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Body Image and the Visceral Dimension

1. Introduction

In this paper, we look at what happens to the concept of *body image* when it is acknowledged that the level of proprioception is just *one* bodily dimension in the core constitution of the body image. Recognizing the in-depth dimension of the body and seeing the role the viscera and the internal milieu play in the basic constitution of the body image results in a change of the status of the body image regarding a number of fundamental features.

First, we present the concept of the body image as it is found in (neuro)phenomenologically inspired research (cf. Gallagher et al., 1995). Next, we present Damasio's (1994; 1999; 2003) point of view, in which body representations, emotion and feeling take a central position. Although Damasio does not use the terminology of body image in the way (neuro)phenomenological authors do, it becomes clear that the restriction to proprioception for the constitution of the body image is unjustified. Third, we try to set in a more extended concept of body image and to indicate what this extended concept amounts to in terms of status and function of the body image.

2. Body Image and its Distinction from Body Schema

The concepts of body image and body schema have a long history of confused and confusing terminology, and a satisfactory degree of conceptual clarification has been absent for a long time. Gallagher and Cole (1995), however, have succeeded in making both a conceptual and an empirical distinction between body image and body schema and have thus made an important contribution to

more conceptual discipline. The (conceptual) research by Gallagher, in several articles (cf. references) shall be our guideline for a presentation of what is understood under the concept of body image and how it differs from the body schema.

a) Conceptual Distinctions

Let us start with a definition of the *body schema*: “Body schema can be defined as a system of preconscious, subpersonal processes that play a dynamic role in governing posture and movement.” (Gallagher & Cole, 1995: 370) The function of the body schema thus is to maintain posture and to move without *consciously* monitoring motor activity. This aspect and the *subpersonal* aspect differ from the characterization of the *body image*: “(...) most often defined as a conscious idea or mental representation that one has of one’s own body.” (ibid: 370) The body image thus is *conscious* and *personal*. The conceptual distinction, however, does not hinder the fact that body image and body schema are functionally interrelated at the level of behavior.

A second way of conceptualizing the difference between body image and body schema is in terms of *intentional subject* and *intentional object*. “The *body image* consists of a complex set of intentional states - perceptions, mental representations, beliefs, and attitudes - in which the intentional object of such states is one’s own body. Thus the body image involves a reflective intentionality.” (ibid: 371) The own body appears here as the *intentional object* of a set of intentional states directed toward the own body. The intentional subject takes herself - or at least her own body - in an act of reflective intentionality as the intentional object of her act.

In the literature, three modalities of the body image are distinguished: 1) a perceptual experience of the own body, 2) a conceptual understanding of the body in general, and 3) an emotional attitude toward the own body. The second and the third aspect need not be *conscious*, but are a set of beliefs or attitudes and are therefore also part of the intentional system.

Now let us have a look again at the body schema: “In contrast to the reflective intentionality of the body image, a *body schema* involves a system of motor capacities, abilities, and habits that enable movement and the maintenance of posture. The body schema is not a perception, a belief or an attitude. Rather, it is a system of motor and postural functions that operate below the level of self-referential intentionality, although such functions can enter into and support intentional activity.” (ibid: 371) The body schema does not have the status of a conscious representation or a belief. It is a preconscious, sub-personal system that enables and supports intentional motor activity. The

body schema is to be found at the side of the intentional subject, and not at the side of the intentional object¹.

A third aspect concerns the degree of representation of the body in the body image. It is stated that: "(...) body image involves a partial, abstract, and articulated perception of the body insofar as thought, attention, and emotional evaluation attend to only one part or area or aspect of the body at the time." (ibid: 373) The body schema, in contrast, functions in a more integrated and holistic way. "A slight change in posture, for example, involves a global adjustment across a large number of muscle systems. Proprioceptive information, originating in different parts of the body, does not function in an isolated or disintegrated manner but adds together to modulate postural control (Roll and Roll, 1988)." (ibid: 374) The body image appears to be an intentional act directed to a *part* of the body, while the body schema concerns the (musculoskeletal) body *as a whole*.

Proprioception is one of the information sources about posture and movement, necessary for the operation of the body schema. Proprioceptive information arrives from kinetic, muscular, articular, and cutaneous sources². The body schema also receives information from other systems than proprioceptive ones, such as vestibular and equilibrical functions.

Yet, proprioceptive processes are not only important for the body schema, but for the body image as well. There are intermodal abilities, which make communication between proprioceptive information (which informs the body schema) and perceptual awareness (of the own body) possible, and thus help in elaborating the perceptual aspect of the body image.

Here, a distinction between proprioceptive *information* and proprioceptive *awareness* must be made. Proprioceptive information informs the body schema, but can serve also as the physiological basis for body-awareness (or the perceptual sensation of one's own movements). The latter is proprioceptive awareness: a conscious perception of movement and position, and it is this felt experience of bodily position that contributes to the constitution of the perceptual aspect of the *body image* and to *body awareness* (cf. Gallagher & Meltzoff, 1996: 223).

