

Attention in Bodily Awareness

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1 Introduction

What is the relationship between attention and bodily awareness? In describing the everyday experience of one's body, one feels pulled in two opposing directions: In daily life the body seems to always be present. But despite the omnipresence of one's body, bodily awareness is dim and recessive, and without the mediation of attention. However, when one focuses attention to a particular body part, conscious awareness is restricted to the attended body part, and the body does not appear to be present as a whole.

The philosophical debate reflects these two diverging observations. On the one hand, there are those who claim that attention is not necessary for bodily awareness. Call this the *Subattentional View*. This position is mostly connected with the work of Brian O'Shaughnessy (1980). On the other hand, there are those who claim that attention is necessary for bodily awareness. Call this the *Attentional View*.

This paper falls into three parts. In the first part (§§ 1-2), I will defend the Attentional View over its alternative. The best formulation of the Attentional View has been developed by the renowned psychologist Marcel Kinsbourne (1995, 2002). Interestingly, his view has never been considered in the philosophical literature. In the second part (§§ 3-4), I will discuss two challenges to Kinsbourne's account that indicate that the Attentional View has not been properly formulated yet. In the final part (§ 5), I shall propose how Kinsbourne's view has to be augmented to solve the challenges.

§ 1.1 Attention and Bodily Awareness

Imagine you are sitting at a table reading a paper – as you probably are right now. If I asked you to tell me the position of your legs or your feet, you would be able to do so without looking at them or touching them. In answering this question you are focusing attention on the information provided to you by the proprioceptive system. I shall understand attention as a capacity for selecting and highlighting information to make it available for the subject. Bodily awareness is the conscious awareness that a subject has of her body and the position of her limbs through the proprioceptive system (Bermudez, Marcel, and Eilan 1995: 13-15). Phenomenologically, it is characterised as conscious awareness of the body and its parts from the inside. This is the central phenomenon I will be concerned with in this paper.

What is the relationship between attention and bodily awareness? Two observations seem central for understanding this relationship: For the most part, bodily awareness is a recessive phenomenon. In ordinary situations, attention is directed to objects in the world, objects we hear, smell, and see. While one does not usually focus attention on one's body, the body nevertheless appears to be always present to one. Suppose you are reading a paper, you are focusing attention on the words on the page trying to understand what the author is saying. Suddenly, you come to notice your crooked and unhealthy posture. You might feel that you have been aware of your body all along in the background of awareness, even if attention was focused on objects beyond your body. But now as it starts to hurt, it comes to the foreground of awareness. The experience of the body as background suggests that bodily awareness is for the most part not mediated by attention.¹

Compare this with instances of attending to the body. Imagine directing your attention to your left foot, say because there is an itchy mosquito bite. If attention is focused on the left foot, the subject will become aware of the bodily location in question. Shifting attention to the body highlights the attended body parts and makes them consciously available for the subject. But the awareness of one's body when attending to it is special. While the attended body part is felt to be located within the body, it isn't usually the case that one is consciously aware of the rest of the body at the same time. Rather, the conscious awareness is limited to the part of the body that you pay attention to, and the degree of bodily awareness appears to change with

¹ For similar observations about the seeming presence of the body in the absence of attention see James (1890: 242), O'Shaughnessy (1980: 221-223), Gurwitsch (1985: 31), Leder (1990). It is a further question as to how detailed the awareness of the body is in the absence of attention. There does not seem to be agreement in the literature. While some hold the body is present in all its details (O'Shaughnessy 1980: 223) others hold that it is merely an elusive presence (Leder 1990).

the amount of attention dedicated to the attended part. The experience of attending to the body suggests that bodily awareness is determined by the degree to which one attends to the body and its parts. In other words, attention appears to be a critical factor in becoming aware of one's body parts.²

In experiencing one's body, one feels pulled in two opposing directions: On the one hand, given the phenomenon of bodily background awareness, bodily awareness seems to be dim, recessive, and without the mediation of attention. On the other hand, in central cases of focal bodily awareness, conscious bodily awareness is mediated by attention and the body usually does not seem to be present as a whole. The central questions of this paper are: (1) What is the relationship between attention and bodily awareness? And (2) what features (i.e. body representations) are required to provide an account of bodily awareness that does justice to its phenomenology?

§ 1.2 Attentional vs. Subattentional View

Attention in bodily awareness is a topic that has received little empirical investigation. There is a growing field of research on tactile attention and some research on vestibular attention, but no account of proprioceptive awareness and attention (for review see Gallace and Spence 2014: ch. 6). Despite the lack of a psychological account of proprioceptive attention, the relationship between attention and bodily awareness has been subject to philosophical debate. The crucial question has been whether attention is necessary for conscious awareness of one's body. One can broadly distinguish between two camps, which reflect the two observations about bodily awareness that are in tension with each other. On the one hand, there are those who deny that attention is necessary for bodily awareness. Call this the *Subattentional View*. On the other hand, there are those who hold that attention is necessary for bodily awareness. Call this the *Attentional View*. In the following, I shall consider the two views in turn.

The main motivation for the Subattentional View is phenomenological. Proponents of this view privilege the observation that one constantly experiences the body as in the background of awareness at all times, even if attention is directed elsewhere. The Subattentional View can be summarised as follows:

Subattentional View:

² For similar observations about the experience one has when one is focally attending to the body see Merleau-Ponty (1945: 33f. and 115), Kinsbourne (1995: 206-209) and O'Shaughnessy (1995: 177-183).

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For a subject S to become proprioceptively aware of her body, it is *not necessary* to attend to the body and its parts. Normal bodily awareness is for the most part subliminal and unmediated by attention.

The most prominent proponent of the Subattentional View is Brian O'Shaughnessy (1980). His view of bodily awareness can be characterised with two claims: First, in mundane cases one is constantly subattentionally aware of one's entire body through proprioception. The subattentional awareness constitutes the experience of the body as background. It is unmediated by attention but very detailed.³ Second, besides the subattentional background awareness of one's body, subjects can also focus attention on their body and its parts. This latter form of bodily awareness is mediated by attention. There are other proponents of the Subattentional View (e.g. Gurwitsch 1964, 1985).⁴ Due to restrictions of space, I shall limit my discussion to O'Shaughnessy's account.

The main motivation for the Attentional View is phenomenological, too. Proponents of the Attentional View privilege instances of focal bodily awareness. The thesis can be put in the following way:

Attentional View:

For a subject S to become proprioceptively aware of her body, it is *necessary* to attend to the body and its parts. Normal bodily awareness is necessarily mediated by attention.

The most prominent proponent of the Attentional View is the neuropsychologist Marcel Kinsbourne (1995, 2002). On this view, bodily awareness arises from selectively attending to one's body. Thus, attention is necessary for conscious bodily awareness. Although, Kinsbourne claims that focal bodily awareness of the body constitutes the standard case, he does not deny that one also experiences the body in the background. However, in contrast to the Subattentional View, Kinsbourne is not committed to the claim that background awareness of the body is a perceptual phenomenon. Alternative explanations are available to him.

