Extended Body, Extended Mind
The Self as Prosthesis

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Abstract

According to Kant [1781/87 & 1929] the most we can say about ourselves is that we are logical subjects of thoughts, necessary for the very possibility of coherent cognition. We look for the self, we reflect, and we find no thing, nothing that is the bearer of properties, and we try to conjure it up in the concept of a soul or mental thing [Descartes 1968], or a bundle of discrete perceptions [Hume 1739]. But we are looking in the wrong direction and must reorientate ourselves. Self-consciousness requires the existence of a perceiving and conceiving being that acts and interacts with other objects and organisms in, what must at least appear to be, an objective world. It requires embodiment and embeddedness within its world; it is ‘fallen’ [Heidegger 1962], necessarily adaptable, necessarily technological, extending itself through the use of tools, restoring lost functions and replacing lost organs and limbs. But also enhancing and reconfiguring itself, augmenting its capabilities and pushing itself further into its world and away from the first place we look. The self is not the body. The self is not the mind. The self is active agency within the world; it is prosthesis.

Introduction

In speaking of self-consciousness we seem to specify some thing or object that is being conscious. I will argue that there is no such object, that the self is neither mind nor body, nor some alchemic amalgamation of the two that manages to satisfy the hard problem of consciousness and bridge the explanatory gap [Chalmers 1995; Shear 1997]. I will argue that the self is active agency within a dynamically changing, experienced world, and that that world is not especially privileged because it is assumed to be physical, for a virtual world or virtual reality would serve the purpose of providing us with a sense of self just as well. Thus, complex selves are inventions which provide a locus for mental states, and which enable us to identify thoughts and ideas as coming from this, rather than that, point of view. Selves are things that can form ‘depictions’ and, so, have a sense of being out there in their world [Aleksander & Dunmall 2003]. The term ‘self’ is just a shorthand for a set of relations between the senses, actions, and objects; it is nothing more than an artifact of engagement with the world.

I am not arguing that having a body, or at least thinking we have a body, is unimportant. On the contrary, it is crucial that we have perceptual and conceptual abilities that enable us to get to the stage where we can bring such an extraordinary thing as a self into existence – even if it is illusory –and it is the body that makes this possible. After all, it could be argued that, it is the activity of the body that shapes the mind. [Viz. Gallese 2005] We must, and this ‘must’ has a nomological force, be ‘embodied’, whatever we may later turn out to mean by that term, for we need to experience our

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world and we need a point of view from which, as distinct from other entities, we can develop a body image and a body schema [Meijssing 2000]. We must also be embedded within our world, for it is the sensation of being and acting in our world that presents us with the stimuli, the afferent and efferent impulses, that we need for thought, will, and action to be possible. Without sensation we would cease to function. Our existence as unitary selves would dissolve with the impossibility of content-free thought.

The necessary and, together, sufficient criteria for this complex, self generating embeddedness can be stated as follows. An organism or agent

1. must be situated and embodied;
2. must have multiple goals;
3. its environment must be sufficiently complex and challenging for it to be capable of complex responses;
4. must sense our world through a rich sensory interface;
5. must be capable of having inner representations of its world;
6. it must have a rich repertoire of possible interactions with its environment, continuously manipulating its world in ways that bring about significant changes.
[Stuart 2002; Dobbyn & Stuart 2003]

From a Heideggerian perspective we are fallen, essentially social, interacting with animate and inanimate things, and with things that exhibit mentality and others which do not, that is, with Dasein and non-Dasein. Within this complex environment we are adaptable, using tools to change our relationship with the world, using technology to extend ourselves and augment our capabilities but also to restore lost functions, replace damaged parts and even replace or alter our physical features. It is, as Heidegger [1962] suggests, contra Aristotle, that our potentiality precedes our actuality; we are but we become our selves. The actuality that emerges is our being, our immersed engagement with our world. Our self is what we do and how we do it. It requires a sensing and actuating body, and a thinking and conceiving mind, but together or alone they are insufficient; we need a world as well. It is, as Merleau-Ponty argues, that “there is no inner man, man is in the world, and only in the world does he know himself”. [1962, p.xii]

How the conventional self was lost: Descartes and Kant

For many of us there remains a strong temptation to follow Descartes in his methodical reflections and bring to mind some idea of the self that is a persisting, purely immaterial, non-composite, thinking thing, the thing referred to by each of us as ‘I’. After all, Descartes’s conception provides us with that essential element of our selves that is not reducible to physics and some kind of physical explanation. It is pure in its being the antithesis of the physically vulnerable, ultimately decaying physical body. But this is the very thing refuted, almost completely successfully, by Kant in his attack on rational psychology in the Paralogisms of Pure Reason [Kant, 1929: A341 / B399 - A405 / B432].

