Toward A Taxonomy of Copresence

Shanyang Zhao

Department of Sociology, Temple University, Philadelphia, PA 19122

1. Introduction

The term "copresence" has recently been appearing in the presence literature with increasing frequency, but, like the concept of presence at its nascent stage, the meaning of this term is yet to be fully explicated. As it currently stands, "copresence" refers to (1) the sense of being together with other people in a remote environment (Muhlbach et al 1995; Lombard and Ditton 1997); and (2) the sense of being together with other people in a shared virtual environment (Slater, et al. 2000; Durlach and Slater 2000). This use of "copresence" is therefore parallel to the established usage of "presence" that entails (1) telepresence -- the sense of being present in a remote environment, and (2) virtual presence -- the sense of being present in a simulated virtual environment (Steuer 1992: Sheridan 1992). The difference between the two, however, lies in the emphasis of copresence on people and human relations. Separating people from things and treating them as a distinctive category for presence research is the main contribution of the conception of copresence.

The purpose of this paper is to further develop the concept of copresence by suggesting a taxonomy that describes the major forms of human togetherness in contemporary society. Not every type of human gathering is a form of human copresence, and there can be human copresence without the gathering of real people. It is therefore important to clearly explicate the conception of copresence. I will start by specifying the criteria I will use to classify copresence; I will then apply these criteria to the construction of a taxonomy that delineates four conditions of human co-location; after that I will examine the interface parameters that define the ways in which individuals communicate with one another in a given condition of co-location; finally I will discuss the implications of the taxonomy for copresence research and design.

2. Classification Criteria

Copresence is defined here as a form of human co-location in which individuals become "accessible, available, and subject to one another" (Goffman 1963:22). In other words, it is a condition in which instant two-way human interactions can take place. "Instant" human interaction refers to real-time or near real-time human communication, which does not include diachronic exchanges like postal correspondence; and "two-way" human interaction refers to reciprocal or feedback-based human communication, which excludes unidirectional "para-social" behaviors like watching TV or listening to radio (Horton and Wohl 1979). For ease of exposition, I will focus on a dyadic situation involving two hypothetical individuals labeled as Person X and Person Y. I will define the situation of

copresence from the standpoint of Person X, thereby referring to Person Y as the other person. Providing that Person X is a real human individual corporeally present in a physical locale, different forms of copresence of Person X with Person Y can be delineated depending on (1) How is the other person present at the scene? And (2) Where is the other person present?

2.1. How Is the Other Person Present?

The other person can be present at the scene either in person or through simulation. A simulated presence is a virtual presence, in the sense that the real person the simulation represents is physically absent from the scene. The presence of a person can be simulated in two different ways: (1) *physical simulation* that produces a physical entity occurring in a physical locale, and (2) *digital simulation* that produces a digital entity occurring in an electronic sphere. Physically simulated entities capable of interacting with real people are called *robotic machines*, and digitally simulated interactive entities are called *computer agents*.

2.2. Where Is the Other Person Present?

For an instant two-way interaction to take place, the other person must be positioned in proximity to Person X. There are two types of proximity: physical and electronic. *Physical proximity* is an area within which naked human senses can reach, and *electronic proximity* is an area within which electronically extended human senses can reach. Through the mediation of a telephone or a Personal Digital Assistant (PDA), for example, individuals not mutually present in the same physical locale can reach each other at a distance in real time.

A cross-classification of the above two criteria generates a two-by-two taxonomy that consists of four basic types of human copresence, which are displayed in Table 1.

Table 1. A Taxonomy of Human Copresence in A Dyadic Situation

Where Is the Other Located? How Is the Other Present?	The Other Is Located In Physical Proximity	The Other Is Located In Electronic Proximity
The Other Is Present In Person	Corporeal Copresence *(face-to-face)*	Corporeal Telecopresence *(face-to-device)*
The Other Is Present Via Simulation	Virtual Copresence *(physical simulation: instrumental robots*	Virtual Telecopresence *(digital simulation: instrumental agents*

	communicative robots)	*communicative agents)*

3. Forms of Copresence

3.1. Corporeal Copresence

Corporeal copresence is a form of human co-location in which the other person is corporeally present at the scene in physical proximity to Person X. The co-location is such that Person X and Person Y are within range of each other's naked sense perceptions, and able to reach each other simultaneously through unmediated sensory channels. Under the "full conditions of copresence," according to Goffman (1963:17), "persons must sense that they are close enough to be perceived in whatever they are doing, including their experiencing of others, and close enough to be perceived in this sensing of being perceived."

