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https://link.springer.com/chapter/10.1007/978-3-030-01800-9_9
DOI: https://doi.org/10.1007/978-3-030-01800-9_9

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Telepresence and the role of the senses

Abstract The telepresence experience can be evoked in a number of ways. A well-known example is a player of videogames who reports about a telepresence experience, a subjective experience of being in one place or environment, even when physically situated in another place. In this paper we set the phenomenon of telepresence into a theoretical framework. As people react subjectively to stimuli from telepresence, empirical studies can give more evidence about the phenomenon. Thus, our contribution is to bridge the theoretical with the empirical. We discuss theories of perception with an emphasis on Heidegger, Merleau-Ponty and Gibson, the role of the senses and the Spinozian belief procedure. The aim is to contribute to our understanding of this phenomenon. A telepresence-study that included the affordance concept is used to empirically study how players report sense-reactions to virtual sightseeing in two cities. We investigate and explore the interplay of the philosophical and the empirical. The findings indicate that it is not only the visual sense that plays a role in this experience, but all senses.

1 Introduction

The aim of this paper is to discuss the theoretical basis for the telepresence phenomenon. We perform empirical research that takes into account the role of the senses. Both theoretical work and empirical evidence are of importance for our understanding of this phenomenon.

According to Don Ihde (1983:10), technology is a basis for an understanding both of the world and of ourselves. Technology is a broad term that refers to artifacts created by humans, such as machines, devices and components, and the methods used to create these artifacts. Telepresence is the feeling of being in a place or environment while not being physically in this environment. Telepresence can be described as a subjective experience evoked by media technology. Questions that can be asked are; why does it happen, can we identify relevant theories or theoretical contributions that we can use to discuss, analyze, and deepen our understanding of this phenomenon. Computer graphics and realistic rendering technologies play a key role in evoking telepresence. These technologies blur the lines between fiction and non-fiction. Although many developers in ICT are not very concerned with the theoretical questions, the developers seem to have a kind of understanding and feeling for how users respond to what they make. Today video games represent a major form of entertainment. As the technology has improved over the years, these games show situations and characters that are realistic and, for lack of a better term, very life-like.

von Helmholtz introduced the notion that visual perceptions are unconscious inferences, a reflex-like mechanism which is part of the formation of visual impressions. For our understanding of the phenomenon the work by von Helmholtz (1866) can be a starting point. To von Helmholtz, human perception was but indirectly related to objects, being inferred from fragmentary and often hardly relevant data signaled by the eyes. The judgment we make operates as if we were making rational inferences from sensory information – through our eyes, we

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necessarily perceive things as real. von Helmholtz's ideas, the type of inferences he describes, and the role of the visual sense seem relevant for telepresence.

The role of visual technologies in evoking the telepresence experience has been documented many times – there is empirical evidence for the phenomenon. Telepresence is a visual experience, and often more than that. Therefore, we will discuss telepresence as a perceptual experience and ask about the role of the senses and sense-reactions. Based on insights from the empirical work, we seek contribute to our understanding of the phenomenon, and to discuss the interplay between theory and empirical observations.

In the telepresence community, some researchers highlight the role of activities. Mel Slater (2009b) asks: Is telepresence better referred to as correlational presence that emphasizes the correlation between activity and sensory feedback? Furthermore, to study the phenomenon in the empirical domain of the human-technology relationship, the question is how to design a study that takes into account sense-reactions.

Some players of videogames report that their virtual experience is a veridical experience and appears similar to an experience without media technology. The telepresence researchers Lombard and Weinstein (2012: 6) give an example: they write; one of the players in the study says:

> *I completely felt that I was a part of the world and the characters and settings were all real and places I have been*.

In this context, the experience is not only described as a veridical experience, but as an actual visit to a place. Schwartz (2006: 315) has a similar observation. He quotes a player of the video game Grand Theft Auto who says:

> *You feel as if you're in a real town/city with other people*.

In this paper, we explore theories of relevance for the telepresence phenomenon. We ask specifically about the role of the senses. If we assume that we can study telepresence in a similar manner as experiences that we have face-to-face in a non-digital environment, it seems relevant to explore the role of all senses rather than focusing mainly on the visual sense. For empirical research, the question is also how to measure the telepresence-experience. In this paper, findings from two empirical studies with video-games are used to discuss this question. Furthermore, based on a literature review, we discuss the concepts affordance and correlation presence, and align these with Merleau-Ponty's theory of perception. Finally, for the question why is telepresence perceived as a veridical experience, we draw attention to the Spinozian belief procedure, the notion that a percept is immediately believed. In decision theory this is referred to as the dual-process theories of reasoning. We are interested in the interplay between the theoretical and the empirical, and we believe this is an example of a research field where philosophy and empirical science can interact. We conclude the paper with remarks about the approaches that can be taken in future research on the telepresence phenomenon.

