

# **‘In the Game’? Embodied Subjectivity in Gaming Environments**

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## **Introduction**

Human-computer interactions are increasingly using more (or all) of the body as a control device. We identify a convergence between everyday bodily actions and activity within digital environments, and a trend towards incorporating natural or mimetic form of movement into gaming devices. We go on to reflect on the nature of player ‘embodiment’ in digital gaming environments by applying insights from the phenomenology of Maurice Merleau-Ponty. Three conditions for digital embodiment are proposed, with implications for Calleja’s (2011) Player Involvement Model (PIM) of gaming discussed.

## **Towards Whole-Body Interaction**

The idea that digital environments could provide complete sensory immersion has long been a ‘technofantasy’ of science fiction (Ihde, 2010; Gregersen, 2011). However, this remains a goal and point of orientation for games design, with 3D game worlds becoming ever more convincing, haptic technologies more sophisticated, and control interfaces based on more diverse forms of interaction. In recent years, video games have been reaching out to wider audiences with more people playing them than ever before. Juul (2010) argues that at least part of this rise in popularity is due to the use of use mimetic interfaces (where “the physical activity that the player performs mimics the game activity on screen”; p. 5). By building conventions and activities that people are already familiar with (e.g. swinging a racquet to play tennis) games that adopt mimetic interfaces (e.g. swinging the Nintendo Wiimote to play virtual tennis) are easier to learn how to use since players are already familiar with how the controllers are supposed to work. This reduces the learning curve and lowers the barriers of access to those interested in playing these sorts of games.

Jenson and de Castell (2008) describe the recent introduction of novel or bespoke games controllers such as dancemats, motion sensitive controllers and guitar shaped peripherals; suggesting that these sorts of game interfaces have led to very different forms of game play. This tendency in game design – and this is a trend we also observe in mobile and educational technologies – seems twofold. Not only are forms of digital interaction starting to use more (or all) of the body as a control device, but human-computer interaction is increasingly based on natural or mimetic forms of movement. In addition, forms of haptic feedback (notably vibration) are often used to promote a sense of embodiment within digital environments.

Since the success of the Nintendo Wii, Microsoft (Kinect) and Sony (PS Move) have also attempted to utilize motion control. Kinect in particular seems to embrace the notion of whole-body interaction by removing the need for a game controller: through an infra-red sensor bar and microphone, for example, Kinect is able to track player movements in real time and respond to specific gestures and spoken commands.

Research in learning technology suggests that advanced human-computer technology – such as eye-tracking – can contribute to the design of new gaming and learning environments (San Diego & McAndrew, 2009). However, the data derived from such investigations must be tempered with an understanding of the subject's own conscious experience. Phenomenological descriptions based on the concept of embodiment can inform the design of gaming and virtual learning environments, and will be especially relevant to the development of new forms of human-computer interaction.

### **Engagement, Immersion, Embodiment**

Game-play is typically described as an engaging activity, and the move towards 'whole-body' interactive approaches appears to assume that more 'embodied' interactions will lead to more engaging and immersive gaming (and learning) experiences within virtual worlds. For instance, Bianchi-Berthouze, Kim and Patel (2007) investigate the introduction of the latest generation of games consoles which "offer control devices that allow for a more natural type of interaction" (2007: 102). They carried out two studies which examined the effect of body movement within *Guitar Hero*. The first study used a within groups design and players were asked to play with a classic game pad controller and with a guitar shaped one. The second used a between subjects design where players were either told how to use star power (which requires the player to increase their level of movement by tilting the guitar controller) or they were not given this information. The authors suggest that body movement results in higher engagement and mediates the player's sense of presence. Specifically they argue the "full-body experience" of playing *Guitar Hero* "facilitates the feeling of presence in the digital environment" and helps provide a "stronger affective experience" (*ibid.*). For authors like these, the trend towards whole-body interaction aims at a more embodied and thus more immersive, engaging and enjoyable game-play experience.

