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Internal perception: some facets of an open problem

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The term ‘internal perception’ typically indicates the experience humans have of what happens inside their bodies, i.e., their bodily states and changes. In the literature, these were mostly considered as parts of two main body monitoring systems, known as the interoceptive and proprioceptive systems. This paper explores the concept of internal perception and suggests that for the purposes of philosophical research, it can be considered as the product of a unified propriosensitive system that provides a constant, dynamic mapping of internal states and their changes. The study examines some positions contending that bodily signals do not constitute a proper form of perception and argues that, on the contrary, proprioceptivity is entirely analogous to exteroception in all significant aspects. This involves identifying criteria to establish under what conditions something can be defined as a form of perception and whether internal perception meets these criteria. The underlying idea of this essay is that internal perception plays a fundamental role in understanding human cognition, although it has traditionally been neglected by philosophy and – more generally – by cognitive research which have predominantly focused on exteroception, and particularly on vision, as

the privileged sensory modality for knowledge acquisition. Lastly, the paper calls for a more rigorous examination of the proprioceptive system, suggesting that internal perception represents a largely untapped field in philosophical inquiry, with potential to reshape our understanding of the epistemological role of the body in knowledge acquisition.

1. Introduction

The term *internal perception* typically indicates the experience humans have of what happens inside their bodies, i.e., of their bodily states and bodily changes. This experience is produced by several internal receptors which are part of two main systems known as the *interoceptive* and the *proprioceptive system*. The interoceptive system is responsible for detecting signals from the viscera, the internal organs, including the respiratory, circulatory, digestive, endocrine, and hormonal systems. The proprioceptive system is associated with the musculoskeletal apparatus and provides sensations related to body actions and movements (Dellantonio, Pastore 2017, pp. 63 ff). The proprioceptive system is often believed to encompass the vestibular system, which relies on receptors in the inner ear to provide information about body position and balance. Both the proprioceptive and vestibular systems work together to contribute to our sense of movement and body position and orientation.

However, some authors propose that we should view the vestibular system as a distinct third system, separated from the proprioceptive one (Ritchie, Carruthers 2015). Other authors suggest an even more specific taxonomy that includes two additional internal informational channels: touch and nociception (cf. e.g., de Vignemont 2020b, p. 5). Touch is commonly considered an external sensory modality that provides us with information about e.g., the shape and texture of objects. Yet, this can also be seen as an internal sensory modality because it carries information about the body, such as detecting pressure on specific spots of the skin. Nociception is generally considered part of the interoceptive system, although in some classifications, it is treated separately due to its specific function. This system is responsible for detecting noxious (i.e., harmful) stimuli, such as tissue damage, and is typically associated with the perception of pain. However, its relationship with pain is not straightforward, as there are forms of pain that are not mediated by nociceptors, and nociceptor activation may not always result in feeling pain.

In some other classifications, all these internal sensory channels are seen as interconnected parts of a unified, broader system. For example, Gibson (1961), [1966] 1983) and Bermúdez (1998) referred to it as *proprioception*, and more recently, Craig has described it as *interception* (e.g., Craig 2002, 2003, 2015). In the philosophical context, these systems are also referred to as *bodily senses* (Ritchie, Carruthers 2015) or as the *propriosensitive system* (Dellantonio, Pastore 2017; for a brief discussion of these taxonomies, see §2 of this article). Consequently, the output of these systems has been termed *bodily perception* and *propriosensitivity*.

Despite there being a general agreement that internal perception is a crucial channel for gathering information about our bodies and their states, its potential epistemological functions and role in other aspects of cognition have long been neglected. This can be attributed, among other factors, to the nature of classic cognitive sciences, which viewed the mind as an input-output system with a fixed functional architecture driven solely by external world information (cf. e.g., Pylyshyn 1980, Fodor 1983). Typically, this approach focuses on vision, where the input processed by the visual system is the information from the retina. However, the same retinal image can correspond to an infinite number of possible external surfaces. To accurately infer the correct description of the physical world, the system relies on rules (encoded as algorithms) to determine the objects that produced the retinal image (Gregory 1972; 2009; Marr, Poggio 1979). In this view, human knowledge is considered a product of the cognitive system, which operates through computations to appropriately represent aspects of the external world (for a critical overview, cf. Varela, Rosch, Thompson, 1992, 42-3).

However, the idea that is gradually taking shape more recently, especially with the rise of the embodied cognition, is that the body and the bodily information play significant roles in cognition, and this contribution deserves exploration from new perspectives (cf. e.g., Shapiro 2019). Embodied cognition has redirected cognitive research's focus towards the body and its involvement in cognitive processes. In particular, considerable attention has been placed on criticizing the traditional (syntactic and computational) concept of representation (the references for this are extensive, one of the classic works on this is Varela, Rosch, Thompson 1992). Additionally, research has explored the role of embodiment in conceptualization (cf. most notoriously Lakoff 1987, Johnson 1987, Lakoff, Johnson 1980, 1999), as well as extended, situated, and enactive cognition (cf. e.g., Shapiro, Spaulding 2021). To a lesser extent, attention has been given to notions like 'bodily self' and 'bodily (self-)awareness', which serve as foundations for investigating issues related to body ownership, body

schema, body image, body representation, and more (for an overview, see de Vignemont 2020a, b). Furthermore, studies have focused on the role that bodily feelings play as integral components of emotional experience. In fact, these reignited a debate dating back to the late 19th century, involving key figures like James (1884) and Lange (1885) which challenges the idea of classical cognitivism that emotions are primarily cognitions accompanied by general bodily activations (Schachter and Singer 1962; for a review, cf. Prinz 2004; Dellantonio, Pastore 2017, chap. 5; Pastore, Dellantonio 2021).

