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Phantom body as bodily self-consciousness

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Introduction

The aim of this paper is to tackle the problem that has been discussed in the literature at least since Paul Schilder's *The image and appearance of human body*. More precisely, what is at issue here is the belief that '(…) perhaps the **body itself is a phantom**'[1] (Schilder 1964). This idea is not that rare among researchers; one could mention for example theses formulated by Ramachandran: '(…) **your own body is a phantom**, one your brain temporarily constructed (…)' (Ramachandran and Blakeslee 1998); or by Halligan: '(…) it is important to consider that **the experience of your body is** largely the product of a **continuously updated "phantom" generated by the brain**' (Halligan 2002). All these remarks seem to point in the same direction, expressing the thought that the experience of one's own body in healthy persons is in a certain way related to the experience of phantom limbs[2]. As Melzack writes: 'the phantom represents our **normal experience of the body**' (Melzack 1989). What does this relation consist in then? It seems one could risk proposing the following thesis: perceiving one's own healthy body includes a constructive element that consists in constant generation and actualization of a phantom of the body. In other words, the central nervous system (CNS) is constantly constructing a phenomenal-functional model of one's own body[3], a model that – due to the

[1] The emboldening of parts of the text was introduced by the present author.

[2] I do not assume here that these authors mean exactly the same thing when they use the word „phantom". Nonetheless, I take it that the intuitions behind this term are at least partially convergent.

[3] This idea is similar to Thomas Metzinger's (2003) proposal, but probably not identical with it. Elaborating on the similarities and differences between those two conceptions at length would require a separate article. One of the fundamental differences though is without doubt the role these conceptions attribute to visual information (here it is construed as strictly functional, not involving

temporal parameters of its updating – can remain unchanged despite limb loss. This paper is dedicated to developing precisely this thesis, along with the concept that the aforementioned body model – or its phenomenal aspect, to be more precise – constitutes a basic form of bodily self-consciousness. It is important though to stress that self-consciousness and bodily self-knowledge are without doubt complex phenomena, and the model discussed here is only one among their many aspects.

The main theme of this paper is then convergent with the belief expressed by the aforementioned Halligan (2002), according to whom experience of a phantom limb is not pathological. How should we understand this thesis? Contrary to delusions and hallucinations, which result from different sorts of dysfunctions of CNS, in the case of post-amputation phantom limbs the CNS actually continues to function properly. What happens in this case is physical damage to the body in the form of losing a limb or part thereof. Halligan writes:

> *I will argue (not withstanding pathology to the physical body) that the prevalent common sense assumption of phantom experience as pathological is wrongheaded and largely based on a long-standing and pernicious folk assumption that the physical body is necessary for experience of a body* (Halligan 2002: 252).

According to Halligan's proposal, we can speak here of a discrepancy between the physical state of the body and the experience of the body. Because of this discrepancy, the existence of the (previously covert) body phantom becomes evident. The current paper will present a more modest proposal, according to which the properties of the seen body affect the properties of the phantom.

In the closing parts of the article, I will propose a theoretical interpretation of the nature of the body phantom, suggesting that it should be understood as constituting a basic form of bodily consciousness, more precisely: a basic form of (bodily) self-consciousness. Whole body phantoms and phantom limbs are not distinguished in this article. I assume here that a phantom limb is just a symptom or an element of what really is a phantom of the whole body. One has to distinguish this assumption from these concerning autoscopy (see: Blanke and Mohr 2005; Brugger 2006). While the role of visual information is of fundamental importance in the case of autoscopic experiences, in the present proposal it is somewhat downplayed[4].

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a phenomenal component, while in Metzinger, I think, it is both functional and phenomenal). In Metzinger's theory, visual information that contributes to the construction of a phenomenal model of the body is not identified with bodily self-consciousness.

4 Brugger (2006) has attempted to intepret autoscopic experiences as a form of phantom limb experience. Nonetheless, he takes them to consist mostly of *visual* phantoms.

