

# “Real” Presence: How Different Ontologies Generate Different Criteria for Presence, Telepresence, and Virtual Presence

## Abstract

This article claims that the meaning of *presence* is closely linked to the concept we have of reality, i.e., to the ontology that we more or less explicitly adopt. Different ontological stances support different criteria for *presence*, *telepresence*, and *virtual presence*. We propose a cultural conception of presence that challenges the current idea that experiencing a real or simulated environment deals essentially with perceiving its “objective” physical features. We reject commonsense ingenuous realism and its dualism opposing external reality and internal ideas. In our perspective, presence in an environment, real or simulated, means that individuals can perceive themselves, objects, and other people not only as situated in an external space but also as immersed in a sociocultural web connecting objects, people, and their interactions. This cultural web—structured by artifacts both physical (e.g., the physical components of the computer networks) and ideal (e.g., the social norms that shape the organizational use of the computer networks)—makes possible communication and cooperation among different social actors by granting them a common reference grid. Environments, real and virtual, are not private recesses but public places for meaningful social interaction mediated by artifacts. Experiencing presence in a social environment such as a shared virtual office requires more than the reproduction of the physical features of external reality; it requires awareness of the cultural web that makes meaningful—and therefore visible—both people and objects populating the environment.

## 1 Introduction: Presence Within Reality

For researchers working on virtual environments (VEs) or teleoperation systems (TSs), a clear definition of *presence* and *telepresence* may be useful to orient their work. Most researchers in these fields share the current

meaning assigned to these concepts, which are defined by Schloerb (1995) as follows. *Physical presence* designates “the existence of an object in some particular region of space and time. For example, this text (in some form) is physically present in front of you now” (p. 68). According to Schloerb, physical presence supports *subjective presence*, consisting of the perception of being located in the same physical space in which a certain event occurs, a certain process takes place, or a certain person stands (Heeter, 1992; Sheridan, 1992; Steuer, 1992; Slater et al., 1994; Slater & Wilbur, 1997). Subjective presence is a necessary but not sufficient condition of presence and, as such, is placed among the criteria of verification next to “objective” criteria: “at the heart of the theory is the idea that presence involves objective interaction” (Schloerb, 1995, p. 65).

The interesting point here is how the “objective” character of presence and the process of interaction are conceived. If presence basically means being “physically present” in a given space at a given moment, then physical telepresence is impossible: a person or object cannot physically be in a different place from the one in which they are physically at a certain moment. Schloerb attempts to avoid this consequence with an ad hoc move. There is, he says, an aspect of physical presence—causal interaction—that does not necessarily require physical presence and that may also function at a distance. This aspect, which he calls *objective presence*, is compatible with telepresence, according to Schloerb, because it is defined in terms of causal (inter)action: “an operator is

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objectively present if and only if it can successfully complete a specified task” (p. 68).

We think that this move does not solve the problem we have with “objective” presence in Schloerb’s sense. Actually, the definition of *objective presence* as success in completing a task is not really satisfactory: I may be asked to repair an engine, and I may be unable to fix it. This does not mean that I am not present in the environment (real or virtual) where the engine and I are. (See note 1.) The problem with Schloerb’s objective presence is that this is a concept introduced to escape the consequences of a bad initial move (putting “physical” presence at the very base of our experience of presence) without removing the real reason of the difficulty, which is the initial move. If telepresence is impossible to conceive if one assumes that presence is only physical presence, the solution could be that of reconsidering the idea that presence is essentially physical. On the contrary, Schloerb maintains his original assumption and tries to overcome the difficulty by making a detour on the secondary route of operation: if telepresence is impossible without physical presence, at least teleoperation, he says, can obviously happen at a distance. This indisputable fact, which we experience often in our everyday lives, remains nevertheless inexplicable in terms of a theory of presence as physical presence: how can a causal agent operate in an environment in which it is not present at all?