Despite the importance and potential impact of these studies, internal perception has been largely overlooked, especially in philosophical research. While psychological studies on interception (broadly understood to encompass all forms of internal perception) are continually increasing, the philosophical literature on this subject remains limited. This is surprising given the widespread appreciation of the embodied cognition program within the philosophical context, where the investigation of bodily senses should hold a central role. One of the reasons why internal perception continues to be overlooked might be the historical tendency for the study of bodily sensory channels to fall under the purview of medicine, physiology, and physiological psychology. Their approach to this matter may have contributed to corroborate the idea that internal perception is primarily if not uniquely a technical issue related to the maintenance of the organism's homeostasis, lacking broader philosophical relevance.

However, there are other specific reasons within philosophical research that have contributed to diverting attention from internal perception, particularly related to a classic view of the nature of the senses. Building on Grice's article from 1962, several studies have proposed that internal bodily perception *should not* be considered analogous to sight, hearing, touch, smell, and taste (Smith 2002). This experience consists solely of sensations that alert us to changes occurring inside our bodies, but they do not generate or contribute to perceptual knowledge in the proper sense of the term. Some suggest that bodily sensations lack an intentional object other than themselves and/or that they lack the constancy and specificity required for content-bearing experiences (for an overview, see Matthen 2015; de Vignemont 2020a).

In the following part of this study, I will try to show that the primary classical objections to the notion of bodily information as a genuine form of perception are unfounded. In the concluding section, I will explore how and why internal perception represents a largely unexplored yet profoundly intriguing territory for philosophical inquiry.

2. The recessive character of internal experience

The first systematic examination of internal perception and its role in perception was conducted by Charles Sherrington in the late 19th and early 20th centuries. Sherrington does not challenge the widely held view that the classic five senses – sight, hearing, smell, taste, and touch – offer a more varied and vivid form of experience compared to internal perception (Sherrington 1906). Nevertheless, he emphasizes that external information is not the sole source of knowledge accessible to living organisms. In fact, there are other types of receptors located deep within the body and along its surface, directed inwards. Sherrington argues that these receptors constitute a sensory field that should not be ignored when discussing the origin and nature of our perceptual knowledge. He proposes that the human body as a whole serves as a source of stimuli that can trigger specific sensations, directly or indirectly contributing to the complex knowledge we possess about the world and ourselves.

Sherrington employs the term “exteroception” to refer to the special senses. Regarding internal perception, he distinguishes between interoception and proprioception (Sherrington 1907, 469). He uses “interoception” to describe the experience derived from the internal organs, primarily the viscera, which produces sensations related to processes such as digestion and defecation. Moreover, he employs the term “proprioception” to refer to the experience derived from the musculoskeletal apparatus, generating sensations related to the organism’s actions and movements. According to Sherrington, the brain centrally integrates the complex array of stimuli captured by these receptors, resulting in an integrated (nowadays we would say multimodal) internal experience that individuals become aware of (Sherrington 1906; 1941). Among other aspects, this integration produces a coherent and unified representation of what Sherrington terms the “material me,” which encompasses a representation of the body integrating posture, environmental position, and affective tones connected to bodily states. This “material me” gives rise, in turn, to a minimal sense of identity.

Sherrington’s view is still widely shared. One significant development concerns the notion of interoception, which has been recently expanded to include signals not only from the viscera and digestive system but also from internal organs, the respiratory, circulatory, endocrine, and hormonal systems (Craig 2003; 2015). However, this extension of the concept has not challenged Sherrington’s perspective on the “material me.” Instead, recent studies have supported the idea that interoception is a fundamental component not only in shaping our bodily awareness and ownership but also

in establishing a minimal sense of identity based on them. For instance, Craig (2003) speaks of the “sentient self,” Damasio (1999) refers to the “proto-self” and the “embodied self” (Seth 2013), and Tsakiris reintroduces the original term “material me” (Tsakiris 2017; Tsakiris & de Preester 2018). These authors have also highlighted the role that interoception plays in relation to of emotional experience taken in a broad sense to include not only emotions, but also moods and background feelings, cf. e.g., Craig 2008; Damasio 1999).

As mentioned in the introduction, the literature presents various (more or less specific) classifications of these systems. However, while these classifications might be useful for studying the physiology of internal perception, they may not be relevant when investigating internal experience. Sherrington’s argument supports the idea that individuals do not perceive different types of internal sensations as something distinct and separate. Rather, they become aware of a complex set of sensations resulting from the integration of all the information acquired through internal perception. Therefore, if our focus is on exploring how people perceive (i.e., become aware of) their bodily states, we can consider internal perception as the product of a unified proprioceptive system that provides a constant, dynamic mapping of internal states and their changes (Dellantonio, Pastore 2017, 2§5).

The information on the state of our body forms a constant flow and is available to us only if we choose to focus on it. It becomes more prominent only when our internal sensations exceed a certain threshold; for example, when we feel hungry, thirsty, have bowel movements, or experience stomach pain. Most of the time, our attention is directed towards perceiving the external world, leading us to overlook the experience coming from our bodies. As a result, internal perception remains largely in the background of our conscious experience (Dellantonio, Pastore 2017, chap. 2§3ff). The information that stays mostly beneath the threshold of consciousness includes not only the physiological condition of our bodies but also the positioning of our limbs and the balance of our body. This information remains in the background of our attention, despite being essential for our movements and awareness of our physical well-being, as well as the recognition that *it is us* moving, standing, or interacting with the external world (Evans 1982, 202ff). As e.g., De Vignemont (2020b, 1) points out: “Yet, despite numerous sources of information, the phenomenology of bodily awareness is limited. In painful and learning situations, our body appears at the core of our interest, but when we walk in the street, we are rarely aware of the precise position of our legs and of the contact of the floor on our feet. [...] Our conscious field is primarily occupied by our environment, instead of the bodily medium that allows us to perceive it and to move through it.” This ‘recessive character’ of internal

experience is one of the reasons why the function of bodily senses was often considered as limited and as consisting ‘only’ in the monitoring of the internal states to allow the organism’s survival.