Classification of phantoms

In this paper, I will concentrate exclusively on post-amputation phantoms, or some special aspects of post-amputation phantoms to be more precise. There are couple of reasons to do so. First, despite some interesting attempts (Brugger 2006) to show the essential properties shared by all phantoms (see: Table 1), there also are reasons to think that one can distinguish a number of separate classes of phantoms. Second, in accordance with Halligan's (2002) idea, it seems there are grounds for thinking that post-amputation cases have a special status and should be distinguished from all other types of phantoms. Specifically, post-amputation phantom limbs are probably the only phantoms that are not related to CNS dysfunction. Third, post-amputation phantoms are proprioceptive/sensorimotor in nature, and therefore they seem related with the bodily dimension of self-consciousness.

Nine classes of phantoms can be distinguished, excluding so called non-bodily phantoms and phantom sensations (see: Melzack 1992).

Table 1

Kind of phantom	**Modality**	**Pain**	**Movement**	**Damages / dysfunctions of neural system**	**Literature**
Post-amputation phantom	somatosensory	Yes	Sometimes	No	Halligan 2002; Jensen et al. 1984
Congenital phantom	somatosensory	No [?]	Sometimes	No	Brugger 2002, 2006
Supernumerary phantom	multimodal	No	Sometimes	Central	Khateb et al. 2009
Delusional reduplication of limb	multimodal	No	Sometimes	Central	Rogers and Franzen 1992
Phantom in paralysis	kinaesthetic	No	Yes	Peripheral	Brugger 2006
Phantom in partial- and hemianesthesia	tactile	No	No	Central and peripheral	Brugger 2006
Feeling of presence	kinaesthetic/proprioception	No	No	Central	Brugger et al. 1996
Autoscopy	visuo-spatial	No	No	Central	Brugger 2006; Blanke and Mohr 2005
Out-of-body experience	visuo-spatial	No	No	Central	Brugger 2006; Blanke and Mohr 2005

Furthermore, it is important in the context of the present discussion to ask about the nature of the neural processes that give rise to the experience of phantom limbs. Two *prima facie* competing answers to this question can be distinguished in the literature. According to one of them, what underlies the phantom is related to inborn neural structure, the so called neuromatrix (Melzack 1992); according to the second, what underlies phantom limbs is massive reorganization of the brain cortex (Ramachandran, Blackslee 1998; Ramachandran et al. 1992). What should motivate us to resolve this dispute is the fact that it is closely tied to the problem of the existence of congenital phantoms, in which case one experiences limbs that one had never actually owned. It seems that Melzack's theory can account for this phenomenon. Ramachandran's proposal on the other hand accounts for another phenomenon, one observed in persons who lost a limb, where the cortex reorganizes in such a way that inactive receptive fields related to the amputated limb are "taken over" by neighboring receptive fields related to other body parts (e.g. the receptive fields of a cheek "take over" the receptive field of an amputated hand). Surprisingly, these two theses can be actually made compatible. Reconciling them would require weakening some of Melzack's theses and showing that while some aspects of body representations in the brain are in fact innate, it is still unjustified to say that those representations are localized in a strict and persistent way (the relation between Melzack's and Ramachandran's theory is discussed e.g. in Halligan (2002)). From this perspective, it seems that it is also possible – after introducing appropriate theoretical adjustments – to explain innate phantoms by showing how they are related to the functional-phenomenal body model[5].

Phantom body/limb – preliminary description

The phenomenon of phantom limbs is fairly widespread among patients who have undergone amputation (Jensen et al. 1984; Giummarra et al. 2007). Phantoms usually appear within the first 24 hours after the operation and they resemble the amputated limb (Jensen 1984; Grush 2004). Studies of post-amputation phantom limb experiences show that they mainly involve sensations of a somatosensory kind. Patients are for example able to experience touch, pressure, itching, vibrations or pinpricks in the phantom limb (see: Giummarra et al. 2007); they are also able to feel the phantom's size, shape or location, but most of all, they can feel its **presence**. It is worth noting that this somatosensory information is mostly composed of information of the