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2 Perceptual realism and the common sense of the ordinary man

Perceptual realism is the view that, in ordinary perception, one is directly aware of physical objects and events—things that exist independently of our perception of them. Most people are perceptual realists. This observation is shared by representationalists (Dretske, 2003) as well as relationalists (Martin, 2004). In everyday life we take the phenomenal world to be the physical world, and we treat the objects and events we perceive as if they were the objects and events themselves (Velmans, 2000). Another term for this is commonsensical realism, or just common sense of the ordinary man (Putnam, 1994).

People experience telepresence. A discussion of the telepresence experience as a technology-mediated experience should, therefore, include this perspective. When ordinary people are asked in an empirical study, they express their subjective feelings, their opinions based on their experiences. Although some might have a theoretical knowledge of relevance for the subject matter, it is unlikely that this is influencing how they answer questions in a survey. If I am asked whether I am having the experience of being there, the answer can be yes or no, or maybe "yes, for a moment I had this telepresence experience". We can describe this as a first person introspective judgment or report. In telepresence research there are many studies from this perspective. Many studies, particularly studies with players of games and users of VR, seem to be more concerned with the subjective, how the players describe the experience, than the theoretical questions and theoretical contributions from other fields such as philosophy. What follows in this section is a brief review of telepresence definitions, Heidegger's and Merleau-Ponty's theory of perception, and Gibson's affordance concept.

3 Telepresence

Telepresence is a relatively new research field. The first journal on telepresence was inaugurated in 1992. However, since the mid-1950s, researchers have increasingly studied the telepresence phenomenon. In the 1950s the first modern VR-devices, such as the Sensorama and a number of 3D films were produced. In an article in Esprit, André Bazin (1967) entitles one section as *The Concept of Presence,* where he defines the term with regard to time and space. Bazin (1967: 96) writes:

> *Presence naturally, is defined in terms of time and space. "To be in the presence of someone" is to recognize him as existing contemporaneously with us and to note that he comes* ***within the actual range of our senses*** (our emphasis)

In the 1990s, a number of research papers were published in the telepresence journal, at conferences, and a telepresence research community was established.

The word telepresence has two parts. "Tele" refers to the Greek term *at a distance* or *far away* and is used in tele-operation and telecommunication to emphasis the remote aspect while presence refers to the here and now. Witmer and Singer (1998) define telepresence as the subjective experience of being in one place or environment, even when one is physically situated in another place. We can refer to this as telepresence as transportation. Steuer (1992:75), the author of an influential paper on telepresence,

writes that:

> *when perception is mediated by a communication technology, one is forced to perceive two separate environments simultaneously: the physical environment in which one is actually present, and the environment presented via the medium. The term telepresence can be used to describe the precedence of the latter experience in favor of the former; that is, telepresence is the extent to which one feels present in the mediated environment, rather than in the immediate physical environment.*

To summarize, the attention is on the mediated environment, and the mediated environment takes precedence over the environment in which one is physically present.

Lombard and Ditton (1997) define telepresence as the perceptual illusion of non-mediation. This definition is one of the most frequently cited definitions in telepresence research. Lombard, Ditton and their colleagues, have also developed a methodology for telepresence measurement. This measurement has a sub-construct named perceptual realism concerning the five senses.

3.1 Telepresence and the Senses

Aristotle, in *de Anima*, writes that there are five senses. To Aristotle, vision is the primary human sense to which the others are subordinate. In the Aristotelian hierarchy of the senses, the visual sense is therefore the dominant sense (Burri, et al. 2011). Also today it is common to distinguish between sight, hearing, touch, taste, and smell, the five senses (Nudd_, 2004). According to Fulkerson (2014) it is unlikely that we will find unified criteria for defining each of the senses. Moreover, the senses seem to be internally linked, and sometimes co-dependent. Gibson (1966) emphasized that the senses are a perceptional system. Furthermore, we can distinguish between the exteroceptive senses (such as sight and hearing) that detect objects, and properties in the external world to the body, and the interoceptive senses, which detect changes to the body (MacPherson, 2011).

Telepresence can be characterized as technologically-mediated experiences, and as a medium-induced experience. The screen and the visual sense play a key role because visual media have the ability to convey non-visual aspects of perception (Merchant 2011). MacDougall (1997) suggests that the visual representation can offer pathways to the other senses. Some researchers in telepresence argue that the more the senses are stimulated, the higher the degree of presence (Sadowski, 1999). When a person is experiencing a mediated or virtual reality environment *as if* the experience were non-mediated, the person is experiencing telepresence.