As a consequence, loss of proprioceptive information not only impairs the body schema, but also results in an impoverishment of the perceptual aspect of

¹ Another distinction between body image and body schema is the following. When the body appears in consciousness, it often appears as differentiated from the environment, while the body schema can be functionally integrated with the environment. The distinction is, however, not absolute, (cf. Gallagher & Cole, 1995: 372-373)

² There also exists something like 'visual proprioception', or the sub-personal processing of visual information about environmental motion in the visual field, on the basis of which adjustments in posture can be made that compensate for movement in the visual environment. The visual sense appears here as a source of information for posture and movement.

the body image (cf. Gallagher & Cole, 1995: 380). Moreover, the intermodal mechanism that allows for communication between the visual and the proprioceptive modality then is no longer functioning (for more details, cf. *ibid.*)

Finally, the role of the body image is its contribution to learning and developing novel movements and turning them into habits, which requires a certain degree of perceptual awareness of the own body (cf. *ibid.*: 385).

b) Clinical Distinctions

Some pathologies, e.g. body neglect and anosognosia, exhibit a distortion of the body image. In such cases, the body image no longer represents the body or a part or side of the body as the subject's own body. In unilateral personal neglect following brain damage from stroke, the body image is disrupted: the left side of the body is excluded from the body percept. The motor capacities, however, are intact at both sides of the body. Pathologies in which the body image is distorted but the body schema remains intact, show the possible dissociation between body schema and body image. A person with hemi-neglect, for example, fails to comb her hair on one side of the head, but does tie her shoelaces with both hands (cf. Gallagher and Cole, 1995).

The opposite case, an intact body image but a disrupted body schema, is much more rare. Gallagher and Cole have followed a patient who had lost tactile and proprioceptive input from the neck down. He can only control his movement by cognitive intervention and visual guidance of his limbs, and uses his body image in a unique way to compensate for the impairment of his body schema, (cf. Gallagher and Meltzoff, 1996: 215-216)

The case of this patient also suggests that not only the *body image*, but the body schema as well is important for the constitution of a sense of *body ownership*. The patient reports that although he still had a conscious visual perception and a conceptual understanding of his own body, he initially felt alienated from his body, because he could not control his bodily movements. In other words, he had lost a sense of authorship of his own actions. A normal, unalienated body image also depends on an intact body schema.

c) Features of Body Schema and Body Image

Let us resume here and list the features of body schema and body image.

The *body schema* is:

- 1) *Preconscious, subpersonal* and plays a crucial role in governing posture and movement.

- 2) More in particular, it is a *set of motor capacities*, abilities and habits, that enables movement and maintenance of posture, and that operates below the level of self-referential intentionality. Therefore, it is situated at the side of the *intentional (motor) subject*.
- 3) The body schema functions in a relatively *integrated* and *holistic* way.
- 4) It is based on *proprioceptive information*, coming from kinetic, muscular, articular and cutaneous sources, but also on vestibular and equilibrical information.
- 5) It plays a role in the feeling of *body ownership*.

In contrast, the *body image* appears to be:

- 1) A *conscious* idea or *mental* representation one has of one's own body. Gallagher conceives of the body image as a system of perceptions, attitudes, and beliefs pertaining to one's own body, which are sometimes conscious.
- 2) Further, the body image is *personal*, except for the conceptual knowledge which pertains to human bodies in general (scientific or not).
- 3) Gallagher preserves the characterization of the body image as an image for which the body is the *intentional object*: the difference between body image and body schema can be seen like the difference between having a perception, or belief, or emotional attitude towards one's own body and having the capacity to move one's own body.
- 4) The body image has at least three *modalities*: perceptual, conceptual, and emotional. Moreover, there seems to be a temporal order of development of these three modalities, with the perceptual features of the body image developing early in infancy and emotional and conceptual aspects developing later.
- 5) The body image pertains to a part or an aspect of the body, depending on thought, attention and emotional evaluation attending to it.
- 6) Proprioceptive awareness contributes to the constitution of the perceptual aspect of the body and is the basis for *body awareness*. Therefore, body image is also important for the sense of self or of body ownership.

3. Questions Pertaining to the Body Image

First, we should say something about the background of the above research concerning body image and body schema. Next to the clinical-empirical part, there is a conceptual part which is inspired by the phenomenology of Husserl and Merleau-Ponty (cf. e.g. Gallagher & Meltzoff, 1996). Husserl has made an important contribution to a phenomenology of the body by distinguishing *Körper*, or objective body, and *Leib*, or the lived body. He has analysed the role of kinaesthesia (what we would call proprioception now) for the moving, intentional

subject (cf. Husserl, 1952). Merleau-Ponty, inspired by Husserl, has given us a phenomenology of the *perceiving embodied subject*, and has used, although sometimes confusingly, the concept of *schema corporel* (cf. Merleau-Ponty, 1945). It is the Husserlian and Merleau-pontian phenomenology of the body which is, nowadays, one of the major roads toward a naturalization of phenomenological insights and phenomenologically inspired research (cf. Roy et al., 1999).

