

Project title:

Being Embodied: First-Person Judgements and Their Relation to Embodiment

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F2 Project Aims and Background

The drawing of boundaries between self and world, so fundamental to self-consciousness, depends in part on the emergence of awareness of oneself as embodied. What determines this sense of oneself as embodied in a particular body? How does this sense of oneself as embodied relate to self-awareness generally?

The general **aim** of this investigation is to determine the factors that account for an individual's sense of being embodied in a particular body. The hypothesis to be evaluated is that the dominant component in an individual's sense of embodiment in a particular body is her ability to actively control and move that body.

The task requires differentiating not only between different possible conceptions of the self (Gallagher 2000a), but also different conceptions of the body. Shoemaker (1976) distinguished between two important notions of embodiment: biological embodiment and sensory-volitional embodiment. An individual is biologically embodied in a certain body to the extent that the body that individual occupies is that individual's natural, biologically 'given' body. By contrast, an individual is embodied sensorially and volitionally in a body to the extent that the individual can experience sensation and control movements directly in that body. We might call this body 'the body-as-agent'.

Usually, an individual's biological body and body-as-agent coincide. But they need not do so. There is a double disassociation between biological and agentive embodiment, creating interesting possibilities for transforming our understanding of the bodily self. The project will investigate disassociations between the two body conceptions under two different headings: **extensions** of the body and **contractions** of the body.

Under the topic *extensions of the body*, we will investigate how technology alters our experience of embodiment. We examine how active tool use can induce the illusion that one's body extends beyond the spatial parameters of one's biological body. We hypothesise that there are two factors accounting for the illusion: an interaction between different sensory modalities like vision and proprioception, and the fact that the subject actively controls the tool rather than being passively moved along with the tool.

Under the topic *contractions of the body*, we will look at how disability and psychopathology may lead to an experience of full or partial disembodiment. We will focus on instances of paralysis, in which patients are unable to move or control their limbs. We hypothesise that an individual's sense of ownership with regard to a limb is deeply rooted in being able to use it, act with it, move it, control it, and experience sensation in it. When the capacity to directly control and be directly affected by one's limb is lost, the limb may be experienced as 'alien', 'dead' or 'useless', despite being physically attached to the patient's body.

Recent international progress in the study of extensions of the body schema has included the discovery of neurons that respond both to the sensory input from a given body part and to visual information from the space surrounding that body part. Moreover, it turns out that the visual receptive field of these neurons expands to include the space accessible using a tool, when a subject reaches using that tool (Maravita and Iriki 2004). This provides a graphic illustration at the level of neural representation of the long held intuition that active tool use leads to incorporation of the tool in the body schema (Head and Holmes 1911). The **body schema** is the brain's largely unconscious set of representations of its body which are updated during movement.

Recent international progress in the study of contractions of the body schema have focused on syndromes resulting from brain lesions. For example, patients with **unilateral neglect** usually have a lesion in their right hemisphere. They generally fail to respond to stimuli in their left hand field of vision, neglect the appearance of their bodies on the left hand side, and fail to initiate movement on the left side. Some patients with severe neglect deny ownership of their hands on the neglected side (Drapati, Sirigu, et. al. 2000). This phenomenon is probably accompanied by a deletion of the hand from the body schema (Coslett 1998).

In a different case, a hemiplegic may profess unawareness that his arm is paralysed, or a lack of concern for the arm (Marcel et. al. 2004). Although neglect and **anosognosia for plegia** (lack of awareness of paralysis) are often found together, they are doubly disassociated (Bisiach 1986). The co-existence and disassociation of these disorders suggest, prima facie, a dual route to disruption of the body schema, through loss of sensory input, on the one hand, and through loss of motor control, on the other.