Some commentators maintain that telepresence can be evoked by imagining another place as well as by directly perceiving and acting in a mediated version of that place (the so-called "book problem" (Biocca 1997, Schubert, 2002). Waterworth et al. (2015, p.36) write that;

> *the most relevant schism in views of presence is between those theorists who suggest that presence is evoked both by internal imagery and perceptions, and*

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those theorists (including ourselves) who suggest that presence is evoked only in the latter case.

Waterworth et al. (2015) see the feeling of presence in a technologically-realized place as an absorption state based around perceptual flow, essentially an equivalent experience to feeling present in the place in which the body is physically located. They suggest that imagined events and situations may also result in absorption, as in a vivid fantasy or daydream. But, people do not normally confuse what 1 they conceive in imagination with what they perceive as the external world. They suggest that these are qualitatively different experiences with the sense of presence underlying an organism's ability to make this essential distinction. This view is compatible with the way people react bodily and perceptually as if they were physically located in a distant place, to a greater or lesser extent.

The telepresence literature presents references to theories and philosophical discussion that might help us understand the phenomenon. Two of the most influential telepresence researchers are Frank Biocca and Mel Slater, and both are concerned with such theoretical questions. For instance, Biocca suggests that presence is a sub-problem of the science of consciousness, specifically the mind-body problem. To him, virtual environments potentially alter the interaction of the senses and motor systems with energy arrays that represent invariants of the environment such as objects, spaces, and other beings (Biocca, 2001: 555).

The definition by Slater (1999) includes the following three factors: Telepresence is *a)* the sense of being there in the virtual environment; *b)* the extent to which the virtual environment becomes the dominant one, i.e., that participants respond to events in the virtual rather than the actual environment; and *c)* the extent to which participants remember having visited the place depicted in the virtual environment rather than having seen computer-generated images of it. The feeling of presence occurs when there is a successful combination of real sensory data and virtually generated sensory data or in the case of virtual reality, replacement of real sensory data (Slater, 2009b). He argues that humans have a propensity to find correlations between their activity and internal state and their *sense perceptions* [our emphasis] of what is going on "out there." Slater (2009a) is influenced by enactivism, and what is referred to as the sensorimotor approach (O'Regan and Noë, 2001).

4 Heidegger, Merleau-Ponty and Gibson

According to Merleau-Ponty, the individual's experience rests upon the body (Low, 2009). We will highlight some of Merleau-Ponty's core ideas in his theory of perception. In this context we also refer to Martin Heidegger's ready-ready-to hand concept. Merleau-Ponty does not explicitly mention Heidegger in his writings, but he has a reference to the notion *Dasein* (Matthews, 2002: 5). Heidegger represents classic phenomenology. In *Being and Time* the scope is broad and goes far beyond technology. In *The Question Concerning Technology* (1954) he analyses the relationship with technology and modern science. He discusses technology as a means to an end and as an instrumental understanding of technology.

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Techne refers to the techniques and activities that bring forth a work (poiesis), but it includes art as a process of creating. *Techne* is a mode of revealing. To Heidegger everyday activities are the starting-point and the world is *at hand* [our emphasis] in an almost-literal sense. We have a primary and pragmatic interaction with things, " *technology is a way of revealing*" (Heidegger, 1954). The *ready to hand* mode is the mode of direct practical engagement in which we actually do much of our everyday living. For the relationships between Heidegger's concepts, see Figure 1.

Merleau-Ponty (1962:94-95) places the body at the center of his ontology. He writes: *I am conscious of the world through the medium of my body [our emphasis]*. It is from the body that I perceive the world. Merleau-Ponty does not explicitly mention Heidegger in his writings, but he has a reference to the notion *Dasein* (Matthews, 2002: 5).