³ One way to think about subattentional awareness is in terms of Ned Block's notion of phenomenal consciousness without access consciousness (Block 1995). I shall say more about this idea in § 1.3.

⁴ The disagreement between O'Shaughnessy (1980) and Gurwitsch seems mainly phenomenological (for discussion see de Vignemont 2004).

More recently, O'Shaughnessy has started to defend an Attentional View as well (O'Shaughnessy 1995, 2003). The reason for O'Shaughnessy's adoption of an Attentional View is that he now thinks that perception by its very nature is a "phenomenon in which the attention culls what it needs, and discards what it does not out" (O'Shaughnessy 1995: 182). Therefore he holds that attention is necessary for bodily awareness. He writes: "A more parsimonious theory suggests itself, namely that we all of the time perceive the body as a whole, recessively and with a limited measure of differentiation of detail, and that particular bodily sensation [...] automatically usher into being a perceptual awareness of the body point or part [...] that takes place on the "ground" of the body as a whole." (O'Shaughnessy 1995: 183).

Although O'Shaughnessy calls his view "more parsimonious", closer consideration shows that it is not the case. For his Attentional View consists in two claims: (1) bodily awareness (as a perceptual phenomenon) is always mediated by attention and (2) subjects are proprioceptively aware of the whole body all the time. From these two claims it follows that we are always attending to the body as a whole. While one might want to agree with O'Shaughnessy's first claim, the second claim and its consequence seem to be rather controversial. Even if O'Shaughnessy is right that attention is often directed to the body or that one is frequently attending to specific body parts (even if it is just to a minimal degree), it is not clear on what grounds one should accept that one always attends to the whole body. Here Kinsbourne offers a more modest alternative. In the following, I shall therefore be exclusively concerned with Kinsbourne as the main proponent of the Attentional View. The dialectical situation can be summarised as follows:

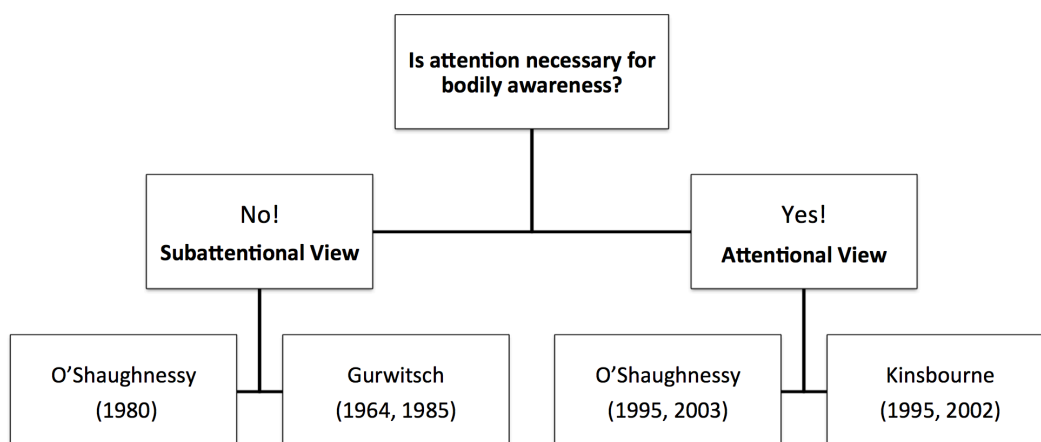


Figure 1: The Dialectical Situation

§ 1.3 An Empirical Challenge: Can Personal Neglect Settle the Debate?

Is there a way to decide which of the different views is the correct one? An initial suggestion might be that introspection provides support for one or the other side. If we could introspect whether attention is always involved when one becomes aware of one's body through proprioception, then this could help to settle the question. The problem is that proponents of both views disagree about the phenomenological or introspective facts. Proponents of the Subattentional View claim that they have a constant sense of the body that is unmediated by attention, while proponents of the Attentional View deny this. Thus, given that the two views disagree about what they think they find through introspection, it seems that one cannot settle the issue purely on the basis of phenomenology.

Thus, we need to settle this issue through a more objective approach.⁵ A central case for settling the debate between the Subattentional and the Attentional View is personal neglect. Personal neglect is a specific form of spatial neglect, where patients fail to attend to one side of their body and also do not report awareness of that side due to contralateral damage of the brain. Can personal neglect settle the debate between Attentional and Subattentional View?

Personal neglect is standardly considered to be an attentional disorder. The key motivation for this interpretation consists in the fact that artificial modulation of attention can temporarily lead to awareness of objects in the neglected perceptual field (Karnath 1988). The same phenomenon can be observed in normal human subjects. When healthy subjects direct attention to a location it gives rise to awareness, and when attention is shifted away, awareness decreases. Given that the modulation of attention has an immediate effect on the patient's awareness of objects within the neglected field, the standard interpretation seems plausible.

The standard interpretation of neglect goes against the Subattentional View. On the Subattentional View, bodily awareness is not mediated by attention. Therefore, we should expect that even when attention is absent in the neglected side of the body, patients still have some residual subattentional awareness of their body. However, this does not seem to be the case. Patients do not report any feeling in their neglected body half. Does personal neglect therefore support the Attentional View? On the Attentional View, by contrast, bodily

⁵ In a paper Schwitzgebel (2007) approached this question empirically. Although Schwitzgebel observed that subjects generally leaned towards the view that visual and bodily awareness is unmediated by attention, he admits that the interpretation of the results isn't certain and the Subattentional View is not a promising avenue. I want to thank one of the referees for directing my attention to this paper.

awareness is constituted by attentional shifts to locations on the body. If attention is impaired, or more precisely, if the mechanisms for spatial orientation of attentional shifts are impaired, and subjects cannot shift attention to one side of their body anymore, then neglect patients will fail to become aware of the affected side of their bodies. This just is what can be found in patients suffering from personal neglect (e.g. Bass et al. 2011). The Attentional View is empirically plausible since it can account for the central symptoms of personal neglect, whereas the Subattentional View cannot.

Proponents of the Subattentional View might try to object as follows. Drawing on a distinction from Ned Block (1995), they might want to distinguish between phenomenal consciousness and access consciousness. A subject has an access conscious perceptual state when she can report the content of that state. A subject has a phenomenal conscious perceptual state when she experiences a specific way it is like to be in that state. According to Block, it is in principle possible that the two forms of consciousness can come apart.⁶ Drawing on this distinction, proponents of the Subattentional View could hold that phenomenal awareness without access consciousness just is what they have in mind when they speak about subattentional awareness of their body.

If we grant the possibility of pure phenomenal awareness, proponents of the Subattentional View would have a way to respond to the argument from personal neglect. For if neglect patients are not reporting anything in the neglected field, this can be either because they have no conscious experience of the neglected body half, or it can be because they have phenomenal awareness that they just cannot report. Thus distinguishing between phenomenal and access awareness could put pressure on the interpretation of neglect as an attentional disorder.