Second, we have two remarks concerning the phenomenology of the body. A first remark concerns the *perspective* from which the body is seen. No doubt, Husserl's phenomenology is a philosophy of consciousness, and where the body is subject to analysis, the described bodily dimensions, in particular kinaesthesia, are accessible to consciousness. Merleau-Ponty's phenomenology of perception is mostly about conscious perception. Moreover, his theory of perception is a theory of the body that witnesses conscious perception. Thus, the body is mainly approached from a perspective in which consciousness is presupposed.

Our second remark is inspired by the philosophical work of Leder (1999) and the research in visceral sensory neuroscience by Cameron (2002). Leder has pointed at a limitation in Merleau-Ponty's writings: his project is limited to the sensorimotor *surface* body. Underneath that bodily dimension, however, there is another, in-depth bodily dimension which is very often forgotten or neglected - maybe because of its relatively silent performance. It is a dimension *beyond* the sensorimotor intentionality accounted for by Merleau-Ponty (1945), and it is referred to as the dimension of the viscera (not only guts, but also heart, blood vessels and skin) and the corresponding interoception. In the following parts, this dimension will play an important role.

Third, two questions arise on the basis of the above remarks. First, is the dominating emphasis on proprioceptive awareness regarding the body image appropriate? Is the constitution of the body image in terms of proprioceptive *awareness* not too much influenced by Husserl's consciousness-based perspective on kinaesthesia and Merleau-Ponty's account of the body as a conscious perceiver of the outside world? Second, why, if the body image is not necessarily conscious (cf. *supra*), are the sources for the basic constitution of the body image situated in *conscious* proprioception? Wouldn't it be the case that the concept and function of the body image fundamentally changes if we remove that restriction and take the in-depth dimension of the body, i.e. the visceral dimension, into account?

These questions cannot be answered straight away. First, we need an account of the in-depth dimension of the body and the way in which that dimension figures for body representation. Therefore, we have a look at Damasio's point of view, in which the in-depth dimension of the body, emotions and body representations are key elements.

4. The Role of the Represented Body: Frame

Damasio (1994; 1999; 2003) shows that the brain structures that regulate emotions, feelings and the vital body functions of the organism are intrinsically intertwined. That means that the organic body is a part of a functionally integrated network that includes both brain and body, and that the biological regulation of the organism is not separate from emotions and feelings³.

The elaboration of those thoughts happens against the background idea that the mental representation of our own body is the indispensable frame of reference for that which we experience as our conscious mental life. It is the point of departure for our constitution of the world and the feeling of subjectivity (cf. Damasio, 1994).

Taken together, that means that the representation of the own body 1) is the basic theme of our feeling and thinking, 2) is indispensable for subjectivity, and 3) is the yardstick for the constitution of the world.

But how do we arrive at such an impressive task for the represented body? What is so special in Damasio's approach and, more in particular, in what way does his account of the way the body is represented differ from the above presentation?

5. Biological Regulation

Let us first look at the issue of the vital body functions of the organism or biological regulation (cf. Damasio, 1994, in particular chapter 6). Without an inborn set of circuits in certain parts of the brain, we would not be capable to breathe, to adjust our heart beat, to keep our metabolism balanced, to find food and shelter, to defend ourselves against our enemies and to mate. We have inborn circuits that regulate those bodily functions and guarantee the survival of the organism because they control the internal biochemical operation of the endocrine system, the immune system, the viscera, the drives and the instincts. Those circuits

³ Damasio uses 'emotion' and 'feeling*' to designate two different things. "Emotions and feelings of emotions, respectively, are the beginning and the end of a progression, but the relative publicness of emotions and the complete privacy of the ensuing feelings indicate that the mechanisms along the continuum are quite different. (...) I have proposed that the term *feeling* should be reserved for the private, mental experience of an emotion, while the term *emotion* should be used to designate the collection of responses [in the brain and in the body], many of which are publicly observable." (Damasio, 1999: 42)

control a large number of processes, but they do not become - in general - mental, i.e. conscious, representations⁴.