1 I say ‘almost completely’ because Kant fails to give Descartes credit for his insight that there is a necessary referent for a thought, or even for a depiction, even if Descartes does then go on to over-develop the ‘I’ or cogito, as a sum res cogitans. It would seem that if the judgement ‘I think’ is a transcendental judgement, the ‘vehicle of all concepts’; it is the vehicle of transcendental concepts in particular, and this ought to be compatible with its implying existence, which it seems Kant is not prepared to admit. The ‘I’ is not just a vehicle, there is some referent having the thought. If Kant resists this existential implication how much of the Cartesian programme is left? Surely it is possible for Kant to accept the cogito without being committed to the sum res cogitans doctrine, but he discards both.

If Descartes had not claimed that knowledge of the experiencing subject was possible a priori, and had not then tried to move from the cogito doctrine to the sum res cogitans, he would have been left with the interesting and informative thesis that the ‘I’ is guaranteed a referent, but he attempts too much. None of this is in dispute, but Kant’s own attack is incoherent. He has said in his arguments for a transcendental unity of apperception that there is an ‘I’ that can accompany my representations,
Descartes falls into error according to Kant because he conflates the meaning of the term ‘thought as subject’ in the following argument:

1. All that is thought as subject is substance.
2. The ‘I’ is thought as subject.
3. The ‘I’ is substance.

Having now found himself with substance on his hands that is unlike any empirical substance, and giving a great deal of thought to what its nature must be, Descartes concludes that this ‘I’ or self must be mental or conscious, indivisible, and immortal, with all that these characteristics imply. But Kant’s objection seems certain: the ‘thought as subject’ in the first premise refers to empirical objects, the things that we think of as physically substantial and divisible, and which are the ‘subjects’ of our thoughts; the ‘thought as subject’ in the second premise refers to the subject having the thoughts, the ‘I’ or self, about which nothing more can be said, except that which Kant has said already in the *Transcendental Analytic* [Kant, 1929: A65 / B90 - A292 / B349].

**The self negated, then reinstated**

Kant’s account of the mind has two essential elements which we might think of individually as reception and ordering; they are:

1. perceptual awareness or *intuitions* of our world;
2. conceptualisation of the perceptual experience of our world through *categories* or *concepts*.

And we can say exactly what Kant means by looking at two of his most famous phrases: ‘Thoughts without content are empty, intuitions without concepts are blind’. [Kant 1929, A52/B76] If we have no content, no experiential or perceptual input, our thoughts will be no thoughts at all for they will be empty. If we have perceptions or experience without any understanding to guide us in our organisation of the data of that experience, we will be as good as blind, for all we will experience is chaos. So what makes our experience unchaotic – well, the concepts in our understanding that make possible the synthesis of our experience, drawing together the unity of self-consciousness and the unity of objective experience. The revelation of a self is only possible in simultaneous relation to the revelation of a world. Let us unpack this just a little.

Experience is only possible if it refers to an objective world, that is, if we are embedded in an experientially rich and changing environment. This is as true of human beings as it is of animals and even of artificially constructed animated agents.

If, for a moment, we suppose that Descartes is right that I can determine my consciousness in time without granting the existence of a physical world, then we must ask how can this can be so. In judging my own existence in time I need to be able to perceive myself in relation to other things, some of which will be moving and some of which will not, for it is only in this state that I am able to perceive change. If everything was moving or if everything was still, I would be unable to measure the passage of time in any ordered way. We need order and regularity against which change can be perceived. This is most clearly demonstrated if we look at a simple analogue watch. The

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it is an ‘I’ whose existence is implied, yet in the paralogisms he speaks as though we cannot even go this far. The Cartesian point seems good because existence is implied, regardless of the truth-value of the statement ‘I think’, and the ‘I’ is guaranteed a referent. Kant should not attack the *cogito*. The ‘I’ is more than a vehicle, some referent is disclosed by the use of ‘I’, and Kant suggests as much in his introduction of the transcendental subject.