The current project uses these latest developments in neuroscience and neuropsychology to enrich the philosophical understanding of embodiment. In particular, the project will

- (a) determine the philosophical significance for the philosophy of mind of the brain's flexible representation of the body;
- (b) contribute to the understanding and explanation of disorders of embodiment;
- and
- (c) isolate the role of factors such as agency in contributing to an individual's sense of being embodied in a particular body.

In doing so, the project will enrich our understanding of what it is to live in a body and to experience extensions and contractions of bodily power.

F3 Project significance and innovation

3.1 Significance

The problem of embodiment has replaced the mind-body problem as *the* central problem in philosophy of mind. The mind-body problem is the problem of how the mind and the body relate to one another. This problem arises from the dualist assumption that minds and bodies belong to different kinds of substances. Nowadays most philosophers are materialists. But the problem remains of relating the conscious subject of experience to the body. But awareness of the body does not seem to be tantamount to self-awareness, at least as classically conceived on the model of introspection (Martin 1995). It can be expected that part of the reason these problems remain is that the notion of embodiment is inadequately conceived. Therefore, progress in understanding the concept of embodiment would enable progress in some of the major outstanding problems in philosophy of mind.

The problem of embodiment has, if anything, become more pressing than ever in the light of new technological developments. We have begun to develop machines that interface seamlessly with human subjects. Paralysed people may rely on remotely controlled robots to perform movements on their behalf and receive sensory feedback from their local environment. The need for a robot external to the brain and skull may even disappear with the use of neural prosthetics and implants (Nicoletti 2001). There already exist airplanes that are remotely controlled by the 'brainwaves' (cortical potentials) of pilots' brains (Hong 2003). All of these developments blur the boundary between the conscious subject and the external world.

The problem of embodiment is of interest not just to philosophers, but also researchers in cognitive science, artificial intelligence, psychology and psychiatry. In the field of cognitive science and artificial intelligence (AI), embodiment is increasingly seen by researchers as the key to creating truly intelligent robots (Brooks 2002, Clark 1997). Early attempts to create machine intelligence reduced intelligence to being able to apply a set of abstract rules. It was soon shown that such machines lacked the human intelligence of being able to respond in a way appropriate to context. It is now thought that what is necessary for fast and flexible context-sensitive behaviour is embodiment, be it real or virtual. However, work on embodied AI is still in the early stages in which progress requires clarifying various conceptions of embodiment. If the history of AI is any indication, our conception of human intelligence and embodiment will influence our approach to a host of other problems. Insofar as our project will contribute to a refined conception of human embodiment, it may be important for AI too.

The problem of embodiment also has significant ethical and legal implications. Many liberal theorists think that there is such a thing as a right to bodily integrity (Church 1997, Gracia 1998, Calabresi 2003). Some theorists also think that individuals have a right to dispose of their body parts, organs, or products, but not those of other individuals. However, in order to spell out what these rights consists in, it is first necessary to clarify what is understood by a person's body. Although the fact of what constitutes a person's body differs from that person's sense of embodiment, it is arguable that a person's sense of embodiment in a body should play an important role in defining the boundaries of that person's body.

Our project will extend our understanding of what counts as a body for the purposes of ethical and legal considerations. In particular, insofar as the body-as-agent belongs to the self, we conclude that the vehicles of the body-as-agent (prostheses and indispensable tools to the individual's normal functioning) constitute the person's own bodily property and that the person's rights to dispose of that property extend thus far.

3.2 Advancement of Knowledge within the Discipline

The project will significantly advance knowledge and understanding within the discipline of cognitive science and philosophy of mind in several ways. First, the project will provide a comprehensive theoretical framework in which issues of embodiment can be discussed. At present in the field, there is a bewildering variety of different meanings and interpretations given to 'embodiment' and 'the body'. We will clearly distinguish and isolate the relevant concepts of embodiment.

Second, the project will contribute to an understanding of how individuals subjectively *experience* embodiment under the different conditions of using prostheses, tools, and under the conditions of paralysis. Our method (see section 4 below) will specifically probe for answers as to whether individuals regard limbs or prostheses as part of their own body or not. We expect to learn more about disorders of embodiment, particularly as the disorders we will focus on have not received extended philosophical treatment.

