

Enhancing Presence: Sensory Integration and Proprioception in Cinema

I. INTRODUCTION

In the last two decades, philosophers writing about film have drawn on recent findings from cognitive science and neuroscience. Film artists are encouraged to meet new challenges set by the latest scientific discoveries in order to improve ways of engaging their audience. The latest findings on the human senses and their integration, with special emphasis on hearing and olfaction in relation to vision, as well as proprioception, may satisfy the need for enhancing the sense of presence in cinema. This theoretical discussion has also been affected by ongoing research in digital technologies, especially since cinema can be viewed both as an ancestor of new media and a new medium itself, digital cinema.¹ My aim in this paper is to show that cinema creation, experience, and interpretation can benefit by a neuroscientific approach that goes against ocular centrism and focuses on the complex perceptual mechanisms involved and their relation to the world.

II. PRESENCE

The “old” need for realism in cinema has resurfaced in the context of discussions on new media. It may be a synthetic realism, as Lev Manovich calls it (based on the introduction of the synthetic moving image, computer animation, and interactive three-dimensional computer graphics), but Christian Metz’s “cinema effect,” dependent on the narrative form and the manufacture of the reality effect, has never been abandoned.² Rather, it has slightly shifted. What filmmakers working in and with the emerging technologies appear to seek is to enhance the sense of presence. Presence is defined as “a perception, an illusion that a mediated experience is not mediated.”³ Such a type of experience was not possible before the emergence of computing and new technologies. This concept is nowadays mostly discussed in virtual reality research, but presence in films as well as in novels cannot be overlooked. Daniel Dennett talks about “an illusory shift in point of view” that interactive teleoperations can produce and chooses to compare it to the Cinerama of the 1950s.⁴ The point here is that, even since the fifties, cinema’s aim has been to enhance the psychological impact and make the viewers experience the film as if they were part of it. However, hasn’t this always been the aim of narratives presented in literary texts as well? What has been called “the book problem” refers to the fact that people do experience presence in narratives presented in books but with a very low immersion compared to film and virtual reality.⁵ This leads us to think that the need for presence has always been an issue across

different art forms and that new technologies have made possible for film and virtual reality a strong sense of presence that has been seemingly low in literature.

Three of the conceptualizations of presence that Matthew Lombard proposes for literature are particularly useful in the context of film (and new media): Presence as realism explores how apposite the representations of a medium are to the “real thing,” if the representation looks, sounds, or feels the same as that thing in real life.⁶ This concept of presence involves two key types of realism, social and perceptual realism. A science-fiction scene, for example, may be socially unrealistic, as the events it portrays are unlikely to happen, but perceptually realistic since people look and sound as if they do exist in real life. In an animated show, on the other hand, we may experience social realism, but no perceptual realism. Presence as transportation refers to the medium that takes the audience to a world or brings the world to the audience or shares the world with the audience. Here again, what is in question is whether the audience feels, although being “transported” to a mediated environment, as if they were physically present in it. Presence as a perceptual and psychological immersion examines how the media user is shut out of the real world and delves into another. With her senses immersed, the challenge is for the media user to get absorbed by the mediated experience, as if it were not mediated.

Research has shown that visual and aural display characteristics affect the sensation of being part of a mediated environment, as if it were real.⁷ Higher resolution images, larger screens, larger viewing distance in IMAX theatres, moving images as opposed to still images, color images as opposed to black and white, camera work that provides depth cues, stereoscopic images as opposed to two-dimensional images, camera techniques like subjective camera shots, direct address and rapid point-of-view movement, along with surround sound systems have been measured to evoke a greater sense of presence.

From the point of view of traditional cinematic realism, presence appears to be just another notion that deals with the dilemma between reality and illusion that is typical of cinema’s past. Is what’s on screen photorealistic? Is it a representation of the real world? Are trees on screen like the trees of the world around us? Are the situations represented, no matter where or when they take place, true to real life? However, the question now is whether filmmakers still care to represent reality in this way. My answer would be no — at least not only in this way. Now, the main issue appears to be immersion and transportation. Artists, taking advantage of the technology that governs IMAX screens, simulation rides, and video games, struggle to represent a world that feels real, as being here and now. They aim at a reproduction not only before the audience’s eyes but also before their ears, their noses, and their bodies. They want to capture consciousness and absorb the spectator into constructed worlds.

