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Feeling the world as being here¹

Frédérique de Vignemont

Abstract:

A vast array of experimental results has recently shown that there is something specific in the way we perceive the space immediately surrounding the body, also known as peripersonal space, by contrast with the perception of what lies farther away. However, we seem to have no conscious awareness of peripersonal space as being “special” in any sense. Instead we are presented with a continuous visual field without a phenomenological boundary between what is close and what is far. The computational peculiarities of peripersonal perception thus seem to have no phenomenological consequences. Here I will argue that when you see an object in the immediate surroundings of your body, not only do you have a visual experience of the object (comparable to the experience you can have of further objects), but you also experience what you see as being *here*. This sense of here-ness can be conceived of as a specific type of sense of presence. To better understand it, I shall turn to illusions in virtual reality and to the feeling of disconnection in the psychiatric syndrome of depersonalisation.

Keywords: space, indexical, here, feeling of presence, phenomenology, virtual reality, depersonalisation, first person, embodiment, impact prediction

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A vast array of experimental results has recently shown that there is something specific in the way we perceive the space immediately surrounding the body, also known as peripersonal space, by contrast with the perception of what lies farther away. As described at length in this volume, the processing of peripersonal space has a distinctive sensorimotor and multisensory signature. Research in cognitive neuroscience seems to indicate that we process the space surrounding the body as a spatial buffer between self and world, both for protecting one's body from immediate danger and for interacting with the environment. However, we seem to have no conscious awareness of peripersonal space as being "special" in any sense. Instead we are presented with a continuous visual field without a phenomenological boundary between what is close and what is far. At first sight, the mug that I see next to my hand does not appear to me as different in any significant way from the mug on the other side of the table. The former appears closer than the latter and it occupies a larger area in the visual field. But the same could be said about the difference between the mug on the opposite side of the table and the mug even farther away on the cupboard. Differences in how things visually strike me are not specific to peripersonal space; they are merely a consequence of distance. The computational peculiarities of peripersonal perception thus seem to have no consequences for phenomenology.

Here I shall propose that when you see an object in the immediate surrounding of your body, not only do you have a visual experience of the object (comparable to the experience you can have of further objects), but you are also aware of the object as being *here* in a primitive embodied way. This sense of here-ness can be conceived of as a specific type of sense of presence. To better understand it, I shall turn to illusions in virtual reality and to the feeling of disconnection in the psychiatric syndrome of depersonalisation.

1. Preparing for impact

In what sense do our perceptual abilities differ between close and far space? To answer this question, it suffices to acknowledge a simple fact: what is close to our body can be soon in contact with it, either because the close-by object moves or because we move. A further basic fact is that this contact may be welcome (when grasping an object), but not necessarily (when colliding into an obstacle). Hence, there is an immediate significance of our surrounding, which imposes clear rules for its perception. In brief, peripersonal perception must follow the old Scout's motto: "Be prepared" (*semper paratus*). As I shall now describe in detail, it must be prepared both at the sensory level (prepared to detect and process whatever may be soon on the skin) and at the motor level (prepared to react to it).

1.1 Seeing what is right under one's nose

In 1981, Rizzolatti and his colleagues recorded the activity of neurons in the ventral premotor areas in monkeys and found that some were activated not only by tactile stimuli on the body, but also by visual stimuli presented in the space close to the body, from a few centimetres from the body to approximately 30 cm. In humans too, it has been shown that the perception of visual stimuli presented in peripersonal space interferes with tactile perception. This multisensory signature of peripersonal perception is well illustrated by the cross-modal congruency effect. Participants are asked to localize a tactile stimulus applied on one finger, while trying to ignore visual distractors presented simultaneously at either congruent or incongruent positions. Crucially, incongruent visual distractors interfere with tactile localization (i.e. participants are both slower and less accurate), but only when the visual stimuli are close to the body (Spence et al., 2004). This visuo-tactile interaction can be explained by the fact the sight of objects close to one's body generates expectation of a tactile event, which then influences the experience of the actual tactile stimulus.

The spatial relationship with your surroundings keeps changing: you see the tiger running towards you or the ball thrown at you, you navigate in rooms full of furniture and in streets full of people. In all cases, you need to be prepared for immediate impact and the prediction of impact entails a specific course of action. Consequently, peripersonal perception is especially sensitive to dynamic stimuli, some neurons responding more than twice as much to stimuli in movement relative to the subject (Colby et al., 1993). For example, it was found that participants detected a tactile stimulus on their hand earlier when they simultaneously perceived a dynamic sound, which gave the impression of a sound source approaching as long as it was heard at a limited distance from the hand (Canzoneri et al., 2012).