However, precisely what is meant by 'embodiment' within digital environments remains unclear (Bayliss, 2007). There is a persistent ambiguity within the literature over 'immersion, engagement and presence' (McMahan, 2003), since the terms are often used interchangeably (Bayliss, 2007; Calleja, 2007; 2011) further complicating explanations of how these forms of involvement relate to the concept of embodiment. For instance, Brown and Cairns (2004:1298) suggest that players experience involvement on three levels: "engagement; moving on to greater involvement in engrossment; and finally total immersion". In order for the player to feel like they are inhabiting a different physical location three criteria must be met: namely, (i) engagement (based on attention); (ii) engrossment (requiring emotional investment or 'stakeholding'); and (iii) immersion (where "total immersion is presence"

(*ibid.*, 1299). Meanwhile, McMahan (2003) distinguishes immersion as a term which relates to the diegetic level (i.e. with respect to the game narrative) and engagement to the non-diegetic level (“at the level of gaining points, devising a winning (or at least a spectacular) strategy, and showing off their prowess to other players during the game and afterward, during replay.” (McMahan, 2003:69). She suggests that both contribute to a sense of presence, where she draws upon Lombard and Ditton’s (1997:73) definition of presence as “the perceptual illusion of nonmediation” (see also McMahan, 2003).

Gee describes games as “action- and goal-directed simulations of embodied experience” (2008:254) suggesting that, during play, the virtual minds and bodies of characters become the player’s surrogate mind and body. Through “taking a projective stance” (where the player projects their own goals onto the character) Gee argues players are able to engage in a form of embodied thinking which is quite similar to the kinds of problem solving and learning people engage in during everyday life. It would seem that games also have scope to serve as simulators which support situated learning. But as Bayliss (2007) notes, experiencing a “highly sophisticated simulation” – for instance when players are “controlling a fictional American soldier taking part in the Normandy invasion”– “does not equate with them actually storming a beach in north western France”. While the thinking process might be similar, the digitally ‘embodied’ experience of playing game (what Bayliss refers to as “embodiment as a state of being”) clearly differs from the experience of taking part in the Normandy invasion.

Experiences which take place within digital game worlds are obviously unsimilar to non-digital experience (and we generally wouldn’t want them to be). Unlike *Medal of Honor* (and other simulations), game worlds are often fictional and have no real-life correlate: a player who takes on the role of Cole Phelps in *LA Noire* isn’t emulating an experience so much as experiencing a story about a fictional Los Angeles police department in the 1940s. Furthermore, in addition to fictional avatars, entire game worlds can be fictional; a *Skyrim* player effectively interacts with an entire fantasy world through an ‘embodied’ avatar. Conversely, the avatar controlled by the player may not be recognisably humanoid in form at all (such as the spirit-wolf from the eponymous *Okami*, or, more abstractly, the breath of wind in *Flower*).

Some avatars are evidently more human than others, and manifest different forms of ‘being-in-the-game’. But is embodiment is the right way to conceive (or frame) being ‘in-the-game’ then how might designers of digital worlds promote this? Is it through more natural interfaces / control systems or some other feature? If a sense of immersive ‘being’ in a game is rather something that can be promoted by the convincingness of the world itself, what attributes would such a world have? In what follows we approach these questions with reference to the phenomenology of Merleau-Ponty, focusing on the influential *Phenomenology of Perception*.

## **The Phenomenology of Embodiment**

Phenomenology is the study of conscious experience. Since the mid-1990s (after a short-lived media interest in virtual reality technologies) specialists in human-computer interaction (HCI) have tried to provide rich and thorough phenomenologies of user embodiment with a view to rendering digital worlds more plausible and immersive (e.g. Murray, 2000). While there are a number of phenomenologists whose work may shed light on the experience of gaming, there are a number of reasons for focusing on Merleau-Ponty in relation to the issue of digital embodiment. Merleau-Ponty's work is also a focal point in Dourish's (2001) influential book on the philosophical basis of computer interaction (where a whole chapter is devoted to discussing the phenomenological tradition). Similarly Clark draws on Merleau-Ponty to argue against representationalist paradigms in cognitive science and the philosophy of mind (1997:148). More recently, Crick (2011) has returned to Merleau-Ponty's text in order to propose a phenomenological model of bodies within games based on Sobchak's (2004) account of the phenomenology of the filmic body.

