Introduction: The Subject's Matter

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We feel the wind pressing against us, as we in turn push against it. We feel the coldness of the snowball in our palm as we form it, and its lightness as we cast it forth. We feel the tickling sensation of the feather on our skin, and the convulsions of our chest as we recoil in laughter. In its continuous presence as that which "invariably accompanies the knowledge of whatever else we know" (James, 1890, p. 242) our body may be the object we know the best. It is the only object from which we constantly receive a flow of information through sight and touch. And it is the only object we can experience from the inside, through our proprioceptive, vestibular, and visceral senses.

Yet there have been very few books that have attempted to consolidate our understanding of the body as it figures in our experience and self-awareness. The only recent book that systematically addresses the topic is *The Body and the Self* (Bermúdez, Marcel, & Eilan, 1995), published by the MIT Press more than twenty years ago. It has become a landmark in the field and remains an almost unique reference. However, the study of the body in psychological disciplines such as cognitive psychology, cognitive neuroscience, psychiatry, and neuropsychology has boomed in the last twenty years. In this period, a range of new bodily illusions have emerged and pathologies of bodily experience have been studied in greater depth than ever before. Concomitantly, there has been a resurgence of philosophical attention paid to the significance of the body in our mental life, particularly in structuring the most basic aspects of perception and self-consciousness. The aim of this collected volume is to revisit conceptions of bodily self-awareness in the light of new empirical, technical, and theoretical advances. It comprises sixteen specially commissioned essays from philosophers and psychologists, which we hope collectively demonstrate the indispensability of each discipline in a complete understanding of the subject. The book is divided into three parts, each covering a topic central to an explanation of bodily

self-awareness: representation of the body; the sense of bodily ownership; and representation of the self. What follows in the rest of the introduction is a summary of the background issues framing the discussion in each of these parts.

Part I: The Body Represented

The modern notion of a body representation can be traced back at least as far as Bonnier (1905), who used the term *body schema* to refer to the spatial organization of bodily sensations. Head and Holmes (1911–1912) posited the existence of *three* distinct body representations: a *body image*, which constitutes the conscious percept of the body, as well as two types of unconscious body representations, *body schemata*, one of which records every new posture or movement and the other maps the surface of the body on which bodily sensations are localized. Since then, a long tradition in psychology and in philosophy has defended the view that there are representations of the body, which structure and calibrate bodily experiences and bodily actions.

The notion of body representation is more general than that of the cortical maps of the body found in various parts of the central nervous system, the most famous of which was coined as the "homunculus" by Penfield and Rasmussen (1950). Such maps are highly distorted and thus cannot directly supply information about body size and shape required for action control and for bodily awareness (Medina & Coslett, 2016). For instance, although the homunculus in the primary somatosensory cortex generally follows the natural anatomical divisions of body parts, associating cortical areas to specific parts of the body, some body parts are overrepresented (e.g., hand), whereas others are underrepresented (e.g., torso). Furthermore, the homunculus does not represent the anatomical contiguity of body parts (e.g., the hand-specific area is next to the face-specific area) and does not obviously reflect the constitution and organization of the body (e.g., that the hand is next to the arm). To account for metric and structural properties of the body, one requires a more inclusive notion that can also encompass integrative representations of the body, which can serve to spatially organize sensory information concerning the body for a variety of purposes. Arguably, it is thanks to body representations that sensations are experienced as being at more than an isolated body point: if you are touched on the right index finger and on the right middle finger, you can feel these sensations to be both located *on your right hand* (O'Shaughnessy, 2008). It is also thanks to body representations that one can experience sensations in the complete

absence of somatosensory input. For instance, when the sensory input from the lips and front teeth is fully blocked following anesthesia (e.g., for dental surgery) one feels one's lips and teeth increasing in size by as much as 100 percent (Gandevia & Phegan, 1999). Such an illusion cannot be explained by information coming from peripheral sensory receptors, since they are completely blocked; it seems best explained by the presence of a representation of the body functioning in independence of sensory input.