Commands for biological regulation, necessary for survival, are based on 'dispositional'⁵ representations in the hypothalamus, the brain stem and the limbic system. The hypothalamus plays the most important role in the regulation of the endocrine glands (such as the pituitary, the thyroid, the adrenals, the reproductive organs) and of the immune system. The hypothalamus secretes directly or via the pituitary molecules that change the state of the internal milieu (the fluids in the blood and in the space between the cells), the functioning of the viscera and the functioning of the central nervous system itself. Biological regulation by means of brain stem and hypothalamus is in turn controlled by the limbic system. Thus, with help from structures in the limbic system and the brain stem, the hypothalamus regulates the internal milieu, i.e. the sum total of biochemical processes going on at a certain moment in the organism. It is necessary for survival that these biochemical processes are maintained within a certain range, because larger deviations from important set points in the total profile can lead to death or illness. The hypothalamus and the structures connected with it are not only regulated by neural and chemical signals from other brain regions, but also by chemical signals coming from diverse systems in the body itself.

It is important for what follows that life-regulating phenomena, from chemical homeostatic processes up to emotions, are all connected with *changes in the state of the body* and all lead to *changes in the mapping of body states in the brain*. Those changes in representation will in turn be the basis for feelings.

6. The Representational Function of the Brain and Body Maps

The general function of the brain is to be informed about what happens in the rest of the body, in the brain itself, and in the environment, in order to effectuate in the organism itself or in the environment changes that are beneficial for the survival of the organism. The relation between organism and environment is established by way of the motor and sensory apparatus of the organism. But how does the brain know what is going on on the inside of the body?

The central nervous system is in neural contact with virtually all the parts of the rest of the body, via the peripheral nervous system. The somatosensory systems

⁴ According to Damasio, the processes of emotion and feeling also form part of the neural machinery for biological regulation, of which homeostatic control, drives and instincts are the core.

⁵ A dispositional representation exists as a *potential* pattern of neuron activity and makes neural activity happen elsewhere (cf. Damasio, 1994: 102).

in the brain are responsible for the *external* sense of touch, temperature and pain, and the *internal* senses of joint position, visceral state, pain etc. Moreover, brain and body are also chemically connected, via substances such as hormones and peptides that are secreted in the body or the brain and transported via the bloodstream. This chemical connection gives rise to a non-localised representation of the body regarding its general condition along a certain parameter⁶.

Damasio does not use the term *body image* for the representations of bodily states based on neural or chemical signals. Instead, he talks of the *representation* of the body, and where he uses the term *body schema*, this term does not cover the same thing as the body schema defined above (cf. also *infra*). The place where a coordinated, dynamic map of the body emerges, is the right hemisphere. That map in the right hemisphere is an integrated body sense, in which two kinds of representation come together in an integrated way⁷: first, the representation of states of limbs, trunk and the head (the musculoskeletal apparatus), and, second, a representation of visceral states. In this way, we arrive at an integrated sense of the body in a coordinated dynamical map. There is right hemisphere dominance for this representation, as well as for the representation of extra-bodily space and emotional processes. Representations in the left hemisphere are probably partial and not integrated (cf. Damasio, 1994: 66-67).

We can distinguish three subsystems in the somatosensory systems (cf. Damasio, 1999: 150). First, the section of the internal milieu and the viscera, second, the section of the vestibular system and the musculoskeletal system, and, third, the section of the fine touch. The first section is continuously active and signals non-stop the state of most of the inner aspects of the body to the brain. The brain is under most conditions also being informed of the state of its musculoskeletal apparatus. The musculoskeletal part of second section is also called proprioception or kinaesthesia, while the vestibular system maps the coordinates of the body in space. The section of fine touch receives signals from the changes in specialized sensors of the skin, which undergo changes if they are in contact with another object of which texture, shape, weight, temperature and the like are examined. This section describes, in contrast to the section of the viscera and the internal milieu, *external* objects, based on signals generated on the surface of the body. The second section of the musculoskeletal system is situated somewhere in between, and can reflect both internal states and help to describe the outside world.

⁶ As we shall see, the organism sends an emotional state of the body back to the brain both via a neural way and a chemical route. Hormones and peptides secreted in the body during an emotion can reach the brain via the bloodstream.

⁷ Actually, this is not one single map, but rather an interaction and coordination of signals in separate maps (cf. Damasio, 1994: 66).

In the case of anosognosia, in which the patient does not recognize that the left side of his or her body suffers from paralysis, there is a lesion in a specific group of cortical regions in the right hemisphere. These regions are somatosensory areas and include the insula, cytoarchitectonic areas 3,1 and 2, and area S2 (the latter all in the parietal lobe). They receive signals from throughout the body (muscles, joints, and internal organs). In anosognosic patients, not only are those regions damaged, but the connection with the thalamus, the basal ganglia and the motor and prefrontal cortical area is disrupted⁸.

7. Emotions as Changes in Body State

“I see the *essence* of emotion as the collection of changes in body state that are induced in myriad organs by nerve cell terminals, under the control of a dedicated brain system, which is responding to the content of thought relative to a particular entity or event.” (Damasio, 1994: 139) Emotions are induced by a small number of brain sites. Most of them are subcortical, and the main ones are situated in the brain stem region, the hypothalamus and the basal forebrain. Also important are the amygdala, and on the level of the cerebral cortex, the anterior cingulate region and the ventromedial prefrontal region.