However, despite this apparent difference, internal sensory modalities do not function differently from exteroceptive ones; in fact, they appear to be governed by entirely analogous principles. Both proprioceptivity and exteroception are influenced by the interplay of stimulus intensity, modification, and attention.

An example that clarifies this aspect is the sense of smell. Olfactory stimuli need to reach a sufficient intensity for our sensory receptors to detect them. If they do not exceed a certain threshold, we are unable to perceive them. However, intensity alone does not entirely account for olfaction. Olfaction often remains in the background of our awareness until there is a significant change in smell. Some researchers propose that the primary function of conscious olfaction is to detect changes, freeing up cognitive resources. This explains also sensory adaptation, where we stop perceiving stimuli when they remain constant. Nevertheless, if there is even a subtle change in the background scent, our conscious attention is immediately engaged (Köster et al., 2014).

Another factor that can influence olfactory perception, particularly in making the olfactory stimulus conscious, is attention. Numerous studies have shown that attention can be directed towards olfaction, similar to how it is directed towards other sensory modalities. These studies indicate that focusing attention on odors leads to a decrease in response time to odors (Spence et al., 2000, 2001). Furthermore, when exposed to a mixture of odors, attention can be directed to a specific quality of them. More generally, attention allows us to discriminate the complex features of the odor mixture (Keller 2011). One might argue that olfaction is more similar to internal sensory modalities than to exteroception. However, as explained, for instance, by Keller (2011), there are more similarities than differences between vision and olfaction.

All sensory receptors continuously register a flow of information, thus perceptual monitoring – whether external or internal – is always active in the background. However, awareness of this information only arises when it becomes relevant; in the case of proprioceptivity, this occurs when bodily states undergo a change and/or when the signal intensifies, surpassing a certain threshold (e.g., when pain or hunger shifts from latent to acute). Similar to olfaction, it is plausible to assume that this serves the function of freeing up cognitive resources when bodily states do not demand our immediate attention. Just as in exteroception, attention also plays a prominent

role in bodily awareness (Hochstetter 2016). Attention is a crucial element in making the output of perceptual monitoring consciously available to us. When attention is directed towards our proprioceptive states, we are able to perceive, discriminate, and discern even highly complex features of them. Attention not only helps us differentiate between states but also allows us to analyze them in their nuances and even regulate them by exercising some form of top-down control (Joshi et al., 2021).

We are not often aware of our body, just as we are not often aware of the smells around us. Both things are surprising given the significant roles they play in our daily lives (Smith 2015, 342; De Vignemont 2020b, 1). This might be attributed to the absolute primacy of vision (in sighted individuals) over other sensory modalities when it comes to navigating and interacting with the environment. However, this primacy does not imply that they are different monitoring systems or that they lead to distinct outcomes. This ‘recessive character’ of proprioception is not unique to internal sensory modalities, and it does not fundamentally differentiate them from exteroception. Thus, in terms of accessing consciousness, proprioceptive information is entirely comparable to exteroception.

3. Proprioception and perception

Determining whether proprioceptive information is indeed a form of perception analogous to exteroception is not a straightforward task. To address this question, we can turn to the criteria proposed by Matthen (2015) in a broader discussion about what qualifies as a sensory modality. This inquiry aims to ascertain, among other things, whether the bodily senses are comparable to exteroceptive ones.

Matthen (2015, p. 268) states that “Minimally, a sense is a faculty that monitors the current state of its external and bodily environments in order to mediate an organism’s response to these environments.” However, he also argues that “this is not a sufficient characterization, for it includes too much.” Matthen uses a specific example to illustrate why certain forms of environment monitoring cannot be considered as a form of perception. He focuses on a particular type of internal receptors, the chemoreceptors responsible for monitoring the CO₂-level in the blood. These receptors play a vital role in regulating breathing and maintaining the body’s homeostasis. However, they do not give rise to a form of perception because we do not directly experience the information they convey. Instead, this information is automatically used to regulate and adjust our breathing rate. While we might

become aware of our increased breathing and infer that our CO₂-level level is high, this knowledge is the result of an inference rather than a direct perception. In other words, we can deduce our elevated CO₂-level from the fact that we are breathing harder, but we have no direct access to this information (Matthen 2015, 568). Although Matthen's illustration of this issue minimally mentions *consciousness* (the word is used only once at the end of his explanation), this is precisely the crux of the matter. We can regard something as a perceptual experience only when it is directly provided by a sensory modality (i.e., not derived from inference based on prior knowledge) and when it gives rise to a *conscious, content-bearing experience* that enables us to respond to the environment with a non-automatic reaction.

This discussion highlights that some bodily receptors do not give rise to a form of perception. However, it also serves as a starting point to argue that it is legitimate to speak of internal perception, as certain experiences generated by bodily receptors are conscious and content-bearing.

Propriosensitive experience is conscious. In the preceding section, we have already established that proprio-sensitivity is not simply recessive; rather, it shares the same characteristics as any other form of perception: it becomes conscious when the signal exceeds a certain threshold and/or when we pay attention to it. Furthermore, in contrast to the example of monitoring the CO₂-level in the blood provided earlier, several sensations corresponding to internal states of the body, such as hunger, thirst, and pain, are indeed conscious experiences. We directly experience these sensations without the need for inference.