III. SENSORY INTEGRATION

If cinema seeks to evolve by enhancing presence, it should take advantage of the research on cross-modal perceptual interactions and the evidence of how these could modulate the experience of cinema. From its beginning the cinematic medium has been developing, along with research on the human senses, to explore and emulate the world around us. The visual system is the one that we currently understand best; moreover, vision has dominated our (multi-) sensory perception of the world. Our understanding of the auditory system is far behind in comparison to vision, but the interest in sound has greatly increased, especially in the last decade.⁸ Even the so-called “lower” sense of smell has been gaining ground recently. Researchers promise applications that will add odors to our “media lives.” The integration of information from different sensory systems is a fundamental characteristic of perception and cognition — qualitatively different kinds of information from the various sense organs are put together in the brain to produce a unified, coherent representation of the outside world.

Traditionally, it has been assumed that the integration of such disparate information (at the cortical level) was the task of specialized, higher-order association areas (of the neocortex). Visual-brain specialist Semir Zeki has proposed a modular theory of the brain and of visual perception, extending it also to artistic production and aesthetic appreciation in the visual arts. "The theory of functional specialization supposes that different attributes of the visual scene are processed in geographically separate parts of the visual brain, that there are different processing systems for different attributes of vision," such as form, color, motion, and facial recognition.⁹ Zeki extends this theory to neuroaesthetics, maintaining that artists "tailor" their art according to the physiology of brain cells that are responsive to distinct visual attributes. He then applies it to express specific aesthetic judgments, such as this: kinetic visual art (which is based on motion) is best if monochromatic, for in this way the aesthetic effect of functional specialization related to motion is not blurred by the admixture of other visual qualities such as color (perception of which depends on the stimulation of a different brain module).¹⁰ If this were the case, cinematographic art, which is based on integrating several senses, would have never gotten off the ground! In contrast to this modularity assumption, however, other neurobiological data suggest that "much, if not all, of the neo-cortex is multi-sensory."¹¹

In recent years, several results have appeared in the relevant literature concerning the interaction between different modalities in order to achieve a higher sense of presence. Researchers at the California Institute of Technology claim that visual perception can be manipulated by other sensory modalities. They have discovered a visual illusion that is induced by sound; when a single visual flash is accompanied by multiple auditory beeps, the single flash is incorrectly perceived as multiple flashes. The results indicate that the illusory flashing is caused by an alteration of visual perception by auditory stimuli.¹² Recent research, focused on the study of the localization of any multisensory interactions associated with changes in conscious experience, has shown that the responses of the visual areas of the brain to visual stimulation are significantly enhanced by concurrent auditory stimulation. Whenever an auditory stimulation gave rise to an illusory change in perceptual experience, this was associated with specific enhancement in the primary visual cortex.¹³ Results of an investigation of soundscape design to increase the sense of place in virtual reality show that sounds can create a sense of place, although people are not able to precisely recognize a place by listening to the soundscape alone.¹⁴ Furthermore, researchers suggest that adopting a multimodal approach will benefit the audio-visual processing, as opposed to the unimodal that media technologies have adopted up to now. The study shows that moving image sequences may be filled in by the addition of directionally congruent, discrete auditory stimuli sampled at a higher rate.¹⁵

However, in the history of cinema, odors were used even before sound. In 1906, a wad of cotton wool that had been soaked in rose oil was put in front of an electric fan during a newsreel about the Rose Bowl Game.¹⁶ Several decades later, in the sixties, Hans Laube invented Smell-O-Vision, a system that released odor during the projection of the film *Scent of Mystery*. The process injected thirty different smells through pipes into a movie theatre's seats, when triggered by the film's soundtrack.¹⁷ In 1982, John Waters released an Odorama version of his film, *Polyester*. He included scratch-and-sniff cards with ten-numbered spots that were to be scratched when each number flashed in the bottom right corner of the screen.¹⁸ Recently, in 2006, NTT, a Japanese communication company, developed a new way to add odor to Terrence Malick's film, *The New World*. At seven key moments during the film, an Internet server, linked to the reel of film, downloaded and emitted scents in the theatre.¹⁹