Despite the fact that endorsing Block's distinction gives rise to alternative explanations of the neglect case, proponents of the Attentional View will argue that the appeal to phenomenal consciousness without access consciousness is not properly motivated. While Block provides a straightforward criterion of when to attribute access conscious states to subjects, the same is not true for purely phenomenal states. The problem is not that there have to be verbal reports for when patients are phenomenally aware of their bodies. The problem is rather that proponents of the Subattentional View have so far not given us any criterion for when to attribute phenomenal consciousness to a subject. It would be sufficient if there would

⁶ Block's claim about pure phenomenal awareness hinges on his interpretation of Sperling's experiment (1960). However, Block's interpretation is far from uncontroversial. For discussion of this point see Prinz 2010, 2011 and Wu 2014 ch. 6.

be some feature indicative of a phenomenal state, the presence or absence of which could then justify the attribution of a phenomenal state. However, as long as proponents of the Subattentional View haven't made this clear, the rejoinder that I have sketched for them will not be convincing. The Attentional View, on the other hand, can accommodate personal neglect without problems and provide a nice explanation of the symptoms found in personal neglect. Therefore, we should favour this view over its alternative.

Summing Up

As it stands, Kinsbourne's Attentional View is the best account to explicate the relationship between attention and bodily awareness. It both accurately captures central aspects of the phenomenology of bodily awareness and attention, and it provides an explanation of what is happening in the case of personal neglect. In the next section, I will develop Kinsbourne's account in more detail.

2 The Attentional View

§ 2.1 Kinsbourne's Attentional View

Marcel Kinsbourne developed the Attentional View in two of his papers (1995, 2002). Although he provides merely a sketch of an account which needs to be worked out in detail, it is still very suggestive. Kinsbourne holds that three components are sufficient to characterise bodily awareness: (i) the capacity for selective attention, and two body representations, which are (ii) the body schema and (iii) the somatosensory homunculus, the body map on the somatosensory cortex. In the following, I shall characterise how the interplay between these three features constitutes bodily awareness on Kinsbourne's view.

Kinsbourne points out that there is constant processing of proprioceptive information that feeds into different cognitive and motor functions. For the most part the subject is not aware of it. Bodily awareness arises from the ability to direct attention to the body. Kinsbourne writes: "Attention amplifies the previously unconscious somatosensory signals. The contents of consciousness simply reflect the dominant pattern of brain activity" (Kinsbourne 2002: 25). On this picture, attention functions like a spotlight that can be directed at different locations on the body. The spotlight of attention highlights information coming from one location on the body, while playing down information that falls outside the focus of attention. Importantly, one need not think of attention as a spotlight in a literal sense,

for one can attend more globally to a larger part of the body or even attend to the whole body at once, and not just to a specific location (Kinsbourne 1995: 207). Once a location is selected, attention gives rise to conscious awareness of the respective body parts. This happens mainly under two conditions: when the stimulus is strong and enduring, e.g. as in the case of pain, or when the information is required for acting, e.g. fitting a thread through the eye of a needle (Kinsbourne 2002: 25).

Bodily awareness cannot be understood without an understanding of the proper functioning of body representations. Body representations represent the long-term or short-term properties of the body and its parts, such as size, shape, and body structure, as well as the functional and kinaesthetic properties (de Vignemont 2010). The importance of body representations for different functions, such as body perception and motor control, has been stressed ever since psychologists and philosophers have started to think about proprioception (see Bonnier 1905; Head and Holmes 1911; Schilder 1935; O’Shaughnessy 1980; Gallagher 1986, 2005; Longo et al. 2010; de Vignemont 2010, 2014; Longo 2015a, 2015b; Wong 2014, 2015).

Kinsbourne acknowledges the importance of body representations. He observes that when acting, attention is usually directed outwards at the objects that one acts on but not to the body that one acts with. The reason why awareness of the body is not needed in mundane cases is that “motor control is informed by an unconscious representation of the body not under intentional scrutiny” (Kinsbourne 1995: 207). It is generally agreed that this is the role of the body schema (de Vignemont 2010: 671). According to Haggard and Wolpert the body schema can be characterised in the following way:

Body Schema

The body refers to a representation of the positions of body parts in space, which is updated during body movement. This typically does not enter into awareness, and is primarily used for spatial organization of action. The body schema is therefore a central representation of the body’s spatial properties that includes the length of limb segments, their hierarchical arrangement, the configuration of the segments in space and the shape of the body surface (Haggard and Wolpert 2005: 261).

While the body schema plays an important role in motor control, it is also central for the control of attentional shifts. In order to shift attention to different locations on the body, one needs an “implicit knowledge” of the spatial parameters of the body parts that one is to attend

to (Kinsbourne 1995: 208).⁷ The function of the body schema is thus to provide the structural information that is required for this purpose.

This brings me to the second important body representation for Kinsbourne, the somatosensory homunculus (Penfield and Rasmussen 1950; Blankenburg et al. 2003; Kandel 2013). The somatosensory homunculus is the body model located in the somatosensory cortex (see Figure 2). It constitutes a further source of information about the body. One can characterise the somatosensory homunculus in the following way:

Somatosensory Homunculus

The somatosensory homunculus is a neural correlate of the different body parts on the somatosensory cortex. The neural correlate represents the size of the body parts as a function of the size of the tactile receptive fields on the body (Kandel 2013: 376). The somatosensory representation generally follows the natural division of the human body; however, it does so in a discontinuous and distorted way (de Vignemont et al. 2005: 149).

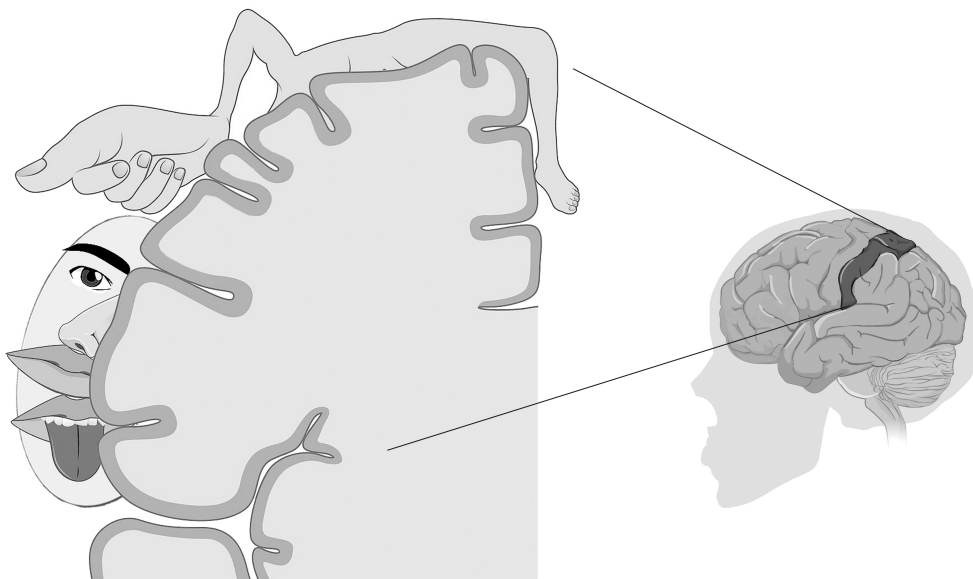


Figure 2: Somatosensory Homunculus in S1 (adapted with permission from Open Stax College)

⁷ There is a hermeneutical issue. Kinsbourne is at times inconsistent in his terminology. Given the standard definitions used in the literature, I take it that the most plausible interpretation of “implicit knowledge of the structure of one’s body” as Kinsbourne makes use of it, is to understand it as referring to the body schema.