The ‘I’ needs a referent and the Cartesian insight in the *cogito* is secure. Kant should shift his attack on rational psychology more decisively to the *sum res cogitans* where he can acknowledge the partial success of the Cartesian programme whilst bringing to a halt its further excesses. After all we find that the Cartesian ‘illusion cannot be avoided’, though a direct attack on the *sum res cogitans* doctrine can render it ‘harmless’.
face remains static whilst the hands move. If we, our entire world, consisted only of ourselves in relation to the watch, and the face and the hands either both moved or both stood still, we would have chaos or nothingness. Either way no coherent notion of a self would emerge, or continue for very long, for no relationship would exist. It is only in the sensing of motion, that change is conceived, and it is only through the conceptualisation of change that a distinction between self and other is made possible. Self is not possible without other. They are not simply inter-related; they are interdependent. Thus Kant concludes that inner experience cannot be all there is; for inner experience requires outer experience, and outer experience brings content through the sensing of motion and the conceptualisation of change.

Kant says of the self that “it must be possible for the ‘I think’ to accompany all my representations” [Kant 1929, B131], and what he means is simply this: when I have an experience it must be possible for me to be self-consciously aware of it, but it is not necessary for me to be so. Thus, the ‘I think’ is only, after all this, the ‘vehicle of all concepts’ [Kant 1929, A341/B399] awaiting content from the sensory system [B421], and once we have some content to make up a thought we have the means, on reflection, of inventing a complex self that must be having it. As Walsh says, ‘what is being sought is presupposed in the seeking’ [Walsh 1975, p179]. What we cannot then do is conclude that what is presupposed is known in some other way. “The ‘I think’ expresses the act of determining my existence’, but does not itself amount to a form of self-intuition.”[Ibid.] The ‘I think’ or ‘I’ is not an expression of an experience, it is merely the form that an experience can take.

So what remains of our traditional view of the self? On the one hand, it has become a Cartesian non-entity, and on the other it is merely the form that a thought must take. But Kant’s theory bears more fruit than most, for in uncovering the necessary unity of self-consciousness we first require sensations, understanding, and the employment of a cognitive imagination that makes it possible for us to recognise our thoughts as our own; and none of this is possible without an ‘external’ world with which we must engage if we are to have even the illusory sense we have of a continuing self. [Hume 1739; Brook 1994; Strawson 1997 & 1999]

The Kantian subject posits a world, but, in order to be able to assert a truth, the actual subject must in the first place have a world to be in the world, that is, sustain round about it a system of meanings whose reciprocities, relationships and involvements do not require to be made explicit in order to be exploited. [Merleau-Ponty 1962, p.149]

Our picture now is of cognition as an embedded process with the mind, body and world interacting to such an extent that the traditional boundaries between world and mind no longer exist. [Clark & Chalmers 1998] What appears to be a separate world of distinct objects is not. Boundaries appear but in reality we are only conceivable as selves in dynamic conjunction with our world, and the roles that technology plays in that conjunction alter irrevocably our perception of our location, our extension, and our limitation.

In a similar vein to Clark & Chalmers [1998] I am advocating ‘an active externalism, based on the active role of the environment in driving cognitive processes’, but where they say simply that ‘human reasoners . . . lean heavily on environmental supports’ it needs to be emphasised that ‘leaning’ is not optional. It is a necessary part of conscious being in the world, the part that makes possible the creation and, thus, conception of distance and proximity, of other and separateness, and which presents us with a locus for thought, a point of view. The element of choice arises only in the individual instances of reliance, so I might count on my fingers, or keep in my pocket a notebook of names I frequently forget, or use ‘pen and paper to perform long multiplication’ [McClelland et al. 1986; Clark 1989]. To this list we might easily add the use of all kinds of instruments such as logarithmic tables and astrolabes, and we might think further of how our idea of our selves has evolved through the shift from an oral tradition, through writing, to the printing press, the telegraph,

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2 One might think here about solitary confinement or sensory deprivation, both of which create in the experiencer feelings of dislocation and disorientation.

3 Externalists hold that there are mental events that do not supervene merely on physical events internal to the agent’s body, but supervene on environmental events as well.
telephone, networked computer, and on to SMS texting with, and without, images. In extending my mind into the world, I demonstrate my role as an embodied and embedded, active cognitive system. I have skills but they are merely part of my self in their manifestation.\(^4\) I am what I sense, think, and do, not merely what I say, though saying in certain circumstances, for example, like these, can be doing.