Corporeal copresence is the oldest form of human copresence. To interact with a person in corporeal copresence is to interact with that person face-to-face from body to body. Examples: Dining with someone at a restaurant; playing volleyball with friends on the beach; dancing with a partner at a party

3.2. Corporeal Telecopresence

Corporeal telecopresence is a form of human co-location in which the other person is corporeally present at the scene in electronic proximity to Person X. The two individuals are positioned outside the range of each other's naked sense perceptions, but within reach of an electronic communications network that both are logged on. By extending their sensory channels through the Internet, Person X and Person Y are in immediate contact with each other, even though physically they could be half a world apart.

Telecopresence, which allows for instant two-way communications between distant individuals, needs to be distinguished from *telepresence* (Minsky 1980), which does not support reciprocal human interactions. Telepresence enables a person to receive live sensory inputs from a distant environment and, under certain conditions, to telemanipulate the objects there, but this capacity of distant presence is not available to the people at the remote location. In watching a live coverage of a football game on television, for example, TV viewers are telepresent at the football stadium, but people at the football stadium are not telepresent in the place of the TV viewers. As a result, only the TV viewers can see the stadium people but the stadium people cannot see the TV viewers. By the same token, listening to radio is also a form of telepresence. However, when individuals in separate locations have the capacity to be simultaneously telepresent at each other's site, telepresence is turned into telecopresence (Zhao 2001).

To interact with someone in corporeal telecopresence is to interact with a person "face-to-device," i.e., person-to-person via a communications network plus an interface device. The person on one end of the communication line uses an electronic device, such as a networked computer, to get in touch with the person on the other end of the line, who is also equipped with a network device, such as a wireless handheld. Through such electronic mediations, remote people are able to extend their instant contact over a great distance. Examples: Talking to a friend over the phone; chatting with someone through instant messaging; holding a business conference via satellite.

3.3. Virtual Copresence

Virtual copresence is a form of co-location in which the other "person" is present at the scene in physical proximity to Person X through physical simulation (including any necessary electronic component). Located within the range of the naked sense perceptions of Person X, the robotic machine (which may or may not be networked) enables Person X to interact with it "face-to-face."

There are two types of robotic machines used to substitute for real people in virtual copresence. *Instrumental robots* simulate the *causative* aspect of human copresence, and are used to replace real people in their repetitive dealings with other human individuals. ATM machines, for example, conduct routine business transactions with human customers in place of bank tellers, cashiers, and other human assistants.

Communicative robots, on the other hand, simulate the *emotive* aspect of human copresence, and are used to replace real people in their intimate contacts with other human individuals. Humanoid robots like Kismet (Thomson 2001), for example, may one day take the place of a friend or a social worker in providing entertainment and companionship to socially isolated individuals.

Both instrumental and communicative robots can be called *social robots*. While non-social robots are designed to replace humans who interact with non-humans (e.g., in place of a human worker, a robotic arm operates inside a nuclear reactor), social robots are designed to replace humans who interact with other humans (e.g., in place of a bank teller, an ATM machine interacts with human customers). In general, instrumental robots are automated machines that perform duties according to preprogrammed instructions, and communicative robots, on the other hand, are trainable machines with a learning capacity (Alpert 2001). Although both can be used to operate remotely via a communications network, social robots are most effective when used in a copresence setting.

3.4. Virtual Telecopresence

Virtual telecopresence is a form of co-location in which the other "person" is present at the scene in electronic proximity to Person X through digital simulation (including any necessary physical component). The digital agent is an interactive computer program, and Person X interacts with it through an electronic medium: a local computer if the program

directly runs on it; or a networked computer if the program is located somewhere else and needs be accessed remotely.

Like robotic machines, computer agents are divided into two categories: instrumental and communicative. *Instrumental agents*, often used for automated response services, handle routine human inquires on behalf of human operators. Examples: MapQuest on the World Wide Web that gives driving instructions upon request; and Googly, an online automated buddy, that answers human queries in natural human language (Liebeskind 2001). *Communicative agents*, typically used by individuals for personal recreation, interact with real people on an emotional level. Examples: interactive computer programs like ELIZA with which people converses for fun (Weizenbaum 1966); and digital characters like the one simulated by Princess Maker that people can adopt (Coleman 1996).

Interactive computer agents differ from other types of computer programs in that they are specifically designed to communicate with humans in place of humans. In the case of an instrumental agent, a computer program replaces human assistance with an automated response system that makes information sharing more efficient. And in the case of a communicative agent, a computer program mimics human interaction in providing people with entertainment, interpersonal training, and psychological comfort.

To interact with someone in virtual telecopresence is therefore to interact with a computer program that simulates human responses. If such a program runs on a local computer that is not networked, then "telecopresence" becomes an analogy rather than an accurate description, for the user can interact with the program without the mediation of a communications network. In the foreseeable future, however, remote computing will become the norm, as most programs will be installed on centralized servers to be accessed by different users over the Internet.