The somatosensory homunculus represents some properties of the body, like the different body parts, and a rough outline of the structure of the body. However, the somatosensory homunculus is clearly not a body representation in the same sense in which the body schema or the body image is a body representation. It is part of the neural underpinning of these representations (Dijkerman and de Haan 2007; Longo et al. 2010). In calling the somatosensory homunculus a body representation, I am following Kinsbourne (2002: 23). According to Kinsbourne, the body schema and the somatosensory cortex provide all that is needed for giving a full account of bodily awareness.

Having given an overview of Kinsbourne's Attentional View, I will now focus on two controversial aspects of his account. First, I discuss Kinsbourne's representational structure in relation to the standard taxonomy of body representations, and then I will consider his conception of attention control in more detail.

§ 2.2 Kinsbourne and the Standard Taxonomy

How does Kinsbourne's account fit with the standard taxonomy of body representations? There is an on-going debate about how to individuate body representations and how many body representations there are (for discussion see de Vignemont 2010). However, the standard taxonomy claims a twofold distinction between body schema and body image (Paillard 1999; Gallagher 2005; Dijkerman and de Haan 2007). The twofold taxonomy is based on a functional distinction between two sensory processing systems, one for action and the other for perception, which can be found in vision (Milner and Goodale 2006) and other sensory modalities such as proprioception and touch (Dijkerman and de Haan 2007). According to this proposal, the body schema is for action, while the body image is for perception of the body. For the purpose of this paper, I will assume that the functional dissociation between body representations for perception as opposed to body representations for action is correct.⁸

I have already introduced the body schema. What is the body image? Although the use of the notion "body image" is often ambiguous (de Vignemont 2010: 671), I take it that the

⁸ The alternative view is a triadic taxonomy (e.g. Schwoebel and Coslett 2005). The triadic taxonomy includes the body schema, but splits up the body image into a semantic body representation, i.e. body semantics, and a body structural description, i.e. a visuo-spatial body map (see de Vignemont 2010: 671). I shall discuss the triadic distinction in more detail in section § 3, where I consider whether it could help Kinsbourne to defend his account against objections.

key notion is that of a cognitive map which represents the long-term spatial structure of the body. It can be characterised as follows:

The Body Image

The body image refers to the conscious representation one has of the size, structure, shape and physical composition of the body and its parts. It is a multisensory percept that integrates visual, proprioceptive, and tactile information about the body. The function of the body image is (i) to represent the spatial parameters so as to provide a sense of the position of bodily sensations within the body (O'Shaughnessy 1980). Furthermore, the body image is (ii) required for identifying and recognizing one's body or body parts (Paillard 1999).

Kinsbourne's account differs in interesting ways from the standard taxonomy, since he dismisses the idea that one needs to posit the body image as a *sui generis* form of body representation. This can be gathered from the following passage:

The attentional perspective contends that when coordinated regions of the somatosensory maps (tactile, kinaesthetic, and vestibular) distributed in the gray matter are simultaneously activated, they construct the body image. [...] There is no need for a particular part of the brain to be specialized for representing the body image. The brain has a readily available repository of information about itself, an "outside memory", like a handy reference library, in the body. The brain can sample this database as needed, rather than internalizing all the body information all the time, just in case some part of it becomes relevant.

(Kinsbourne 2002: 23)

Kinsbourne's idea seems to be this: Given that the somatosensory homunculus represents most of the bodily properties that have been associated with the body image (de Vignemont et al. 2005), the body image is not required as a further element in the cognitive architecture.⁹

⁹ In fact, Kinsbourne could be read as either claiming that bodily awareness in creatures with a possible cognitive architecture (e.g. robots) does not require the body image, or as claiming that bodily awareness in actual creatures with a cognitive architecture like us does not require the body image. I take it that Kinsbourne's main aim is to establish the latter claim rather than the former. I want to thank an anonymous referee for pointing out this helpful distinction to me.

This hypothesis is supported by empirical evidence, for it has been shown that the somatosensory homunculus has direct and indirect effects on tactile perception and felt size of the body (Weber 1834/1996; Gandevia and Phegan 1999; Linkenauger et al. 2015).¹⁰ The patterns of experienced distortions are characteristic of the distortions that can be found in the structure of the somatosensory homunculus. In light of these findings, Kinsbourne's rejection of the body image seems *prima facie* plausible. To establish his account conclusively, Kinsbourne has to show that his model has sufficient resources to accommodate the paradigmatic cases that gave rise to the twofold distinction between body schema and body image. I shall take up this task in § 3.

§2.3 Attention and Bodily Awareness Reconsidered

The last section spelled out a general concern in regard to the taxonomy of body representations that Kinsbourne posits. However, there is still a more specific concern in regard to attention. As it stands, Kinsbourne claims that conscious awareness usually arises when external stimuli elicit attention. Following the common terminology, I shall call this *exogenous attention*. Exogenous attention seems to accurately capture the paradigmatic cases of bodily awareness. When a bodily action fails to reach its goal, when one is in pain, or when one has an increasingly uncomfortable posture, then attention is exogenously drawn to the proprioceptive input (Kinsbourne 1995: 207).

However, there is no reason to think that exogenous attention is the only form of attending to one's body, for one might also direct one's attention to the body at will. Imagine (once again) sitting at a desk reading a paper. If I asked you to tell me the position of your legs under the desk, or the posture of your whole body, you will be using attention in a way that is internally controlled. You will need to voluntarily shift your attention to your legs or your posture in order to tell me whether your legs are bent or straight, or whether your posture is healthy or not. Attentional shifts that are voluntarily generated are called *endogenous attention*.

The crucial point is that the two forms of controlling attention appear to impose different requirements in regard to the spatial information that is necessary for attentional shifts. While exogenous shifts of attention work in a reflex-like fashion, without one

¹⁰ Kinsbourne's account seems to be juxtaposed between enactive accounts (for discussion see de Vignemont 2011) and classic accounts of bodily awareness. While proponents of enactivism hold that the body schema is sufficient to account for bodily awareness, Kinsbourne in addition takes into view the somatosensory homunculus which has been left out in the enactivists' picture.

necessarily having a grasp of the spatial location that attention shifts to, endogenous shifts of attention do seem to require that the subject have a grasp of the location she wants to shift attention to. One difficulty with this point is that there are currently no empirical studies that would directly vindicate my claims about endogenous attentional shifts to the body. I will therefore address this point by drawing on the visual case. Imagine you are sitting in a café and you want to check whether your bike is still locked to the lamp post. In order to check, you need to shift your visual attention to the location of the lamp post. If you had no sense of where the lamp post is you would not be able to control your visual attention, rather you would have to direct your attention to different places until it finally lands on the bike. The case of visual attention suggests that having a sense of the location is required for endogenously shifting attention (see Campbell 2002 for a similar point).