Propriosensitive experience is content-bearing. The fact that an experience is content-bearing can encompass various meanings. For example, it can indicate that it enables us to discriminate between different experiences or to group similar ones. We will discuss these aspects later. For now, it is essential to recognize that proprio-sensitive experiences are informative, as they provide us with insight into the specific states of our body, allowing us to use this information to react appropriately.

Furthermore, Matthen (2015, 567-571) proposes two additional criteria to ascertain whether the output of a monitoring system genuinely qualifies as a form of perception. The first criterion stipulates that *perception imposes itself on us, even though we can question it* (e.g., the Müller-Lyer illusion arrows appear to be of different lengths, but we can rationally recognize that this perception is incorrect). The second criterion asserts that *we can use perception as information*, making it the subject of learning or rational reflection on how to appropriately respond to the environment.

Perception imposes on us, even though we can ‘withhold assent’ from it. This information imposes on us: we cannot avoid to experience a proprioceptive state of thirst or of hunger that become aware to us (because it exceeds a threshold and/or because we start paying attention to it e.g., after a period of habituation). However, we can ‘withhold assent’ from this information in the sense that we can reason on it and conclude that we are not really hungry or thirsty at least in the sense that these sensations do not correspond with a real condition of the body because we had enough calories or hydration. Moreover, our reaction to this proprioceptive information does not have to be mandatory and automatic as in the case of the accelerated breathing when our CO₂-level is high. Instead, we can use this information to learn more about our body and its interaction with the environment or to engage in rational reflection to determine the most appropriate reaction in a given situation.

Other proprioceptive states such as pain, for example, prove to be more difficult to define, but they are not radically different in the way they present themselves. Many people suffer from pains that — at least on the surface — do not have an organic origin such as tissue damage. However, it is difficult to determine whether these are phenomena similar to illusions or even hallucinations or if there is a real organic cause that we are simply unable to identify. A more unequivocal case in this direction is that of individuals with an amputated limb who experience pain localized in that limb. In these cases, the person feels pain (and cannot help but feel it) even though they know it is not possible. In this sense, their perception of pain imposes itself on them, although they know that such pain cannot exist. This example is subject to two complications.

The first and more controversial regards the fact that pain does not seem to allow for an appearance/reality gap. That is, if one “feels” pain, then s/he “is” in pain. However, the case of optical illusions and even more so that of sensory hallucinations is not so different. Vision is the sense designated for perceiving visual stimuli. Sometimes our visual system processes information in ways that can lead to incorrect interpretations, creating illusions; in rarer and more complex cases, one might even fall victim to visual hallucinations, where a person sees something that doesn’t actually exist in the external world. In both these circumstances, the person sees things differently from how they are, or even sees things that aren’t there. The person who sees something differently from how it is, or sees something that isn’t there, cannot help but see what s/he sees. Reality testing depends on rational reflection that imposes itself on perception, without altering it (e.g., in the case of optical illusion); in the case of hallucinations, reality is imposed by

the presence of external viewpoints that deny the existence of what the person sees. Similarly, interoception (specifically nociception) is the sensory modality through which we detect noxious stimuli. It is plausible that sometimes this system can process information in ways that can lead to incorrect interpretations, creating illusions or even hallucinations. In these cases, it is conceivable that a person might experience pain even though the system has not detected any harmful stimuli. The case of vision (and more generally, exteroception) differs from that of proprioceptivity primarily because it seems more intuitive to distinguish between external and internal viewpoints. This reflection is not decisive considering that in the literature it is a subject of debate whether pain illusions or hallucinations are possible (and which cases can be considered examples of one and the other). The case of phantom limb pain seems to suggest that they are, at least in some particular cases; in fact, sensory illusions or hallucinations of other types are also encountered only under exceptional circumstances.¹

A second complication inherent in the proposed example concerns the fact that in the case of proprioceptive sensations, localization (as we will consider in the following section) is a fundamental characteristic for operating their recognition. Not only can pain be felt in a limb that no longer exists, but the pain can also be referred, that is, it can be perceived as located in a position of the body different from where it should actually be located and where, for example, the tissue damage occurs (cf. e.g., de Vignemont 2020b, pp.6-7). Referred pain in a part of the body different from where the noxious stimulus is present is problematic because it endangers the fact that proprioceptive experiences are informative and provide us with insight into the specific states of our body. However, referred pain does not have a random or variable location. Its location is stable and meaningful (consider the case of arm pain when having a heart attack) and this stability can be used to recognize which part is really involved. An analogy can be made with color blindness and the ability of those who suffer from it to distinguish colors and use correct linguistic labels by leveraging the shades of grey they can distinguish. As in the case of referred pain, in the case of color blindness the shades of grey are not random, but each reliably corresponds to what a person with normal vision perceives as a color or as a shade of color (Bonnardel 2006). For this reason, both the real color and the real location of the noxious stimulus can be correctly inferred.

¹ For a favorable position, see, for example, Reuter, Phillips, Sytsma 2014. For a skeptical position, see Radden 2021. According to Radden (2021, p. 154), what is certainly possible is to imagine pain, that is, to envision a possible painful experience, such as catching a flying knife.

Based on these criteria, proprioceptivity must be recognized as a form of perception. However, some authors argue that it cannot be equated with exteroception for other reasons. One such argument suggests that perception can only occur when sensory information is linked to a distal object in the external world (Grice 1962; McGinn 1996; Smith 2002). At first glance, this view seems to exclude internal sensations from being considered perceptual experiences by definition. However, the idea that perception needs to be related to a distal object is typically justified, in turn, on the basis of further requirements. To approach the issue from a more theoretically meaningful perspective rather than simply excluding internal states from perception by stipulation, it is worthwhile to consider whether these additional requirements apply to proprioceptivity.

