Chapter 1
Lighting a Path While Immersed in Presence: A Wayward Introduction

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Abstract The sense of presence in simulated environments, be it fragile and fleeting or sometimes deep and traumatizing, is the construct used to describe, measure, and sometimes evaluate and design and optimize systems that provide that ability. We spend more and more time in simulated realities provided by the systems that occupy our walls as screens or projections, fill our hands with messages from other places, or increasingly attach to our bodies and senses augmenting our physical reality with virtual objects, places, and beings.

Within the work on presence there is an interdisciplinary community of researchers, who bring different theoretical and methodological approaches to the study of presence. The community of presence researchers include: psychology, philosophy, medicine, engineering, communication, and various other areas.

This book represents some of the work from experienced researchers on presence with a weight on definitional and psychological issues and less on the engineering and technical aspects of specific interfaces.

Keywords Media technologies • Simulation • Sense • Reality systems • Presence

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1.1 Introduction

Media technologies are simulators for the mind. They are Plato's cave, casting shadows of things outside by pressing on our senses and firing up our imagination for the forms out of reach. In this press of imagery our bodies have the illusion of being transported to place beyond the cave, a sense of things and others just outside our reach. But we might feel as if we can see, hear, and touch them.

Sometimes the sense of presence is faint, like the sense of hearing the voice of friend when reading their text. Sometime the illusion is intense vivid as when we are being chased by some predator on some virtual savanna or human battleground.

The simulations may work because our minds automatically simulate places and other beings in the process of perceiving and modeling the space. To paraphrase the perceptual psychologist Richard Gregory, "Virtual reality seems so real, because reality is so virtual." We conjure (distal attribution) spaces and things based on patterns of energy that press on our senses (Loomis 1992). We understand the emotions and intentions of other people by simulating them with our own bodies, activating the same neurons we use to act and be. All media, Marshall McLuhan long ago reminded us, are extensions of our bodies, most of our senses. Through them our bodies adapt and extend their range, neurons magically adapt and respond to touches on the end of stick extending our hands beyond our bodies, even when it is our virtual hands on a computer screen (Maravita and Iriki 2004; Shokur et al. 2013). In a phrase we are capable of feeling present in a space other the one we are in. We feel present and respond emotionally to virtual others in computer game, pixelated faces on teleconferencing systems, humanoid forms in a computer, or an empty spirit inhabiting a robot shell. Spaces and beings appear present and available to us to act. We are inside. We feel present in the environment.

The sense of presence in simulated environments, be it fragile and fleeting or sometimes deep and traumatizing, is the construct used to describe, measure, and sometimes evaluate and design and optimize systems that provide that ability. We spend more and more time in simulated realities provided by the systems that occupy our walls as screens or projections, fill our hands with messages from other places, or increasing attach to our bodies and senses augmenting our physical reality with virtual objects, places, and beings.

I encountered the concept of presence while doing research on virtual reality systems (Biocca 1992a, b), body tracking systems (Meyer et al. 1992), and simulation sickness (Biocca 1992c) with colleagues at NASA. As a student of Marshall McLuhan, it struck me that the concept presence attempted to describe a fundamental property of media, how we use and experience media, and how the psychological process is independent of the technology used to achieve presence. The very word "tele" in tele-vision, tele-phone, had in its root the idea of transporting the senses to a different place. In its incarnation within tele-operation and tele-robotics, that a focus on tele-presence came again to the foregrounded and a journal bearing the destination of Presence (Held and Durlach 1992).

As an editor contributing several articles already to a special issue of virtual reality, I convinced Jonathan Steuer at a San Francisco coffee shop, then an open-minded, young researcher at Stanford to describe and array media in terms of presence, in an article now cited thousands of times (Steuer 1992, 1995). I dug into the topic treating it in a psychological version in my own work on embodiment and presence immersive systems (Biocca 1997).