Perhaps the most commonly recognized form of body representation is that invoked by the experience of phantom body parts, especially phantom limbs, in amputees (Finger & Hustwit, 2003). Amputation is a clear case in which the body can be subject to radical change over time; the body can also gradually change size and shape from conception to mature adulthood. However, amputation and developmental changes are not the only kinds of change that body representations must track. There are also impermanent, short-term artificial changes to one's ability to affect the environment with one's body that are enabled by tool use. Representations of the body must accordingly adapt to these changes if they are to function adequately. It is unclear whether the nervous system treats having a body that grows in size over decades as a fundamentally different phenomenon to using a tool for a few minutes. But it is clear that as soon as we act without the tool, only representation of the body's original parameters (e.g., the actual size of our limbs) will be adequate.

Despite the intuitions prompted by phantom limbs, the fact that the nervous system must adapt, in many cases very quickly, to changes in the nature of the body and its ability to engage the environment might raise suspicion about whether the nervous system represents the body at all. Representations are computationally costly and arguably unnecessary if a system can retain perceptual contact with the objects of its cognition. As noted at the start of this introduction, the amount of information received from the body is quantitatively superior to that received from any environmental object. Modifying Brooks's (1991) expression, perhaps "the [body] is its own best model" underscores that the body presents a highly special feature compared to any other object in the world: it never leaves us; why do we then need an internal representation of the body?

Following Husserl (see Smith, 2007), Merleau-Ponty holds that there is a distinctive way in which the body manifests in experience as the subject of experience, such that it is "not one more [thing] among external objects" (2002, p. 105). Rather the body is our perceptual anchor, the singular structuring principle for every way in which we perceive the world as that which we can practically engage. Hence, according to Merleau-Ponty, it could

not structure the presentation of a world of objects in this way if it were presented as just another object in the world. On this phenomenological understanding, the body schema ought to be understood as a set of relatively invariant functional relationships between sensing and acting, rather than a sensorimotor representation that might enable such a relationship (Gallagher, 2005). As for phantom limbs, Merleau-Ponty interprets them as resulting from the preserved readiness to move the amputated limbs, rather than a preserved representation of the limbs, as he puts it: "The phantom arm is not the representation of the arm, but the ambivalent presence of the arm" (2002, p. 94).

However, the virtue of a cognitive system's ability to "decouple" from the body itself by representing it ought not to be underestimated. In many biological systems (humans especially) peripheral signals specifying the dynamics of bodily movement are ambiguous and cannot travel fast enough to provide timely influence on central motor processes (Latash, 2008). Nevertheless, smooth sensorimotor control is achieved. According to a well-established—though still controversial—line of research in motor control, the reason for this is that the brain encodes a model of the musculoskeletal system. By feeding copies of the outflowing motor signals into this model, the system can then compute the likely sensory feedback that would be generated by the movements specified (see, e.g., Desmurget & Grafton, 2000). This enables the system to not only accommodate signal delay and unreliability, but also explore likely changes in the causal process without any obligation to implement such changes. If this is right, then skillful sensorimotor engagement is enabled precisely in virtue of driving a model (often known as a forward model) of the causal process, alongside or in absence of the actual control process. Representations, and in particular body representations, may thus be an efficient solution to the problems posed by our bodily interactions with the world.

All the contributions comprising part I of the volume concern the relationship between representations of the body and the body itself, including issues about the possibility of innate body representations (Bremner), the phenomenology and persistence of phantom limbs (Mezue & Makin), short-term changes in body representation after tool use (Martel, Cardinali, Roy, & Farnè), and spatial principles of body representations (Longo; Haggard, Cheng, Beck, & Fardo).

Part II: The Sense of Bodily Ownership

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Each subject of experience has a "very special regard for just one body," such that each seems to "think of it as unique and perhaps more important

than any other" (Strawson, 2003, p. 93). This selective concern for a particular body is an implicit but essential element of everyday thoughts about ourselves which involve the attribution of bodily properties. Perhaps you wish you were taller. Summer has passed and you had hoped to be more tanned. Do you ever think about losing a little weight? Entertaining such possibilities requires that these thoughts single out one's body as one's own. For one cannot think of one's body being some way by merely thinking about just any body.