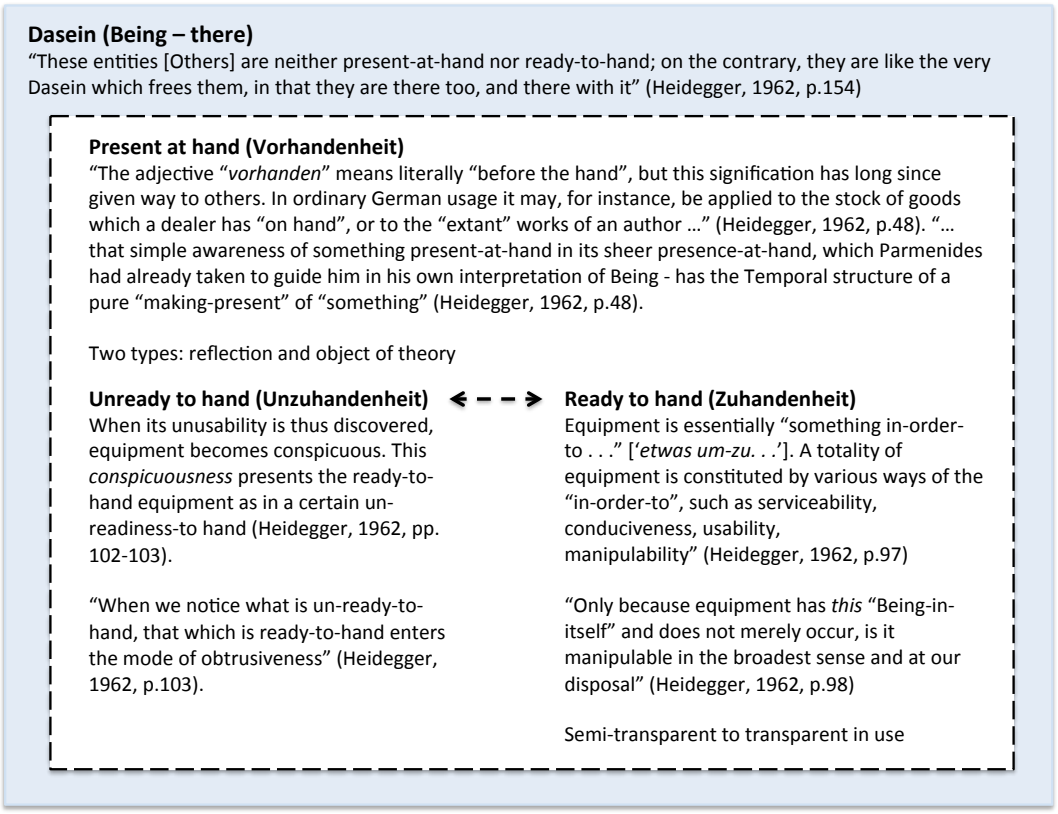

Fig.1 Heidegger and Dasein

Merleau-Ponty argues that perception and action are linked. His research has influenced scholars in phenomenology and contemporary philosophy, but very few have used his theory and concepts as a foundation for studying experiences in virtual environments. We have only identified two researchers that refer to and discuss his work, Tripahti (2005) and Morie (2007). Tripathi argues that we are never disembodied, not in cyberspace, not in front of a computer because we should focus on the act of experience rather on the thing being experienced. Morie (2007) emphasizes that Merleau-Ponty has paved the way for a discourse about immersive

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environments. She refers to Merleau-Ponty's book *The Visible and the Invisible*. Morie (2007: 107) applies Merleau-Ponty's ideas and concepts to VR and writes:

> *virtual environments are not purely imaginal; we experience them through our bodily senses, and in this way they are also real in the sense of the lived world.*

To Merleau-Ponty, things and worlds of our imagination are variations of the actual world. In *Visible and Invisible*, he states (ibid: 112):

> *it is the possible worlds and possible things that are variants and doubles of the actual world and of actual beings*.

Merleau-Ponty emphasizes that the most immediate and essential aspects of the lived dimension of space are sensory experiences. In his main work *The Phenomenology of Perception* (ibid: 239) he states:

> *by thus remaking contact with the body and with the world we shall rediscover our self, since, perceiving as we do with our body, the body is a natural self and, as it were, the subject of perception*.

The senses and perception are interrelated, and the experiences we have with our body have a meaning aspect. It is our body that actually absorbs meaning, in the form of bodily experience (ibid: 146-147). The body is both the generating and enduring aspect of experience, he writes; "*Our body is not primarily in space, it is of it.*" (ibid: 148), and existence is spatial (ibid: 342). Human subjectivity is essentially an embodied phenomenon, and there is a circular interplay between the three; body-mind-world. For instance, we have learned from our experience how to find our way around in a city. Merleau-Ponty calls this a feedback loop. Merleau-Ponty (ibid: 136) writes:

> *Cognitive life, the life of desire or perceptual life – is subtended by an intentional arc which projects round about us our past, our future, [and]our human setting.*

This intentional arc "*brings about the unity of the senses"* (ibid: 136). Merleau-Ponty explains how technology is part of the embodied experience, or how technology can be an extension of the body. His example is a blind man's use of a cane. The blind man perceives the world through his cane. This is a skill that has to be learned and a way of actively probing his environment. When he walks down the street, he is not primarily aware of the cane, instead he is aware of the curb etc. Like all other perception, it is an active communion with the world. The person's experience is created in a bodily encounter and in the reflection of this encounter. In the context of telepresence and mediated experiences, the screen and the game-console is the cane. The device becomes part of the *here-body experience* to use a term by Ihde (2002).