[5] There also exist a number of recent proposals according to which mirror neurons and the visual perception of other people play a crucial role in the development of so-called innate phantom limbs. (One has to keep in mind, though, the only way for us to learn whether a given child experiences a phantom limb is to communicate with it verbally, which is only possible long after it began interacting with other people. It is not possible then to verify whether allegedly innate phantoms actually existed before birth or that they owe their existence to mirror neuron activation during early interactions with others). Also, it has been observed that many post-amputation patients experience so called synesthetic pain, that is, they feel pain in their phantom limb upon observing or imagining the pain of other people (Fitzgibbon et al. 2010). Brugger and colleagues (2000) on the other hand stress the fact that emergence of phantom limbs (especially in the case of lower body parts) is sometimes triggered by using prostheses. We could generally say that such proposals, if true, would make the subjective – that is, bodily self-consciousness – dependent upon the intersubjective, that is, interaction with other people.

kinesthetic/proprioceptive kind. Visual access to phantom limbs – being able to actually see them – is almost never reported (for an exception see: Riese 1828). These facts are important as they show that phantom limbs are not ghost-like entities, visible, yet brighter looking, more transparent and penetrating physical objects. They exclusively involve a somatosensory model of the body, or a model of only some of the body's properties to be precise.

Providing a phenomenological description of bodily experience that involves only proprioceptive sensations raises many problems. Therefore, it might prove useful to start by making some sketchy remarks about the way the body is experienced normally. This way the thesis of the body phantom as constituting a basic form of bodily self-consciousness will become clearer as well.

In the case of bodily experience, the kinesthetic/proprioceptive experiential content is both poor and coarse-grained (for a discussion of coarse-grainedness of bodily experience see: Smith 2009). In other words, proprioceptive consciousness does not provide us with rich, phenomenal informational access to our own bodies. This proprioceptive information is characterized by low spatial and temporal accuracy and relatively moderate qualitative variability. One has to keep in mind though the fact that perception in general can be described as being multi-modal in nature (see e.g. Macaluso, 2006; de Vignemont in press). In the case of normal, non-pathological experience, proprioceptive and tactile perception is always accompanied by other senses (e.g. vision). It seems justified therefore to put forward the following two theses:

> [T1] *Experiencing one's own body includes information of a proprioceptive and kinesthetic kind, yet every proprioceptive phenomenal content is accompanied by at least minimal visual information*.
>
> [T1a] *Visual information in the aforementioned case fulfills a scaling functional role that requires reference to physical body parts (both one's own and of the other people).*[6]

Interestingly, in this context Halligan's proposal regarding the similarity of normal bodily experience and post-amputation phantoms could lead us to predict that vision should play an important role in the case of post-amputation phantom limbs. Phenomenal visual information itself would not be an essential factor here though, but rather phenomenal proprioceptive information modulated by purely functionally characterized visual information.

Among further properties of post-amputation phantoms is the fact that they – contrary to what happens in the case of phantom limbs emerging due to spinal cord injury,

[6] Later in the article I will turn my attention to the problem of normal and pathological body perception in blind persons. I would like to stress at this point that we lack satisfactory studies regarding this subject matter.

strokes or in persons born without limbs – can disappear with time (so called telescoping; see Giummarra et al. 2010). This may be due to the fact that former cases involve not only bodily dysfunctions, but dysfunctions of the neural substrate of the body phantom as well. Furthermore, phantoms usually appear after sudden limb loss and rarely due to slow limb loss (e.g. in the case of leprosy). This could mean that the CNS is constantly updating the body phantom according to a specific time schedule. In the case of gradual limb loss this updating process would be able to "keep up" with changes in the physical body, which would be impossible in the case of sudden limb loss. That way we could explain telescoping as resulting from the fact that the bodily injury happened too fast for the body phantom to be appropriately updated by the brain[7]. It is important also to mention the fact that the phantom undergoes the most change within the first 6 months after limb loss and it ceases to change after 2 years (Jensen et al. 1984).