Much work on the sense of embodiment has focused on proprioception—the sense of body's position derived mainly from somatosensory receptors on the body's joints, muscles, and skin. When proprioceptive sense is lost, a profound sense of disembodiment can ensue (Cole 1995, Gallagher and Cole 1995). However, relatively little attention has been paid to instances of apparent *extensions* of proprioception.

In classical neurology, Head (1911) proposed that active tool use may induce a modification of the body schema. The body schema is the set of largely unconscious representations that the brain has of the body's current position and extent, which is updated during movement. Through active tool use, the tool can become incorporated into the subject's body schema. The philosopher Merleau-Ponty noted a similar phenomenon when

he described how a blind man's stick may become 'an area of sensitivity, extending the scope and radius of touch' available to the hand (Merleau-Ponty 1966: 143).

However, since this observation by phenomenologist Merleau Ponty there has not been much philosophical work on extensions of the body-as-agent (or 'lived body' as phenomenologists say.) In fact we can identify just two such works, both of which take a different approach from our project. One work is Don Ihde's *Technology and the Lifeworld* (1990) which uses a phenomenological and historical approach and does not make use of any recent knowledge in the neurosciences. Another such work is Andy Clark's *Natural Born Cyborgs* (2003). Clark (2003) is very good at presenting the latest examples of brain-machine interfaces and does pose the question of the implication of these devices for the individuation of the self. However, Clark's main concern is with the cyborg phenomenon in which bits of artificial intelligence are incorporated into the human mind. Our main concern is with human embodiment and in relating the experience of embodiment to its neural basis.

Our project will not simply look at extensions of the body schema through tool use, but also distortions of the body schema that arise simply through muscle manipulation. Matthews (1982) showed that vibration of the biceps muscles at 100 Hz can lead to reflex muscle contraction, so that a subject is left feeling that her arm is actually extended more than it is. Building on this result, Lackner (1988) showed that other parts of the body may recalibrate to adjust to the new perceived extent of a limb. In short, the somatosensory representation of the body by the brain is extremely plastic and alters in response to experience.

The existence of such experiences raises philosophical questions concerning the nature of embodiment. Should the subject's perceived extent of the body be taken as in some sense actually constituting her body's boundaries? Should the enhanced powers made possible by tools and incorporated into the body schema be understood as part of the subject's body? Answering these questions requires drawing on the distinction between the biological body and the body-as-agent.

Finally, our project will examine disorders of embodiment that involve a contraction of the body schema. We will focus on asomatognosias (disorders involving a lack of body recognition), especially those accompanied by full blown somatoparaphrenic delusions. We will ascertain whether any of the existing frameworks for explaining delusions can be applied to somatoparaphrenic delusions. Recently there has been much high quality international research into the philosophical analysis of delusions generally (see Graham 1994, Frith 1997, Campbell 1999, Gerrans 1999, Coltheart and Davies 2000.) These studies have tended to focus, however, with few exceptions (e.g Gerrans 1999) on delusions about mental states, rather than delusions about the body. For example, the most discussed such 'mental delusion' is the phenomenon of 'thought insertion' experienced by some schizophrenics. A schizophrenic with thought insertion is under the impression that he is not responsible for generating the thought that he nonetheless finds himself thinking. This delusion has been explained as resulting in part from a deficit in action monitoring, where 'actions' are construed broadly enough to include mental activity (Frith 1997). This explanation plausibly extends to the failure to recognise or identify one's own physical movements.

One of the emerging areas of consensus in the study of delusions is that there are likely to be two factors involved in producing the delusion: both an abnormal experience and a deficit in rationality (Coltheart and Davies 2000). We think that this two-factor approach also applies to somatoparaphrenic delusions. However, there may be differences between mental and bodily delusions. For example, some would argue that perception and affect (emotion) have a greater role to play in delusions concerning the body than in mental delusions. It will be necessary to determine whether, for example, the lack of recognition of

a hand by a patient is a perceptual deficit, an intellectual deficit, or an affective deficit, or some combination of all three.