Now consider the case of endogenous attentional shifts to the body. If you intend to direct bodily attention to your feet, say in order to check whether you have left your shoes on when you entered the apartment, you will need some sense of location of where your feet are in space. If you had no idea where your feet are, how could you perform an endogenous attentional shift to them? Without such sense of the location, you would not be able to control your attentional shifts. As in the visual case, one would have to direct attention to different locations on the body until attention finally “lands” on the feet. Given examples like these, it seems plausible to assume that having a sense of the spatial location that one wants to attend to is also required for endogenous shifts of attention to the body.

If I am correct about the analogy between visual and bodily attention, then the following problem arises. In setting up his account, Kinsbourne focuses only on exogenous attention. Because of this, the body schema plays a central role in his account. However, as I have introduced it, the information provided by the body schema is only available on the subpersonal level. Given that endogenous attention depend on the subject having a conscious grasp of the spatial location that she wants to shift attention to, one might therefore worry whether the representational structures that Kinsbourne posits are sufficient to account for a wider conception of attention that encompasses endogenous attention as well. This is what I will consider in § 4.

Summing Up

The previous discussion gives rise to the following two questions:

- (1) Is Kinsbourne's account sufficient to provide a general explanation of bodily awareness?
- (2) Is Kinsbourne's account sufficient to explain the control of attention to the body?

These two questions shall be addressed in § 3 and § 4. This shall put me in a position to characterise the conditions of a more accurate account of bodily awareness in § 5.

3. A Double Dissociation for Bodily Awareness

§ 3.1 The Double Dissociation Challenge

An effective way to test the necessity of an element in the cognitive architecture is to find double dissociations (Shallice and Cooper 2011). Scientists observed a double dissociation between the ability to locate bodily sensations by pointing to the location on the body, and the ability to locate the bodily sensation by pointing to a body map – two abilities, which are thought to come together in normal human subjects. Scientists took these findings to be evidence for the existence of two distinct kinds of representation of bodily space (Paillard et al. 1983; Paillard 1999).

The challenge that I want to present in this section draws on a double dissociation discussed in the work of Anema et al. (2009).¹¹ Anema and her colleagues investigated two stroke patients: patient KE, a 60-year-old right-handed male who suffered from an ischemic stroke in the ventral posterior lateral nucleus (VPL) of the right thalamus; and patient JO, a 79-year-old right-handed female who suffered from a partial infarction in the supply area of the left middle cerebral artery (Anema et al. 2009: 662). Both of the subjects were able to detect tactile sensations on their body indicating that they both possess intact somatosensory

¹¹ Another interesting neurological case in the vicinity is 'numbsense' (Rossetti et al. 1995; Paillard 1999). In numbsense patients can know whether they are being touched without being able to localize the sensation on a body map. This indicates the lack of a body image. If you can argue that body schema and somatosensory homunculus are relatively intact, the case of numbsense could be used against Kinsbourne's reductive view more generally. I want to thank an anonymous referee for pointing this out. While numbsense constitutes an interesting case and raises general issues for Kinsbourne's account, I use Anema's double dissociation because it can directly show that body image is required as a further element in the cognitive architecture.

processing and an intact somatosensory homunculus. However, when the two patients were asked to locate a tactile sensation on their hand, either by pointing to the location on their own body or by pointing to the location on a structural map of their hand, they showed reverse patterns of impairment. Patient KE was poor at identifying the location of the tactile sensation by pointing to his own hand, whilst he was able to locate it on a hand map. In contrast, patient JO was poor at locating the bodily sensation on a hand map whilst she was able to locate the sensation on her own hand by pointing to it.

In line with the standard interpretation used in neuropsychology (Paillard 1999), Anema et al. hypothesized that the two location tasks trade on distinct forms of information processing of body space. They took the hand location task to serve as evidence for the possession of a body schema, whilst they asserted that the hand map location task is associated with the possession of a body image. Based on this premise, they concluded that patient KE can be taken to possess a body image but not an intact body schema, while patient JO can be thought to possess a body schema but not an intact body image.

The challenge for the attentional model of bodily awareness arises from the case of JO. Given that JO could accurately locate tactile sensations on her own hand, indicates that she possessed a body schema, and given that JO showed no impairment of somatosensation, there are good reasons to assume that the somatosensory homunculus in S1 was intact.¹² Furthermore, there were no signs that her ability to attend to objects was in any way impaired. Thus, JO possessed all three elements that Kinsbourne conceives to be jointly necessary and sufficient for bodily awareness. Yet, according Anema's findings JO was unable to accurately locate tactile sensations on a hand map. Following the standard interpretation, one should take this to be evidence for an impaired body image. However, Kinsbourne rejects the existence of a body image as a *sui generis* form of body representation. The challenge for Kinsbourne is to explain JO's inability to locate bodily sensations on a hand map without having to appeal to a body image. Call this the *Double Dissociation Challenge*.

§ 3.2 *Body Semantics*

To address the Double Dissociation Challenge, Kinsbourne could appeal to a further body representation.¹³ Subjects typically have a rich knowledge of the structure, size, shape and

¹² Unfortunately, no scans were available for JO to directly confirm this hypothesis (Anema et al. 2009: 662).

¹³ The strategy outlined in this section exploits the idea of a triadic taxonomy of body representations (e.g. Schwobel and Coslett 2005). The triadic taxonomy includes the body schema, but splits up the body image into a semantic body representation, i.e. body semantics, and a body structural description, i.e. a visuo-spatial body map (see de Vignemont 2010: 671).

function of their body and its parts (Longo et al. 2010: 662). They can name different body parts, and characterise the location of body parts within the body by drawing on a structural description of their body. Thus, subjects usually possess what I shall call ‘body semantics’.¹⁴

Body Semantics

Body semantics refers to the propositional knowledge a subject typically has of (i) the shape, size, structure, and function of her body and its parts and (ii) the spatial location of the body parts within the body as a whole. It is a semantic or lexical representation of the body (cf. Schwoebel and Coslett 2005: 544-545; Longo et al. 2010: 662; de Vignemont 2010: 671).

Body semantics provides spatial information about the body, and so it could potentially provide an alternative explanation of how subjects locate bodily sensations on a hand or body map – an explanation that does not require appealing to the body image. Identification of body locations based on body semantics might be realised as a two-stage process. In the first stage, the bodily sensation is located in a specific body part. In the second stage, the exact location of the body part is inferred from the set of descriptions of the structure of the body that make up body semantics. Take the following example: If one has a bodily sensation in one’s hand, one first identifies the bodily sensation as a sensation of the hand, and then one infers the location of the hand within the body from further structural descriptions about the body (e.g. the hand is a part of the arm, the arm is at the end of the shoulder, etc.). Thus, body semantics is *prima facie* able to provide the information required for locating bodily sensations on a body map.