I distinguish here the experience of the phantom limbs themselves from specific phantom sensations, such as phantom pain, itching, etc. It seems that the existence of a phantom is necessary for the occurrence of phantom sensations, but not the other way around (Hunter et al. 2003). Furthermore, characterizing e.g. phantom pain would actually lead us closer to characterizing the pain itself rather than give us additional insight into the problem of a phantom body.

Visible phantoms and the visible and felt phantom bodies

From time to time, phantom limb patients claim to be able actually to see their phantom (see: Khetab et al. 2009). However, this occurs in the case of phantoms that emerge due to CNS or peripheral nervous system injury rather than post-amputation phantoms[8]. One of the best examples of this latter type of phantoms – occurring after stroke – has been described by the group led by Khetab (Khetab et al. 2009). They studied a patient who was experiencing something extraordinary: not only was she experiencing her phantom multimodally (proprioceptively/kinesthetically, visually, tactually), but was also able to control it and use to actually produce tactile sensations in other body parts (e.g. cheek). The patient claimed to feel tactile sensations in body parts that she "touched" with her phantom limb, which was confirmed by the data regarding neural activity in cortical areas responsible for face representation. What is more, the phantom was not permanently present, but used to appear only when the patient intended to move her paralyzed hand. Although such extraordinary experiences are not widespread among patients, Antoniello and colleagues (2010) report that the occurrence of post-stroke, supernumerary phantom limbs is much more fre-

[7] Considering Body Integrity Identity Disorder (BIID) as a sort of phantom body disorder seems particularly interesting in this context (Hilti, Brugger 2010).

[8] A certain distinction must be introduced here. During limb amputation, a part of peripheral nervous system is removed and therefore we can say the system is "damaged". However, in this article "damage" is defined as occurring only when both the (part of) peripheral nervous system and/or a given limb remain to be a part of the patient's body, yet they do not function properly as a result of injuries or different kinds of disorders.

quent than has been previously thought. Experiences reported by the Khetab patient seem to be especially complex and it seems that her case constitutes a dysfunction of a form of bodily self-consciousness that is far more sophisticated than the one characterized in this article.

The foregoing discussion needs to be supplemented with some remarks regarding autoscopy. Persons who undergo them often report being able to see whole bodies (usually their own) from different perspectives, depending on what type of autoscopy they suffer from (Brugger et al. 1997). This fact inspired Peter Brugger (2006) to state that autoscopic experiences are a kind of phantom limb experience, of a very peculiar kind, one might add. In the case of post-amputation phantoms we deal with purely somatosensory experience and in the case of phantom limbs that have different causes than amputation we deal with experience of both the somatosensory and visual kind. But in autoscopy the patient experiences a visual phantom either of a whole body, or of a whole body combined with a shift of spatial perspective from which she perceives her own body (see: Blanke and Mohr 2005). A certain type of autoscopy in which the patient reports feeling the presence of some other, as yet invisible person seems to be an exception to this, albeit a controversial one. It is said that this type of experience is mostly related to proprioception (Brugger et al. 1996). However, this conclusion has been reached by eliminating other modalities as potential sources of this experience rather than by showing that proprioception actually plays a role in producing it.

Phantoms in blind persons

One of the most interesting questions one might ask in light of the foregoing discussion is about the occurrence of phantom limbs in blind persons. Unfortunately, at this point we lack studies on this subject matter. This might be related to the fact that data regarding bodily experience of blind persons in general is rather scarce. Nonetheless, there are a couple of studies that should be mentioned (see: Crithley 1953; Millar 1975; Kinsbourne and Lempert 1980). They show that body representations in blind persons are seriously disturbed unless the persons are explicitly informed about the vertical dimensions of their body (top-down). (Minar 1975; Kinsbourne and Lempert 1980) Without this type of information their sense of location of body parts is disturbed as well. Moreover, regardless of any information they are given, blind persons tend to misrepresent the size of their body parts.