3.3 Innovation

Innovative aspects of the project include:

- (i) a new theoretical framework;
- (ii) application of a method not previously used to look specifically at body delusions;
- (iii) employment of an under-represented approach on the topic;
- (iv) a new focus of inquiry, on body delusions rather than mental delusions.
- (v) incorporation of new data from neuroscience evidence

The project employs a **new theoretical framework** in which to discuss issues of embodiment. We are careful to distinguish between biological and agentic embodiment. Although this distinction has been made briefly before (Shoemaker 1976) and parallels the distinction drawn in phenomenology between *Körper* and *Leib*, we will be using the distinction in a new way. We want to map the transformations of agentic embodiment onto the contractions and extensions of neural topographic representations of the body. While this mapping may appear obvious to psychologists, it has made little sustained appearance in philosophy of mind.

The project extends a **concept and method** from the philosophy of mind and applies it to an area where it has not previously been applied at length—delusions and illusions concerning the body. The concept of immunity to error through misidentification has been applied to analyse a subject's knowledge of her own mental states. Evans (1982) broke new ground in applying the concept to knowledge of one's bodily states. We plan to **apply the concept to new situations**, such as the use of prostheses and to asomatognosias.

The **approach** of the project is novel in combining elements of both analytic philosophy and phenomenological perspectives. Philosophers working within the phenomenological tradition, have made a significant contribution to the study of embodiment (e.g. Gallagher 2000b, Leder 1990, Merleau Ponty 1962). Until recently there has been little engagement by analytically trained philosophers with the phenomenon of bodily awareness (Bermudez et. al. 1998, Cassam 1997). One reason is that analytic philosophy proceeds primarily by the analysis of language, whereas awareness of the body is non-verbal. However, by exploiting the verbal reports of patients in case studies, it is possible to analyse bodily awareness using the methods of analytic philosophy. Nonetheless, given that embodiment was the central theme of the phenomenological philosophers, an analytic philosopher studying embodiment must still build on some of the distinctions and observations noted by phenomenologists. The approach of this project seeks to move beyond the stale division between analytic and continental approaches in philosophy, as exemplified by some of the best recent work on the body in philosophy.

It should be borne in mind that the **focus of inquiry** itself is quite novel for the discipline. Although philosophers have long been interested in illusions and delusions, the focus of these explorations has been on distorted perceptions of one's mind or the mind's perception of the environment. We think a new area of research could be opened up by examining illusions and delusions of embodiment. In particular, the disorders of embodiment that we have chosen to study are not the 'celebrity phenomena' such as phantom limbs which have been discussed from Descartes onwards and have recently received exhaustive treatment (Ramachandran and Hirstein, 1998). We think that the disorders we examine, including asomatognosias, are just as rewarding for understanding the brain's representation of the body.

Finally, neuroscience has progressed tremendously in the last three decades. There is a real need to update the data used by philosophers of mind, so that it takes into account the

latest developments in neuroscience. Our project will thus be also be innovative in using **new data** from neuroscience. Our planned research stay at ICS and IJN will ensure contact with state of the art cognitive neuroscientific research.

F4 Approach and time table

4.1 Conceptual Framework and Design

The project will be divided into two main areas of study: contractions of the body and extensions of the body. We will work on the assumption that an individual's sense of embodiment has as its physical basis the neural representation of the body in the brain (Berlucchi and Aglioti 1997). By a 'contraction' of the body we mean an omission or deletion of a body part from the body schema. By an 'extension' of the body, we mean an addition or enlargement of some part of the body as represented in the body schema. We think that the primary determinant of extensions and contractions of the body schema is the subject's experience in perception and action, rather than the actual alteration of the spatial boundaries of the subject's biological body.