So, we are sensing and cognising systems that have an intricate neuroanatomy and physiology which requires stimulus from outside if we are to function effectively in responding safely to our world in real time. The ‘we’, spoken of here, is not a collection of stories constituting the narrative self [Dennett 1992, and in the film Rashōmon 1950], nor is it some Lockean feat of memory [Locke 1690], of the kind favoured by films as diverse as Total Recall (1990), Dark City (1998), and Memento (2000)\(^5\). It is intentional agency with our perceived environment playing an active part in the orchestration of our behaviour.

Our conception of our perceived environment as a physical, mind-independent reality has been constructed over many years of interacting with our world through a complex network of sensors, transducers, and actuators; more technically through a system of afferent and efferent impulses conditioned by action-feedback mechanisms. It is a framework that led Descartes, and many others both before and after him, to believe that the mind and body are, not only, separable, but separate. In Descartes’s case consciousness, self-consciousness, and the mind are all one and the same thing, and only possessed by human beings. All other organisms are mechanical in nature and, therefore, non-conscious.\(^6\)

But we know Descartes to be mistaken. We have established a necessary link between the perceiver and the perceived, and whilst it is possible that only human beings are conscious of their environment, it is unlikely that consciousness is a phenomenon limited only to them. Consciousness imparts an evolutionary advantage to those that possess it, and given that it is explicitly linked to neurophysiology, those animals that have qualitatively similar neurophysiologies to our own are likely to be conscious. [\textit{Viz.} Griffin 1981, 2001] Many animals use a language of some kind to communicate across distances, and in humans and some other animals tools are devised to accomplish tasks for which bodies by themselves are insufficient. In this way our tools come to embody some aspect of our mind, the need for something to be achieved and an abstracted way in which it can be seen to possible.

But, a note of caution must be sounded. This complex system of relations between senses, actions and objects, the self, presents us with only sense data, whether it is through our outer senses, in actively perceiving and bringing about changes in our world, or through our proprioceptive sense. This complex relationship has, at its core, phenomenology and it is a phenomenology that is revealed because of the rich and lively interplay of the body and world. So, two pathways open up. Firstly, we might accept the world as a given but be inclined to jettison the idea of ever being able to talk about it in a mind-independent way. In this instance a correspondence theory of truth – by which we can confirm that the world is how it seems to be – is doomed to failure, for there is nothing we have access to other than our sense data against which we can do our ‘check’ of reality. Secondly, we might admit that with the rapid progress being made in virtual reality interface technology, we are, all too quickly, beginning to ask the sorts of question Bostrom [2003] asks in: ‘Are You Living In a Computer Simulation?’, and the answer is neither obvious nor straightforward. The sense of realness we currently have can be reproduced – and we deceived – by good simulacra of the kind found in virtual reality simulators. It is, as Pepperill has argued in the previous chapter, and Bradley [1893] has

\(^4\)I might say that I am a pianist, but unless I play the piano, unless I demonstrate my skill, I am not a pianist. Being a pianist is not part of me, my self, if I cannot play the piano - though wanting to be a pianist might be. The point though is that being a pianist is only possible through a complex set of relations of my body, my senses, my cognitive processing, and the outside world. Being is only possible in the doing.

\(^5\)Information about these films can be found at The Internet Movie database \url{http://www.imdb.com/}

\(^6\)Descartes’s position is complicated but the basis for his division is possession of a soul. Only human beings possess souls, so only human beings have minds and are conscious. We know of their self-consciousness because they have a language with which they report their thoughts and feelings, and no other animal has language. Indeed Descartes takes the absence of language to be \textit{a priori} proof of the absence of consciousness. [For more information read Descartes edited by John Cottingham.]
argued that: ‘everyday conceptions of the world contain hidden contradictions which appear, fatally when we try to think out their consequences’ [Chp. XIV].