Damasio distinguishes primary emotions from secondary or social emotions. Examples of primary emotions are happiness, sorrow, fear, anger, and surprise. Examples of secondary emotions are shame, jealousy, guilt, and pride. According to Damasio, all emotions use the body - the internal milieu, the viscera, the vestibular system and the musculoskeletal system - as their ‘theatre’, i.e. the place where they act or are active. Next to the changes brought about in the body, emotions also influence the way many *neural* circuits function.

Let us have a look at an example of a primary emotion, fear. We perceive a number of features that we perceive as frightening, and those features are detected by a part of the limbic system, the amygdala. The neuronal nuclei of this system contain a dispositional representation that triggers, on the one hand, the bodily state characteristic of the emotion of fear, and, on the other hand, alters the cognitive processes in a way that fits the state of fear (cf. Damasio, 1994: 131). Thus, after the activation of the amygdala, there are internal reactions, muscular reactions, and reactions of the viscera, via signals along the autonomous nervous system. There are also signals to neurotransmitter nuclei and the hypothalamus. The latter cause endocrine and other chemical reactions, which are transmitted via the bloodstream.

⁸ Anosognosic cases also show that a disruption in the representation of the body goes with a lack of emotion and feeling.

Primary emotions are dependent on the circuits of the limbic system, in which the main role is played by the amygdala and the anterior cingulate cortex. *Secondary* emotions can only arise once we experience *feelings* and discover systematic relations between categories of objects and situations on the one hand and primary emotions on the other hand. The structures of the limbic system are not enough to underscore the processes of secondary emotions. Prefrontal and *somatosensory* cortical areas are necessary for this.

Secondary emotions cannot arise *without* primary emotions, because they use the same machinery as primary emotions. The reaction of prefrontal dispositional representations is unconsciously, automatically and involuntarily signalled to the amygdala and the anterior cingulate cortex. Dispositional representations in these areas react 1) by activating nuclei in the autonomous nervous system and by sending via the peripheral nerves signals to the body, such that the viscera come in the state mostly associated with the situation by which the process is elicited; 2) by sending signals to the motor system, such that the skeletal muscles complete the external image of the emotion with a certain facial expression and bodily posture; 3) by activating the endocrine system and the peptide system, which change with their chemical reaction the state of the body and the brain; 4) by activating the non-specific neurotransmitter nuclei in the brain stem and the basal forebrain, which send their chemical message to all kinds of regions of the telencephalon (such as the basal ganglia and the cortex). The changes caused by 1, 2 and 3 are changes that influence the body, bring about an emotional bodily state and are signalled back to the limbic and the somatosensory systems. The changes caused by 4 and which do not come about in the body in the strict sense (i.e. the body except from the nervous system), influence the style and efficacy of cognitive processes (cf. Damasio, 1994: 138). All these changes together constitute an emotion.

8. The Feeling of Emotion and Background-Feelings

The continuous registration of what the body does while certain thoughts about certain contents are developed, is the core of what Damasio calls 'feelings'. As we have seen, an emotion is a set of changes in the bodily state, which is related to certain mental representations that have activated a specific brain system. The *feeling* of emotion is essentially the representation of such changes, which is juxtaposed to the representation that has set the cycle into motion. "In other words, a feeling depends on the juxtaposition of an image of the body proper to an image of something else, such as the visual image of a face or the auditory image of a melody." (Damasio, 1994: 145) Thus, feelings arise from emotions, and are based on the representation of the body while the body reacts emotionally

to a certain content. This does not mean yet that the feeling is *conscious*. For a conscious feeling, we need something more.

But let us first have a look at another kind of feelings, which do not arise from emotions.

Next to feelings arising from emotions, Damasio distinguishes *background-feelings*. The brain receives continually information about all changes in the body: from skin, blood vessels, viscera, voluntary muscles, joints etc., nerve terminals signal to the brain. That happens via the spinal cord and the brain stem to the reticular formation - a set of nuclei in the brain stem which regulates wakefulness and sleep - and the thalamus and from there to the hypothalamus, the limbic structures and a number of separate somatosensory cortical areas in the insular and parietal regions. These cortical areas in particular receive an account of what happens moment by moment in the body. The information coming from muscles and joints arrives in topographic organised maps. A large part of the information coming from the viscera arrives in structures which are not topographically organised, although much of the information is still topographical enough to point to pain or discomfort in parts of the trunk or limbs. The topographic maps of the viscera are less precise than the map we make of the external world, but the supposed vagueness is often exaggerated.

There is nothing static about this, instead there is continuous change. Some of the patterns are topographically organised, others less, but they are never localised in one single map or in one single centre. Those maps are *on-line representations* of what happens on a certain moment in the body and they constitute background-feelings.