Classically, a distinction is made between perception and sensation. Perception is considered to be “a complex, meaningful experience of an external event or object, created from a combination of many different sensations,” while sensations are viewed as “elementary experiences evoked by stimulation of a sense organ, such as brightness, loudness, or saltiness” (Mather 2011, 18). Sensations are not, in themselves, a form of perception; they are the unstructured components of perception and lack information because they directly depend on sensory stimulation, making them fleeting and unstable. Their informational contribution becomes relevant only within the structure of a perceptual experience. Authors who argue that proprioceptivity cannot be a form of perception usually suggest that it gives rise to sensations rather than perceptions in the proper sense of the word. To assess this point, we need to establish some characteristics that univocally belong to perception and distinguish it from mere sensations. Among these characteristics, we can certainly mention (a) perceptual constancy and (b) specificity, as well as (c) the possibility to identify and re-identify the “object” of the perception.

(a) In the case of exteroception, perceptual constancy describes the phenomenon wherein people perceive external objects as unchanging, despite observing them in different conditions and from various angles or distances which should make them appear different in sizes, shapes, brightness levels, etc. (Cohen 2015).

(b) Moreover, perceptual specificity indicates that through perception we can discriminate in a non-conceptual manner specific qualitative differences among entities. As e.g., Kelley (1980, 402) points out: “Perception [...] is specific: we perceive the specific shade of red; we form the concept of red precisely by abstracting from the perceived differences between different shades of red. Thus, concepts are abstract, but perception is not [...]. The

perception of a red chair, for example, is the awareness of a specific entity, including the awareness of its specific color; that awareness is different from the awareness we would have in looking at a different chair, with a different shade of red. [...] To put it another way, perception is the discrimination of entities from other entities, and this involves the discrimination of the specific qualitative differences between them. But in using concepts, we abstract from these differences, focusing instead on what the entities have in common.”

(c) The third requirement can be traced back e.g., to Shoemaker’s “object perception model” (1994, 253): “Sense perception affords ‘identification information’ about the object of perception. When one perceives one is able to pick out one object from others, distinguishing it from the others by information, provided by the perception, about both its relational and its nonrelational properties. The provision of such information is involved in the ‘tracking’ of the object over time, and its reidentification from one time to another.” The characteristics described by Shoemaker show some similarity to the previous ones. However, they actually point to the opposite aspect: by using sense perception we can identify and recognize objects in time. This means that we can identify and recognize occurrences (tokens) and types of objects and thus also – reversing Kelley’s (1980) considerations – abstract away from the differences in our perceptual episodes and focus instead on what the entities have in common to classify them.

If a form of perception can be linked to or depends on a distal object, the constancy, specificity and identity of the object will ensure/anchor the constancy and specificity of the perception as well as the possibility to identify and recognize the object. To determine whether proprioception can be considered as a form of perception comparable with exteroception, we need to establish whether proprioceptive information possesses the characteristics described in (a), (b), and (c) *even though it cannot be linked to a distal object*.

4. Constancy, specificity and (re)identification of internal sensations

Consider exteroception, using vision as an example. When we see, for instance, a red ball, the object of our perception is the ball, i.e., the subjective cognitive reconstruction of the three-dimensional distal object that we are experiencing. Nevertheless, we also have a number of sensations that depend on the stimulation of the retina and are subject to continuous changes due to movement, changes in light, increased/decreased distance to the ball, etc. To see (i.e., to perceive) the ball, these sensations must be integrated to achieve

perceptual constancy; otherwise, the world would appear as a kaleidoscopic flux of impressions without any organization (to paraphrase Lee Whorf, 1956, 213). Additionally, our perceptual experience must possess sufficient specificity to enable us to perceive differences among objects, such as variations in shades of red, thus allowing us to identify and recognize distinct objects and distinguish between instances of the same category or occurrences of the same objects at different moments. In other words, both constancy and specificity are crucial components of our perceptual experience; they are both needed for the identification and recognition (or re-identification) of the ‘object’ of perception. The ability to identify and recognize (re-identify) objects, in turn, represents a necessary (though not sufficient) condition for acquiring language and its specific classifications, as it presupposes the capability to identify the shared characteristics of objects denoted by the same word.

Constancy. The internal experience is not a mere collection of sporadic sensations with varying locations, intensities, and qualities, akin to random notes played on a keyboard. Propriosensitive information proves to be reliable; generally, we can accurately recognize whether we have already experienced a certain state in the past, as well as the differences between present and past states. Even in medicine, the patients’ experience is an essential element for the initial step of a diagnosis. This implies that our experience reliably covaries with certain stimuli and does not manifest as an indistinct stream of sensations. We are capable of identifying distinct occurrences, representing cohesive units of experience, and differentiating between instances of the same and different experiences. Regardless of the constant variation in the informational flow detected by receptors, our experience exhibits a phenomenological stability akin to the perceptual constancy observed in exteroception. Hence, revisiting the classic distinction between sensations and perceptions discussed earlier, proprioceptive information does not assume the form of mere sensations but rather takes the shape of perceptions, i.e., of complex experiences indicative of a state and formed through the amalgamation of various sensations.

Specificity. The experience of our internal states appears to be highly specific. When we direct our attention to it, we can discern subtle qualitative distinctions that are often challenging to articulate verbally as if our perceptual ability to discriminate among nuances is far more refined than linguistic classifications can express. Despite this difficulty in verbal expression, these subtle differences are not experienced as confusing or elusive. On the contrary, we can often feel and identify them quite distinctly. From this standpoint, proprioceptivity does not appear to differ significantly

from exteroception. Both forms of perception seem to share this capacity for discerning specific and subtle nuances in our experiences, even though the ability to put them into words may be limited.