For a discussion of Merleau-Ponty and telepresence, there is another metaphor that should be mentioned. It is the *mirror*. Merleau-Ponty (1968) refers to Paul Schilder, an Austrian psychoanalyst and the function of a mirror. Merleau-Ponty uses the

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example of man with a pipe standing in front of a mirror. The mirror externalizes or extends my body, my here, in the world over there (Merleau-Ponty 1964: 129–30):

> *The mirror's phantom draws my flesh into the outer world (traîne dehors ma chair), and at the same time the invisible of my body can invest its psychic energy in the other bodies I see*.

Schilder (1935: 224) writes:

> *The experience of the sensation in the mirror is as immediate and original as the experience in the real hand*.

Some researchers in telepresence discuss the phenomenon from a theoretical point of view, but Merleau-Ponty is rarely cited. There can be many reasons why very few researchers have adopted Merleau-Ponty's theory of perception and the role of the body in studies of telepresence and presence-evoking technologies. This might indicate that insights from phenomenology and philosophy are not appreciated or understood in a field dominated by computer scientists. In our view, Merleau-Ponty's theory, his concepts and ideas, seem to be relevant not only for a theoretical understanding of the phenomenon, but for empirical work in the field of telepresence, in particular, for the choice of measurement in studies that concerns the subjective experience, that is when and why players report this *feeling of being there*.

Affordance and correlational presence.

The perceptual psychologist James J. Gibson introduced the term affordance in his book *The Ecological Approach to Visual Perception* (1979). Since then, the affordance concept has been used in a number of disciplines other than psychology. According to Gibson (1979), an affordance is neither an objective property nor a subjective property. It is both a fact of the environment and a fact of behavior. He argues that we perceive objects as having properties of what we ought to do with them, and he attributes full normativity to affordances. Not all agree to this strong claim. Nanay (2010), for instance, holds the view that when we perceive objects, the property affords action sometimes but not always.

According to Slater (2009b), the feeling of presence occurs when there is a successful combination of real sensory data and virtually generated sensory data. Slater (2009a) treats (tele)presence as rooted in activity, the response of people to their surroundings and their ability to actively modify those surroundings (Flach & Holden, 1998; Zahorik & Jenison, 1998). Slater (2009b) argues that presence does not demand high fidelity to physical reality, but rather that people do respond, and be able to respond, as if the sensory data were physically real, and Slater (2009b: 198) suggests that:

> *humans have a propensity to find correlations between their activity and internal state and their sense perceptions of what is going on out there.*

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5 The Spinozian Belief Procedure

In his book *Ethics,* Spinoza put forward the notion that a comprehended proposition is automatically believed. This means that in the moment, we automatically accept information before being able to reject it. The proposition 49 reads (Spinoza, 1677, 1982):

> *There is in the mind no volition or affirmation and negation, save that which an idea, in as much as it is an idea, involves*.

Spinoza suggested that people believe every assertion they understand, but quickly un-believe those assertions that are found to be at odds with other established facts (Gilbert, 1991). Spinoza argued that to comprehend a proposition, a person implicitly accepts the proposition; only later, if the person realizes that the proposition is in conflicted with some other, he or she might change his or her mind (ebd.). Richter et al. (2009) refers to the notion of an initial acceptance of information as the dual-stage model of comprehension and validation. Stanovich (1999, Stanovich and West 2000) labeled two types of cognitive processes, system 1 and system 2. In decision science, this is a concept often used to explain different decisions processes. There are similarities with this theory and the Spinozian belief procedure. System 1 regards intuitions that can be described as thoughts and preferences that come to mind quickly and without much reflection (Kahneman, 2002). Some formulate this belief procedure as a strong claim. Gerard (1997) writes:

> *perception is quintessentially Spinozian; a percept is immediately believed. Only in the case of rare illusions are our senses tricked into believing what is not there or in to not believing what is there*.

However, there are studies that indicate that this claim is too strong, and in some cases not an initial accept (Street and Richardson, 2015). Merleau-Ponty refers to Spinoza when he discusses attention, judgement and perception, but not the Spinozian belief procedure.

Against this backdrop, we ask whether there are indications that the Spinozian belief procedure can inform our understanding of why telepresence occurs from an empirical point of view? The experience in the virtual environment can evoke what we name the telepresence experience, the feeling of being there. Telepresence is also referred to as a medium-induced experience (Steuer, 1992). In the next section we present a study with video-games where the experience of a place in a VE is created.

6 Two Empirical studies with video-games

The telepresence experience can be evoked in many ways. Schwartz (2006) argues that realism and attention to detail allow gamers to experience the game spaces as real. One of the areas in which we have seen significant technological advancement the recent years is computer graphics and computer-generated imagery. This technology seems to blur the line between fiction and non-fiction, and it plays a key role in both movies and video games. A trend in this industry is photo-realism (Leister et al 1991). It is possible to mimic not only how humans look, but also how they

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behave. An example is Kara (Robinson, 2012), an avatar made by the video game developer David Cage for Playstation.