3.5. Other Forms of Copresence

Corporeal copresence, corporeal telecopresence, virtual copresence, and virtual telecopresence are four basic forms of human copresence in contemporary society. However, there are other forms of human copresence that have been omitted from the taxonomy. For example, when both Person X and Person Y are present through physical simulation in each other's physical proximity, we have a situation of *hypervirtual copresence*; and when both Person X and Person Y are present through digital simulation in each other's electronic proximity, we have a situation of *hypervirtual telecopresence*. In the first instance, human interaction is replaced by complete physical automation; and in the second instance, human interaction is replaced by complete digital automation. Finally, there are hybrid or mixed types of human copresence, which combine two or more basic forms of copresence.

3.6. Multiple Meanings of Virtuality

It is important here to clarify the multiple meanings of virtuality that have been used in the presence literature. The first meaning is the substitution of a person's corporeal

presence by physical or electronic simulation. The second meaning is a person's mediated presence in a distant environment. The third meaning refers to the interaction between simulated human characters played by real people. In the first two cases, the presence is virtual (one party is not corporeally present) but the interaction is real (it is a real life event occurring to the person who is corporeally present); in the third case, however, the presence is real (the players are physically present) but the interaction is virtual (it takes place between simulated human characters). A more generic concept of virtuality is "virtual reality," which refers to the totality of computer-simulated objects, including settings, events, humans, and human activities. These conceptual differences are subtle, but by no means trivial, for they have important social and ethical implications, which I will touch upon in conclusion.

4. Interface Parameters

Forms of copresence are types of human co-location in which human interactions take place. Within each type of co-location, however, there can be different interface arrangements that allow copresent individuals to interact with each other in different ways. The combination of a given form of co-location and a given interface arrangement constitutes a given modality of human copresence.

Interface parameter structures the ways in which co-located individuals come into contact with each other. In this section of the paper, I will discuss four interface parameters of human copresence: (1) embodiment, (2) immediacy, (3) scale, and (4) mobility.

4.1. Embodiment

Embodiment refers to the involvement of human bodies in the process of communication. A continuum can be constructed ranging from total body to fully disembodied communications. "Total body communication" (Poyatos 1975) involves both verbal and nonverbal human behaviors, with the latter including a rich array of "body idioms (Goffman 1963) like facial expressions, gestures, and postures. This type of fully embodied communication requires a "face-to-face" interface that engages all human sensory channels. Only corporeal copresence supports this interface.

As the physical distance between communicating individuals increases, the involvement of unmediated sensory channels decreases, starting with the loss of taste, smell, and touch, and then hearing and vision. Such perceptual losses, however, can be partially restored through sensory extension via electronic mediation. A multimedia interface in telecopresence (e.g., a videophone), for example, allows distant individuals to see and hear each other as if they were corporeally copresent. Efforts are now being made to restore haptic and other perceptual channels in remote communications. The least embodied interface is plain text messaging, which reveals nothing about the corporeal characteristics of copresent individuals.

Perceptual losses due to distance can also be remedied through computer simulation (e.g., avatars) that generates artificial corporeal characteristics. These simulated characteristics

may or may not resemble the true characteristics of the telecopresent individuals, but they add sensory cues to an otherwise disembodied process. Graphical images, synthetic sounds, electrocutaneous displays, and other tele-immersive techniques can be used to create a virtual environment that mimics a real physical setting for telecopresent interaction (Lanier 2001).

4.2. Immediacy

Immediacy refers to the speed at which messages travel back and forth between copresent individuals. An interface for synchronous communication, such as the face-to-face condition, enables copresent individuals to reach each other instantaneously. Depending on the bandwidth of a given transmission medium, there are varying time lags in telecopresent data transmission. The immediacy of communication also can be deliberately regulated through an interface design, which permits real-time or near real-time interaction in the case of instant messaging and conference calls, but imposes an asynchronous structure in the case of email, listsevs, and bulletin boards.

4.3. Scale

Scale refers to the number of people enabled by a given interface to interact with one another. The face-to-face interface in corporeal copresence allows only a small number of people to communicate with one another. In telecopresence, the "scale of community" varies tremendously depending on the types of interface used in the communication: telephones are typically used for two-person conversations; email supports one-to-one dialogues as well as one-to-many broadcasting; and electronic bulletin boards open the floor to virtually any number of people who want to participate in the discussion (Feder 2001).