Under the heading of 'extensions of the body', we will focus on cases of active tool use. In such cases, the space of the subject's body-as-agent extends beyond the boundaries of the biological body. The brain naturally interprets the body-centred information deriving from touch or sight as pertaining to its own biological body, and thus there is a feeling of extending the body outwards into the surrounding space, the space of action. Under this heading, we anticipate confirming that the body-as-agent can extend beyond the biological body so long as the individual has control and sensation beyond the boundaries of the biological body in the body-as-agent.

Under the heading of 'contractions of the body', we will look at bodily illusions and delusions. Our starting point will be the assumption that deficiencies in action monitoring and active control of body parts lead to deletion of that body part from the body schema. Clearly, this null hypothesis has to be refined. We expect that a deficiency in agency is not sufficient for development of a somatoparaphrenic delusion, but we do not know whether it is necessary. Consideration of neglect patients without agency deficits suggests it is not necessary. However, given the success of invoking deficiencies in action monitoring in explaining mental delusions such as 'thought insertion' (Frith 1997), we think it will be worth while to explore how far the agency hypothesis extends to delusions about the body.

4.2 Method and Approach

Our approach will be integrative, drawing on concepts from analytic philosophy, phenomenology, and the cognitive neurosciences. From analytic philosophy, we will use the concept of immunity to error through misidentification (explained below). From phenomenology, we borrow the distinction between biological and agentive embodiment (or *Körper* and *Leib*), as well as the idea of a non-conceptual level of bodily knowledge. From the cognitive neuroscience, we borrow the idea that there are neural representations of the body in the brain.

Our method will make extensive use of a concept from analytic philosophy that can be used to probe the extent of a subject's perceived bodily boundaries. This method involves determining whether a subject's judgement about herself or her body parts is immune to error through misidentification (IEM) relative to the first person. The basic idea is that there are some attributes or properties that we take for granted as pertaining to ourselves, so much so that when these attributes are detected in the usual way, there can be no open question about *whose* attributes they are. For such an attribute F, detected in the usual way, it does not make sense to say: 'Someone is F, but is it me?'. For example, the experience of pain is such that when one experiences pain one does not need to ask *whose* pain it is. Thus, the judgement 'I

am in pain', made on the basis of experiencing pain, is immune to error through misidentification relative to the first person (Wittgenstein 1953, Shoemaker 1968).

Generally, 'I' judgements made on the basis of immediate experience of one's own body will be immune to error through misidentification relative to the first person pronoun. We call this principle 'the immunity principle' (adopted from Gallagher (2000)). Our method will be to assess whether the immunity principle is violated across different cases where the sense of body is extended or contracted. In many cases, case study reports with patient interviews contain enough information to make the judgement that immunity is violated. For example, a patient with a delusion may claim 'That's not my hand'. This judgement clearly commits an error of misidentification. It puts the patient in the position of wondering—'This is a hand, but is it mine?'. We will attempt to correlate errors of misidentification of a body part and deletion of that body part from the brain's neural representation of the body.

The significance of whether judgements exhibit immunity to error through misidentification relative to the first person pronoun or not is that they show whether the subject takes for granted that a certain attribute or property is part of *herself*. Thus, when applied to judgements about one's body, we can determine whether the subject considers that body part or its attributes to pertain to herself. This technique has fruitful applications when applied to, for example, case studies of bodily illusions and delusions.

It is worth noting that the concept of immunity to error through misidentification is not limited to first person judgements, but may be applied to judgements using perceptual demonstratives generally ('here', 'this' etc.). Thus it may be possible to use the concept to analyse whether, for example, tool users consider the area reached by their tool to be part of their immediate egocentric location ('here'). There is already neuroscientific evidence (Berti and Frassinetti 2000) that could be used to support this claim. Moreover, this case would constitute a novel application of the concept.

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