Although olfactory interfaces weren't particularly successful in the cinema's past, today they are being seriously explored again for their potential to enhance the experience of virtual environments, television, and Internet. University of Central Florida's Institute for Simulation and Training conducted an olfactory study as part of its Research in Augmented & Virtual

Environment Systems, a cross-disciplinary project researching multimodal virtual environments. The research tested olfaction's impact on a human operator's sense of immersion in a virtual environment. Similarly, Georgia Institute of Technology conducted experiments on the effects of olfactory sensory cues on participants' sense of presence in a virtual environment, specifically, on their memory of the environment and the objects in it. The results indicated that introducing olfactory cues increased the realism rating; however, it was not a statistically significant trend.²⁰ The sense of smell is, also, "missing" in video games that usually seek total realism. The experimental *Smell Me*, an interactive olfactory game, leaves open the question of how useful olfaction may eventually prove. Based on researchers' reports that when a monkey smells a fruit's scent, not only the olfactory area but also the visual area becomes activated, *Fragra*, another olfactory game that enables players to explore the interactive relationship between olfaction and vision, encourages further exploration of the interaction between the two modalities.²¹

In the same direction, a growing number of research papers appear in the literature, working on the process of smelling and its incorporation in media.²² However, significant problems await the design of olfactory experiences. Researchers who work on developing the olfactory displays (by analogy to visual displays), head-mounted displays or air cannons, focus on the difficulties of the spatiotemporal control of odor.²³ Charles Platt has stated that "if this technology takes off, it's gonna launch the next web revolution."²⁴ Nowadays, a successful and popular olfactory cinematic experience, if possible, will have to come after the success of olfactory applications for the Internet, personal computers, and smart phones.²⁵ As Wijnand Ijsselsteijn suggests, "people's responses to media do not appear to be a linear product of the extent of sensory information that the medium provides. Instead, they are very much shaped by people's previous experiences with and expectations towards media — i.e. their media schemata."²⁶ If an audience gets familiar with digital smells in their daily life by, for example, sending scented emails and text messages, their medium schema may change, their experience and expectations toward an olfactory cinematic medium may be transformed, and they may be ready to enjoy and support a cinema with scents.

The above list of studies on the integration of the senses confirms the trend and the need of the research community to be skeptical toward ocular centrism, that is, toward vision alone. Along this line, the film and new media community seeks to renew its material and to challenge human perception and emotion by producing works that, by appealing to all the senses, enhance the sense of presence.

IV. PROPRICEPTION

The long philosophical tradition of considering body and soul as separate entities has recently been challenged by an emphasis on the "embodied mind."²⁷ Research on the brain in the past few decades has revealed important aspects about mind and consciousness, showing that the mind functions together with the body. This approach supports the idea that "perception is not something that happens to us, or in us. It is something we do."²⁸ Perceptual experience is a sensorimotor activity, and as such it doesn't depend only on the incoming stimuli but also on the embodied perceiver. If this notion of perception is put together with the integration of the senses, it leads us to an understanding of perception as a mutual composition of the integrated senses with proprioception.

In an article, which aims to identify proprioception as an aesthetic sense, Barbara Montero defines proprioception as "the sense by which we acquire information about the positions and movements of our own bodies via receptors in the joints, tendons, ligaments, muscles and skin."²⁹ Montero maintains that, based on this bodily information, we can form aesthetic judgments for

our own movement (first-person proprioception) and for other people's movement (third-person proprioception). She grounds her claims on empirical data and research on the mirror neurons that has revealed that when a subject is either performing a task or watching another person performing the same task the same area (the premotor cortex) of the brain is activated.³⁰ Traditionally, it is two senses, vision and hearing alone, that are considered to be what connects us to the world of art and enjoyment. The so-called lower senses (touch, smell, taste) as well as proprioception have been excluded from the aesthetic sense realm. Proprioception has been excluded because it is by definition a sense of self-perception and it doesn't represent objects but the sensory itself. Traditional aesthetics, based on a sense of distance from the object perceived and appreciated, has not shown concern for such self-referential senses. The so-called aesthetic senses were related to external objects one sees and hears, even smells, touches or tastes, to objects, that is, beyond one's body; whereas proprioception relates to the bodily sensation itself. Montero's aim is to dissolve this distinction.