The geographer Edward Relph writes that virtual places can be more or less accurate reproductions of real places and more or less convincing on their own terms (Relph, 2007). In his theory, Relph (1976) proposes *vicarious sense of place*, a type of transportation to a place through imagination. Relph (2007, 1976) writes:

> *I have limited knowledge of digital virtual reality. […]Nevertheless, it seems to me that mutual interaction is at work between what might be called "real" place and virtual places*.
>
> *It is possible to visit a place in a second hand view or vicarious way that is without actually visiting them.*

Some researchers distinguish between fantasy or imaginary places and actual places, also referred to as remote places. This is evident in the early telepresence literature. Held and Durlach (1992), Sheridan (1992), and Steuer (1992) refer to one type of the telepresence experience as telepresence *in remote places*.

6.1 Telepresence in remote places; Las Vegas and Los Angeles as virtual places

In many console and videogames, well-known cities are used as an urban environment and an integrated part of the narrative. In some games it is possible to explore these cities as a tourist in what is referred to as a tourist mode option. For the purpose of exploring to what extent a sightseeing experience in a virtual place evoke reactions to the senses, we chose two cities that are used in videogames: 1) Las Vegas in Project Gotham Racing 4 made by Bizarre Creations for Xbox, 2) Los Angeles in Midnight Club Los Angeles made by Rockstar for Playstation. In Table 1, we present the profile of the participants. The data-collection took place at three locations; a) Temple University in the US, b) Erasmus University in the Netherland and c) University of Oslo in Norway. The participants had their origins in the USA, the Netherlands, Norway, and some other European countries.

Table 1 – The profile of the participants

	Las Vegas		Los Angeles
The nationalities of the participants:	From the US	From the Netherlands	From Norway and other European countries
Age			
19–24 years old	91% (43)	41% (9)	48% (29)
25–29 years old	4% (2)	32% (7)	27% (16)
30 years or older	4% (2)	27% (6)	25% (15)
Gender			
Female	28% (13)	28% (6)	60% (36)
Male	72% (34)	72% (16)	40% (24)
N	47	22	60

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6.2 The research design of the two studies with the cities Las Vegas and Los Angeles

Both cities are presented in a photorealistic manner in the games. The visuals from both games were used unchanged, but the sound was substituted with an audio-guide for tourists in order to create a sightseeing experience. The audio-guide the "*Hollywood Audio Tour*" by he company Tourcaster was combined with the video-game. In the studies, the participants were not given any information about the game itself, just the name of the city.

For the Las Vegas study a between-group design was chosen and the participants were randomly assigned to two groups. For both groups the task was to take part in sightseeing in Las Vegas. The participants all listened to a guide and looked at the buildings along *the Strip* on a big screen. The sightseeing tour lasted seven minutes. For the first group a photo-mode setting was used. Photo-mode is similar to a recorded slideshow that present pictures one by on while the guide is talking about the buildings and the history of the city, the hotels and casinos. The other group had a similar presentation, but in motion-mode. The motion-mode is default for players of the game. However, by comparing this to a photo-mode, a slideshow of pictures, the motion-effect can be revealed.

For the Los Angeles-study the sightseeing was a live event in the sense that the visual of the game was used without any adaptation. The introduction was:

> "*You are now going to do sightseeing in LA on the screen in front of you*." And, "*I, the interviewer will be a co-guide and tell you when to move forward, when to stop and listen to the guide*.

All participants started on Vine Street with a view of the Capital Records Tower, and continued into Hollywood Boulevard. The virtual sightseeing tour lasted for approximately fifteen minutes.

There are six measuring instruments that are commonly used in telepresence research. The purpose is to capture the subjective experience of the player (Nunez, 2007). These six instruments are; the Slater, Usoh and Steed (SUS) Questionnaire (1994), the Presence Questionnaire (PQ) (Witmer and Singer 1998), the Igroup Presence Questionnaire (IPQ) (Schubert et al., 2001), the Independent Television Commission's Sense of Presence Inventory (Lessiter et al., 2001), the MEC Special Presence (MEC-SPQ, Vorderer et al. 2004), and Temple Presence Inventory (TPI) (Lombard et al., 2000; Lombard et al., 2011).

For this study, the TPI was chosen because it contains the sub-construct named perceptual realism about the five senses; sight, smell, touch, sound and taste.

We hypothesized, based on our theoretical discussion that it is when the senses are evoked that a telepresence experience occurs, or a stronger telepresence experience occurs. In order to study the correlation between activities and sensory feedback, the affordance concept was chosen.

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DOI: https://doi.org/10.1007/978-3-030-01800-9_9

6.2 The Key Findings

First we report the mean scores, see Table 2.