Merleau-Ponty's analysis is of particular interest in our case because of his emphasis on the centrality of the body and the embodied nature of human experience: *Phenomenology of Perception* attempts a radical re-description of the nature of conscious experience which steers a course between empiricist and 'intellectualist'(Neo-Kantian) positions on the relationship between mind and body (Merleau-Ponty, 1962:28). Merleau-Ponty argues that human subjectivity is embodied, meaning that being a human means being in a world which cannot be reduced to any kind of solipsistic interiority. For Merleau-Ponty, our perceptual relationship to the world – our consciousness – is not a transcendental act, but an interpretation of bodily stimuli. This is expressed in the irreducibility of the *Gestalt*, and the fact that the world enjoys a privileged place in our perception by its very appearance, and not as a result of the condition of its possibility. Thus, our perception of our own being is embodied (MP, 1962:60-61). The objects of perception (including one's own body) have an inner horizon in consciousness and an outer horizon in the external world. This 'horizon' is temporal and future-focused (Merleau-Ponty, 1964:21). However, our ability to experience the world results from our form of being-in-the-world (*être au monde*) and specifically from the body, which experiences sensory information and enables us to have a place in "a world of implicit relations and movements" (Merleau-Ponty, 1962:148). Faithful descriptions of experience are, for Merleau-Ponty, vague and often disordered. Nonetheless, the self is *always* embodied: "at every moment living, breathing, feeling, suffering (being affected), changing and decaying" (Carlisle, 2006:19).

## **Interfacing Bodies and Game Worlds**

We highlight three phenomenological arguments from Merleau-Ponty's *Phenomenology of Perception* which are relevant to the issue of embodied subjectivity in digital gaming environments.

(i) *Touching and Being-Touched*

According to Merleau-Ponty, it was Husserl who first proposed the immediacy of touch as a form of sensation relatively undistorted by language.<sup>1</sup> One of the distinctive things about being a human being is that we cannot touch ourselves or others without becoming aware of our own corporeality, our capacity to *be touched* (Merleau-Ponty, 1968:147). Indeed, the reversibility of touching and being-touched are what distinguishes living objects from inert matter which can only be sensed and not sense. Put another way, the body can be both the organ or perception and the object that is perceived. This dual-aspect of touching and being-touched [*touchant-touché*] is part of the primordial experience of human subjectivity (Merleau-Ponty, 1964:92) and characteristic of the ontology of the flesh more generally construed (Slatman, 2009).

Embodiment is often understood in terms of its opposition to representation: the immaterial mind ‘opposes’ the material body. (Ihde, 2010:11-15). The fact that bodies within game worlds cannot conform to this duality is a good illustration of the fundamentally asymmetrical nature of digital embodiment. Consider the example of pain: we never experience the physical pain of a wounded avatar; only a representation of it (whether a diminishing health bar, a shuddering controller, or blood streaking across the screen). Regardless of the particular form of representation (or amelioration) non-digital forms of embodiment are ontologically and epistemologically prior to digital experiences. Rhetoric about digital forms of embodiment often overlooks this. Crick (2011:267) for example overstates his case when he writes that “like our lived phenomenological experience, roaming a virtual game world is a fully embodied, sensuous, carnal activity” on account of an aesthetic convergence between the game body and the cinematic body. We do not relate to bodies in virtual worlds (or in cinema for that matter) in the same way that we relate to our own corporeality. For one thing, we tend not to care too much about dying and we do not experience pain through our avatar: these phenomena are experienced as representation, not as subjective experience.

(ii) *Virtual Polymorphism?*

We can reject the ‘Matrix’ model of complete immersion as a construct of the imagination: in Ihde’s (2010) parlance, a *technofantasy*. However, as Crick (2011) correctly notes, playing a game is an embodied experience in its own right (for instance, as reflected by a racing heart rate during in-game combat) where the controller can be viewed as an extension of the player’s body, allowing them to act within the game-world.<sup>2</sup>

To accept the idea that our consciousness can be ‘embodied’ in digital environments is tacitly claim that the interfaces which make this possible can be successfully integrated into this experience. For a convincing and immersive experience, one should be more or less unaware

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<sup>1</sup> This interpretation is challenged by Derrida (2005:193-193).

