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SYMPOSIUM

Phenomenology and interoception: Comment on Leder

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Abstract Interoception is an important contributor to our everyday phenomenology. Two thought experiments can tell us something about the role it plays in our experience. The first is Avicenna's "flying man" thought experiment which involves the idea of sensory deprivation, but shows how difficult it is to eliminate interoception. The central question is whether one would still have self-awareness if, along with all of the external senses one could eliminate interoception. I argue that this type of thought experiment necessarily leads to an abstraction that fails to take into account the rich context of bodily and environmental factors. A second, more recent thought experiment, the brain-in-the-vat argument, on one interpretation, fails to take into consideration the constraints imposed by the biological body with respect to hormonal, neurotransmitter chemistry, as well as anatomically based pre-neural processing of sensory input and post-neural processing of motor output, as well as interoceptive and affective/emotional processes. As Leder points out, most interoceptive processes happen without our awareness, although they shape our experience and if they were altered or missing our experience would be different, which is what he calls the "projective" feature of interoception. I conclude by suggesting that, as part of the rich context of everyday phenomenology, the projective feature can involve intersubjective processes.
KEYWORDS: Interoception; Sensory Deprivation; The Flying Man; The Brain in the Vat; Avicenna

Riassunto *Fenomenologia e interocezione: commento a Leder* – L'interocezione è una componente importante della nostra fenomenologia quotidiana. Due esperimenti mentali possono dirci qualcosa sul ruolo che essa svolge nella nostra esperienza. Il primo è quello dell'*uomo volante* di Avicenna, che implica l'idea della privazione sensoriale, ma mostra quanto sia difficile eliminare l'interocezione. La questione nodale qui è la possibilità di avere ancora autocoscienza se, assieme a tutti i sensi esterni, venisse eliminata anche l'interocezione. Mostrerò che questo tipo di esperimento mentale porta necessariamente a un'astrazione che non tiene conto di un ampio contesto di fattori corporei e ambientali. Un secondo e più recente esperimento mentale è l'argomento del cervello nella vasca, che, in una delle sue interpretazioni, manca di considerare i vincoli imposti dal corpo biologico alla chimica degli ormoni e dei neurotrasmettitori; quelli imposti dall'anatomia al processamento pre-neurale dell'input sesoriale e a quello post-neurale dell'output motorio; quelli imposti dai processi interocettivi e affettivo/emotivi. Come sottolinea Leder, la maggior parte dei processi interocettivi ha luogo senza la nostra consapevolezza, anche se modellano la nostra esperienza e, se fossero alterati o mancassero, la nostra esperienza sarebbe diversa, che è ciò che lui definisce caratteristica "proiettiva" dell'interocezione. Concluderò suggerendo che, come parte del ricco contesto della fenomenologia quotidiana, la caratteristica proiettiva può coinvolgere i processi intersoggettivi.
PAROLE CHIAVE: Interocezione; Deprivazione sensoriale; L'uomo volante; Il cervello nella vasca; Avicenna

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1 Queasiness

AS I WRITE THIS ESSAY I am experiencing a serious bout of jet lag. As a result, my stomach is queasy. That's the easiest description. It may be stomach or intestines or some other internal process that is not right, but the way it feels not right is best captured by the term "queasy". This is an odd term since its meaning is not precise. It's something different from nausea although it could transition to nausea in an instant. As for most terms I don't remember learning its meaning, and I don't remember any significant person in my life actually using the term. My mother, for example, never taught me to use the term. I've looked up the definition. Merriam-Webster defines it as "causing nausea" or "causing uneasiness". I would say that it's a physical feeling of uneasiness in my stomach.

The feeling of queasiness is a form of interoception. That we use the word signals that we do have a rather indeterminate vocabulary to express conscious interoceptive sensations. Indeterminate only in the sense that we may not be able to say precisely or scientifically what is causing the feeling. One might think it is some vague chemical process located somewhere in the vague stomach-abdomen-viscera area. Science would tell us that brain processes are also involved. There would be some correlation or causal relation between our lived experience of queasiness and the physiological processes that underlie it. Staying with the phenomenology, however, queasiness is what Merleau-Ponty has called a determinate indeterminateness. It's a definite feeling but ragged around the edges, indeterminate about bodily location and about how close we are to a state of nausea, which itself is also experienced as somewhat indeterminate, until it isn't.