Table 2 The Las Vegas and the Los Angeles studies and perceptual realism

	Las Vegas	Las Vegas	Los Angeles
	Sightseeing in photo-mode	Sightseeing in motion-mode	Interactive sightseeing in game-mode
	Mean	Mean	Mean
Perceptual Realism, 7-point scale (1=fully disagree, 7=fully agree) Overall how much did touching the things and people in the city you saw feel like it would if you had experienced them directly?	2.85	3.40	4.27
How much did the heat or coolness (temperature) of the city you saw feel like it would if you had experienced it directly?	2.74	3.09	3.23
Overall, how much did the things and people in the city you saw smell like they would if you had experienced them directly?	1.97	2.54	2.33
Overall, how much did the things and people in the city you saw look like they would if you had experienced them directly?	3.09	3.97	4.60
Overall, how much did the things and people in the city you saw sound like they would if you had experienced them directly?	2.62	3.71	3.60

The higher scores for the motion mode indicate that moving pictures have a stronger telepresence effect on the participants than still photographs. This is in accordance with both theory and findings in other empirical studies (Yoon, Laffey and Oh, 2008; Ozok and Komlodi, 2009).

For the Los Angeles study, all participants did an interactive sightseeing. With the exception of smell, it seems that, compared to the two alternatives, the interactive sightseeing experience evokes a stronger telepresence experience, that is, a higher score on four of five senses. We counted the number of participants that answered agree on the senses touch, look and sound, that is four on one of them and five or higher on the other two. We can describe those belonging to this group as "senses evoked". A mean score around four can be interpreted as neither negative nor positive. In the Las Vegas study, in the motion-mode, 12 of the 35 participants reported a positive sense-reaction. In the Los Angeles study 18 of the 60 participants reported that the virtual sightseeing evoked a sense-reaction, see Table 3.

Secondly, it is pertinent to ask how are the 18 (30%) that have the telepresence-experience different from the 35 that did not report they had this feeling of being there? Mel Slater claims that humans have a propensity to find correlations between their activity and internal state and their sense perceptions. This is the key argument for the concept named correlational presence. Is there empirical evidence for this claim? Correlational presence and affordance are closely related. One of the purposes

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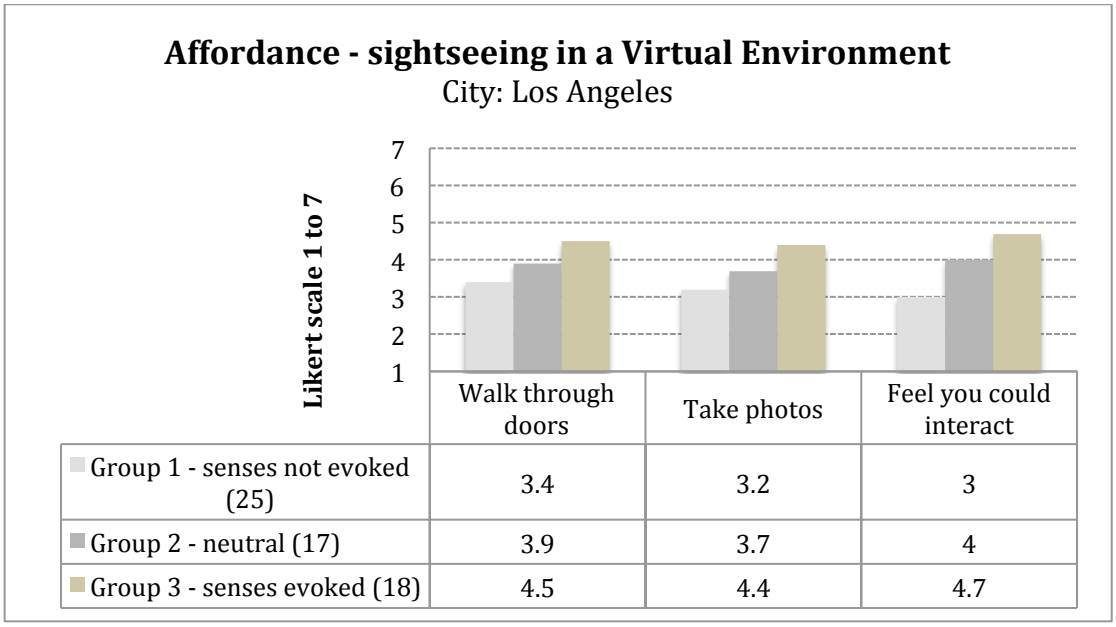
of the empirical study was to use these concepts together with measurements from telepresence.

Figure 2 shows a pattern. The findings indicate that the participants in the third group had a telepresence experience. The participants in the senses-not-evoked group were different. The numbers indicate that most participants in this group did not have a telepresence experience.