Technology: location, extension, limitation

Stern [1985] suggests that in the early months of life the human child begins to form a distinction between itself and its world. The ability to make such a distinction must be a precondition of self-consciousness and the formation of a self, for without it the development of a point of view and the ability to locate, identify and interact with objects relative to your current spatio-temporal position would be impossible. This further confirms the need for a body, separable from but not independent of the environment, with a sensed boundary between it and the wider world. The defining features of a body seem to be a set of sensory channels through which information about the environment can be gleaned, an actuator system enabling manipulation of the world, and proprioceptive mechanisms that enable the evolution of an inner ‘egocentric’ space [Brewer 1992]. It is as a result of these mechanisms that we are able to update and maintain our body schema, which is the very thing we need for locating the position of a touch to our skin or the region of our body in which a pain is felt.7

Our body schema provides us with ‘continually updated, non-conceptual, non-conscious information about [our] body ... [providing] the necessary feedback for the execution of ... gross motor programs and their fine-tuning’ [Meijsing 2000, p.39]. Gross motor functions can determine lifting and holding, and we need accurate input if we are going to be able to fine-tune our actions to distinguish between holding a glass, holding a marshmallow, and holding a child. Without the ability to fine-tune your haptic sensing and actuating mechanisms we might crush the child or smash the glass.

In human beings the dominant sense is vision with the other senses playing a subservient, though often corroboratory, role.8 If your dominant sense is impaired to such an extent that it alters your experience of depth and proximity, then it is expedient to have your eyes tested and wear spectacles with correcting lenses. Without this technology you would be different, tentative in movement, and more reliant on your other senses, most specifically on touch and hearing. With your spectacles your unimpaired functionality is restored and your sensory system extends you once more out into your world, a world that, once again, consists of distinguishable objects in spatio-temporal relations to you and to one another. In more extreme cases where the visual sense is seriously impaired, or lost altogether, depth and distance perception might come through using a stick, especially in non-local, unfamiliar environments. No visual feedback is available about the distance to the edge of the kerb, or how deep the kerb is, so the stick supplies the afferent input through the tactile and muscular feedback system in the hand and arm; it is a haptic device for touching and feeling the world and responding appropriately. The active perceiving person, now plus stick, with its world and its processing and acting, constitutes the self.

The emphasis in this case is on the interplay between vision and touch, and on touch when vision is lost or impaired. But a curious reversal of sensory emphasis is present in those people who have lost their proprioceptive sense, and thus the ability to create or maintain their body schema. Cases of this kind reveal, as Gibson [1979] thought, that the visual sense is crucial for their retaining a sense of self. Meijsing says of patient IW that ‘In the dark he did not know where his hand was; and even if he knew, he would not have been able to move it towards the bedside table without visual feedback’ (Meijsing 2000, p.42). IW felt disembodied, absent, even ‘dead’, and his sense of self returned only when he had learned once again, and with a great deal of visual concentration, to move in a controlled manner. Here we find again that self-directed movement is crucial for self-identity, and that a sensory system is only necessary in organisms that move, because organisms that do not move require no capacity to avoid or manipulate objects. Being informed that there are environmental changes is not

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7The neurologists Head and Holmes (1912) coined the term ‘body schema’ from their examination of patients with lesions of the nervous system. Contemporary work on body schema and its role – from a neurological point of view by the research into phantom limbs, paralyses, and mirror neurons – in defining our sense of self, see, for example, Ramachandran 1998 & 2003, and Reed 2002

8Duke-Elder states that “the most salient factor in the evolution of man was the ousting of smell as the dominant sense and its replacement by the infinitely more useful and effective faculty of vision”.
enough, there needs to be a rich interplay between this information we are receiving and our active self-movement, for it is this ‘that places the self firmly at the centre of the environment. Active self-movement gives a sense of agency, as the perceived environment changes as a result of the purposive action’. [Meijsing 2000, p.46]

IW had to work hard to recover this sense of selfhood and agency but one of his greatest breakthroughs came when using the DART robot – a teleoperations device that extends an individual’s sensing and manipulation abilities – at NASA's Johnson Space Center, Houston.

This robot has arms and joints isomorphic to the human arm. In other words it has a shoulder, elbow and wrist joints which move as ours do. Its hands consist of a thumb and two opposing fingers . . . Its arms are looked down on from its head by two cameras which allow stereo vision. This is the ‘slave’.

The ‘master’ is a human subject rigged up with sensors on the head and arms and with special gloves which sense the master’s joint angles and movements. When [the subject moves], the robot moves, after a short delay. Finally the subject wears a virtual reality set on the head which gives him a view of the robot’s arms. It also precludes vision of the subject’s own arms or hands. Then the game, and it is extraordinary fun and easy to do, is to move the robot’s arms by moving one’s own with the feedback coming from vision. The human master can make the slave robot pick up a drink, tie knots, pass a wrench hand to hand . . .