2 Interoception, sensory deprivation, and the flying man

In philosophical contexts interoception has been ignored for a long time. Sartre may be an exception since nausea for him is something of an ontological concept. Even in some recent embodied approaches the focus tends to be on body-schematic, pragmatic, "I can" affordance-related processes, and less on affectivity, and even less on interoceptive phenomena. Drew Leder rightly calls our attention to interoception. He recalls the historical distinction between interoception, proprioception and exteroception (citing SHERRINGTON 1906), but also notes a more recent expanded meaning «used to refer to *all* perceptions of our own body, including those with a musculoskeletal or skin origin» (and he cites CEUNEN *et alii* 2016). The expansion may help us to realize that the body is an integrated whole, as Leder notes, and that our experience is typically constituted as a mélange of phenomenal qualities; but it could also lead to further vagueness about interoception.

Perhaps for this reason Leder resists the extended concept and focuses on visceral sensations, pain, and sensations that relate to mainly non-conscious processes involving circulation, respiration, digestion, and other chemical functions in the body. There is a rich phenomenology to explore here. In some of my own work I've built on an inventory of such sensations offered by Mason (1961).

> Pain, with various qualifications, burning sensations, prickling, itching, 'crawling' of the skin, giddiness or light-headedness, faintness, throbbing, tightness, nausea, defined as 'a sensation felt at the back and lower part of the throat, not being usually associated with pain', accompanied by 'uneasiness in the pit of the stomach' (MASON 1961, p. 289), queasiness, 'lump in throat', fullness, distension, tension, heartburn, tingling, 'smothering', palpatation, 'cardiospasm sensation', 'flutter', hollowness or emptiness, pressure , heaviness,[1] soothing, sinking, hunger, cramp, swelling, 'turning' of the stomach, erotic sensations such as orgasmic ejaculation and genital sensations, bowel sensations, 'quiver', sweating, limbs 'asleep', chills, pull, 'pins and needles', numbness, weakness, dirtiness, sensations of blocked openings, dizziness, 'thickness', 'flushing' (as in a blush), innumerable sensations associated with pregnancy, and sensations of warmth, coldness, etc. (GALLAGHER 1986a, p. 142).

This is a lived physiology that Husserl might call "hyletic" experiences pertaining to one's body. On the one hand, as Mason and others have noted, these sensations may be so pervasive that we fail to notice them. Typically they don't cross the threshold of explicit consciousness until something goes wrong and some process reaches its own threshold. On the other hand, even when they remain below threshold, they may contribute to what Matthew Ratcliffe (2008) calls "existential feelings", or what Thomas Fuchs (2012) calls the "feeling of being alive". In terms suggested by Merleau-Ponty (1962), we could say they sustain the lived body: «they establish and maintain its place, [and] prevent it from being abolished» (p. 86). As such, I think interoception plays an important role in some traditional philosophical thought experiments. Let me mention one relatively ancient thought experiment and one relatively more recent.

The older thought experiment is presented by Avicenna (1959), who, like Leder, was both a physician and a philosopher. He proposes the "flying man" (or floating man) argument.

> One of us must suppose that he is created all at once, and created as perfect, but with his sight

> prevented from seeing anything external [to him]. He is created hovering in the air, or in a void, in such a way that the air does not buffet him so that he would have to feel it. His limbs are separated so that they do not meet or contact one another. He must then reflect as to whether he will affirm the existence of his self [*dhat*]. He will not hesitate to affirm himself to exist. He will not, however, affirm things exterior to his members nor the hidden things of his interiors nor his soul nor his brain nor anything else extrinsic. He will affirm himself to exist though he will not affirm the length or the width or the thickness of himself. If in this situation he were able to imagine a hand or another limb, he would not imagine it as a part of himself, nor as a condition for his self ... As to the self whose existence he affirms, it is specific for it that it is identical to him and distinct from his body or his limbs, which he has not affirmed. Thus the alert person has a way to be advised concerning the existence of the soul [or self] as something distinct from the body, or rather distinct from body, and [a way] by which he may understand it and be aware of it. (pp. 15-16)

Avicenna is here arguing against Aristotle's emphasis on the role of the body in experience. Aristotle suggested that what we call mind is not actual before it thinks (*De anima* 429a 23-24) and remains in a potential state until it has sensory experiences. Even if it is not mixed with the body, it seemingly depends on sensory input to fulfill its proper function. In contrast, we might say that Avicenna is arguing for a non-embodied actuality – a prereflective self-awareness that does not depend on the body (GALLAGHER 2023). Take away bodily input and we can still think and be self-aware. One question is whether Avicenna included interoception in his thinking about the relationship between soul and body, or specifically in setting up his thought experiment. Although he mentions "the hidden things of his interiors", his focus is on exteroception. Interoception, however, would be a complicating factor in his argument.