Since Kinsbourne rejects the idea of a body image, it is important to show that body semantics is distinct from the body image. Given that the body structural description is often thought to be a component of the body image (Gallagher 2005; for discussion see de Vignemont 2010), one might doubt that body semantics is distinct from the body image. Despite that, there is good empirical evidence that the body image and body semantics can be dissociated in various ways (for review see Schwoebel and Coslett 2005; Longo et al. 2010, 662-664). Buxbaum and Coslett (2001) report a patient suffering from autotopagnosia who has an intact semantic knowledge of body structures while having lost the ability to recognize

¹⁴ The term “Body Semantics” is taken from Schwoebel and Coslett (2005). In making sense of the idea of ‘Body Semantics’ as a further body representation, I am mainly drawing on their work. More recently it has also been discussed by Longo et al. (2010: 662-664).

a picture of his own body. On the other hand, Suzuki, Yamadori, and Fujii (1997) report a patient suffering from body-specific aphasia showing a disruption of body semantics with a preserved ability to identify a picture of his own body. These findings speak in favour of the idea that body image and body semantics are two distinct kinds of body representations. Thus, Kinsbourne could appeal to body semantics without thereby committing himself to the existence of a body image.

To conclude this line of reasoning, Kinsbourne could then argue that JO's inability to locate bodily sensations on a hand map was due to a partial or full impairment of JO's propositional knowledge of the shape, size, and structure of her body and its parts. Unfortunately, to my knowledge, nothing has been reported about this in JO's case. For the purpose of this paper, I shall therefore simply assume that this were the case. The crucial issue is whether body semantics can really do the job that Kinsbourne needs it to do. In the next section, I shall consider the evidence that puts pressure on this idea.

§ 3.3 A Problem for Body Semantics

The key problem arises when one considers how body semantics represent spatial properties. It is central to the idea of body semantics that it makes reference to a specific body-part nomenclature, i.e. body part terms (e.g. hand, foot, arm, elbow etc.) that label body parts and salient body structures. On this understanding, body-part terms are like anchor points that serve to segment the body. One needs a rich collection of body-part terms in order to maintain a fine-grained structural description of the body. However, the repertoire of body-part terms of normal human beings is usually relatively poor and restricted. While one would expect that subjects are able to name fingers individually (e.g. index finger, thumb etc.), and some of the joints of the hand, they usually lack terms to name specific locations on the palm of their hand. Given that they do not possess a sufficiently rich body-part nomenclature, how can body semantics of normal people provide the fine-grained spatial information required to locate bodily sensations on a body map?

The intuitive solution to this problem consists in appealing to demonstratives. Demonstratives like 'this' or 'that' can be used to refer to particular locations or objects. On such a proposal, subjects do not need to have more fine-grained body-part terms to specify locations on a body map, since they can simply refer to specific locations by saying, "*this* location on the hand" or "*that* location on the back". Relying on demonstratives would be an interesting way to address the problem. The question is: what is it about demonstrative

concepts that explains the capacity to refer to particular locations or objects? The standard account of demonstrative reference comes from Evans (1982: ch. 6). On Evans' account, using demonstratives essentially involves being able to locate the particular object in egocentric and allocentric space. This involves locating the object on a cognitive map. The problem with this explanation is that if one applies the idea of a cognitive map for the body, the only thing it could be is the body image. But if this were the case, appealing to demonstratives would not get us anywhere, since the body image is what Kinsbourne wants to reject. Therefore, relying on demonstratives will hardly settle the shortcomings of using body semantics to represent spatial information.¹⁵

In sum, appealing to body semantics does not constitute a plausible solution to the Double Dissociation Challenge. What is really required is the body image. In the next section, I will argue that the body image is also required to explain endogenous attention.

4 Endogenous Attention and Bodily Awareness

§ 4.1 The Endogenous Attention Challenge

Attention to the body can be shifted in two ways: Either (1) attention is shifted exogenously, such as when a salient cue elicits the shift (e.g. when one suddenly feels pain in one's foot), or (2) attention can be shifted endogenously, such as when one wants to attend to the location (e.g. when one wants to attend to one's foot at will). In this section, I shall be concerned with the specific requirements for endogenous shifts of attention to the body.

In section § 2.3 I have pointed out that endogenous shifts of attention to the body require that the subject have a sense of the location of the object that they want to attend to. If I am correct about this, endogenous shifts of attention give rise to the following problem for the Attentional View: Given that attending to locations at will requires a sense of the location that is to be attended to, the subject needs to be conscious of the location in question before she shifts attention to it. However, if attention were necessary for conscious awareness of the body, the explanation of endogenous shifts of attention would be circular. Proponents of the

¹⁵ One might wonder why one cannot make use of the body schema to provide the spatial information that is required to locate an object in egocentric and allocentric space. The problem with this proposal is that we know from experiments (e.g. Fournier and Jeannerod 1998; Marcel 2003; Kammers et al. 2009) that the spatial information represented in the body schema is not or only to a very limited amount available to consciousness. Therefore, the body schema does not seem to constitute a plausible alternative. I will say more about this point in Section 4.2. Thanks to one of the anonymous referees for pressing me to clarify this point.

Attentional View have to claim that one has to attend to the location in the first place in order to voluntarily attend to the location in the second place. And this cannot be the case. Call this the *Endogenous Attention Challenge*.

A natural way to avoid circularity is to appeal to the body image. Since Kinsbourne denies the existence of a body image, this option is not available for him. The question is whether Kinsbourne can provide an alternative explanation. The only candidates on his account are the body schema and the somatosensory homunculus.¹⁶

Before one can discuss the challenge further, one has to first specify what sort of spatial information is required for attending to a body part at will. O'Shaughnessy (1995) and others (e.g. Bermudez 2005) have pointed out that there are two ways in which one could specify a bodily location. The bodily location can be individuated relative to the long-term structural organisation of the body, or relative to one's current body posture. Imagine two conditions: first, one holds one's right hand in front of one's belly, then one moves the right hand behind one's back. On the short-term structural organisation of the body, the location of the hand has changed. However, on the long-term structural organisation of the body, the location would stay the same, no matter whether one puts it front of one's belly or whether one bends it behind one's back. The question is this: Do endogenous attentional shifts depend on the short-term or the long-term bodily locations? Here empirical research suggests an answer. For the case of tactile perception, studies have shown that shifts of attention between different tactile stimuli take into account the current posture of the body rather than the long-term somatotopic structural organisation of the body (see Spence and Gallace 2007: 198). If one takes these results to apply to the case of bodily awareness as well, one can conclude that endogenous shifts of attention require a specification of the bodily location relative to the current body posture rather than relative to the long-term body structure. The pressing question is whether either the body schema or the somatosensory homunculus can provide this sort of information. This is what I shall consider in the following.

¹⁶ Given that exogenous shifts of attention do not depend on the subject having a sense of the spatial location that they want to attend to, one might argue that the spatial information that is required for endogenous shifts of attention to a body part could be provided by exogenous shifts of attention to that very location that happen prior to performing the endogenous shift. This would provide a possible explanation of how one could perform endogenous shifts of attention to the body, which avoids the problem of circularity. While I agree with this assessment, I think the suggestion is based on an implausible picture of how endogenous and exogenous attention function in concert. Normally, exogenous shifts of attention arise because of some salient cues that cause attention to shift exogenously. The question is: What is generating the exogenous response in these cases when one wants to endogenously attend to the body? It can hardly be a salient cue. Then what is it? The problem is that I see no plausible answer to give. Therefore, there is little motivation for holding that endogenous attentional shifts are grounded in exogenous shifts of attention. The need to address this point was pressed by an anonymous referee.