<sup>2</sup> Crick neglects to recognise that *all* human experiences are embodied: his implied distinction between ‘embodied’ and ‘cerebral’ experiences is thus unsafe.

of the way in which it is being mediated. Along these lines, Merleau-Ponty encourages us to ask: how do we perceive the body? How successfully can we incorporate technology into our perception of the body? We are typically unaware of our clothes, spectacles or false teeth because these kinds of technologies are often in prolonged contact with our bodies. According to Grosz, (1994:80) “anything that comes into contact with the surface of the body and remains there long enough will be incorporated into the body image”. Merleau-Ponty uses the car as an example of successful polymorphism of this type: a familiar vehicle is car is an “area of sensitivity” which extends “the scope and active radius of the touch” (Merleau-Ponty, 1962:143). Mimetic game interfaces are designed to facilitate this sense of polymorphism through incorporation of controllers and avatars into the phenomenological body. The extent to which control devices and game stimuli can effectively become ‘invisible’ forms of amelioration between the subject and a digital game world is the degree to which they can support more immersive gaming experiences.

### (iii) *The Intersubjective Lifeworld*

Human forms of embodiment as being-in-the-world [*être au monde*] are inevitably bound up with practical context. As social beings, we always find ourselves in a particular cultural and historical context that determines our basic orientation towards the world. Once again following Husserl (1936), Merleau-Ponty argues that to be embodied is to be part of a shared, intersubjective lifeworld [*Lebenswelt*] which is the source of meaningful activity. Game worlds are not necessarily meaningful in themselves. Block puzzle games like *Tetris* or *Puyo Puyo* might present visually coherent representations of space but there’s no intrinsic meaning to be found in destroying blocks.

The recent smash hit *Skyrim* (2011) might seem to be a contender for a game that successfully conveys a meaningful lifeworld. After all, players experience a highly customisable character from a first person perspective who freely roams a detailed and interactive world. Character choices lead to outcomes which are portrayed through convincing visual and audio effects (like damage, being poisoned, etc.).<sup>3</sup> There are hundreds of characters to interact with and an overarching storyline which has been painstakingly crafted. Yet the game has been criticised for lacking any convincing sense of consequences to actions. As Scimea, reflecting on his experiences of exhausting dialogue options with a minor character writes:

I finally realized the problem I was having with *Skyrim*: It felt soulless. I may as well have killed Agnis and taken her stuff, because what did it matter whether she was there or not? I suspected that nothing I did would ever matter, and that has been my experience as I’ve progressed through the game. *Skyrim* is a huge world drawn with a level of detail that entices us to lose ourselves

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<sup>3</sup> These may work quite well, but there are other proprioceptive aspects of embodied sensory experience which could never conceivably be reproduced within digital environments: gravity, heat, etc.

there, and is filled with things to do, enough to keep us occupied probably for years. But it also feels empty and pointless. (Scimea, 2011)

Some games clearly do aspire to portray meaningful worlds within which the avatar is embodied. *Heavy Rain* and the *Mass Effect* series emulate aspects of the experience of freedom by presenting detailed worlds with convincing characters and storylines where the paths of action chosen by the protagonist(s) may be morally ambiguous and (crucially) have lasting consequences.

But perhaps it is only through play with other humans that games become meaningful. Consider this excerpt from the *Edge* annual awards which named *Dark Souls* ‘Best Online Experience’:

*Dark Souls* profoundly understands online play’s defining feature: humanity. Though there’s an in-game mechanic that shares the name (a typically deft touch, blending concept and lore), the focus is always on others. *Dark Souls*’ multiplayer runs alongside its single player, but not always in parallel: asynchronous messages left for you offer hints or tricks, while bloodstains and ghosts flicker in and out of reality. The key is its tightly controlled feature set: with no voicechat and no friends, this lonely world is kept permanently lonely. (Edge, 2011)

Curiously – and perhaps even paradoxically – it is a sense of loneliness, alienation or angst in the imperfection or asymmetry of relations with others that gives this title its appeal.

### **The ‘Player Involvement Model’ (PIM)**

We have argued that the language of embodiment is often used in unclear or inconsistent ways in gaming research literature. Calleja (2007; 2011) also argues that there remains some confusion of how these terms are used. In particular, the use of the “metaphor of immersion as deep absorption [has become] conflated with a metaphor of immersion as traversable space habitation” (Calleja, 2007; p. 94). As an alternative he presents the Player Involvement Model (PIM), which seeks to replace the metaphor of immersion with one of incorporation (Calleja, 2011).