One way of accounting for the ability to think about a particular body as one's own is to claim that experience of one's body is intimately bound to one's consciousness of oneself. Locke opened up this possibility in a suggestive passage:

> That this is so, we have some kind of evidence in our very bodies, all whose particles, whilst vitally united to this same thinking conscious self, so that we *feel* when they are touched, and are affected by, and are conscious of good or harm that happens to them, are a part of our *selves*, i.e., of our thinking conscious *self*. Thus the limbs of his body are to everyone a part of himself; he sympathizes and is concerned for them. Cut off an hand, and thereby separate it from that consciousness he had of its heat, cold, and other affections; and it is then no longer a part of that which is *himself*, any more than the remotest part of matter. (Locke, 1690/1997, bk. II, ch. 27, §11)

Locke seems to assert that experience of parts of the body is experience of parts of oneself, and even, that in order for a body *to be* a part of oneself, it must be connected to one's "consciousness" of its properties. But one might demur that a question about materialism concerning the self is obscuring the possibility of a weaker but highly significant psychological relation, namely that of *experiencing bodily ownership*. Just as one might admit that a dismembered limb remains one's limb—even perhaps if it is no longer a part of oneself—one can similarly admit that bodily experience can present one's body as one's own, whether or not it presents it as oneself.

A further issue that might obscure matters is that the notion of experiential ownership has been used to characterize what some argue to be an invariant feature of experience of all kinds (not just experience of one's body), namely "the quality of *mineness*, that is, the fact that the experiences are characterized by a first-personal givenness that immediately reveals them as one's own" (Zahavi, 2005, p. 124). Such a liberal application of the notion of experiencing something as one's own is clearly compatible with experiencing one's body as one's own. But one may wonder whether in order to experience one's body as one's own, one's experience itself must in general have the quality of presenting itself as owned by its subject. This would also be to obscure a particularly peculiar aspect of experiencing

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bodily ownership, which is that, in contrast to thoughts and experiences, there is a clear respect in which the body itself is an objective entity, as publicly accessible a material object as any other. Yet the body is presented as having a significance for the subject like no other such object.

The aim of these remarks has been to show the significance of the notion of experiencing ownership for self-conscious thought about one's bodily properties, while keeping the notion robustly distinct from that of bodily self-consciousness per se (in which the body is presented *as oneself*) and experiential ownership (in which all one's *experiences* are presented as one's own). These distinctions are important not only to make clear that typically the core notion of a sense of bodily ownership is that of an experience of bodily ownership, but also to make clear that drawing on the notion of bodily self-consciousness or experiential ownership in one's account of experiencing body ownership is a significant theoretical step.

Much of the present discussion of the sense of bodily ownership has been influenced by Mike Martin's (1995) discussion of the structure of bodily sensation. In brief, Martin seems to make the following claims:

- Modal contrast claim: There is a contrast present within the content of bodily sensation between regions where one could and regions where one could not experience bodily sensation.
- Bodily bounded sensation claim: Bodily sensations are necessarily experienced as falling within one's bodily boundaries.

On this basis, one might conclude that the sense of bodily ownership is no more than a consequence of the fact that one necessarily experiences bodily sensations to fall within one's bodily boundaries, which Bermúdez (2011) describes as a "deflationary conception." Martin also suggests that the correct understanding of the idea that we perceive our bodies in experiencing bodily sensation must hold what he calls a "sole-object view" of body awareness: in order for an instance of bodily experience to count as an instance of perception, it must be an experience of what is in fact the subject's actual body. This is, in effect, a metaphysical stipulation, contra a multiple-object view, in which a bodily experience may count as an instance of perception despite—perhaps through some strange circumstance—presenting the body of another. But in comparing the two views a little further, one can clarify certain motivations for studying the sense of ownership itself.

On Martin's sole-object view, the fact that the sense of ownership is veridical in the usual case is explained as a consequence of the nature of bodily sensation. When a subject perceives her body, her bodily sensations

are necessarily presented as falling within the bounds of her body and this bodily experience is necessarily concerned with facts about her own actual body. On the multiple-object view, the fact that the sense of ownership is veridical in the usual case is a contingent fact. According to Martin, this sits uncomfortably with the fact that bodily sensations are necessarily bodily bounded and thus it makes mysterious the fact that we do experience ownership of our body parts.

But the mystery that Martin sees as trouble for the multiple-object view itself motivates positing a mechanism that generates the experience of bodily ownership. That is, the multiple-object view motivates the study of the sense of bodily ownership as an explanandum in its own right. This mechanism is given a particular explanatory role in instances of veridical perception, to explain why bodily sensations seem to present an experience of one's own body part as one's own. But it is also given a similar explanatory role in any potential instances of illusions of ownership, to explain why bodily sensations seem to present an experience of something that is not a part of one's body as one's own.