Operation requires presence, without doubt, but not the type of presence that Schloerb proposes. We suggest an alternative explanation of teleoperation founded on a different view of presence—a nondualistic view relying on the concept of mediation. To think that someone or something can exert a causal influence at a distance, we have to assume the existence of a world of artifacts—both physical and conceptual—that mediate between actors and between them and objects both near and remote. This perspective leads us to think of environments as spaces in which experience is always mediated by physical and intellectual tools. This is the first step towards a sociocultural conception of environments and of presence that is no longer dualistic but relational and interactive; from here we can start to see environments as networks in which people and things construct themselves mutually (Cole, 1996; Mantovani, 1996b). In this

perspective, there are no unmediated, precultural objects; when I contemplate an “intact,” “natural” landscape such as that of a natural park, I see it only through a set of physical (sometimes used) and ideal (always used) lenses that direct my sight and my sensibility to find in what I see the aspects that meet the interests and the values accepted within my community (like “innocence” and “peace” of wilderness as opposed to the corruption and noise of urban life). These values are peculiar to the cultural environment we inhabit and could make very little sense to members of other communities.

The present paper aims at showing that the meaning of *presence* depends on the concept we have of reality and that different ontological positions generate different definitions of *presence*, *telepresence*, and *virtual presence*. We believe that the definition of *presence* based on physical presence is not only critically unfounded but also deleterious for the development of VR and TS systems, which may thrive if used as effective tools to promote cooperation and communication in work environments. We propose an alternative conception of presence as a social construction, following an approach which is now strongly emerging in social psychology (Gergen, 1994). (See note 2.) “Reality” is not out there in the world, somewhere “outside” people’s minds, escaping social negotiation and cultural mediation; reality is co-constructed in the relationship between actors and their environments through the mediation of the artifacts (Mantovani, 1996a; Riva & Galimberti, 1997; Riva & Mantovani, 1999).

If we arrive to view reality as socially constructed—language is the most precious tool we have, as it circumscribes and structures the realm of “reality,” assigning precise places to things, actors, actions, and even intentions—then we realize that all the experience that social actors can have of environments, both “natural” and “artificial,” is mediated. In his book, *Landscape and Memory*, Shama (1995) shows how “intact” (in fact, they were pastures and woods previously heavily used by Indian tribes), “natural” places such as Yosemite were selected to be national parks through the operation of cultural (especially religious) categories that labeled the emerald-green pastures as the “garden of Eden,” the secular giant trees as the columns of a new national sanc-

tuary, and the powerful scenes of wilderness as predictions of the America's call to greatness.

In our perspective, telepresence poses no problems: in TS, by means of a human-computer interface and a telerobot, the operator interacts with objects, which are produced by technology. (However, we would not entirely agree with the idea that the TS operator is able to “*sense and manipulate the real world*” (Durlach, 1997 (italics in the original)), owing to the simple fact that there is no “real” world as opposed to an artificial one). In our view, VEs pose a problem that is not very different from that of TS: actors who move within VE are aware of the fact that they are interacting with a synthetic environment, the artificiality of which is perfectly clear to them before, during, and after the experience (which may be immersive). They are constantly reminded of this during the VE experience, as well as the poverty of sensory stimulation they receive. In VEs, we do not deal with “artificial” worlds as opposed to “natural” ones, but simply interact with various devices that mediate exchanges between actors and environments.

The quality of presence and telepresence does not depend so much on the faithfulness of the reproduction of physical aspects of external reality (we insist that the latter is a social construction, not a primitive or “natural” datum) as on the capacity to produce a context in which social actors may communicate and cooperate. Social context in which new technologies operate is composed mainly of symbolic references that allow actors to orient and coordinate themselves, as Stone (1996) states, tracing a surprising parallel between the task of VR designers and that of phone sex workers: two figures who have the same task of making the human body visible by means of extremely narrow channels of communication and who succeed in their task by resorting to powerful, shared cultural codes.