In Calleja’s model, the term incorporation is used signify how the digital environment is made present to the player’s consciousness through a process of internalising the relevant kinaesthetic, ludic, affective, narrative, spatial and shared frames; which simultaneously allows the player exert agency within the digital world and appear present to others within it. Incorporation is defined as “the subjective experience of inhabiting a virtual environment facilitated by the potential to act meaningfully within it while being present to others” (Calleja, 2011: 219; Calleja, 2007).<sup>4</sup> This model of involvement emphasises how different

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<sup>4</sup> It’s worth noting that the PIM was developed on the basis of data gathered from MMORPGs, perhaps indicating an awareness of intersubjectivity for creating meaning in games. Perhaps only MMORPGs offer the

forms of engagement can contribute a powerful game-play experiences which involve a combination of deep absorption and the sense of inhabiting a virtual environment. Further, Calleja argues that “incorporation operates on a double axis: the player incorporates (in the sense of assimilation or internalization) at the same time as being incorporated (in the sense of corporeal embodiment) through the avatar in that environment” (Calleja, 2011:211; Calleja, 2007).

The PIM appears to suggest that the sensation of inhabiting a virtual world is dependent on the player feeling embodied within that world, though it is worth noting that this does not necessarily mean the experience will be one of ‘deep’ involvement or enjoyment. Bayliss (2007:5) argues “though the sense of ‘being there’ may seem to be a direct experience of the game-world for the sufficiently competent player, it is intrinsically mediated by the complex relationship between the player and their locus of manipulation, a relationship based on the distinction between embodiment as a state of being and embodying as an act.” The distinction between “embodiment as a state of being” and “embodying as an act” relates to the physical experience of someone playing a game in a specific context and to the actions their character or avatar performs within the virtual environment.

The innovation in Calleja’s position is the provision of a dual aspect for explaining what he terms ‘incorporation’ as (i) a sense of assimilation of a virtual environment into the conscious experience of the player and (ii) the systematically upheld *embodiment* of that player into a single location within the game world (the avatar) (2011:169). These correspond to the first two criteria we have identified in *Phenomenology of Perception*. Calleja’s advocacy of the term ‘incorporation’ over ‘immersion’ appeals directly to the language of the lived body [*corps vécu*]. However, Calleja stills relies on the metaphor of spatial and imaginative ‘extension’ into game worlds (2011:181). So while the PIM recognizes some of the philosophical misconceptions that are found in the discourse around gaming and HCI, there remains further work to be done to develop the right kind of concepts and language for understanding new forms of digital interactivity.

## Conclusion

We have argued the following:

1. Technologies and interfaces which promote using more of the body than just the hands to interact with digital worlds do not necessarily promote a sense of ‘embodiment’.
2. Game control systems should strive to be as ‘invisible’ as possible, phenomenologically speaking, if they are to promote immersion.

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kind of meaning-generating interactions that could reasonably justify the label of intersubjectivity, though this is a claim that we cannot properly examine here.



3. A more immersive or convincing sense of embodiment within digital worlds may also depend on experiencing a convincing, meaningful world within which the player has a sense of choice and responsibility.
4. Contra Crick (2011) digital avatars are inevitably embodied in ways significantly different to our own form of being. Digital forms of 'embodiment' are never primordial.
5. While there is undoubtedly some sense in which players can describe themselves as being 'in' a game, we need to ensure that the language of immersion and embodiment remains as clear and meaningful as possible if we are to avoid 'technofantasy'.
6. Calleja's PIM does not so much solve the problem of digital embodiment, but suspend the issue by distinguishing two elements. But even this sophisticated model of digital gaming relies on a tacit notion of embodiment. Further work is needed to clarify the right way to think and speak about 'being' in digital environments, and Merleau-Ponty's corpus remains a useful resource in this endeavour.

## References

- Bayliss, P. (2007) Beings in the Game-world: Characters, Avatars, and Players. In *IE '07: Proceedings of the 4th Australasian conference on Interactive entertainment* (2007), pp. 1-6
- Bianchi-Berthouze, N., Kim, W.W., & Patel, D. (2007). Does body movement engage you more in digital game play? and why? In A. Paiva, R. Prada, & R.W. Picard (Eds.), *Proceedings of the 2nd Annual international conference on Affective Computing and Intelligent Interaction (ACII)* vol. 4738 (pp. 102-113).
- Brown, E., & Cairns, P. (2004). A grounded investigation of game immersion. *CHI '04 Extended Abstracts on Human Factors in Computing Systems*, 1297-1300. Vienna, Austria: ACM.
- Calleja, G. (2007). *Digital Games as Designed Experience: Reframing the Concept of Immersion*. PhD thesis; Victoria University, Wellington, New Zealand.
- Calleja, G. (2011). *In-Game: From Immersion to Incorporation*, USA, MIT Press.
- Carlisle, C. (2006) Creatures of Habit: The Problem and Practice of Liberation. *Continental Philosophy Review* 38: 19-39.
- Cooper, M. W. (1996) The gastroenterologist and his endoscope: the embodiment of technology and the necessity for a medical ethics. *Theoretical Medicine: An International Journal for the Philosophy and Methodology of Medical Research and Practice*. 17 (4): 379-98.
- Clark, A. (1998). *Being There: Putting Brain, Body, and World Together Again*. The MIT Press