Sensory deprivation experiments offer a way to eliminate the external senses. One may also be able to eliminate proprioception and the vestibular sense. Indeed, there are subjects who have lost, or who were born without proprioception (GALLAGHER 2022; GALLAGHER & COLE 1995; MAILL *et alii* 2021).[2] It remains a challenge, however, to eliminate interoception. For example, in sensory deprivation experiments interoception is often enhanced when extrasensory input is removed. It's an empirical issue to what extent one might be able to block interoception. The anterior insula has been identified as integrating «all subjective feelings from the body and feelings of emotion» (CRAIG 2002, p. 655), so one might think that a lesion to that area might remove interoceptive sense.[3] More recent studies, however, demonstrate that it's much more complicated. The sense of one's own body, and multisensory integration involves a complex network that includes frontal and parietal association cortex, such as the premotor cortex and the posterior parietal cortex (EHRSSON *et alii* 2004; GENTILE *et alii* 2013; LIMANOWSKI & BLANKENBURG 2016; GUTERSTAM *et alii* 2019; CHANCEL *et alii* 2022; ABDULKARIM *et alii* 2023). Perhaps even more holistically, there is an additional source of interoceptive sensations – the skin and its somatosensory afferent projections (KHALSA *et alii* 2009; RUDRAUF *et alii* 2009; CRUCIANELLI & EHRSSON 2023).

Of course, in a thought experiment, without the requirement of an ethics review, we can ideally lesion the projections from skin to somatosensory areas of the brain, as well as knock out any areas responsible for multisensory integration and the sense of body ownership. We could then assume that such operations would entirely eliminate interoception. If this were possible, we would have to ask whether something like this would not have profound effects on the subject's other capacities for cognition. Avicenna seemingly stipulates that everything except the broad sensory domain remains intact, since he specifies that the flying man would be "perfect" (except for sensation). It's debatable that one's psyche would remain perfectly intact since disruptions of interoception are often associated with experiences of dissociation (e.g., PICK *et alii* 2020; KALDEWAIJ *et alii* 2023). Furthermore, in sensory deprivation experiments subjects often find themselves having hallucinations (VOSBURG *et alii* 1960; MASON & BRADY 2009), and there may also be complications related to phantom experience.

The question about phantoms is not easily answered. Would a brain without any somatosensory or other bodily sensory input develop a phantom bodily awareness?

In some experimental cases of anesthetic block of the sensory and motor nerves of the arm, the blocking of proprioception does not remove awareness of the limb; rather, a phantom arm is experienced (MELZACK & BROMAGE 1973), or one has contradictory experiences: an experience of the limb as missing and, at the same time, an illusory experience of the limb as enlarged or swollen or shrunken (PAQUERO *et alii* 2003). Even in cases of congenital absence of limbs individuals experience (aplasic) phantoms (BRUGGER *et alii* 2000; BRUGGER 2011).

So even the flying man, who, rather than being born, arrives fully mature but without bodily senses, might experience a phantom body. It's not at all clear what Avicenna would think, since the first mention of phantoms has been attributed to Ambroise Paré in the 16th century. But even if A-

vicenna in his medical practice had encountered the phenomenon of phantom pain, (as Björn Meyerson suggests in FINGER & HUSTWIT 2003), it's not clear how he would go about explaining it. Since Avicenna indicates that the flying man is «created all at once, and created as perfect», we would expect that he came into existence with a perfectly normal brain without any of the subsequent plastic changes that would come about because of a complete sensory deprivation. We can ask whether in this condition he would experience a phantom body (or body part)?

What stimulus would spark this experience of a phantom. If we think that some sensory experience or motor reafference is required, these, as well as bodily pain, phantom or not, are supposedly ruled out by the experiment. If the phantom were to be generated by a completely spontaneous activation of the somatosensory cortex, for example, then from the perspective of the flying man's experience this would be the equivalent of a dream-like phantom or illusion.

Setting aside the issue of phantom experience, however, we can still ask a question more central to Avicenna's concern. Would the flying man still have a minimal self-awareness?