These results have important implications for the present discussion. If phantom limbs were mostly supported by information of the somatosensory kind, we might expect them to occur among blind persons. If this was not the case on the other hand, it could mean that while phantoms are not dependent exclusively on visual information, it still plays an essential role in their development. Therefore, we could feel compelled to take a closer look at the role vision plays in creating the proprioceptive body phantom. After all, studies conducted on blind persons show that vision probably affects the ability to represent body's size, spatial arrangement of its parts or their relative sizes. When we consider the fact that spatio-temporal body representation along with its ownership aspect are among the basic components of experience of phantom limbs, we might expect blind people's phantoms to be severely disrupted regarding their size and spatial arrangement. Consider the following words of John Hull, in which he describes his experiences following loss of sight:

> *The fact that one can't glance down and see the reassuring continuity in the outline of one's own body, moving a distant foot which so to speak waves back saying yes I hear you I am there. There is no extension into space, so that I am nothing but a pure consciousness, I am dissolving I am no longer concentrated in a particular location, which would be symbolized by the integrity of the body* (taken from: Modell 2003: 3-4).

Arnold Modell interprets this report as describing loss of sense of ownership of own body resulting from loss of sight.

Many authors (e.g. Bartlet 1951 or Melzack 1992) juxtapose phantom limbs and visual hallucinations that accompany cataracts (Charles Bonnett Syndrome). Unfortunately, Bartlet only discusses the case of a person suffering from cataracts and never mentions any example of a person experiencing phantom limbs. His proposals regarding the connection between these two phenomena remain sheer speculation. More generally, many authors (including Bartlet) that discuss this problem seem to be content with showing certain analogies between cataract hallucinations and phantom limbs, yet do not attempt to perform more in-depth analysis.

The lack of studies regarding phantoms in blind persons can be contrasted with the wealth of work on the role that vision plays in phantom limbs (see e.g. Ramachandran 2009). This line of research has been initiated by the discovery of how using a so-called "mirror box" can improve the treatment of phantom pains. This type of treatment owes its effectiveness exclusively to visual feedback information. The patient puts her hands (one real, and the other phantom) into two partitions of a box and – thanks to a mirror installed in the middle – is able to see two healthy hands. When the patient is asked to open and close both of her palms (one real and one phantom) synchronously, she gets the impression of having two healthy, intentionally controllable palms. This way, phantom pains tend to eventually fade away (a similar effect can be brought on by enabling the patient to see the palm that has been amputated within virtual reality (Cole et al. 2009)). From time to time, this kind of procedure results in the "amputation" of phantom limb itself, in which case the phantom disappears altogether.

Hunter and colleagues (2003) conducted a study on the role of visual and tactile information in spontaneous and induced phantom limbs. They distinguished (a) phantom awareness (this notion is more or less analogous to the body phantom notion used in the present article) from (b) phantom sensations (that can be equated with what is here described as somatosensory components of a phantom). Unfortunately, they did not include blind persons in their study. It was concentrated exclusively on verifying whether vision – or lack thereof, to be precise – affects phantom awareness and phantom sensations. The researchers found that lack of vision either enables and strengthens the appearance of phantom awareness and phantom sensations, or it has no effect whatsoever. This result is only partially satisfactory. We know that occurent visual information is not necessary for the experience of a phantom limb, which coincides with the intuition that the phantom is of a somatosensory nature. However, this knowledge by itself cannot enable us to determine whether this kind of information (i.e. somatosensory) is sufficient for the occurrence of a phantom, since we need to keep in mind the fact that perception is multimodal (Macaluso 2006), as well as the fact that both proprioceptive (Haggard, Jundi 2009) and tactile (Longo et al. 2008) information is affected by the visual information regarding one's own body.