## 2 Physical Presence: Ingenuous Realism

The most widespread concept of reality—generally not justified but simply taken for granted—in the community of scientists, technicians, and professionals who study virtual environments is ingenuous realism (Manto-

vani, 1995), which Zahoric and Jenison (1998) prefer to call the “rationalistic tradition.” In this view, reality is a set of objects located outside the mind (the influence of Descartes’ dualism between objects and ideas, between *res extensa* and *res cogitans* is manifest) and has a set of well-defined characteristics. In the very act of knowing, the subject perceives the state of these preexisting objects in ways that have been amply debated in Western philosophy and psychology. Ingenuous realism contains an ontological position that states what reality is (what is “real” and what is not, what being “real” means) and a conception of knowledge, that states what human knowledge is (how and what we know, to what degree of truth and certainty, etc.). The second level (knowledge) depends on the first one (ontology) because, according to ingenuous realism, valid human knowledge reflects—with different degrees of fidelity and vividness—“real,” “external” objects.

From the viewpoint of ingenuous realism, “real” presence designates a state of things, the way an object is, the fact that something or someone exists within a certain physical environment. In this sense, Schloerb’s (1995) definition of *physical presence* that we have seen above is only a variant of ingenuous realism. For those who accept ingenuous realism, TS is not an insoluble problem, because what is known—even though we acknowledge the presence of the artifact mediation—is still a piece of the “real world,” however remote from the observer. But the objects experienced in virtual environments do constitute a problem because, from the viewpoint of ingenuous realism, on one hand they “really” do not exist, whereas, on the other (in the misleading perception they give our senses), they do have a certain kind of existence: that of purely mental objects without reference to the “external” state of things: in this sense, they are hallucinations, as cyberphilosophy says.

For cyberphilosophy (Benedikt, 1991), the distance separating reality and virtual environments marks the gap opening between the “real” things (“real” by definition being extramental and “objective” for the ingenuous realist) and the simulated ones that, although not really real (in the sense that what is perceived does not correspond to “external” objects physically present in the environment), is still in some way “real” (in the

sense that it deceives senses, making them believe that certain extramental objects are physically present in the environment while they are not, and deception to some degree succeeds). Most supporters of the cyber movement accept the principles of ingenuous realism and merely ask that VE objects may be granted the same rights of citizenship in “reality” that ingenuous realism grants to “natural” objects. The ontological status of VEs is then that of a socially shared (or at least shareable) hallucination, and VEs become spaces of consensual hallucination in which the human perceptual system is deceived into considering “real” an illusory state of things). Ingenuous realism lies at the root of this vision, in which what is “external,” and extramental is objective and real (the way things per se are) and what is (only) mental is illusory and not real in the sense that it conveys a false information about the state of things in the world.

Many supporters of the cyber movement accept the basic assumption of ingenuous realism-dualism and view virtual environments as a pure mental production, a parallel world that challenges or ignores the “ordinary,” “conventional” world with all its dullness. Lanier, who coined the expression *virtual reality*, on which a large part of the cyber discourse depends, asserts in his interview with Biocca that ordinary reality is an extramental object and that “virtual reality—although it’s a low-quality reality—is the only other one that’s truly objective” (Lanier & Biocca, 1992, p. 160). Steuer says that presence consists of “the sensation of being in an environment,” having specified a few lines above that “presence can be thought of as the experience of one’s physical environment” (Steuer, 1992, p. 75), while telepresence is “the experience of being in an environment thanks to a means of communication” (p. 76). In the dualist perspective, physicality is the ultimate criterion for presence.

For Steuer, while the former experience is “natural,” the latter is “mediated” by technology. In our view, the whole experience is culturally mediated, although not all experiences are technologically mediated, but we claim that there are no “natural,” unmediated experiences of presence in an environment. The interesting problem for us is understanding the different forms that mediation

can take, not that of comparing an imaginary “natural” experience of presence with technologically produced presence. What changes at this theoretical level (we will see later what changes at a practical level, that of current research agenda), if one adopts our perspective is that the whole problem-setting space is deeply transformed: some previous problems appear to be false problems while unprecedented questions become relevant. VE ceases to be compulsively compared to “real” environments, and, at the same time, new problems arise—those of understanding in which ways virtual environments mediate between actors and their environments (i.e., what kind of cultural mediation they realize), by which communities and for which goals they are selected, how their use changes in time and from one social context to another, and so on. Study of the ways technology accomplishes its role in cultural mediation substitutes sterile debate about how precisely VEs can reproduce “real” environments.