Elsewhere I've suggested that to answer this question one needs to distinguish between the content and structure of phenomenal consciousness (GALLAGHER 2023). On Avicenna's view sensory content is not the determining factor for minimal self-awareness (see BLACK 2008, pp. 68-69). The flying man argument tells us (or tells Avicenna in any case) that self-awareness is completely autonomous and independent of any sensory experience or thought, since one cannot say "I think" or "I experience" without already having a prior and implicit sense of I. Nicholas Humphrey (2022), perhaps in agreement with Aristotle, would disagree. On his view, the sense of self depends entirely on having sensory content, which is equivalent to phenomenal consciousness. Take away sensory content and no self-awareness is possible. Harry Frankfurt (1988) offers a view that may be consistent with Avicenna. He appeals to structure, and abstracts away from content:

> What would it be like to be conscious of something without being aware of this consciousness? It would mean having an experience with no awareness whatever of its occurrence. This would be, precisely, a case of unconscious experience (p. 162).

That is, to be conscious means to be aware of being conscious, regardless of what one is conscious of. This is consistent with some phenomenological views, which suggest the positive formulation: if the flying man were still conscious, he would necessarily be minimally self-aware since prereflective self-awareness is intrinsic to (or is part of the structure of) consciousness, and would not be tied to any particular content (e.g., ZAHAVI 2017).

3 Brains in vats and brains in bodies

Perhaps by considering the flying man thought experiment we end up with more questions than answers. One point that seems clear, however, is that this type of thought experiment leads to an abstraction. A less abstract and more embodied/enactive view is that both structure and content are important. On an Aristotelian view, the mind and its structural features are enacted in the process of experiencing, which involves a dynamical coupling of interoceptive, proprioceptive, and exteroceptive factors. This is the complexity of human experience, even without mentioning further complexities that importantly involve social and cultural contexts. It may be, however, that one can gain insight into interoceptive embodied processes only by engaging in certain practices – phenomenology, meditation, philosophical thought experiments, scientific experiments such as sensory deprivation experiments, and so on, all of which unavoidably involve some degree of abstraction.

I think we can reach a similar conclusion if we consider a more recent thought experiment – the well-known brain-in-a-vat (BIV). Hilary Putnam (1981) borrowed the idea from Gilbert Harmon (1973) and proposed the BIV as an argument against skepticism. In this context, he demonstrated that we cannot be a BIV under threat of contradiction.

Subsequently the thought experiment migrated into cognitive science contexts and morphed into an argument against any strong role for extra-neural embodied factors in cognition. If it is in principle possible that a disembodied BIV (kept alive by the right mix of chemicals, and appropriately stimulated by electrodes, etc.) could have the very same experiences had by a fully embodied brain, then the body is contributing nothing to those experiences. Damasio's (1994) argument against the BIV interprets it this way. The claim that cognitive function and experience would be the same, or even similar to a fully embodied subject, if the appropriate inputs were delivered to a disembodied BIV fails to take into consideration the constraints imposed by the biological body with respect to hormonal, neurotransmitter chemistry, as well as anatomically based pre-neural processing of sensory input[4] and post-neural processing of motor output, as well as interoceptive, affective/emotional processes.

Damasio (1994) thus suggests, one would require the creation of a body surrogate, «and thus confirm that "body-type inputs" are required for a normally minded brain after all» (p. 228; also see GALLAGHER 2005b, 2018; COSMELLI & THOMPSON 2010). One can also add that body and brain

evolved together, so that the very structure and operation of the brain has always depended on the kind of body it is in. Take away the body and the immediate plastic changes that would occur in the brain would undermine the claim that experience would be identical for an embodied brain and a BIV. On this interpretation, the BIV thought experiment reverses itself and actually shows why a human body is essential for human experience. Those who would insist that these are all empirical matters that don't touch the in-principle point of the thought experiment would have to argue that brain plasticity and evolutionary constraints don't in principle matter. We would have to abstract away from the complexity introduced by those very real constraints, some of which involve interoception, in order to conclude that the body doesn't matter.

In thinking about the role of the brain in cognitive function, as Henri Ey once pointed out, one should understand the brain as

> [...] a living organization which does not provide for itself according to the principles of a mechanistic associationist psychology, but which is animated by all the forces and needs of the organism. The activity of the cortex does not suppress, but demands a basal functioning of the brain, to which the infrastructure of the field of actuality of lived experience corresponds (EY 1978, p. 140).

Brain organization and functioning depend upon certain "adjustment reactions" that take place throughout the body (GELLHORN 1943, p. 4; MASON 1961, pp. 140-141).