Body phantom content

Two additional theses can be introduced at this point:

> [T2] *Experience of having a post-amputation limb mostly consists of proprioceptive/kinesthetic content. Although proprioceptive content is modulated by visual information, these two ought to be conceived as distinct.*
>
> [T2a]*Proprioceptive experience above all informs one about the very presence of a phantom. I will be calling this aspect of phantom-limb experience an "ownership experience".*

Many studies can be cited as supporting T2a. Hunter and colleagues (2003) write:

> Some amputees (13–24%) describe PLS as exteroceptive and/or proprioceptive sensations, such as tingling, itching, pressure, movement, warmth or cold. However, a larger number of patients (47–71%) describe their phantom experience as a general awareness of the presence of the limb rather than a specific somatic sensation […]. For example, amputees may experience conscious awareness of a particular position, shape and size of their missing limb […]

Moreover - assuming that the phenomenal content of bodily experience and the phenomenal content of post-amputation phantom limbs are similar or even identical - one can also claim that the content is elusive, meaning that it is attentively recessive (O'Shaughnessy 1998). Bodily experience can be both pre-reflective and reflective. In the latter case, one should also distinguish between bodily experiences of central and peripheral kinds. Nonetheless, even when one's attention is centered on one's own body, proprioceptive phenomenal content remains imprecise (de Vignemont says: 'phenomenology of ownership is weak and elusive' (de Vignemont, in press)), coarse grained and mostly related to the sense of ownership (Gallagher 2003).

The telescopic effect that has been discussed earlier in the article can also be regarded as supporting the proposal presented in this article. As has been already said, phantoms usually appear following a sudden loss of limb. After the amputation, patients experience their phantoms as gradually decreasing in size (Jensen et al. 1984), which begins with the feeling that the limb becomes shorter, is followed by the experience of the limb as merely "sticking out" from the body or adhering to it, and ends with the phantom vanishing completely. This fact can probably be accounted for by the fact that the body phantom is being slowly updated so that it can be adjusted to the actual physical state of the body[9].

The issue of phantom limb movement is omitted here (some patients experience their phantom limb as moving or even are able to move it themselves, although this phenomenon is rather rare). What is fundamental for the present discussion is the sensory rather than the motor aspect of phantom limbs.

Constructing (emulating?) the body phantom

The issue that remains to be resolved here is the question of what exactly determines particular properties of phantom limbs, or, more generally, what sort of mechanism underlies phantom limbs. I propose that the thesis about the proprioceptive/kinesthetic nature of phantoms can be elegantly combined with Grush's (2004) emulation theory of representation, even though the latter has never been used by its author – save some sketchy remarks regarding the differences between mobile and "paralyzed" phantoms - to account for bodily experience. Grush (2010) himself admits that there is a connection between both, although he does not elaborate on it.

Grush (2004/2010) does not say much about body emulators[10]. What is of crucial importance here is that in fact there are many emulators that underlie bodily experience (and therefore phantom limb experience as well). In other words, even though our phenomenal body representation is coherent, this does not necessarily mean that it is founded on only one process or mechanism. Grush's theory seems to imply quite the contrary – except for some local and functionally specified body representations required to, for example, perform specific actions, there exists a global body repre-

[9] In this article, I do not delve into the problem of innate phantom limbs too deeply. It has to be admitted though that the fact that the telescopic effect does not occur in patients with innate phantom limbs poses a problem for the proposal presented here.

[10] You can find short introduction to emulation in Grush (2010) more detailed in Grush (2004).

sentation that results from the functioning of many modal and amodal (i.e. spatial and temporal) emulators.

The *a priori* status that Grush attributes to the functioning of amodal emulators could account for the fact that phantom limbs are experienced as having primarily spatio-temporal characteristics, mostly spatial to be exact (extent, localization, etc.). Temporal parameters of the emulator updating process could on the other hand explain the telescopic effect. Modal emulators – motor, proprioceptive, tactile, etc. – would ground other properties of phantoms. Also important is the fact that the emulator's function is to operate even in the absence of the object it represents, which would explain the very occurrence of a phantom following the loss of an actual limb (Grush 2004).