The path to presence has continued. This book before you and most of the articles were partly stimulated by a generous program within the European Union, Future and Emerging Technologies. Whereby a €20 million initiative sought explore presence, to understand how it works psychologically, and to design better presence interfaces to stimulate the construction of virtual environments. The articles in this book were recruited by three of the editors (Biocca, Freeman, IJsselsteijn) under the umbrella of a project called OmniPres, a title suggesting a certain omniscience, if not omnipresence.

Some of the work related from several projects remains in this book, others were scattered elsewhere. Matt Lombard, a tireless supporter, researcher, and organizer of presence research, helped the distracted and, therefore, not omniscient, original editors to finally bring these fine articles to press in this form.

The book represents some of the work from experienced researchers on presence with a weight on definitional and psychological issues and less on the engineering and technical aspects of specific interfaces.

1.2 Telepresence: Defining and Operationalizing a Construct

As one of the articles reminds us, the sensation of being present in a virtual environment is not synonymous with consciousness, but like consciousness it is a global percept cohering from engagement and action of the sensorimotor system with stimuli, motor action, or intention. Presence has from the beginning seen as multidimensional (Biocca 1997; Heeter 1992; Held and Durlach 1992) dealing with a broad, integrated nature of spatial experience of virtual environments and of social experience (social presence) of other apparently intelligent entities mediated humans or agents. Because it deals with a broad, sweeping aspect of experience, there is an issue with specifying conceptually and operationally what psychologically defines presence experience, how the experience can be validated and measured, and how technological form and content can be designed or engineered to increase the sense of presence. Within the work on presence there is an interdisciplinary community of researchers, who bring different theoretical and methodological approaches to the study of presence. The community of presence researchers include: psychology, philosophy, medicine, engineering, communication, and various other areas.

Several articles in this book deal specifying with the construct, how it can be refined or extended, and how it might be used effectively in empirical and design oriented research.

In Chap. 2 the Lombard and Jones' review wades into and organizes the diverse literature that has evolved over the definition of the broad construct of presence. They lay out the key cleavage points on which the broad construct divided or slightly shifts. The end with very practical recommendations the help cleave to practical structures identifying the exact locus of definitions along several fault points: presence or telepresence, objective or subjective presence, spatial or social presence; remote, virtual, or medium telepresence; mediated or unmediated; real/imaginary and realistic/unrealistic.

In Chap. 3 Waterworth and colleagues seek to integrate presence within a larger setting of "conscious mental life." The goal is to connect up the presence experience to the larger continuum of a sense of presence in the world linking this to evolutionary perspectives and to work of Damasio (1994) on consciousness.

The article provides some conceptual support for limiting the scope of presence experiences. Presence experiences have been structured to give primacy to the experience of the physical environment and to delimit the experience of internal mental imagery. For Waterworth and colleagues presence is a perceptual phenomenon that can be enhanced by reflection and by links to personal history and goals (extended presence, "self-presence" in other areas). Following Damasio, they introduce related concepts of proto-presence, core presence, and extended presence dealing with different levels of engagement with perception and the reflective self.

Presence for Waterworth and colleagues is largely influenced by perceptions not by internal imagery. Presence is presence with a stimulus, not imagination. Retreat into mental imagery [the "third pole" for Biocca (Biocca, May 2003)] is absence. In this way the cut the knot of the "book problem" by declaring imagery based absorption as "absence" from the perceptual world, and less primal and present that action and engagement with perceptual works be they real or virtual. "Presence is what it feels like to be embodied and consciously attending to an external, perceptible." Absence is preoccupation with internal world. We cannot share imaginal worlds and the normal brain does not confuse the imaginal world with the world of perceptual action. This has implication on how to measure presence and for therapeutic applications.

In Chap. 4 Turner and colleague wade into the discussion of presence conceptualizing attempting to bridge some psychological and philosophical aspects. For Turner the sense of presence is in part based on the primacy of affective response to stimuli, mediated or otherwise. The affective response is immediate and directed towards quickly modelling corporeal response. In some ways Gibsonian focus (Gibson, 1966, 1979) on the link perception and action is tied to research and philosophy on in which emotions and immediate possibilities for action cohere around environments (spatial presence) and agents in these environments (social presence).