Even though she examines proprioception through dance and its audience, I want to suggest that her ideas may also be applied to film.³¹ As in the case of a dance audience, cinema spectators are proprioceiving the movements they watch and listen to on screen. Here, I would like to add to Montero's argument that it is not only visual cues that trigger the proprioceptive effect but also sound cues, as further experiments on mirror neurons have indicated. It is found that the F5 area of the brain includes neurons that discharge "not just to the execution or observation of a specific action, but also when the specific action can only be heard" (so-called audiovisual mirror neurons).³² So, the process involves not only vision and hearing, but also kinesthetic sensation of one's body. By watching and listening to the actions of the actor on screen, the audience represents his movement in their own bodies. Just like mirror neurons indicate, watching and listening to actors' movements gives the audience the "internal experience" of moving. This third-person proprioception depends on vision and hearing. This is another point against ocular centrism; vision and hearing are integrated with proprioception. If the focus both of the research and the artists' community is shifted to proprioception, as Montero encourages, the audience experience can be enhanced by the awareness of the bodily feeling involved in a kinetic artwork.

V. CONCLUSION

If we attempt to see cinema perceivers from the point of view of artists, who are at pains to enhance the presence of artworks based on a multisensory human perception amplified by proprioception, the audience no longer just watches pictures but becomes transformed from a disembodied passive perceiver into an active, embodied perceiver of an artwork. As technology moves toward total presence by increasing the use of interactive setups, our view of the audience changes toward a more active and embodied participation.

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¹ Lev Manovich, *The Language of New Media* (Cambridge: MIT Press, 2002).

² The phrase “synthetic realism” comes from Manovich’s *The Language of New Media*, 184. The phrase “cinema effect” can be traced to Christian Metz, but the proximate source for this paper was Manovich’s *The Language of New Media*, 310.

³ Matthew Lombard and Theresa Ditton, “At the Heart of It All: The Concept of Presence,” *JCMC* 3, no. 2 (1997), <http://jcmc.indiana.edu/vol3/issue2/lombard.html>.

⁴ For “illusory shift in point of view” see Daniel C. Dennett, *Brainstorms: Philosophical Essays on Mind and Psychology* (Brighton, UK: Harvester Press, 1978), 314–15. For the Cinerama discussion, see Wijnand A. Ijsselstein, Jonathan Freeman, and Huib de Ridder, “Presence: Where Are We?” *Cyberpsychology and Behavior* 4, no. 2 (2001): 179. Cinerama was one of Hollywood’s answers to the growing popularity of television. Cinerama used three 35-mm projections on a curved screen to create a 146-degree wide panorama. It also included a 7-channel directional sound system.

⁵ Thomas Schubert and Jan Crusius, “Five Theses on the Book Problem: Presence in Books, Film and VR,” (paper presented at the *Fifth Annual International Workshop Presence*, Porto, Portugal, October 9–11, 2002).

⁶ Lombard and Ditton, “At the Heart of It All.”

⁷ Ibid.

⁸ Gregg H. Recanzone and Mitchell L. Sutter, “The Biological Basis of Audition,” *The Annual Review of Psychology* 59 (2008): 119, DOI:10.1146/annurev.psych.59.103006.093544.

⁹ Semir Zeki, *Inner Vision: An Exploration of Art and the Brain* (Oxford University Press, 2000), 61.

¹⁰ Zeki, *Inner Vision*, 138.

¹¹ Asif A. Ghazanfar and Charles E. Schroeder, “Is Neocortex Essentially Multisensory?” *Trends in Cognitive Science* 10, no. 6 (2006): 284. The issue of multisensory aesthetics is discussed in Fay Zeka, “Tactile Relief: Reconsidering Medium and Modality Specificity,” *The British Journal of Aesthetics* 45, no.4 (2005): 434-37, where the author distinguishes two different categories: multimedia multimodal and unimedia multimodal, an important distinction between cases in which various senses are added (like in cinema) and those that are based on a single sense with the assistance of synaesthesia (as in “colored hearing” involved in certain kinds of painting or music).

¹² Ladan Shams, Yukiyasu Kamitani, and Shinsuke Shimojo, “What You See Is What You Hear,” *Nature* 408 (2000): 788.

¹³ Sarah Watkins et al., “Sound Alters Activity in Human V1 in Association with Illusory Visual Perception,” *NeuroImage* 31 (2006): 1255-1256.