As Leder points out, most of these adjustments happen without our awareness. The body is set up to be attuned to the world more so than to itself. This is what he has called the "absent body" (1990). I've referred to it as the "absent availability" of the body (1986) since it remains available as we actively engage with the world. But even in action much of our bodily functions (including body-schematic, motor-control processes) remain non-conscious. And when we do try to access such processes, like interoception much of it remains "indistinct" (LEDER 2024, p. 159). Leder provides an insightful analysis of what he describes as the "inside-out" interpretations and the emotive and purposive aspects of our interoceptive experiences. All of these aspects inform what Leder calls the "projective" feature of interoception. Despite their recessiveness and indeterminacy, interoceptive processes can shape the way that we perceive the world. As Leder indicates, queasiness or a chest pain can color our experience of the world (p. 159), something that I've labelled the "prenoetic" effect of bodily processes (GALLAGHER 2005a). Focusing on such prenoetic effects can be productive for understanding not only our perception of the world, but our everyday or exceptional performances.

Here is one example, related to what is sometimes taken to be a measure of interoceptive awareness, i.e., one's ability to report one's own heartbeat (BRENER & KLUVITSE 1988; HERBERT & POLLATOS 2012; LEDER 2024, p. 160). Simon Høffding has worked closely with the Danish String Quartet (DSQ), running experiments and collecting phenomenological reports through second-person interviews (HØFFDING 2019). Noting that some musicians have heightened interoceptive awareness compared to the normal population (SCHIRMER-MOKWA *et alii* 2015; HINA, ASPELL & CARDINI 2020), Høffding and colleagues examined *heart rate variability synchronization* (HRVS) in expert (DSQ) and non-expert (student) musical quartets (HØFFDING *et alii* 2023). They showed that compared to the non-expert quartet, the DSQ had significantly increased HRVS while playing. That is, the heartrates of the members of the expert quartet were in greater synchrony during performance than among members of the non-expert quartet. They hypothesized that heightened interoceptive awareness in expert musicians establishes a more robust and versatile system of bodily attunement among the members of the quartet. Bodily attunement may also be based on a shared kinaesthesis which in other studies researchers have shown to reflect a joint or shared body schema (SOLIMAN & GLENBERG 2014).

> This system of heightened awareness and shared bodily attunement is likely to functionally enhance the quality of the shared performance. These results might have further implications for understanding the efficacy of other tightly-knit groups, such as athletes, surgical teams, or any team-like interaction (HØFFDING & GALLAGHER, forthcoming).

4 Conclusion

The point I want to make here is just to reinforce Leder's argument about the projective nature of interoception and that it can also be an intersubjective phenomenon, and not just an intrasubjective one. As Leder (2024) puts it,

> [...] interoception is more than simply internal sensation; it is also "thrown forth" into the lifeworld and its endeavors (p. 162).

I think that it's important to emphasize this idea especially in intersubjective or social contexts. On the one side it's possible to point to negative effects of intersubjective interactions when such relations lead to stress, disruptions in interoceptive processes, and ill health, or when racist or sex-

ist perception can distort body-schematic processes (pp. 111ff), or when the complete absence of such interactions, as in solitary confinement (pp. 117ff) can lead to a complete breakdown in one's bodily integrity (see also GALLAGHER 2014). On the other side, however, the positive effects of intersubjective interaction and its interoceptive effects, as we can find in simple things such as playing music together, but also in what Leder calls «communing, receiving and giving» (LEDER 2024, p. 130), can be the right kind of intersubjective practices in the service of health maintenance or therapeutic practices.

Notes

[1] Erwin Straus (1970) points out that the lived body is not experienced as having weight: «under ordinary conditions the weight of the arms is never experienced as heavy. The arm of a muscular man, disarticulated in the shoulder, may weigh 15 pounds. In the hand a weight of 15 pounds is experienced as heavy, while the "lived" arm is not at all heavy» (p. 115). It might be noted, however, that the body may appear as heavy, e.g., in fatigue and in paralysis.

[2] MAILL and colleagues report on the subject KS who congenitally lacks all somatic sensation in her entire body and head.

[3] Primary afferent fibers of small diameter (Aδ and C fibers) mediate pain, temperature and possibly other aspects of interoceptive sense (CRAIG 2002), in response to which the autonomic nervous system offers feedback regulation. Patients with Congenital Insensitivity to Pain with Anhidrosis (CIPA) lack not only the interoceptive primary afferent fibers, but also neurons essential to autonomic sympathetic response (INDO 2009).

[4] Mason (1961), for instance, states: «[i]n the human at least, the potential awareness of a given experience or sensation at a given time is dependent on *all* of the nervous system that is functioning at the time. This would seem to be the case not only because the nervous system is highly integrated and reverberatory in nature, but also because the afferent neural impulses from a given area, as, for example, the lower leg, will most likely undergo modifications of some kinds at different neural levels» (p. 32).

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