In Chap. 5 Riva and colleagues position their perspective on presence in psychological and neuroscientific terms. The see presence as a mechanism related to evolutionary processes. The resulting argument and theoretical frame is multilayered and cannot be readily summarized here.

The sense of presence emerges from basic psychological processes related to the process of embodiment. Presence is related to the body and emerges out of the embodiment process. In mediated environment a second-order mediation of the interface becomes the center of action. Riva and colleagues also focus on enabled action in the environment viewed from the different levels of proto, core, and extended presence (see Chap. 2). Presence is related to human action and its organization directed with intention to the environment. They argue based on neuroscientific evidence that action and perception are fundamentally linked. Motor functions (motor neurons) not only control action and also represent the action. The link between perception and action, especially at the lower sensorimotor levels helps enable a sense of presence with mediated tools and environment. Intention is a property of all mental states, directed at some state of affordances in the world. Differentiating different forms of intention they argue presence provides feedback as the status of actions and goals, based on perceptions of one's actions upon the environment. Higher quality of presence is achieved through the quality of intention, action, and experience. Media that support lower sensorimotor levels activity help induce optimal presence. Activity theory shows that action is linked to physical and social tools. Cognition, including presence, occurs in specific environment with specific end. Therefore presence is causal emergence of a user engaged with the physical world and social environment.

Riva and colleagues also discuss social presence in this content. Motor intention models others actions, whereby we infer the mental state of the other. Social presence results from prediction of other's actions and intentions. Sensorimotor integration "…establish a direct link between one's being and other beings, in that both are mapped in a neutral fashion: the observer uses her/his own resources to directly experience the world of the other by means of an unconscious process of motor resonance." Recommendations for design are made which focus on the specificity of support for actions at the different levels of presence.

In Chap. 6 Gamberini and colleagues use activity theory to take an action theoretic approach to presence experiences. They see presence as part of the hybrid connection between a user, a tool, and a set of enabled actions within a system. They focus on the constructs of space/place, action, and mediation to characterize behaviors that are shaped by the tool and the spatial context.

Using a more behavioral and descriptive approach, they seek to describe and document actions and only to lesser degree psychological processes. In this way they claim to describe presence in digital and non-digital environments through behaviors, using driving a car or motorcycle as an example action-place-tool framework. Through this approach they may make the construct independent of the psychological state of the user.

In Chap. 7 Hartman and colleagues focus on spatial presence and very much on the spatial element of the experience and perception of physical location. They examine spatial presence as a psychological construct, common among different media, and one that provides for a potential interaction of medium and user.

Hartman et al. link spatial presence to empirical studies of presence, showing that components of the experience. Spatial situation model is created and in second level

support the primary egocentric reference frame which places the user in relation to objects and the environment. They also look into attention to the stimulus, its role that is critical for the onset and sustaining presence. Sensory components, vividness, and presence are analyzed. They review issues of whether presence is binary or continuous, the role of attention, and the implications for measurement.

1.3 Telepresence: Research and Design

Research on presence has focused on how media form or content influence presence or how presence affects human performance in mediated environments. This section of the book covers some of this research; some of the threads also extend into the following section on applications.

Building on previous reviews of measures and methods, Chap. 8 by Laarni and colleagues provides a thorough review of the different ways in which the construct of presence has been measured. As presence deals often with unconscious, global judgments of the location of the actors' perceived location, spatial location relative to objects and intelligent others, it is widely accepted that there are several dimensions to the sense of presence. Laarni and colleagues detail the various subjective and so- called objective measures of presence that try to assess the contract as whole or its sub dimensions.

They detail various ways to capture the judgments of spatial location, perceived realism, and potential actions typically mined in retrospective self-report. They also review various ways in which interactants reveal that they are present with shifts in their natural behaviors (behavioral indicators) or by behavioral probes such as secondary-reaction time. As the sense of presence is a continuous process some have also sought to measure shifts in presence, sense of space, and ones location within a space via continuous measures such as physiological indicators that may correlate with onset or intensity of presence.