For ingenuous realism, the difference between “real” and “virtual” presence is that the former is a “natural” fact, whereas the latter is a mediated fact, produced by technology. The adequacy of a telepresence system depends on the faithfulness with which it succeeds in recreating conditions that allow us to perceive ourselves, or other people or objects, as physically present in a “real” environment. We do not believe that this is a good solution to the problem of presence and telepresence; we propose to reject the basic assumption of the ingenuous realism, the idea that “real” objects exist outside social actors’ minds and ideas and that “virtual” objects exist only in people’s heads. This dualistic view has no real foundation because the whole human experience of being in an environment is bioculturally mediated so that there is no “outside” (things, objects) as independent from and opposed to an “inside” (mind, knowledge, perception, and so on).

### 3 Relational Presence: The Ecological Approach

Ingenuous realism has been contested from several points of view. Among the most interesting of these are

those relying on Heidegger's philosophy and on Gibson's theory of perception (Zahoric & Jenison, 1998). Gibson does not accept Descartes' dualism according to which there is a "real" world made of "objects" on one hand and an ideal world of "subjects" on the other. In Gibson's approach, the relation between organisms and their environment is circular: "actions of the organism have consequences for the environment, and the nature of environment has consequences for the organism" (ibid., p. 81).

Gibson's opposition to ingenuous realism regards both ontology (external "reality" independent of the subject does not exist for him) and knowledge (knowing does not mean people contemplating "external" objects without touching them, but means also moving in the environment, using it for their goals): "Gibson's unique insight rests with the notion that the perceiving organism and the environment are intimately related—namely, that the environment has provided conditions commensurate with the organism's evolution. As a result, perception for the organism is the pickup of information that supports action, and ultimately evolution" (ibid., p. 83). Perceiving is an activity by means of which the organism identifies the resources it needs in the environment and attempts to capture them in order to achieve its own evolutionary aim: sustenance and transmission of its own genetic pool.

The environment does not provide undifferentiated information, ready-made objects equal for everyone. It offers different opportunities according to the actors and their needs. Affordances are not "things that are outside" simply waiting for someone to come and take them. They are resources that are revealed to those who seek them. If "a nipple is for sucking," then this affordance is taken up by a hungry calf that perceives the nipple precisely because it needs it, but this is not the case of an eagle circling high in the sky, as the eagle does not need milk for its survival. The tree in the middle of a field on a summer's day is an affordance only to those who seek its cool shade. Objects, again according to Gibson, are perceived "directly," not through mental representations. (We have reserves regarding this last point, but they are not relevant to this discussion.)

This vision of reality, knowledge, and perception supports a criterion of validity of perception that is very different from that suggested by ingenuous realism. In the latter case, perception is valid to the extent that it faithfully reproduces the state of affairs existing in "external," extramental reality, which is considered to preexist knowledge. In the former case (that of Gibson) valid perception is that which allows actors to perceive affordances; these may differ from one person to another, reflecting the peculiar relationship existing at any given moment between potential resources in the environment and individual needs. Gibson's (1979) criterion of validity is both pragmatic and relational: valid perception is what makes possible successful action in the environment. (Success here is not meant as the favorable outcome of an operation similar to the abovementioned fixing of an engine, but is meant in an evolutionary, adaptive framework focused on the ability to act in accordance with the characteristics of the environment, perceiving and exploiting the affordances it offers.) One may question how this type of adaptive success may be measured, but we have to recognize that Gibson's criterion for presence in an environment has a solid theoretical basis that is different from that of ingenuous realism. While the latter is dualistic, the former is relational in conception of both reality and knowledge.