Within a few minutes of moving and seeing the robot’s arms we experienced our corporeal selves occupying the robot’s body. [Cole 2000, p.51]

IW, who had no proprioceptive sense but was used to acting on visual feedback, very quickly became ‘reasonably proficient at a task of robot manual dexterity’. The simplest explanation for this is that his body schema is dependent upon visual feedback and not shared between visual and tactual feedback – as is the usual case, or based on tactual feedback alone – as is the case in someone with a serious visual impairment. IW’s case works in completely the opposite way from the blind person who uses a stick to gain extended haptic feedback about their world; he cannot use touch, so he must use vision.

The illusion of occupying the robot’s body, of it being your body, your interface with the world, and not just part of you, is clearly possible, but there is still something clunky and exoskeletal about the experience. It may ‘feel’ real but we can see it is not; we know we can be separated from it. Like riding a horse, when you are working well together, the gait is right, and you and the horse are in harmony; or when driving a car and the gear change is smooth, the cornering is controlled and you feel as though you are one entity. In both cases your experience of your self has been extended to include the horse or the car as part of your world, as part of you. Yet in each case you can get off or out, and distinguish yourself from the horse or car by increasing the distance or otherwise altering the relationship between you and it.

The sensation of unity we can have with the robot, horse, or car, is made possible not simply – with the exception of IW’s unusual case – by the visual sense which is only one-way, but by the tactile sense which is two-way or co-dependent, providing a sensation of resistance, or force-feedback, to the pressure of our touch. Salisbury [1995] says of feeling a cup that:

... we grasp and manipulate the object, running our fingers across its shape and surfaces in order to build a mental image of a cup. This co-dependence between sensing and manipulation is at the heart of understanding how humans can so deftly interact with their physical world.

But the sense of realness that is presented to us in this way is no more reliable as an indicator of a mind-independent physical world than the visual input we receive, or even the unified input from our combined sense experiences. The experiences are real, possibly even verifiably so, but their objects existing in a mind-independent reality are not. Perhaps Bradley is right that: ‘Feeling, thought and
volition … are all the material of existence and there is no other material, actual or even possible’ [Bradley 1893, Chp. XIV]. It is certainly true that our worlds need to be there, for otherwise our thoughts would have no content and we, ourselves, would not exist, but it is also true that we cannot speak about these worlds independently of ourselves. But, even though our worlds may be a given in our experience, there is no compelling reason why either they or our embodiment need be physical. Claims of this kind can be fortified by an examination of the impressive but illusory sense of ‘realness’ offered by haptics technology in the form of haptic devices which provide rich and self-consistent sensory feedback [Hannaford 2002].

Haptics, the science of touch, lets computer users interact with virtual worlds by feel … Scientists use computers to simulate not only the impact of a golf club hitting the ball, but also the springiness of a kidney under forceps, the push of an individual carbon nanotube in an atomic force microscope, and the texture of clothing for sale on the internet. [Ruvinsky 2003]

The home page of the Immersion Corporation offers these kinds of experiences for sale.

Feel your light saber hum or your shot gun blast and reload with Immersion’s force-feedback sensations through your mouse, joystick, game pad or steering wheel. Easily add a new dimension of realism to gaming!

Allow your medical professionals to practice difficult procedures in a risk-free environment with Immersion medical’s force-feedback surgical training simulators and improve your quality of medical care. http://www.immersion.com