This reflection on perceptual constancy and stability needs to be complemented with a consideration on the subjective nature of proprioceptive information. As it is often said, proprioceptive information is indeed subjective. Subjective, however, does not mean arbitrary but rather accessible only to the person experiencing it. While a distal object - e.g., a red ball – is intersubjectively observable, an internal state such as hunger or pain can only be experienced in the first person. The possibility of intersubjective observation is classically an element of differentiation between exteroception and proprioception, and it also allows classifying the various external senses as more or less reliable in detecting intersubjectively controllable properties. This discussion includes the distinction between primary and secondary qualities and many others that have made vision play such a central role in the discussion on observation in philosophy of science and in the acquisition of knowledge within cognitive research.²

Beyond undeniable differences among sensory modalities concerning this aspect, caution should be exercised not to exaggerate their importance. The subjectivity of proprioceptive information is accompanied by a certain interindividual variability. Individual differences – e.g., in sensitivity and accuracy – in the awareness of our proprioceptive states are well-known and they represent a prominent issue in the psychological research on interoception, which seeks to understand how they affect other aspects of our mental life (Murphy et al., 2019; Garfinkel et al., 2015). However, interindividual differences are not a peculiarity of the proprioceptive system. Revisiting a previously discussed example, even color perception has highlighted significant differences in how individuals see colors such as red or green. Nevertheless, these differences are not arbitrary: they are stable and typically remain within a certain range of variability. The same stimulus produces the same perceptual experience, and this stability provides a reliable basis for its recognition and classification. This also applies to cases such as color vision deficiency and color blindness: of associating specific shades of gray with what other people identify as red or green.

Additionally, the fact that variability is not total but (at least in cases of normal vision) lies within a certain range still allows for classifying

² The primacy of vision takes on many forms. In cognitive studies, it is primarily expressed in the tendency to consider vision as the privileged sense for language and knowledge acquisition (cf. e.g., Dellantonio, Job 2017). In epistemological or philosophy of science, the primacy of vision takes shape in the idea that intersubjective/objective observation must rely on properties mediated by sight (and touch). The Dictionary of Media and Communication, published by Oxford University Press, has even included the entry “ocularcentrism” (2023), which describes “A perceptual and epistemological bias ranking vision over other senses in Western cultures.”

different instances of green as green or distinguishing different shades of green. The case of proprioceptive experience is entirely analogous. Saying that there are individual differences in how we perceive hunger or pain, for example, does not imply that these experiences are arbitrary: they still allow us to recognize the corresponding states, and their partially variable quality still presents similarities such that we can all talk about hunger, thirst, pain, etc. as shared experiences.

Identify and re-identify an “object”. To learn a language, it is necessary (though not sufficient) to be able to identify and recognize what the words refer to, and thus be able to classify phenomena according to occurrences (individuals) and types (classes). People learn to associate specific proprioceptive information with corresponding words such as, for example, ‘hunger’, ‘thirst’, ‘stomach ache’, ‘headache’, ‘cramp’, ‘warmth’, ‘fatigue’, ‘nausea’, and ‘dizziness’. This is already evidence that proprioceptive information is constituted in ‘objects’, or more precisely, in states that can be identified and recognized (re-identified). In a previous study (Dellantonio, Pastore 2017, 211ff), we discussed relevant criteria for identifying and classifying our internal experience. We proposed four features that our cognitive system might use to process and recognize internal states. i) First, internal states are characterized by specific qualitative feelings: think for example of headache or hunger, which are qualitatively distinct from each other and each of them is characterized by a specific phenomenology. ii) Second, internal states have a specific intensity; we might use intensity to identify different tokens of the same state – e.g., different occurrences of a headache – or to distinguish among states that are denoted by different words, e.g., appetite, hunger and starvation. iii) Third, internal states are distinguished by a specific localization of the sensation in the body. For example, thirst only as localized in the mouth and throat and depending on the specific thirst that we might experience in a certain moment, it may be localized more in the mouth than in the throat or the other way around. iv) Lastly, the proprioceptive system detects various bodily changes occurring simultaneously; each proprioceptive state co-occurs with others and the *presence/absence of concomitant sensations* contribute to make it more specific and thus to identify it. For example, the thirst we feel after a long run is identified by specific simultaneous sensations related to the muscles or the skin, and it lacks other simultaneous sensations (e.g., in the stomach) that may occur in other types of thirst (e.g., like the one experienced after a hearty and overly salty meal). These four features – specific quality, specific intensity, bodily localization, and presence/absence of concomitant sensations – could be the basis for how we process and identify our internal states.

If these similarities between exteroception and proprioceptive information are well-founded, then it makes complete sense to call the latter internal perception and consider it, in all respects, as a form of perception. However, if this is the case, all the epistemological questions that have always engaged epistemology must be extended to include this new territory.

5. Final remarks: Internal perception as an open field for the philosophical inquiry

A not insignificant number of philosophers have embraced the perspective of embodied cognition and have, in some cases, used evidence from psychological and neuroscientific research to argue that embodiment plays a role in specific aspects of cognition. Yet, relatively few philosophical studies focus on bodily perception: little attention has been dedicated to investigating internal perception in analogy to external perception as a source of information that contributes to shaping ourselves, our emotions and our knowledge of the world.