What does all this have to do with presence, telepresence, and virtual environments? Zahoric and Jenison (1998, p. 87) explain it clearly: "*presence is tantamount to successfully supported action in the environment*" (italics in the original). This criterion sweeps away distinctions between "outside" and "inside" the mind, between presence and telepresence, between "virtual" and "real," which make sense only for the ontology and theory of knowledge of ingenuous realism. Since the definition of reality implicit in Gibson's theory is not dualistic but relational (affordances emerge in the relationship between actors and environment)—and since the resulting definition of presence is also not dualistic—the criteria used to verify presence are not dualistic either. There is no need to contrast "objective" and "subjective" criteria of presence, as researchers who depend

on ingenuous realism do; in Gibson's perspective, "meaning is not a subjective interpretation . . . meaning can be objectively specified and measured in terms of constraints on action" (Flach & Holden, 1998, p. 93). In this sense, action belongs to both actors and the environment.

The ecological approach changes the focus of attention in designing and assessing simulation environments: faithfulness in reproducing the physical characteristics of the "real" environment is not necessarily the only thing to be borne in mind in simulation. The possibility of action and interaction that TSs or VEs allow is also important. More than on precise presentation of static, computer-generated scenes, sense of presence may depend on the availability of information about spatial and temporal changes related to actor's movements in the simulated environment (Sheridan, 1992, 1996; Smets, 1995; Wann & Mon-Williams, 1996). Humans need a certain amount of freedom of movement in order to adapt smoothly to a new environment; this is why a good TS or VE should encourage exploration by adapting itself gracefully to actors' movements.

In this perspective, the key questions in VE design are: "Can [the users] accomplish the tasks they accept? Can they acquire the necessary information? Do they have the necessary control authority? Can they correctly sequence their subtasks?" (Ellis, 1996, p. 258). In fact, successful implementation of VE simulations will largely depend on the answers given to these types of questions. Emphasis shifts from quality of image to freedom of movement, from the graphic perfection of the system to the actions of actors in the environment. "Experience of space will depend more on the mode of locomotion than on the visual and acoustic images. The reality of a surface will be in its implications for action (e.g., does it impede locomotion) rather than in its appearance (e.g., does it look like a wall). In this approach, the reality of experience is defined relative to functionality, rather than to appearances" (Flach & Holden, 1998). This may also explain how it is possible to speak of a sense of presence in text-based VEs, commonly called MUDs (multiuser dungeons). Although these environments are absolutely poor from the sensory viewpoint, recent re-

search on 207 MUD users showed that 69% of the subjects did feel a sense of presence (Towell & Towell, 1997).

#### **4 Presence as Social Construction: The Cultural Perspective**

The ecological approach supplies an interesting line of research and development of TSs and VEs. As an alternative to dualism, it proposes a relational concept of presence and telepresence, and, as an alternative to the cult of the faithful image and exact perception, it proposes centrality of action. We wish to take up and expand this approach, integrating it with what Gibson had neglected: the social and cultural dimension of experience. Individuals experience "reality" through interpretive grids that are generated by the preexisting social structures that have presided over their socialization processes and live in a "reality" that is usually a social space—such as class, office, neighborhood—in which individuals learn to perceive, categorize, and use environmental affordances in ways that are meaningful and socially recognizable. Shared reality, both natural and computer generated, is produced by the encounter between specific environments and specific, structured, human communities equipped with their own cultural tools (which implies a particular system of artifacts, myths, rites, values, etiquette, taboo, cookery, recipes, etc.).