One of the major developments in the psychological literature since Martin's piece was written has been the intense study of just such an illusion of ownership, the rubber hand illusion (RHI), described by Botvinick and Cohen (1998). In the classic experimental set up, one sits with one's arm hidden behind a screen, while fixating on a rubber hand presented in one's bodily alignment; the rubber hand can then be touched either in synchrony or in asynchrony with one's hand. After a few minutes, one can find the following main effects after synchronous stroking.

At the phenomenological level (measured by questionnaires):

- Referred tactile sensations: Participants report that they feel tactile sensations as being located, not on their real hand that is stroked, but on the rubber hand.
- Sense of ownership: They report that it seems to them as if the rubber hand was their own hand.

At the behavioral level:

- Proprioceptive drift: They mislocalize the finger that was touched in the direction of the location of the finger of the rubber hand that was stroked in synchrony.

At the physiological level:

- Arousal: When they see the rubber hand threatened, they display an increased affective response (as measured by their skin conductance response).

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Since 1998, several other bodily illusions manipulating the sense of ownership have been found, including out-of-body illusions (Ehrsson, 2007; Lenggenhager, Tadi, Metzinger, & Blanke, 2007) and the enfacement illusion (Sforza, Bufalari, Haggard, & Aglioti, 2010; Tsakiris, 2008), among others. Some of these bodily illusions use fake bodies while others appeal to virtual bodies or to another person's body. They can be local (restricted to the hand or to the face) or global (including the whole body). They can manipulate first-person or third-person perspective on the body. Despite these differences, in every variant participants have reported feeling as if a particular body (or body part) was their own, despite being aware that it does not belong to them.

Although many have become critical of the RHI paradigm, the fact that subjects report experiencing bodily ownership for another object than their own hand strongly suggests that the experience is contingently associated with the particular body that is one's own, which may seem incompatible with the sole-object view. The insistence that sensations are necessarily bodily bounded also seems potentially in conflict with certain pathological cases, in particular somatoparaphrenia, also known as asomatognosia or alien hand sign (de Vignemont, 2013). This pathology is caused by a lesion or an epileptic seizure in the right parietal lobe and it is often associated with somatosensory deficits and spatial neglect, but the main symptom is that patients deny that one of their limbs belongs to them (Vallar & Ronchi, 2009). Surprisingly, these patients can sometimes feel tactile and painful sensations to be located in their "alien" hand. It is not absolutely clear what to conclude from pathological cases such as these; as indeed, it is not absolutely clear what to conclude from studies of illusions of ownership. In part, this is because more work needs to be done in order to understand the precise nature of the experience in question.

The chapters in part II are concerned with the nature of bodily experience, the nature of the self-attributive quality involved in what is often referred to as the sense of bodily ownership, and the theoretical connection between the two. In particular, they cover questions about the deflationary conception (Gallagher), the spatial grounds of the sense of bodily ownership (Bermúdez), its agentive and affective grounds (de Vignemont), the relation between experiential ownership and bodily ownership (Billon), and pathological cases of bodily ownership (Garbarini, Pia, Fossataro, & Berti).

Part III: The Self Represented

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A common theme in work on the nature of mental representation is that a subject's representation of herself is distinctive. Arguably this is so, even if

subjects of experience are in a certain respect not distinctive. If subjects not only have bodies but are bodies, then they have a materiality in common with other entities of the world that they experience. Yet it cannot suffice for self-representation that one merely represents the world of which one is a part. For though there is a sense in which one then represents oneself, this situation is compatible with failing to represent oneself *as oneself*. To illustrate how a seemingly all-inclusive representation can fail in this way, consider David Lewis's (1979) story of the two gods. Imagine that there are two gods, living in different parts of the same world and each has a perfect and complete view of their world; for all the possible ways things could be, they know which of those ways holds true in their world. Yet, Lewis claims that we "can imagine [that] . . . neither one knows which of the two he is," noting that the trouble might be that "they have an equally perfect view of every part of their world, and hence cannot identify the perspectives from which they view it" (Lewis, 1979, pp. 520–521).