- Crick, T. (2011). The Game Body: Toward a Phenomenology of Contemporary Video Gaming. *Games and Culture* 6: 259-269
- Dark Souls (2011). From Software.
- Derrida, J. (2005). *On Touching – Jean Luc Nancy*. Palo Alto: Stanford University Press.
- Dreyfus, Hubert L. (1998). The Current Relevance of Merleau-Ponty's Phenomenology of Embodiment. Available from <http://ejap.louisiana.edu/EJAP/1996.spring/dreyfus.1996.spring.html>. Accessed 2nd January 2012.
- Edge (2011). The 2011 Edge Awards: online. Available from <http://www.edge-online.com/features/2011-edge-awards-online>. Accessed 3<sup>rd</sup> January 2012.
- Gee, J.P. (2008). Video Games and Embodiment. *Games and Culture*, 3 (3-4), pp. 253-263.
- Gregersen, A. (2011). Genre, technology and embodied interaction: The evolution of digital game genres and motion gaming. *Mediakultur – Journal of Media and Communication Research*, 51, pp.94-109.
- Grosz, E. (1994). *Volatile Bodies: Toward a Corporeal Feminism*. Bloomington and Indianapolis: Indiana University Press.
- Husserl, E. (1936). *Die Krisis der europäischen Wissenschaften un die transzendente Phänomenologie*. Belgrade.
- Ihde, D. (2010). *Embodied Technics*. Automatic Press.
- Juul, J. (2010). *A Casual Revolution: Reinventing Video Games and their Players*. Cambridge, MA: The MIT Press.
- Jenson, J. & de Castell, S. (2008). From Simulation to Imitation: New controllers, New forms of Play. In *Proceedings of the 2nd European Conference on Games-Based Learning*. Barcelona, Spain, 16-17 October, 213-218.
- Merleau-Ponty, M. (1962). *Phenomenology of Perception* trans. by Colin Smith, (New York: Humanities Press, 1962) and (London: Routledge & Kegan Paul, 1962) translation revised by Forrest Williams, 1981; reprinted, 2002)
- Merleau-Ponty, M. (1964). *The Primacy of Perception*. Northwestern University Press, Illinois.
- Merleau-Ponty, M. (1968). *The Visible and the Invisible*. Northwestern University Press, Illinois.
- McMahan, A. (2003). Immersion, engagement, and presence: A method for analyzing 3-D video games. In *The Video Game Theory Reader*, M.J.P. Wolf, and B. Perron, Eds. Routledge, New York, 68-86.

Murray, C. (2000). Towards a phenomenology of the body in virtual reality. *Research in Philosophy and Technology*, 19. pp. 149-173.

San Diego, J. P. and McAndrew, P. (2009). The feasibility of capturing learner interactions based on logs informed by eye-tracking and remote observation studies. *Journal of Interactive Media in Education* (4)

Scimea, D. C. (2011). Skyrim is Souless. *The Escapist*. Available from <http://www.next-gen.biz/features/2011-edge-awards-online>. Accessed 20th January 2012.

Sobchack, V. (2004) [1990]. *Carnal Thoughts*. Berkeley: University of California Press.

Skyrim (2011). Bethesda Softworks.

Slatman, J. (2005). The Sense of Life: Husserl and Merleau-Ponty on Touching and Being Touched, *Chiasmi International*, no 7, pp. 305-325.

Schütz-Bosbach, S., Musil, J. J. & Haggard, P. (2009). Touchant-touché: The role of self-touch in the representation of body structure. *Consciousness and Cognition* 18 (1):2-11.

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