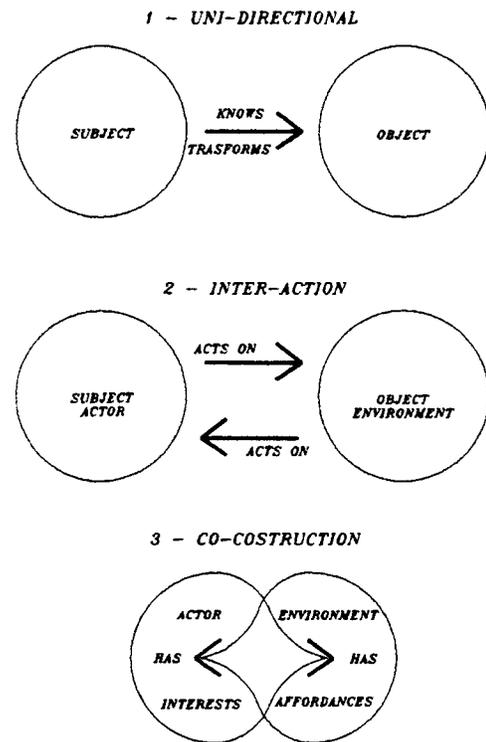
Action in everyday situations is not just made up of movements that single individuals execute, but is part of a strategic game (March, 1991) in which certain goals, both individual and collective, are aimed at through the joint efforts of several actors. In order to be achieved, many human activities—work, play, dancing, courting—require that knowledge relevant to the goal be distributed and that actions be coordinated among the various actors by means of cultural modes that preexist those interactions (between actors, and between them and the environment) and make them possible. In his brilliant study of the activities of a navigator team on a U.S. carrier, Hutchins (1995) showed the role that culture plays in organizing human cooperative activities: it is present

not only in the hierarchical organization of the Navy, but also in the tools the navigators use, the regulations covering behavior to be observed in the various situations in which the ship may find itself, and the task definitions of each member of the team in the different operational conditions of the ship.

The ontology at the root of social constructionism (see note 2 for further information) is pluralistic, while ingenuous realism contains a good-sized dose of dogmatism. “For the constructionist there is no justification for fundamental enunciations of the real; whatever we take to be essential is an outcome of social interchange. Theories cannot be falsified by virtue of their correspondence to something else called ‘the real,’ but only within the conventions of particular enclaves of meaning” (Gergen, 1997). In place of the dualism proper to ingenuous realism—which made it difficult to account for telepresence, virtual presence, and generally that plurality of worlds that cultural mediation makes available to us (with various degrees of involvement of technological resources)—social constructionism conceives the “real” as a coconstruction, a process of reciprocal modeling between actor and environment. (See Figure 1.)

In the first mode of Figure 1 (unidirectional relation), subject and object are separate, and the problem of their correspondence is constantly posed. (For ingenuous realism, it is essential to be able to distinguish between “real” and constructed objects.) In the second mode, interaction connects two separate entities as subject and object that are communicating but not mutually shaping. In the third mode (coconstruction), actor and environment modify themselves through their relationship: “reality” is coconstructed within their relationship. (Social constructionism has no difficulty in accepting the fact that there are different realities, experiences, and types of presence that correspond to the various types of coconstruction of reality.)

The common actor-environment area arises from the encounter between the interests of actors (which are multiple, changing in time, often inconsistent, and not clearly ordered on a scale of priorities) and environmental affordances (which are also multiple, changing, and smoothly respondent to initiatives taken by actors). The result of this state of affairs is that everyday situations are



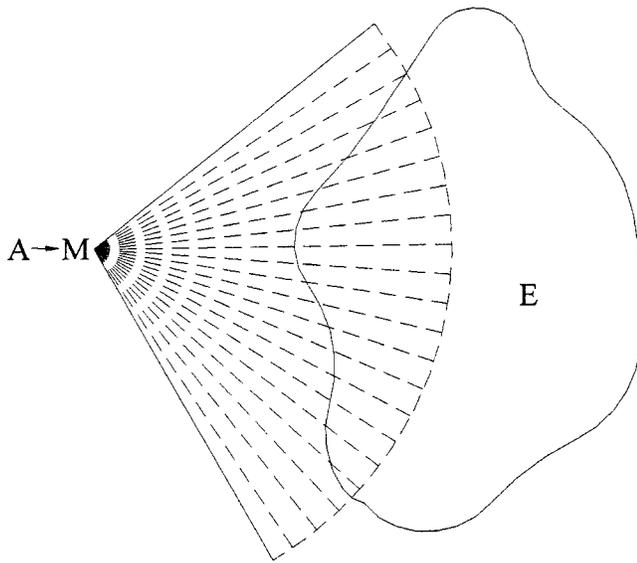
**THE THREE FORMS OF THE ACTOR-ENVIRONMENT RELATIONSHIP**

**Figure 1.** Three different ways of viewing the subject-object (or actor-environment) relationship (Mantovani, in press).