Fig. 2 Affordances in a virtual environment



7 Discussion

In most cases the person that has *the feeling of being there* in a virtual place knows that a medium is involved. We do not discuss this question any further, but we agree with Floridi (2005) who argues that we should not define something as complex as presence by what it is not and by the failure of someone not to notice something.

Many telepresence studies only report whether or not the feeling of being there is experienced in the moment or immediately after. We designed a study with a sightseeing experience. We have documented that some of the participants reported that it was an experience of the place, a feeling of being in the actual city. The participants reported this immediately after the sightseeing had ended.

Baruch Spinoza rejected the mind-body dualism of Descartes. One of his propositions concerns how we react and make judgment when receiving information. Heinemann (1941) with references to the empiricist school founded by Philinos of Kos in Alexandria distinguishes between three sorts of experiences. These are:

> *immediate experience, mediated experience (that is observation made by others before us), and analogous experience (thus in case of illness which has not been observed it may be useful to compare similar cases).*

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Heinemann, in his discussion on types of experiences, refers J. A. H. Murray, the *A New Dictionary on Historical Principles* (Oxford, 1817). Murray distinguishes between to have an experience of, to learn by experience and to try something, a tentative experience. Regarding to have an experience, the first of these three Heinemann writes (1941: 570):

> *(i) To have, experience of; to meet with; to feel; to suffer; to undergo. We could call this an immediate experience; it covers what we immediately feel or undergo during the course of our life.*

The immediate experience corresponds most often to how we use the word in this paper, and for instances in the phrase "*an experience in a VE*." We emphasize the present tense, the experiencing.

There can be many answers to the question why this feeling of being there occurs although the person knows that it is a media-induced experience. This question can be investigated with different lenses, and within an interdisciplinary context. In this paper we have drawn attention to some of the theories and ideas from phenomenology and philosophy, theories that can be used to reflect on what telepresence is and why it happens. And we have briefly discussed Merleau-Ponty and some of his thoughts and the Spinozian belief procedure.

Experiences also include perceiving through the senses, as well as feeling and doing. Logue (2009) defines perceptual experience as experience associated with sense modalities (vision, hearing touch, smell and taste) in virtue of which it appears to one that one's environment is a certain way. He emphasis is on the word *of*. He posits that a perceptual experience is a matter of a certain sort of relation obtaining between the subject of the experience and what the experience is of, that is the object of the experience.

To design studies and investigate the interplay of the empirical and the philosophical is not an easy task. Technology plays a key role in our society and research that can contribute to theoretical discussion of experiences in which technology plays a key role should be encouraged.

The telepresence researcher Sheridan (1992) considers the extent of sensory information provided by media technology to be a mjor factor contributing to telepresence. According to Mingers (2001), the success of VR will depend on the extent to which it can mimic a response to all the nervous system's sensory modalities. Not all will agree, but in the history of (console and PC) games, there are examples of games with simple graphics that can create a sense of presence. It is, however, pertinent to study the role of the senses with regard to telepresence and experiences in virtual environments. With video-games and video-game technologies, there are many opportunities for empirical studies, to test hypotheses about the role of the senses.

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We have based our studies on virtual environments of cities from two video-games that are made by professional game-developers. The results from the two empirical studies indicate that the experience in the virtual environments evoked a bodily reaction for some of the participants, but not for all of them. The main contribution of this study is to draw attention to the need for a theoretical discussion about telepresence that includes phenomenology and theories of perception. For empirical work, we have given an example with the affordance concept and how sense-reactions can be measured in telepresence studies.

McLuhan (1964) stated that media are extensions of the senses. Steuer (1992) had the vision that media technologies become more and more vivid. Thus, it is possible that we will, in the future, experience that systems will be capable to pass a version of the imitation game (Turing, 1950) that we can refer to as a "perceptual Turing test". We are not there yet, but theories on the belief procedures, why a percept is believed, and the role of the body should be in our inquiries and analysis.

The affordance concept can be operationalized and used in empirical studies. The development of decision theories is often based on empirical work. Insights from this field seem relevant for a discussion of the telepresence phenomenon. For future research, we should ask; are there good alternatives to the survey-based approach, that is, to ask the person to report to what extent the person has a telepresence experience? In addition to asking participants, that is, use introspective methods, we believe that electroencephalography (EEG), biosensors, and similar technology will play and role in telepresence research in the future. Such technologies are suitable to monitor sense-reactions in the moment. There is already research along this path. An example is the neurophysiological study by Baumgarten et al. (2006) on electro-encephalography and spatial presence, a functional magnetic resonance imaging (fMRI) VR-study by Hoffman et al. (2003), and the study by Clemente et al. (2013) on telepresence and the activity of the right insula in the brain. This leads to an intricate question: how should we interpret this type of data without asking the person about the subjective experience?

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