In Chap. 9 Smyth and colleagues address and very specific attempt to design a telepresence experience of particular places via image based rendering technology. How can the interactive experience of place be as realistic as possible? In this HCI design oriented chapter they look at how observations and measures play a role in the design of telepresence within place reproducing environments. They focus on embodiment in a very particular "somewhere."

They support the design with the use of place probes to capture users' experience of particular places to assess how well the qualities of the physical spaces could be reproduced in the virtual place in all its specificity. The design process included different "patterns" for spatial characteristics, technology, meaning, affect, and others. In this way they sought high levels of presence by successful mapping real experience to virtual experience hopefully rendering the mediating technology more transparent.

Presence research often explores the effect of stimuli on visual displacement towards the represented environment and away from the physical environment. This

is accompanied by sense of genuine physical displacement. In Chap. 10 Riecke and Schult-Pelkum integrate the well-studied phenomena of "vection" in the context of emerging presence.

Explored for more than 100 years, the experience of vection is the illusion that one's body is moving when one is stationary, something that can be induced by purely abstract moving visual field such as rotating stripes or even acoustic stimuli. This process is automatic and widely exploited in simulators and virtual environments to create the illusion of self-motion. Riecke show that this phenomenon is related to physical or spatial presence. Like presence it is influence by visual technical features such as field of view and perceptual realism (spatial frequency) and multimodal consistency.

Reicke and Schult-Pelkum provide evidence of very strong relationship between vection effects and self-report measures of spatial presence. They also provide evidence that spatial presence may be related to successful training and learning in virtual environments.

1.4 Telepresence: Applications

While presence issues may be related to psychological states, ultimately the study of presence is motivated and directed to understanding and extending mediated telepresence experiences.

In Chap. 11 Steed and Schroeder focus on collaborative virtual environments, specifically how social, 3D, and largely immersive technologies can be characterized by spatial extent that is shared and different degrees of user modelling. Both dimensions of an interface or environment can be seen as supporting different levels of other awareness and coordinated action, termed co-presence. The article embeds the discussion in the context of specific design issues and existing collaborative systems. The article considered different levels of user representations and avatar interaction, different avatar interaction approaches which they term "puppeteered, tracked, and reconstructed." Illustrating with specific systems, they point how affordances provided by different avatar types enable different levels of communication and co-presence, and where the interface allows co-presence to break down. Steed and Schroeder also examine how modality, realism and context affect the sense of presence and co-presence. They end by looking at different blends of collaborative environments between captured environments and simulated.

Probably one of the areas where presence inducing technologies are systematically applied is in the area of mental health applications. Among these, virtual reality is often used to support compelling therapeutic experiences.

In Chap. 12 Riva and colleagues review the application of "presence inducing systems," specifically virtual reality technologies in mental health interventions. Presence inducing technologies allow patients to elicit optimal experiences in the support of psychological change. Riva and colleagues show the application of presence within a range of clinical issues including the treatment of phobias (e.g., flying

claustrophobia, etc.) panic disorders, eating disorders, post-traumatic stress, pain treatment, and other areas.

More immersive experiences such as VR are associated with more optimal experiences than other media or the past use of doctor-patient driven imagined reconstructions. Riva and colleagues demonstrate the presence systems, that afford interaction with more intuitive, perceptual, bottom up sensorimotor interfaces, elicit stronger effects for some problems as compared to more rational operations on internal representations or classic patient-therapist talk. While presence is not a guarantee of successful outcomes it is related, and especially when linked to meaningful, relevant, emotional experiences.

Riva and colleagues point out that user-patients can confront a perceptual representation of his or her problem in controlled yet safe settings. The vivid perceptual experience, the sense of the real embedding within meaningful experience, can help induce changes in behavioral routines and responses to stimuli in the physical environment. Riva and colleagues review the relationship between presence and therapeutic changes in this application area.

In summary the book represents an interesting range of research and theory on presence technologies and experience.

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