As has already been stated, it seems that the emulator is a functional-phenomenal unit. The problem of where the phenomenal aspect comes from needs to be discussed in more detail now. Emulators can be treated as a sort of "enabler", whose activity makes it possible to grasp specific sorts of content. It is us, understood as a set or group of functionally specified emulators, who grasp these contents. This thesis concerns both our consciousness of the external world and of our bodies (and therefore phantom limbs). In this perspective, emulators are responsible not only for the functional aspect of the body model, but for the phenomenal aspect as well. Once again we have to keep in mind that the present article is mainly concerned with discussing the body model as sensory in nature. While Grush himself discusses the differences between **moving and non-moving** phantoms, here I concentrate exclusively on the most foundational issues regarding phantom limbs, i.e. their essential properties. Discussing what I consider to be their non-essential, secondary properties – e.g. phantom movement, pain or itching - at length would require a separate article. It seems that efficient functioning requires having not only motor body model that Grush (2004) concentrates on, but also a sensory, long-term model that is related to modeling "plant drift" (Grush 2004), i.e. ongoing changes in body size and flexibility.

Referring to emulation theory also opens the problem of explaining the ownership experience, which some researchers take to constitute the fundamental aspect of bodily experience (Gallagher 2003). It seems that if proprioceptive information is essential for the body emulator, and at the same time emulators serve to enable one to access a given content, then the body emulator should enable one to access the ownership aspect of bodily experience (e.g. as an effect of integration of information from visual and proprioceptive body emulators).

The fact is that Grush has never used his theory to analyze the phenomenon of multimodal integration (Malacuso 2006). Therefore, it is not clear how the emulation framework would explain, for example, the interactions between proprioception and vision or the fact that vision plays an important role in tactile consciousness. On the other hand, it seems that emulation theory and multimodality are compatible, but accounting for the latter in terms of the former would require subtle analytical work (I suggest that confronting Grush's work with the work of de Vignemont could lead in the right direction).

Conclusions

The aim of this paper has been to apply certain results from the phantom limb research to the problem of bodily self-consciousness. I concentrated on: (1) providing the description of phantom limbs; (2) explaining bodily self-consciousness using phantom limbs as a model. I claimed that phantoms are related to, or explainable in terms of a functional-phenomenal body model. On the one hand, this model plays the role of a tacit, sensory body representation. On the other hand, it has a phenomenal aspect that constitutes the phenomenal content of the phantom body. The results of many recent studies (Haggard and Jundi 2009; Longo and Haggard 2010; Schutz-Bosbach et al. 2010) lead to the conclusion that the implicit, functional sensory body model is related to the spatial properties of the physical body. I suggested in this article that this model is of crucial importance for the emergence of ownership experience, which itself constitutes a phenomenal aspect of the aforementioned model (de Vignemont 2007). To summarize, the spatial, functional model of the body realized by body emulators is one aspect of the body phantom. Its functioning gives rise to the other, phenomenal aspect, which includes conscious, phenomenal spatial content as well as the experience of ownership. This content is coarse-grained and imprecise. Furthermore, phenomenal bodily experience can either be prereflective (Gallagher 1986; Legrand 2007), marginal (de Vignemont 2004), or attentively reflected on (Kinsbourne 1998). This means that the body can (a) be outside both center and periphery of attention, or (b) be in the periphery of attention, or (c) be in the center of attention. Even when the body is within the center of attention, this type of consciousness remains local (it is always directed at a part of the body, never at a body as a whole) and coarse-grained. Therefore, it should be distinguished from visual consciousness of the body. Bodily self-consciousness is proprioceptive/kinesthetic in nature, even though vision probably plays a role in its emergence.

I claim that the occurrence of phantom limbs supports the thesis that there exists a (whole) body phantom. It constitutes a continuous proprioceptive/kinesthetic basis for bodily self-consciousness. This type of self-consciousness informs its subject about the body's spatial and temporal properties as well as about somatosensory sensations. The body phantom is the basic form of bodily self-consciousness.

> [T3] *Both [T1, T1a] and [T2, T2a] describe phenomenal-functional aspects of bodily self-consciousness, indicating its constructive, emulative or phantomatic character*.

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