inherently ambiguous. The origin of the ambiguity of everyday situations lies in the characteristics of the encounter between the changing interests of the actor and the equally changing affordances offered by the environment. If an unavoidable feature of everyday situations is ambiguity, how can actors communicate and cooperate effectively?

The answer comes from cultural psychology, which shows how the experience of the members of a given community is sustained by a framework that preexists individual interactions and makes them possible (Cole, 1996). Culture is the device that human societies use to reduce the ambiguity intrinsic to everyday situations: the space in which actors’ interests and environmental affordances meet is defined and shaped by the mediation exerted by artifacts. (See Figure 2.)

Ambiguity of everyday situations does not disappear, but it is made tractable by the presence of the cultural



**Figure 2.** Actor (A) through artifact mediation (M) explores and structures the environments (E) (Mantovani, *in press*).

tools and by the social negotiation of the meaning of situations that these tools make possible. This can happen to the extent to which an (at least partially) shared frame of reference exists among the participants. (See note 3 on cultural psychology.) Our conception of presence starts from the ecological approach but, unlike it, it

- (a) recognizes the (culturally) mediated character of every possible experience of presence,
- (b) conceives experience as always immersed in a social context,
- (c) emphasizes the component of ambiguity inherent in everyday situations, and
- (d) highlights the function of clarification of situational ambiguity that culture (artifacts and principles) plays.

Breaking down this concept into formulas, we may say that:

1. Presence is always mediated by both physical and conceptual tools that belong to a given culture. “Physical” presence in an environment is in principle no more “real” or more true than tele-

presence or immersion in a simulated virtual environment.

2. The criterion for presence does not consist of simply reproducing the conditions of physical presence but in constructing environments in which actors may function in an ecologically valid way. We accept the emphasis of the ecological approach on the adaptive and active dimension of perception.
3. Action is essentially social (as knowledge in everyday situations is often distributed among various actors and various artifacts). Human presence in a given situation requires freedom of movement both in the physical environment (locomotion) and in the social environment composed of other actors and objects (task and goal definition, negotiation of the course of action to choose).

## 5 Conclusions

Our discourse was focused on the connection linking different views of reality—ingenuous realism, the ecological approach, and the cultural perspective—to different concepts of presence, telepresence, and virtual presence used by researchers working on VEs. First we discussed ingenuous realism and its project of trying to reproduce in VEs the physical features of “external” reality; we pointed out that this view could reduce the potential of virtual environments as cultural tools intended to support human knowledge and action. Then we presented the ecological approach as an alternative to ingenuous realism, based on a richer vision of presence. Finally, we proposed our perspective, which is founded on a view of reality as cultural construction, as a conceptual framework that can help researchers model cooperative environments for socially distributed knowledge and action. We also made some examples of the consequences that our approach could have for research and development in VEs.

Our theoretical approach is not without concrete consequences for research on VEs. First, by focusing on the

specificity of the mediation tools that VEs are, our approach encourages a principled approach to VEs as special spaces for knowledge and learning. VEs become important laboratories for analysis of how graphic representations work (Scaife & Rogers, 1996), following the line of cognitive science studies exploring the relationship between the ways in which information is displayed and the ways in which it is processed (Zhang & Norman, 1994). Second, our approach provides a framework for analysis of social contexts in which distributed action takes place (Mantovani, 1996b) and specific tasks can be accomplished. This framework is important for VE research because a good VE is not a mere 3-D representation but has to be a structured space that can be navigated, traversed, and engaged (Wann & Mon-Williams, 1996) according to the requirements of both the task and the social context. Third, our approach supports the research directed to build a socially plausible virtual office (Benford et al., 1995) that can account for communication, cooperation, and conflict among different actors and not only for precision in graphic presentation of walls, desktops, or human faces. Image-based modeling and spatially immersive displays (Raskar et al., 1998) can stand as a superb piece of computer graphics, but they cannot substitute for the social dimension of the office as culturally constructed human activity.

