the sensory outputs (the data) come from the medium (the simulator) the users use, rather than from the perceived environment (the plane) the users feel present in.

Most of the existing media technologies belong to presence technology. Creative writing, storytelling, painting, photographing, and acting all aim to give media users a sense of presence in a perceptual environment the media create. But the core of the presence technology involves the coordinated use of two or more media technologies for the purpose of maximizing the power of evoking a sense of presence. Examples of such multi-media efforts can be found in the making of movies, stage plays, and virtual reality games. Presence technology is most useful for the creation of virtual and synthetic environments, but its role in remote presence is rather limited.

The use of presence technology for remote presence is confined to the realm of data selection and display. As pointed out earlier, the way an object is presented to a person affects the person's perception of the object. Although the sensory outputs to the users come from an actual environment in remote presence, these outputs must be collected from the environment and presented to the users after transmission. The process of data collection and presentation involves presence technology, which includes factors like camera techniques, recording quality, image size, and viewing distance [24].

Presence technology plays two pivotal roles in creating virtual presence: content creation and content delivery. Content creation concerns the design and production of the content of a presence medium that simulates the virtual environment that users perceive to be present.

Content delivery involves the making of a presence medium that delivers a particular media content.

Take for example the movie industry. Script writing, acting, directing, and editing belong to content creation, and the movie theater, which includes the screen, the projector, sound quality, and lighting, belongs to content delivery. These two factors together shape users' sense of presence in a virtual environment.

Presence technology, along with telecommunications technology, helps to produce a synthetic environment. Telecommunications technology is responsible for establishing a linkage between users and the remote environment and for transmitting information between them. Presence technology, on the other hand, is responsible for creating a presence medium that generates a virtual environment. The combination of these two technologies holds the promise of producing an incredible environment that blurs the distinction between the real and the virtual.

9.6 References

- [1] B. R. Reeves, *'Being there': Television as Symbolic Versus Natural Experience*, Unpublished manuscript, Stanford University, Institute for Communication Research, Standard, CA, **1991**.
- [2] R. M. Held, R. M. & N. Durlach, Telepresence, *Presence: Teleoperators and Virtual Environments*, 1 **1992**, 102-112.
- [3] J. Steuer, Defining virtual reality: dimensions determining telepresence, *Journal of Communication*, 42 **1992**, 73-93.
- [4] H. R. Rheingold, *Virtual Reality*, New York, Summit Books, **1991**.
- [5] R. Braham & R. Comerford, Sharing virtual worlds, *IEEE Spectrum*, 34, **1997**, 18-19.
- [6] M. Minsky, Telepresence, *Omni*, June, **1980**, 45-51.
- [7] T. B. Sheridan, Musings on telepresence and virtual presence, *Presence: Teleoperators and Virtual Environments*, 1, **1992**, 120-126.
- [8] A. Schutz & T. Luckmann, *The Structures of the Life World*, Vol. 1. Evanston, Northwestern University Press, **1973**.
- [9] See [8]
- [10] S. Zhao, *Toward a taxonomy of copresence*, Paper represented at the 4th Annual International Workshop on Presence, **2001**.
- [11] M. McLuhan, *Understanding Media: The Extensions of Man*, New York, McGraw-Hall, **1964**.
- [12] R. E. Rice, Task analyzability, use of new medium and effectiveness: a multi-site exploration of media richness, *Organization Science*, 3, **1992**, 475-500.
- [13] F. Poyatos, Cross-culture study of paralinguistic 'alternants' in face-to-face interaction, in *Organization of Behavior in Face-to-face Interaction*, A. Kendon, R. M. Harris, & M. R. Key (ed.), Chicago, Aldine, **1975**.
- [14] J. Weizenbaum, ELIZA: a computer program for the study of natural language communication between man and machine, *Communications of the ACM*, 9, **1966**, 26-35.
- [15] D. Zeltzer, Autonomy, interaction, and presence, *Presence: Teleoperators and Virtual Environments*, 1 (1992), 127-132.

- [16] F. Biocca, Communication within virtual reality: creating a space for research. *Journal of Communicaiton*, 42, **1992**, 5-22.
- [17] See [7]
- [18] W. Barfield & S. Webhorst, The sense of presence within virtual environments: a conceptual framework. *Proceedings of the Fifth International Conference of Human-Computer Interaction*, **1993**, 699-704.
- [19] N. Durlach & M. Slater, Presence in shared virtual environments and virtual togetherness, *Presence: Teleoperators and Virtual Environments*, 9, **2000**, 214-217.
- [20] E. Paulos & J. Canny, Social tele-embodiment: understanding presence, *Autonomous Robots*, 11, **2001**, 87-95.
- [21] G. Walker, J. Bowskill, M. Hollier & A. McGrath, Telepresence: understanding people as content, *Presence: Teleoperators and Virtual Environments*, 9, **2000**, 119-136.
- [22] J. Lanier, Tele-immersion: like being there. *Scientific American*, 284, **2001**, 68-75.
- [23] W. Gibson, *Neuronmancer*, New York, Ace Books, **1984**.
- [24] M. Lombard, At the heart of it all: the concept of presence, *Journal of Computer-Mediated Communication*, 3, **1997**.