9. How do we Feel a Feeling? - The Need for a Self

But how do we *consciously* feel a feeling, or when do we *know* that we have a feeling? We have just seen that the relevant brain areas receive an extended set of signals about the body state, but this is only the beginning and not satisfactory to *feel* a feeling.

For the *experience* of those representations, there should be a connection between the continuous representation of the *body* and the neural representations that form the *self*. For consciousness requires *subjectivity*. Here, background- feelings enter again. They arise from background body states, not from emotional ones, and can be considered as the feeling of life itself, the awareness of being. According to Damasio, without background-feelings, the core of the representation of the self would be broken (Damasio, 1994: 151).

Let us look again at background-feelings. The representations of the current bodily states arise in multiple somatosensory cortical regions in the parietal regions

and the areas of the insula, and also in the limbic system, the hypothalamus and the brain stem. Thus, spread over a large number of structures in cortical and subcortical areas, a composed and continually changing representation of bodily states arises. Next to that dynamical, on-line representation of the body, we have somewhat more stable representations of the overall structure of the body, probably based on proprioception (muscles and joints) and interoception (viscera). According to Damasio, those representations are the basis of our idea of *body image*⁹. They are ‘off-line’ or dispositional, but side by side with the on-line representations of the actual body states, they can be activated in topographically organised somatosensory cortices, “to provide an idea of what our bodies *tend to be like*, rather than what they are now.” (Damasio, 1994: 152) The proof for the existence of those representations is the phenomenon of the phantom limb, in which there is no longer online information available from the missing limb, but a representation on the basis of off-line (and out-dated) information about the missing limb.

It is often thought that we are aware of only a small part of our bodily state, but that is not correct. The representations of what happens in the external world and internally generated representations distract us from the ongoing representation of the body (cf. Damasio, 1994: 153). In the background, however, there is an uninterrupted bodily awareness, although we hardly pay attention to it. This awareness is not about a specific part of the body, but rather a general state of almost everything in the body.

Now, let us take up our question again: how do we feel feelings? We know that feelings are about the body; they offer us cognition about the state of our viscera and of the musculoskeletal system (cf. Damasio, 1994: 159). For background-feelings and emotions, the component of the viscera is probably more important than that of the musculoskeletal system. But regarding the feeling of feelings, we have to find out how the continuously changing bodily representation becomes *subjective*.

10. How do we Feel a Feeling? Continuation

Let us look at what we already know. The more or less topographical representation of the bodily activities on the level of the brain stem and the

⁹ Further, Damasio (1994) seems to use the term ‘body schema’ for the more stable representation. “My idea is that the brain’s somatosensory complex, especially that of the right hemisphere in humans, represent our body structure by reference to a body schema where there are midline parts (trunk, head), appendicular parts (limbs), and a body boundary. (...) This dynamic map of the overall organism anchored in body schema and body boundary would not be achieved in one brain area alone but rather in several areas by means of temporally coordinated patterns of neural activity.” (Damasio, 1994: 231)

hypothalamus (where the topographical organisation of neural activity is minimal), is coupled to brain areas in which a clearly topographical organisation of the signals coming from the body is available: the cortical areas in the insula and the somatosensory cortical areas S1 and S2. The sensory representation of movable parts is coupled to several areas and levels of the motor system. The dynamical set of maps is 'somatomotor'.

According to Damasio, the original representations of the functioning body play a role for consciousness. They give a core to the neural representation of the self and provide in that way everything coming from the external or from the internal world with a natural frame of reference. At the very basis of our idea of a self there are representations of background states and emotional states. The whole of bodily representations is the basis for our idea of a self, which is continually reconstructed. But in order to have a subjective perspective, something more is needed.

While the representation of an object affects the organism, there is a third party (better: a third-party neuron ensemble) that receives signals from both the representation of the *object* and the representation of the *self*. In other words, a third party makes a dispositional representation of the self that changes while the organism reacts to (the representation of) an object. Like other dispositions, that disposition can reactivate in the early sensory cortices a somatosensory representation of the organism responding to a particular object. According to Damasio, that might be the basis for subjectivity, or the subjective perspective, an essential part of consciousness. The feeling of the 'self' introduces at the mental (i.e. conscious) level of information processing the idea that all the activity represented in the brain and the mind belongs to one single organism. The basic self is a second order representation, based on two first-order representations: the representation of the object that we perceive and the representation of the body changed by the perception of the object.