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### Notes

1. We owe this remark to one of the anonymous reviewers of this paper.

2. A good presentation of social constructionism is provided by Kenneth Gergen's book, *Realities and Relationships: Soundings in Social Construction* (1994). The starting point is that "all that is meaningful grows from relationships" (p. ix). The mention of "relationships" does not have the limited sense of acknowledging that people often interact in everyday situations but is intended to emphasize the fact that human experience is essentially constructed through relationships between social actors and their social and physical environments. Meaning is not the product of isolated individuals. On the contrary, it originates inside a community whose members are able to negotiate it by referring to an at least partially shared common ground. "Discourse is not the possession of a single individual. Meaningful language is the product of social interdependence. It requires the coordinated actions of at least two persons, and until there is mutual agreement on the meaningful character of words, they fail to constitute language. If we follow this line of argument to its ineluctable conclusion, we find that it is not the mind of the single individual that provides whatever certitude we possess, but relationships of interdependency" (Gergen, 1994, p. viii). Social constructionism offers a sound framework for discourses on fragmented selves that are now flourishing in research on MUDs, VEs, and similar communication environments. Gergen highlights the erosion undergone by the stable identifiable self in advanced societies, a self that was previously the kingpin of psychological disciplines. "Under postmodern conditions, persons exist in a state of continuous construction and reconstruction; it is a world where anything goes that can be negotiated. Each reality of self gives way to reflexive questioning, irony, and ultimately the playful probing of yet another reality. The center fails to hold." (ibid., p. 193). In this fluid situation, the narratives that construct the self become more and more precarious. When one of the participants in a relationship changes his narrative, by the same act he jeopardizes the narratives of others. We see identity as something that is constructed moment by moment within a web of relationships, just like reality is constructed within a cultural web. Constructionists are not relativists; only, "they call attention to the multiplicity of ways in which 'the world' is, and can be, constructed" (ibid., p. 82). This is not relativism, but awareness of the role of mediation in cognitive and social processes.

3. A rich presentation of cultural psychology is provided by Mike Cole's book *Cultural Psychology—A Once and Future Discipline* (1996). The history of cultural psychology dates back to the founder of scientific psychology, Wilhelm Wundt,

who devoted to it the last thirty years of his life, from 1890 to 1920, during which he wrote the ten volumes of his *Volkerpsychologie*. Wundt believed that study of “high-level” mental processes, i.e., those involving historical and social dimensions, should be the competence not of experimental psychology, which he considered applicable only to the most elementary psychic processes, but of another type of psychology. A second milestone in the history of cultural studies was the expedition promoted by the University of Cambridge in 1895 to the Torres Straits (which separate Australia from New Guinea) in which natives’ eyesights were analyzed and compared with data from other cultures. Recent cultural psychology is focused on distribution of knowledge in the social world. “Within each local setting, such ‘cognitive actions’ as remembering and decision making are distributed not only among the artifacts (the menu, the arrangement of chairs and tables, the sign pointing to the restrooms) but among the rules (one pays before leaving the premises; sitting up at a table with strangers requires one to ask permission) and among people according to the division of labor (waiters fulfill different parts of the activity at the café than the customers or the dish-washer; the janitor must remember to put away the mop and bucket; the owner is responsible for paying the janitor and waiter)” (Cole & Engestrom, 1993, pp. 17–18). Attention for the social distribution of knowledge and action, the rules governing it, the cultural grid providing the common reference ground for joint activity is what our paper wished to introduce in research on VEs.

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