§ 4. 2 The Body Schema

According to Kinsbourne, the body schema provides the spatial parameters required to shift attention between different body parts (see § 2.1). Therefore it is natural to consider this suggestion first. Can the body schema really yield the spatial information required to shift one's attention to locations on the body at will?

Findings from empirical research suggest otherwise (e.g. Fournieret and Jeannerod 1998; Marcel 2003; Kammers et al. 2009). Consider a striking experiment by Marcel (2003) using vibro-tactile illusions (VTI). In VTI, the tendon of the joint of the arm gets vibrated. The induced reflex movement of the arm is prevented since the arm is fixated. This induces an illusion of arm movement, which has the effect of the stimulated arm feeling to be at in different position than it actually is.

In Marcel's VTI experiment, subjects were placed at a table (see Figure 3). The right arm was occluded from vision by a surface. On the surface a number of lights marked possible target locations the subjects could move towards with their right arm. After the VTI has been induced, subjects were asked to indicate the current position of their right arm and in which direction they think their right arm would have to move in order to reach the target light on the surface of the table. The left arm was used to both indicate the position where the subjects feel their stimulated right arm to have moved and to simulate the movement they think the right arm has to make in order to reach the target light. After the report, subjects had to use their right arm to actually move under the target light.

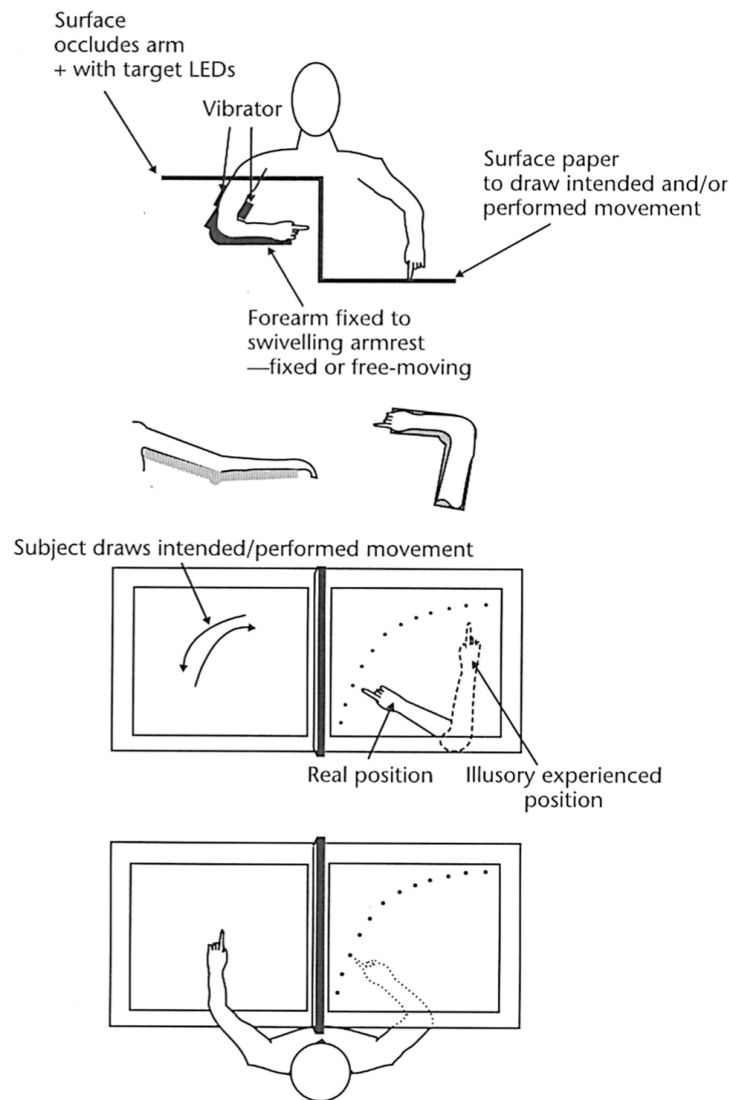


Figure 3: Vibro-Tactile Illusion from Marcel 2003

Marcel found striking results. The movement that subjects performed with the left arm to report the felt location of the right arm reflected the induced bias of the VTI. Contrary to what the subjects indicate in report, the movement of the right arm was always accurate when moving under the target light, even if it was occluded from vision. As Marcel pointed out, “the most interesting trials are for those central targets when the hand is to one side of the target light but feels to be on the other side, since on those trials it is not just extent but direction of movement which differs for real and illusory pre-movement hand location” (Marcel 2003: 65). It even happened that the movement of the subjects’ left arm that was performed to indicate the felt movement of the right hand, was in the opposite direction of the actual movement they performed with their right arm to reach the target light. Marcel’s results therefore indicate that the spatial information used to perform the movement of the right arm

was not directly accessible to the subject. In this experiment, subjects had neither conscious access to the real position of the stimulated arm nor did they have access to the direction of the movement the stimulated arm performed.¹⁷

Taken together, Marcel's results indicate that subjects have little or no awareness of the spatial parameters of their bodily movements. Given that bodily movements are typically generated by drawing on information from the body schema, one can conclude that subjects have little or no conscious awareness of the information provided by the body schema. However, if it is correct that subjects require a fairly accurate grasp of the spatial location they want to shift attention to, then Marcel's findings directly put pressure on the suggestion that one should invoke the body schema to explain attentional shifts at will.

Kinsbourne could still point out that due to the specific setup of the experiment, the subjects' attention was directed at the visual feedback but not at the bodily feedback of their hand movement. Thus, Kinsbourne could argue that if the subjects had shifted attention to the actual bodily movement, they wouldn't have been susceptible to the illusion. However, further evidence from Marcel suggests otherwise. In some of the trials, Marcel informed the subjects about the induced bias. Contrary to expectation, subjects did not improve their post-movement judgement in subsequent trials, even if they were aware of the induced bias. This indicates that the inability to access postural information is not due to the lack of attention. Rather it seems to be a general feature of bodily action that the exact spatial parameters used for bodily movements remain largely inaccessible to the subject.

In sum, Marcel's experiment indicates that subjects have little to no conscious awareness of the spatial parameters provided by the body schema. But if the spatial information of the body schema is largely inaccessible, then it is difficult to see how it could play a role in explaining voluntary shifts of attention to bodily locations. The spatial information in question needs to come from elsewhere.

§ 4.3 The Somatosensory Homunculus

The second response to the Endogenous Attention Challenge available for Kinsbourne is to argue that the somatosensory homunculus yields the relevant spatial information required for endogenous shifts of attention. Since the somatosensory homunculus provides information about the body and its parts, it is a good candidate for answering the challenge.

¹⁷ There are other experiments that demonstrate the same point. Information used to compute bodily movements seems to be only accessible to a limited extent. See Jeannerod and Fournet (1998) and Kammers et al (2009).