The main reason to think about the self in the above way is the stability the self exhibits (cf. Damasio, 1999). That stability is found in different aspects. First, the composition and the functions of the living body are qualitatively the same during a whole life. Second, the continuous changes in the body are quantitatively small. They have a small dynamic range, because the parameters of the body must stay within a small range if the organism is to survive (cf. also *supra*). The inner state of the body should be relatively stable, by comparison to the environment. Third, this stable state is governed from the brain by means of a highly developed machinery, designed to detect minimal changes in the internal chemical composition of the body, and to command actions that correct those detected changes, directly or indirectly (Damasio, 1999: 22)

Thus, the deep roots for the self are to be found in the whole of brain devices which keep in a continuous and non-conscious way the body state within the

small range and the relative stability required for survival. Those devices constantly represent in a non-conscious way the state of the living body, along all its dimensions. This is what Damasio (1999) calls the *proto-self*, or the non-conscious forerunner for all levels of self which are conscious: core-self and autobiographical self (cf. Damasio, 1999, for an extended treatment of those selves).

The proto-self is a coherent set of neural patterns which continuously map the state of the physical structure of the organism along all its dimensions, but we are not aware of the proto-self. The following brain structures are necessary for a proto-self. First, several nuclei in the brain stem that regulate the body state and map bodily signals. Second, the hypothalamus and the basal forebrain, in which an actual register of the state of the internal milieu, along several dimensions (sugar, ion concentration, pH, hormone concentration in the blood, etc.) is maintained. Third, the insula, the cortical areas S2 and the medial parietal cortices, all part of the somatosensory cortices. There, we have the most integrated representation of the current internal state of the organism on the level of the hemispheres, next to representations of the unchanging schema of the whole of the musculoskeletal system. The fine-touch part of the primary somatosensory cortex (SI) is not necessary for a proto-self (but it is for core consciousness). Damage to the early sensory cortices does not endanger core consciousness, but damage to the somatosensory areas does lead to a disruption of consciousness, because they are part of the basis for the proto-self.

According to Damasio, “core consciousness occurs when the brain’s representation devices generate an imaged, nonverbal account of how the organism’s own state is affected by the organism’s processing of an object, and when this process enhances the image of the causative object, thus placing it saliently in a spatial and temporal context.” (Damasio, 1999: 169) The account thus describes the relation between the changed proto-self and the sensorimotor maps of the object that causes the changes¹⁰. In fact, background feelings and core consciousness are so closely linked that it is difficult to distinguish between them.

For the proto-self, the representations of the viscera and the internal milieu are most important. In cases of asomatognosia, signals from the internal milieu, the viscera and the vestibular system give the basis for the feeling of existence. They guarantee that part of the proto-self from which core-consciousness can emerge. But the lesions which cause anosognosia destroy the set of representations which connect the whole of the musculoskeletal system with the state of the internal milieu and the viscera. The highest level on which this integration can

¹⁰ Extended or autobiographical consciousness is based on the same fundamental mechanism as core-consciousness: the generation of maps in which the current relation between organism and object is described. This mechanism is not applied to one object, but to a coherent set of previously stored objects (memory).

happen is that of the somatosensory maps in the insula and areas S2 and SI in the right hemisphere. The autobiographical memory is therefore provided with partial information.

Finally, in order to feel & *feeling*, the pattern of neural activity in the areas that induces emotions has to become an object that is represented and put in relation to the self in a second-order representation. The details of that process exceed the range of this article (but cf. Damasio, 1999, chapter 9 in particular). Yet, we have all the ingredients for reassessing the issue of the body image.

11. Status and Function of the Body Image

We have listed the features of the body image (cf. *supra*). What does a reassessment of those features show us? First, it has become clear that the representation, or the multiple representations, of the body precede the conscious awareness of the body, and that the issue of conscious awareness should be considered in terms of *several strata* in the body image, i.e. from visceral and regarding the internal milieu (interoceptive) to the musculoskeletal system (proprioception), to skin and fine touch. The body is not monolithic; a number of registers or strata should be distinguished, which are *all* important for the body image, but which do not come into our consciousness to an equal degree (as background-feeling or as feeling arising from an emotion) or in the same vein (topographical versus less topographical).

Second, on the one hand the body image is extremely *personal* in its origins, because at the core it reflects our deepest inside, the viscera, and the fluids running through our bodies and keeping us alive and functioning. On the other hand, the representation of this deep dimension is subpersonal and pre-personal. “The perceptual subject is a later thing, arising out of a fetal state of impersonal circulatory and metabolic exchanges. Nightly, in deep sleep, I slip back into this existence, abandoning my sensorimotor sheath.” (Leder, 1999: 200) The body image, in its interoceptive aspect, can be regarded as *preconscious and subpersonal* as the body schema. Moreover, it is the dimension of the viscera and the internal milieu in particular that is the basis for the formation of a protoself, and eventually supports the conscious self (core consciousness).

Third, the status of the body image has become much more difficult to seize. Is the body in the above account merely an intentional object? True, the body, body states and changes of body state are still the *object* of the neural representations. But where is, at all levels, the intentional subject? In the proprioceptive case, that question is easier to handle. We, as conscious subjects, know what our limb position is, based on proprioceptive awareness. However, proprioception is only a part of the total body image, and even not the core part.