One way in which this is sometimes put is that although these (divine) subjects know their situation in logical space, they lack any knowledge of their situation in physical space. One of the most basic ways in which a subject can represent the world is spatially; and if at least one of the ways in which a subject can represent herself is to represent her body, it would seem sufficient to represent the spatial properties of the particular body that she is. The difficulty here is that it is conceivable that a subject could have a spatial representation, which includes the spatial properties of her body (e.g., its spatial situation) and fail to represent that object as itself. On the face of things, the natural solution is to appeal to a distinctive form of spatial representation, namely perspectival spatial representation, as representing the subject's body in the distinctive way required. Visual experiences, for instance, are perspectival, not only in that they present the world from somewhere, but also in that they present the world from the place at which one's body is. The spatial structure of visual experience would then seem to be sufficient to pick out the spatial properties of the subject of the experience. But even if the thing located at the place from which one perceives is identical with oneself, more needs to be said about how one comes to be aware of this fact. Indeed, a concern variously raised by philosophers since Schopenhauer is that the world-directedness of perceptual experience makes its content essentially inadequate to pick out the subject *as the subject*. If this is right, then one requires a further account of how it is that the subject is related to the world perceived, such that she can appropriately represent herself as being a part of it.

It should be noted that part of the worry here might be based on the assumption that genuine self-consciousness requires explicit representation

of the subject. To this it might be replied that simply because the subject is not explicitly represented it does not follow that she is not represented at all. Indeed, it might be that as one's experience of the world accumulates, certain implicit assumptions about one's nature (as similar to certain objects that one perceives) and one's place in that world (as invariantly the same as the body from which one perceives) might form a conception of oneself as a body, as being the best explanation of the course of one's experience.

Moreover, it seems plausible that we can move from merely representing the world to representing ourselves when our experience of the world interfaces with the unique way in which we experience a particular part of it. When one has a visual experience of a tree ahead, one is entitled to judge: "I am standing in front of a tree." One can be wrong about whether it is a tree (it can be a painting of a tree, for instance). But, as noted by Evans (1982, p. 222), one cannot have the following doubt: "someone is standing in front of a tree, but is it I?" Employing terminology Shoemaker (1968) introduced, Evans concludes that self-locating judgments are immune to error through misidentification relative to the first person. Similarly, one cannot be wrong about whose legs are crossed when one *feels* them that way (de Vignemont, 2012). Arguably, then, bodily judgments cannot fail to pick out the subject if they are appropriately grounded.

The immunity of bodily judgments to this kind of error is often explained by appeal to the fact that the body is the only object that we experience from the inside. The notion of experiencing something from the inside is somewhat vague, but may be taken to include the experience of our posture and the movement of our body parts, our translation, rotation and orientation, and the state of our internal milieu. Each of these ways of experiencing our body from the inside can variously inform a subject's representation of herself. Proprioception and kinesthesia present the posture and movement of the parts of the body with which one perceives the world. But they also provide a means by which perceptual experience can be connected to one's capacity for bodily action. The vestibular system—together with sight, touch, and perhaps even somatic graviceptive organs in the trunk (Mittelstaedt, 1996)—carries as much information about the external world as about one's body, by coding the relation between the two. Finally, interoception provides information about the physiological condition of the body, manifest in awareness as, for example, the thump of one's heart, and feelings of hunger, thirst, and bloatedness (Craig, 2002). Though often devoid of determinate spatial phenomenology, experiences such as these

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are perhaps the primary way in which one is presented with one's nature as a biological entity.

The final six chapters of the volume concern the relationship between the body and self-representation. Issues discussed include: whether visual experience ever represents its subject in a visual mode (Richardson); how bodily agency enables perceptual experience to represent its subject's location (Alsmith); how the metaphysics of subjects (as agents) affects the possibility of their representation (Peacocke); the significance of balance as a source of information about the subject (Wong); and how self-representation might emerge from the integration of internal and external bodily information channels (Tsakiris) and modeling the self as a deeply hidden cause of behavior (Hohwy & Michael).

A Note on the Structure of the Book

Each part and indeed each chapter can be read individually. Moreover, there are many chapters that could have easily appeared in other parts than those in which they appear. But there is a rationale to the organization that we have chosen: the complex relationship between the body and its mental representation (described in the first part) will in turn deepen one's understanding of the sense of bodily ownership (discussed in the second part) and bodily self-awareness more generally (in the third part). We hope, then, that this organization will benefit anyone with the luxury of enough time to read the volume from start to finish.

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