The sensory and kinaesthetic feedback provided in haptic technology is the same kind of force-feedback we get in our experience of every day objects, and in a virtual environment those things which might start off feeling artificial quickly begin to feel real. Advances in telepresence systems, which make use of a head-mounted display along with body-operated remote actuators and sensors to control, for example, distant machinery or a weapon in a game, reveal how easy it is for the virtual environment to feel real, and with transparent telepresence it is possible to have the experience of being fully present in another part of the world, geographically remote from one’s own physical location. As Stone says developers aim to create ‘the ideal of sensing sufficient information about the teleoperator and task environment, and communicating this to the human operator in a sufficiently natural way, that the operator feels physically present at the remote site’ [Stone 2000 p.1]. Virtual reality environments are not particularly new; we have had simulators that enable a golfer to practise her swing, or an airline pilot to learn to deal with landing safely in inclement conditions for quite a few years, and new, small-scale environments are being developed all the time.9 But these are not the fully immersed environments of the kind with which we are only now becoming familiar. Fully immersed environments are those in which we can feel ourselves walking around and manipulating objects, whilst at the same time feeling the warmth of the sun on our face, smelling the newly mown grass, and hearing the dog next door barking. Our immersion in these virtual environments will be so complete, the integration of our array of sensory input will be so seamless, that we will feel as though we are there, that the objects and experiences are real. [Viz. Kurzweil 1999 & Hayles 1999] Telepresence will have been achieved and to such an extent that we will be unable to tell the difference between the virtual world and the one we once assumed to be physically real and separable from us. In the context of a medical training environment Salisbury says:

People will really begin to feel like they’re holding the tissue and they’re tearing it … And they’ll feel bad about it because they squeezed too hard. [Salisbury in Ruvinsky 2003]

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9One excellent example is the “haptic cow” being designed by Sarah Baillie at the University of Glasgow http://www.dcs.gla.ac.uk/~sarah/brpsX.htm.
In the film *The Matrix* (1999) Neo, Morpheus, and Trinity discover that the world that has appeared to them to be real is only a facade created by a malevolent cyber-intelligence known as the ‘Matrix’ who are sapping human beings of their life-force. 10 and the subject of more than one undergraduate dissertation, but it is based on an implausible premise that some powerful and nasty artifice – a Cartesian malin genie [Descartes 1968, First Meditation] – is employed in controlling all of our sensory input. Why go to such extremes, except to make a good film, when full-body haptic suits are being developed as we write and speak [Viz. Washburn 2004], and over a decade ago Youngblut, Johnson, Nash, Wiemlaw, & Will were specifying what would be needed for a fully-functioning body suit that would present the wearer with a complete experience of a virtual environment.11

The role of visual interfaces is obvious and needs no discussion except to point out that humans are strongly oriented to their visual sense ... While tracking is a type of interface that is largely transparent to the user, it is critical in keeping the VE system informed about user movements so that sensory inputs can be correlated to the users position. Auditory interfaces can play a key role in providing informational inputs to the user, increasing the realism of a simulated environment and promoting a users sense of presence in a VE. ... Haptic interfaces provide the tactile and kinesthetic feedback arising from user contact with objects in the environment. Full-body motion interfaces fall into two categories. Active self-motion interfaces allow a user to move freely through an environment, for example, walking over various types of surfaces or climbing stairs as necessary. Passive motion interfaces reflect the use of some type of vehicle to move a user through the environment. The final interface technology ... is that of olfaction, where odors are used to provide the user with additional sensory cues about his environment. [Youngblut, et al. 1995]

It takes very little stretch of the imagination to see that once the military release the unclassified technology, it will spin down into our economy for commercial use. In a few years full immersion virtual reality suits will be readily available to the public in some shrink-to-fit synthetic skin, tempting us with all manner of experiences that can be had without our actually going anywhere. The range of experiential opportunities is limitless from walking holidays in the Appenine mountains and snorkeling off the coast of Borneo, to taking up an apprenticeship in stonemasonry, and learning how to cloud hop. And, if we don’t have to be restricted by the laws that hold in what we take to be our physical world, then why should we be restricted to ‘travelling’ in only this current time period. The traditional school trip could become a lot more exciting as we learn our history by being taken to some virtual version of it. Our experiences will, all the time, be feeding back into the construction of what we think of as ourselves, and there will be little, perhaps nothing to tell them apart from those we have – up until now – been calling real experiences. The phenomenology at the heart of our being, at the heart of our self-consciousness, will remain the same.

Following many thinkers before us we have dismantled the artificially constructed division between mind and body. Our selves remain, but as a complex set of relations between sensings, thinkings, actions, and objects, and a virtual world is as successful as a real world in providing the interplay and content we need to make these *relata* possible. What we think of as our selves turn out to be nothing more than artifacts of these integrated experiences; they are, after all, very simply creations of the interplay between mind and world; they are prostheses.

**References**


11Technology of a much more limited kind is already employed to extend the perception of self to correspond to the inner sense of self and the best example to date is Ramachandran’s mirror box with which he treats patients with phantom limb pains. [1998, 2003, pp 10-20]
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