The nature of perception and perceptual experiences, as well as the relationships and boundaries between perception and cognition, are classic themes in philosophy. In recent times, they have been developed along different branches, becoming relevant common junctions of philosophical and psychological research. However, within this discussion, issues such as the relationship between conceptual and non-conceptual content of internal perception; the role of proprioceptivity within an authentically multimodal conception of perception; the permeability vs. impermeability of proprioceptive information; the possibilities of error in perceptual experience to include perceptual illusions and hallucinations in proprioceptivity; the transparency of internal perception; the conscious and unconscious aspects of proprioceptivity and more generally the several ways in which internal perception might contribute to develop knowledge on ourselves but also on the external world are still largely open.

Internal perception is a particularly challenging phenomenon. Even the possibility of empirical observation is limited to only a few aspects and often relies solely on self-report questionnaires. Although these questionnaires undergo validation and careful selection of relevant items, they inevitably reintroduce the quandary of introspective methods' reliability and the inherent circular relationship between the operational construct being studied and its measurement (cf. Dellantonio, Pastore, in press).

This is precisely why the contribution of theory and philosophical analysis is crucial, as they can serve as guides for observation and offer clarity on specific aspects of internal perception, also by analyzing the analogy between proprioceptivity and external perception. This inquiry remains relatively underexplored, making internal perception a captivating subject in philosophical discussions.

References

- Bermúdez, J. L., 1998, *The Paradox of Self-Consciousness*, Cambridge (MA), MIT Press.
- Bonnardel, V., 2006, «Color naming and categorization in inherited color vision deficiencies», *Visual Neuroscience*, 23, 3-4, pp. 637–643.
- Cohen, J., 2015, «Perceptual Constancy», in Matthen, M. (ed.), *The Oxford Handbook of Philosophy of Perception*, Oxford, Oxford University Press, pp. 621–639.
- Craig, A.D., 2002, «How do you feel? Interoception: The sense of the physiological condition of the body», *Nature Reviews Neuroscience*, 3, 8, pp. 655–666.
- Craig, A.D., 2003, «Interoception: The sense of the physiological condition of the body», *Current Opinion in Neurobiology*, 13(4), pp. 500–505.
- Craig, A.D., 2008, «Interoception and emotion: A neuroanatomical perspective», in Lewis, M., Haviland-Jones, J.M., Barrett, L.F., (eds.), *Handbook of emotions*, New York, Guilford Publications, pp. 272–288.
- Craig, A.D., 2015, *How Do you Feel? An Interoceptive Moment with your Neurobiological Self*, Princeton, Princeton University Press.
- Damasio, A., 1999, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*, London, William Heinemann.
- de Vignemont, F., 2020a, «Bodily Awareness», in Zalta, E.N. (ed.), *Stanford Encyclopedia of Philosophy*.
<https://plato.stanford.edu/archives/fall2020/entries/bodily-awareness/>
- de Vignemont, F., 2020b, *Mind the Body: An Exploration of Bodily Self-Awareness*, Oxford, Oxford University Press.
- Dellantonio, S., Job, R., 2017, «La concretezza del corpo. Una revisione della concezione classica di astratto e concreto», *Sistemi Intelligenti. Rivista Quadrimestrale di Scienze Cognitive e di Intelligenza Artificiale*, 1, pp. 9–32.
- Dellantonio, S., Pastore, L., 2017, *Internal Perception: The Role of Bodily Information in Concepts and Word Mastery*, Berlin, Springer.

- Dellantonio, S., Pastore, L., in press, «Constructs and operational definitions in psychology. When assessment misrepresents the phenomenon: ‘alexithymia’ as a case study», in Ippoliti, E., Magnani, L., Arfini, S. (eds.), *Model-Based Reasoning, Abductive Cognition, Creativity: Inferences & Models in Science*. Cham, Springer.
- Evans, G., 1982, *The Varieties of Reference*, Oxford, Oxford University Press.
- Fodor, J.A., 1983, *The Modularity of Mind: An Essay in Faculty Psychology*, Cambridge (MA), MIT Press.
- Garfinkel, S.N., Seth, A.K., Barrett, A.B., Suzuki, K., Critchley, H.D., 2015, «Knowing your own heart: Distinguishing interoceptive accuracy from interoceptive awareness», *Biological Psychology*, 104, pp. 65–74.
- Gibson, J.J., 1961, «Outline of a new attempt to classify the senses and the sensory input», in Pittenger, J., Reed, E.S., Kim M., Best, L. (eds.), *James Gibson’s purple perils. A selection of James J. Gibson’s unpublished essays on the psychology of perception*. <https://commons.trincoll.edu/purpleperils/>
- Gibson, J.J., [1966] 1983, *The Senses Considered as Perceptual Systems*. Westport, Greenwood Press.
- Gregory, R. L., 1972, «Seeing as thinking: An active theory of perception», *London Times Literary Supplement*, 23 June, pp. 707-8.
- Gregory, R. L., 2009, *Seeing Through Illusions*, Oxford, Oxford University Press.
- Grice, P., 1962, «Some remarks about the senses», in Butler, R.J., (ed.). *Analytical Philosophy*, Oxford, Oxford University Press.
- Hochstetter, G., 2016, «Attention in bodily awareness», *Synthese*, 193, 12, pp. 3819–3842.
- James, W., 1884, «What is an emotion? », *Mind*, 9, 34, pp. 188–205.
- Johnson, M., 1987, *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason*. Chicago, Chicago University Press.
- Joshi, V., Graziani, P., Del-Monte, J., 2021, «The Role of Interoceptive Attention and Appraisal», *Frontiers in Psychology*, 12: 714641.
- Keller, A., 2011, «Attention and Olfactory Consciousness», *Frontiers in Psychology*, 2, 10.3389/fpsyg.2011.00380.
- Kelley, D. (1980). «The Specificity of Perception», *Philosophy and Phenomenological Research*, 40, 3, pp. 401–405.
- Köster, E., Møller, P., Mojet, J., 2014, «A ‘misfit’ theory of spontaneous conscious odor perception (MITSCOP): reflections on the role and function of odor memory in everyday life», *Frontiers in Psychology*, 5, 64.
- Lakoff, G., Johnson, M., 1980, *Metaphors we Live by*, Chicago, Chicago University Press.