The core part is constituted by body states that are emotions and by body states that become background-feelings. The latter, rather than being an object for a conscious subject, are a necessary condition of possibility for a conscious subject, and probably also for the origin of the (human) subject in any way. We have seen that the body *schema* is the condition of possibility for intentional motor behavior. Now, the body image turns out to be essential for the constitution of a subject, not only in its highly important motor aspect, but also regarding emotions, feelings and even consciousness. The body image is as much a necessary condition of possibility for the constitution of a subject as the body schema is. Therefore, one might reject the label of intentional *object* attributed to the body in the case of body image. To label the body as an object presupposes the existence of a subject that is able to take its body as an object, while we have just seen that the body image is a preliminary condition for the coming about of the subject. Moreover, in the case of the body schema, the body is also taken as an 'object', namely a proprioceptive object at an unconscious level (cf. proprioceptive information). The initial characterization of the body image is not wrong, but is a late manifestation or possibility of a highly developed body image. It is only possible to contrast body image and body schema if the body image is taken lately in its development and the body schema at its origin. If the body image is approached from its deeper roots, then we see that the opposition is no longer entirely adequate.

Fourth, and by consequence, we have to reconsider the temporal order of the three modalities of the body image. If we look at the constitution of the body image, we seem to have an on-line representation of the body (cf. background- feelings), an off-line representation of the rather unchanging parts of the body (which Damasio calls body image or body schema) and representations of what happens with the body in relation to objects (emotions and feelings). The dynamic aspects of the body image are undeniably related to feelings and emotions, such that we can no longer say that the emotional modality develops later on. However, we have a difficulty here, because meanwhile the status of the body image has changed (cf. also *infra*). As long as the body was the object of an intentional attitude, a preceding perception was required. But now, the body image as preliminary has changed status from object to condition of possibility for the subject (and thus underlies the intentional subject). If we look at the roots, the body image is intrinsically related to feelings and emotions. If we oppose instead the body image to a subpersonal, unconscious body schema and treat the body as an object for the subject, the subject develops - at a later stage - an *emotional* attitude toward his or her own body.

Fifth, in its new status, the body image is as global and integrated in right hemisphere neural structures as the body schema, and it is only in the left hemisphere that we may find fragmented representations of the body.

Sixth, one might object that we merely have given another meaning to the term ‘body image’ and that, by consequence, nothing really changes. That is not entirely correct for two reasons. First, by extending the sources of the body image from proprioception to other modalities of internal sense, the concept of body image has changed inevitably. The limitation to proprioception was not justified. Second, the first characterization of the body image (cf. *supra*) starts from the perspective of *consciousness*, even if the body image need not be conscious. That is very clear when it is said that *body awareness* is the basis for *body image*. Conscious awareness is, however, nor necessary for the development of a body image, nor for the intentional attitudes, which may also be unconscious. If we *really* abandon the perspective of consciousness (instead of merely dropping the claim that the attitudes should be conscious), the status of the body image necessarily alters. Third, the fact that body awareness and body image are related, point to the deeper roots of the body image, and not only to a perceptual, conceptual or emotional *attitude* toward the body. That means that, in the first account, the body image is also something which is fundamental for unconscious and conscious body representations that necessarily precede intentional attitudes toward the body, such as an *external* perception of the own body, toward which an emotional attitude can afterwards develop.

The above is what changes when 1) we don’t limit the sources of the body image to proprioception, but extend it to interoception, 2) we don’t take consciousness as our (explicit or implicit) point of departure.

We end with one more remark. Husserl and Merleau-Ponty have shown that the body is double because it has a double touch sensation: of itself and of the object. By consequence, the touching hand can be touched by the other hand; in touch, the body can feel itself both as subject and as object. The body-as-subject can become a body-as-object; not at the same time, but alternating.

The distinction between body schema and body image and between proprioceptive information and proprioceptive awareness seems to reflect more or less that double status of the touching/touched body, as intentional subject and as intentional object. In a certain sense, touch and its characteristics seem to radiate on the proprioceptive sense. Indeed, proprioception also has a double status, which reminds us of touch. Proprioception is a sense that informs us both about the internal world and about the external world, in particular it can help us to differentiate between subjective and objective movement. It is a system almost on the edge of our body, at the place where body and world interact. Interoception does not have this double function: it informs us or our brains about what is going on deep inside our body. It is not related to an object the way proprioception is. Its relation with objects and events is mainly emotional. That deep emotional body cannot be taken as an intentional object in the same way the proprioceptive body is. Its relation to the body image is mainly as a source, and not as a possible

object. The in-depth body has no double status like the touching/touched and even the proprioceptive body does. To take the interoceptive, visceral dimension into account means that the body image is no longer only the result of an intentional attitude toward the own body, but instead helps to constitute the fact that we eventually can experience our body as our own.

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