¹⁴ Stefania Serafin and Giovanni Serafin, “Sound Design to Enhance Presence in Photorealistic Virtual Reality,” (paper presented at the *Tenth Meeting of the International Conference on Auditory Display*, Sydney, Australia, July 6–9, 2004).

¹⁵ Aleksander Väljamäe and Salvador Soto-Faraco, “Audio-Visual Interactions in Dynamic Scenes: Implications For Multisensory Compression,” (paper presented at the *19th International Congress On Acoustics*, Madrid, Spain, September 2–7, 2007).

¹⁶ Avery Gilbert, *Hollywood Psychophysics: What the Nose Knows* (New York: Crown Publishers, 2008), 148.

¹⁷ Gilbert, *Hollywood Psychophysics*, 151-62; see, in particular, page 153. Several efforts at providing olfactory interfaces were also made prior to 1960. In 1929, in New York City, during *The Broadway Melody* perfume was sprayed from the ceiling. In 1933, on Broadway an in-theatre smell system was installed. In 1940, Walt Disney considered including scents in *Fantasia*, but due to cost reasons he rejected the idea. In 1943, Laube, a Swiss, presented Scentovision, a system to connect pipes to individual seats, but he didn’t manage to sell his patent. Finally, in 1953, General Electric developed Smell-o-Rama.

- ¹⁸ Robert Jutte, *A History of the Senses, From Antiquity to Cyberspace* (Cambridge: Policy Press, 2005), 277–78.
- ¹⁹ NTT Communication, accessible online: http://www.ntt.com/release_e/news06/0004/0411.html.
- ²⁰ Donald A. Washburn and Lauriann M. Jones, “Could Olfactory Displays Improve Data Visualization?” *Computing In Science & Engineering* 6, no. 6 (2004): 80.
- ²¹ Arito Mochizuki et al., “Fragra: A Visual–Olfactory VR Game,” (paper presented at *ACM SIGGRAPH 2004 Sketches* Los Angeles, California, August 08–12, 2004).
- ²² Oluwakemi A. Ademoye and Gheorghita Ghinea, “Synchronization of Olfaction-Enhanced Multimedia,” *IEEE Transactions On Multimedia* 11, no. 3 (2009); Horea Todoran, “Smelling Objects for Multimedia Database Applications,” *Studies in Informatics and Control* 14, no. 4 (2005); Bernadette Emsenhuber and Alois Ferscha, “Olfactory Interaction Zones,” (paper presented in *The Seventh International Conference on Pervasive Computing*, Nara, Japan, May 11–14, 2009); Fumitaka Nakaizumi et al., “SpotScents: A Novel Method of Natural Scent Delivery Using Multiple Scent Projectors,” (paper presented in *IEEE Virtual Reality*, Alexandria, Virginia, March, 2006).
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- ²⁴ Charles Platt, “You’ve got smell!” *Wired*, October, 1999, 256.
- ²⁵ Digi Scents, accessible online: <http://digiscents.com/blog/>.
- ²⁶ Wijnand A. Ijsselsteijn, “Presence in the Past: what can we learn from Media History?” in *Being There: Concepts, Effects and Measurement of User Presence in Synthetic Environments*, ed. Giuseppe Riva, Fabrizio A. M. Davide, and Wijnand A. Ijsselsteijn (Amsterdam, The Netherlands: Ios Press, 2003), 36.
- ²⁷ Antonio R. Damasio, *Descartes’ Error: Emotion, Reason and the Human Brain* (Tennessee: Harper Perennial, 1995).
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- ³⁰ Luciano Fadiga et al., “Motor Facilitation during Action Observation,” *Journal of Neurophysiology* 73 (1995); Vittorio Gallese, et al., “Action Recognition in the Premotor Cortex,” *Brain* 118 (1996); Alessandra M. Umiltà et al., “I Know What You Are Doing: A Neurophysiological Study,” *Neuron* 31 (2001); Giacomo Rizzolatti, and Laila Craighero, “The Mirror Neuron System,” *Annual Review of Neuroscience* 27 (2004).
- ³¹ Montero, “Proprioception as an Aesthetic Sense,” 236–39.
- ³² Evelyn Kohler et al., “Hearing Sounds, Understanding Actions: Action Representation in Mirror Neurons,” *Science* 297 (2002): 848.

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