- Lakoff, G., Johnson, M., 1999, *Philosophy in the Flesh: The Embodied Mind and its Challenge to Western Thought*, New York, Basic Books.
- Lakoff, G., 1987, *Women, Fire, and Dangerous Things*, Chicago, University of Chicago Press.
- Lange, C.G., [1885] 1912, «The mechanism of the emotion», in Rand, B., (ed.), *The Classical Psychologists*, Boston, Houghton Mifflin, pp. 672–684.
- Lee Whorf, B., 1956, *Language, Thought and Reality*, London, New York, MIT Press.
- Marr, D., Poggio, T., 1979, «A Computational Theory of Human Stereo Vision», *Proceedings of the Royal Society of London. Series B, Biological Sciences*, 204, 1156, pp. 301–328.
- Mather, G., 2011, *Essentials of Sensation and Perception*: London, Routledge.
- Matthen, M., 2015, «The Individuation of the Senses», in, Matthen, M., (ed.), *The Oxford Handbook of Philosophy of Perception*, Oxford, Oxford University Press, pp. 567–586.
- McGinn, C., 1996, *The Character of Mind: An Introduction to the Philosophy of Mind*, Oxford, Oxford University Press.
- Murphy, J., Catmur, C., Bird, G., 2019, «Classifying individual differences in interoception: Implications for the measurement of interoceptive awareness», *Psychonomic Bulletin & Review*, 26, 5, pp. 1467–1471.
- ocularcentrism. Oxford Reference. Retrieved 29 Jul. 2023, from <https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100245338>.
- Pastore, L., Dellantonio, S., 2021, «Anger issues: The nature and complexity of emotions and emotional valence», in Giacomoni, P., Valentini, N., Dellantonio, S., (eds.), *The Dark Side: Philosophical Reflections on the “Negative Emotions”*, Springer Verlag, pp. 233–260.
- Prinz, J.J., 2004, *Gut Reactions. A Perceptual Theory of Emotions*, Cambridge (MA), MIT Press.
- Pylyshyn, Z.W., 1980, «Computation and cognition: Issues in the foundations of cognitive science », *Behavioral and Brain Sciences*, 3, pp 111–32.
- Radden, J., 2021, «Imagined and delusional pain», *Rivista internazionale di filosofia e psicologia*, 12, 2, pp. 151–166.
- Reuter, K., Phillips, D., Sytsma, J., 2014, «Hallucinating pain», in Sytsma, J., (ed.), *Advances in Experimental Philosophy of Mind*, London, Bloomsbury, pp. 75–99.
- Ritchie, J.B., Carruthers, P., 2015, «The bodily senses», in Matthen, M., (ed.), *The Oxford Handbook of philosophy of perception*, Oxford, Oxford University Press, pp. 353–370.

- Schachter, S., Singer, J., 1962, «Cognitive, social and physiological determinants of emotional state», *Psychological Review*, 69, 5, pp. 379–399.
- Shapiro, L., 2019, *Embodied Cognition*, London, Routledge.
- Shapiro, L., Spaulding, S., 2021, «Embodied cognition», in: Zalta, E.N., *The Stanford Encyclopedia of Philosophy* (Winter 2021 Edition), URL = <<https://plato.stanford.edu/archives/win2021/entries/embodied-cognition/>>.
- Sherrington, C.S., 1906, *The Integrative Action of Nervous System*, Yale, Yale University Press.
- Sherrington, C.S., 1907, «On the proprioceptive system, especially in its reflex aspects», *Brain*, 29, 4, pp. 467–485.
- Sherrington, C.S., 1941, *Man on his Nature*, Macmillan.
- Shoemaker, S., 1994, «Self-knowledge and ‘inner sense’: Lecture I: The object perception model», *Philosophy and Phenomenological Research*, 54, 2, pp. 249–269.
- Smith, A.D., 2002, *The Problem of Perception*. Cambridge (MA), Harvard University Press.
- Smith, B.C., 2015, «The chemical senses», in Matthen, M. (ed.), *The Oxford Handbook of Philosophy of Perception*. Oxford, Oxford University Press, pp. 314–353.
- Spence, C., Kettenmann, B., Kopal, G., Mcglone, F.P., 2000, «Selective attention to the chemosensory modality», *Perception & Psychophysics*, 62, pp. 1265–1271.
- Spence, C., Mcglone, F., Kettenmann, B., Kopal, G., 2001, «Attention to olfaction – a psychophysical investigation», *Experimental Brain Research*, 138, pp. 432–437.
- Tsakiris, M., de Preester, H., 2018, *The Interoceptive Mind: From Homeostasis to Awareness*, Oxford, Oxford University Press.
- Tsakiris, M., 2017, «The material me: Unifying the exteroceptive and interoceptive sides of the bodily self», in: de Vignemont, F., Alsmith, A.J.T., (eds.), *The Subject’s Matter: Self-Consciousness and the Body*, Cambridge (MA), MIT Press, pp. 335–362.
- Varela, F.J., Rosch; E., Thompson, E., 1992, *The Embodied Mind. Cognitive Science and Human Experience*, Cambridge (MA), MIT Press.

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