4.4. Mobility

Mobility refers to the capacity of copresent individuals to carry the interactions around. The face-to-face interface in corporeal copresence supports a limited amount of mobility, provided that all the participants move along with one another. In telecopresence, there are three basic types of mobility conditions: stationary, portable, and wearable. The stationary condition, such as communicating through desktop computers in fixed locations, essentially permits no mobility. The portable condition, such as communicating through laptop computers, allows individuals to temporarily suspend their communication while on the move, and to resume it when they are stationary. The wearable condition, such as communicating through mobile phones, monocular head-mounted displays, and other body-worn networked devices, enables distant individuals to continue interacting with one another while some, or even all, of them are simultaneously moving around. The widened use of wearable communication devices in the general population will eventually make telecopresence a ubiquitous phenomenon.

Different combinations of interface parameters within different forms of co-location give rise to different modalities of copresence for human interaction. The increasing

diversification of the modalities of copresence in contemporary society has important implications for copresence research and design.

5. Implications for Research and Design

5.1. Sense of Copresence

The sense of copresence is an individual's subjective experience of being together with other people. Such experiences are directly influenced by the interface characteristics. The face-to-face situation undoubtedly generates the most vivid sense of copresence. In situations other than corporeal copresence, high levels of embodiment or "media richness" (Daft and Lengel 1984) tend to enhance the feeling of "social presence" (Short et al 1976; Rice 1992), which culminates in a fully immersive environment. The strongest mediated sense of copresence is sometimes defined as the "perceptual illusion of nonmediation' (Lombard and Ditton 1997).

However, creating a strong sense of copresence is not always the main objective of the copresence design. One of the advantages of a telecopresent condition is that it is possible for people to remain anonymous while communicating with one another. The text-based online chat program, for example, is least embodied, yet it is tremendously popular among users of all ages because the disembodiment of the program enables the users to be "simultaneously linked to and buffered from one another" (Sproull and Kiesler 1991:30). Low level of media richness, in this case, becomes a desirable feature.

In other instances, however, high levels of embodiment are preferred. When interacting with simulated "persons" on an emotional level in either virtual copresence or virtual telecopresence, individuals expect the robotic machines or computer agents to look and act like humans. Humanoid robots and lifelike avatars are therefore employed to evoke a rich sense of copresence that resembles those obtained in corporeal copresence. This has not been always the case, however, with instrumental robots and agents, for the purpose of these simulations is to maximize efficiency rather than intimacy. But efforts are now being made to enable robots like ATM machines to communicate with humans in natural human language (Kurzweil 2001). In so doing, a stronger sense of copresence will be generated even when interacting with instrumentally simulated beings.

5.2. Copresence Design

The purpose of the copresence design is to provide a variety of interface devices that meet different human copresence needs. Besides technological knowledge and skills, it is crucial for the designers to acquire a good understanding of various copresence situations and the needs of those who find themselves in these situations. By designing a new interface device, the designers are in fact suggesting a new mode of human copresence, hence a new way of interacting with other people.

Copresence designs have recently begun to depart from the traditional telepresence paradigm by adopting a "people as content" approach (Walker et al. 2000). Attentions are

now being paid to the unique needs people have in different situations of copresence. Examples of such efforts include the designs of (1) "symbolic acting," which uses an online avatar to act out the symbolic meaning of a person's activity on a desktop machine; (2) "contact space," where acting avatars indicate the availability status of an individual so that others can initiate a chance meeting if they want to; and (3) "online public gathering," which allows online viewers to see their fellow audience in the same way as they watch a TV show together with other people in the same room (Davies and Revett 1997; Walker et al. 2000). Efforts have also been made to improve existing conference call interfaces by adding functions for visual representation, turn-taking, chairman control, and private chat.

6. Conclusion

I would like to end this paper by briefly discussing the ethical implications of the above conception of copresence. Expanding human copresence into the realms of automation, simulation, and virtual reality introduces a host of ethical and legal issues that we will have to confront. As Biocca (1992:13) points out, all computer-based interactivity is inherently social, even when no real people are present, for the human essence of the designers remain resident in the logic of the interactive programs. For the same reason, the behavior of a robotic machine or a computer agent may have to be subject to the same norms and laws that regulate the behaviors of real people. The owner of a shop, for example, will probably be held legally responsible if his or her ATM machine is found selling controlled substances. But what about someone's computer agents stealing someone else's personal documents? Or someone's avatar sexually abusing -- in the public domain -- the avatar that represents someone else? Or a communicative robot spewing vicious insults at a feeble elderly? Or an interactive video game suggesting mass murder to the young players? Answers to these questions lie in our definition of human beings and being humans, and our understanding of the growing virtualization of human interaction. By making machines more human-like, humans are becoming more machine-like. And as computer technologies are more and more integrated into the fabric of social life, social reality becomes increasingly virtual, and virtual reality increasingly social. The taxonomy I proposed here has been an attempt to map out and make sense of the changing contour of human copresence in the Internet era.

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