While this response is interesting and merits further exploration, it immediately faces two problems. First, Kinsbourne needs to take into account the fact that the somatosensory homunculus does not accurately represent the actual size of the body (de Vignemont et al. 2005: 153). Since the somatosensory representation on the cortex is a function of the density of the tactile receptive fields of the body parts, there are significant distortions between the cortical representation and the actual size of the body parts (see Figure 2). Thus the somatosensory homunculus will only provide a distorted picture of the human body. The second problem arises from the fact that the structural organisation of the somatosensory representation on the cortex does not follow the actual structure of the body. The thumb is located next to the neck followed by the skull and finally, teeth and tongue. Given the massive structural and size distortions, there seems to be no straightforward way in which the somatosensory homunculus can by itself provide a sense of location.

At this point one might object that in arguing against the somatosensory homunculus, I have conflated an important distinction. When one speaks of mental representations, one has to distinguish between the vehicle and the content of the representation (Dennett 1991; Millikan 1993; Hurley 1998a, 1998b). The idea is that a mental representation has a material or neural substrate (i.e. the vehicle) and a distinct representational content. What matters here is that the properties of the vehicle can be distinct from the properties represented in the content. So the worry is that the spatial properties that can be read off from the somatosensory representation on the cortex are only properties of the vehicle, which does not license any conclusions about the content represented. Even if this is so, the very same distinction between vehicle and content also poses a problem for Kinsbourne, for he hasn't given us more than the properties of the vehicle. In order to account for the two problems, Kinsbourne would need to say more about how the structural and size distortions of the somatosensory homunculus can be corrected for to provide accurate spatial content of the body.

A natural way to deal with these problems would be to argue that the sense of the spatial location is partly constituted by information coming from other sensory modalities (Gandevia and Phegan 1999; de Vignemont et al. 2005: 153; O'Callaghan 2012). Such a strategy has recently been exploited to explain the character of bodily experiences (de Vignemont 2014) and body representations (Wong 2014, 2015). A good candidate for this purpose is vision. Since vision provides an accurate spatial representation of the external world, it could systematically supplement the spatial information provided by the somatosensory homunculus and adjust its structural and size distortions.

As attractive as the proposal might initially appear, it raises more questions than it answers. Given that normal human beings are usually able to locate bodily sensations with their eyes closed, it is not clear why actual visual information should be required for having a sense of the spatial location of one's body parts. So instead of thinking that actual visual information is crucial, one might suggest that visual information shapes the processing of somatosensory information over time (de Vignemont 2014; Wong 2014, 2015). On such a picture, vision has a long-term effect on the way body-specific spatial information is processed. Unfortunately, Kinsbourne does not provide any details that could shed light onto how this would work, and it is not immediately obvious to me how it could.

In sum, neither the body schema nor the somatosensory homunculus is able to provide the spatial information required to shift attention between different locations on the body at will. Therefore, Kinsbourne's account is not sufficient to explain endogenous attention. This result points towards supplementing Kinsbourne's account with the body image – a conscious representation one has of the size, structure, shape and physical composition of the body and its parts – as a further body representation to explain endogenous shifts of attention to the body.

5 Revisiting the Attentional View

What insights can be drawn from the previous discussion? First, I have argued that the Attentional View of bodily awareness as formulated by Kinsbourne is currently the best model to describe the relationship between attention and bodily awareness (§ 1). While proponents of the Subattentional View fail to accommodate important neurological diseases such as personal neglect (e.g. O'Shaughnessy 1980; Gurwitsch 1964, 1985), other proponents of the Attentional View fail to do justice to the phenomenology of bodily awareness (O'Shaughnessy 1995, 2003). Kinsbourne's model (1995, 2002), by contrast, is the empirically most up-to-date account of bodily awareness and attention. Interestingly, it has never been considered in the philosophical literature.

By introducing Kinsbourne's attentional model in more detail, I have observed that it posits an unusual set of body representations (§ 2). In contrast to the standard taxonomy of body representations – which distinguishes between body schema and body image – Kinsbourne holds that the body image is not required. All he thinks is required to explain bodily awareness is the body schema and the representational properties provided by the

somatosensory homunculus – a somatotopic map located in the somatosensory cortex. While Kinsbourne’s achievement has been to highlight the role of attention in mediating bodily awareness, the reductive account of body representations that he put forward is not sufficient to characterise the relationship between attention and bodily awareness adequately. In order to demonstrate this, I presented two challenges for his view. First, I have shown that Kinsbourne’s model fails to explain a double dissociation between the ability to located bodily sensations on one’s hand and a map of one’s body (§ 3). This spoke in favour of endorsing the body image as a further body representation. Second, I have shown that the body image is also required to explain how it is possible to have endogenous attentional shifts to locations on the body (§ 4). Given that endogenous shifts of attention require having a sense of the location that one wants to direct attention to, it seems that the body image is also required for that.

The solution to both challenges therefore consists in supplementing Kinsbourne’s model with the body image. Supplementing Kinsbourne’s account with the body image constitutes the minimal model that is required to give an adequate account of attention and bodily awareness. There are of course further directions of refinement. I have already pointed out that Kinsbourne’s conception of attention is too narrow. One direction is to refine the conception of attention. Clearly there are many ways to attend to the body through proprioception. To develop this detail, one minimally needs a tripartite distinction: (i) Attention can be used *focally*, selecting a particular location or more *globally* attending to a wider array of space. (ii) Attention might not only work in an *on-off* fashion but can also come *in degrees*. For instance, you might pay more or less attention to proprioceptive input. Finally, (iii) one seems to be able to attend to multiple body parts at a time (cf. Watzl 2011; Wu 2011). Given how important the proper understanding of attention is for understanding perception, it is surprising that none of the recent accounts of bodily awareness has taken this into account (Longo 2015a, 2015b; de Vignemont 2014; Wong 2014, 2015).

Another point that will require refinement is our understanding of somatosensation more generally. In conversation, Longo has pointed out that we as yet have no clear idea of how bodily experience and our higher-order body representations, such as the body image, derive from basic somatosensory areas in the brain. The most sophisticated model of the neural networks involved, which is broadly consistent with my minimal picture, is the one from Dijkerman and de Haan (2007). Dijkerman and de Haan’s model traces body image and body schema to representations in S1 and subsequent areas on the cortex. This shows that there will be much more to say about how attention relates to bodily awareness and to

different body representations in the brain in the future. But these refinements will need to build on the minimal model of attention and bodily awareness that I have sketched in this paper.¹⁸

¹⁸ Earlier drafts of this paper were presented in London, Warwick, Budapest, Frankfurt, Stuttgart and Tübingen. I am grateful to the audience on all these occasions for discussion, and, in particular, to Thomas Crowther for a set of written comments. I would also like to thank Elizabeth Irvine, Alex Morgan, Krisztina Orbán, Ferdinand Pöhlmann, Katia Samoilova, Wayne Wu and two anonymous referees for their valuable feedback. Finally, I would like to thank Hong Yu Wong for his criticism, advice and constant support throughout the writing of this paper.

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