A further consequence of the anticipatory function of peripersonal perception is the type of spatial frame of reference that it exploits. The perceptual system predicts that the location of objects that are for now only close to the body will soon be *on the skin itself*. Consequently, peripersonal vision exploits the same frame of reference as touch. Tactile experiences are felt to be located in what we may call somatotopic coordinates (or what others call skin-based coordinates or bodily coordinates). The location of pressure is encoded as occurring at a specific spot on the surface of the body: I feel touch on my hand, on my foot or on my back. These somatotopic coordinates do not change when the sensing body part moves: I still feel touch on my hand no matter where my hand is. They are given within the frames of reference based on the representations of the body parts (Vignemont, 2018). If my body representation has not been updated after amputation, then I would still feel sensation in the hand although it is no longer there. The somatotopic reference frames are common to all bodily sensations (i.e. touch, pain, thermal perception, proprioception), but it is normally not used by external sensory modalities, such as vision and audition. Clearly, I do not localize the bus stop that I see on the other side of the street in somatotopic coordinates. More precisely, I can experience it as being on the left or the right, and these coordinates are relative to some key body parts

(such as eyes, head, and torso), but the visual system does not project the localization of the bus stop on the surface of my body. This is so because it does not anticipate its impact on me. By contrast, when I walk toward the bus stop, which is now 30 cm away from me, the visual system anticipates that my left arm might hit it. The location of the bus stop is then given in somatotopic coordinates, although I have access to it only through vision (Graziano and Gross, 1993).² Graziano (2018) thus qualifies peripersonal space as a “second skin”:

a gelatinous medium surrounding the body, that deforms in a topology-preserving fashion whenever the head rotates or the limbs move. (Graziano and Gross, 1993, p. 107)

A last consequence of the anticipatory function of peripersonal perception is that impact prediction enables better processing of the anticipated event (Engel et al., 2001; Hyvärinen and Poranen 1974; Clery et al., 2015). It has been shown that the detection of objects and the processing of their global spatial properties such as shape are facilitated when presented in close space (Dufour and Touzalin, 2008; Reed et al., 2006; Gozli et al., 2012; Kelly and Brockmole, 2014; Blini et al., 2018). For instance, Blini and colleagues (2018) found that one’s visual capacities were better for objects presented in peripersonal space. Participants were presented with 3D shapes in an immersive virtual reality environment either in close space or in far space, and the objects in far space appeared illusorily bigger than the objects in close space. Even so, participants were better in discriminating the shape of the objects for those that were presented next to their body.

Still one should not believe that the closer, the better. The fact is that peripersonal perception appears sometimes to be less efficient than the perception of far space. For

² A question that one may ask is whether peripersonal vision still qualifies as being visual since it uses a spatial frame that is normally used by touch and other types of bodily perception. Instead, one may claim that peripersonal perception is multimodal: neither visual, nor tactile. I shall leave this question open here.

instance, the processing of colour information and of fine-grained spatial properties is less reliable in close space than in far space (Gozli et al., 2012; Kelly and Brockmole, 2014). It has also been found that participants take more time at performing a visual search task when presented in close space. In one study, participants were asked to localize a target among distractors and they were slower when the visual display was close than far (Abrams et al., 2008). How could participants be bad at finding a target that was just under their nose?³ I shall now argue that sensory processing of objects presented in peripersonal space is enhanced not for the sake of improving their recognition but instead for the sake of guiding the motor system for it to react in the best way.

1.2 Ready to react

To recapitulate, there are specific computational principles that characterize peripersonal perception, which differ from those that govern far perception. As I shall now argue, they can be explained by the specific relationship between peripersonal perception and action. Since its discovery by Rizzolatti and his colleagues, peripersonal perception has been ascribed a motor function (Rizzolatti et al., 1997, Brozzoli et al., 2012, Bufacchi and Iannetti, 2018). This motor function explains the properties of the seen object for which peripersonal perception is the most reliable: they are those that are useful for the selection of the type of movement to perform, what Grush (2007) calls type-selecting dispositions (for details, see Vignemont, in press).

By definition all bodily movements take place in peripersonal space. Hence, peripersonal perception cannot afford to be relatively detached from the motor system. What is seen there must be able to directly connect with what one does, and vice-versa. This direct connection to action is made possible by the fact that peripersonal space is mainly represented in brain

³ This shows that one cannot explain the advantage of peripersonal perception by attentional facilitation only. If whatever is close were given attentional priority just because it is close, then one should be better in every perceptual task and this is not the case (see Blini et al., this volume, for discussion).

regions that are dedicated to action guidance (in the premotor areas and in the ventral section of the intraparietal sulcus). The tight link to bodily movements is also revealed by the fact that the practical knowledge of one's actual motor capacities influences what falls under the scope of peripersonal perception. In brief, the space that is processed as being peripersonal space is larger when one can act farther away, because of tool use, for instance (Farnè and Ladavas, 2000). Increased motor ability leads to a modification of perceptual processing of the objects that are next to the tool. Before tool use, they are processed as being in far space; during tool use they are processed as being peripersonal. This was first described by a seminal study by Iriki et al. (1996) who trained monkeys to use a rake to reach food placed too far to be reached without the tool. They found that visuo-tactile neurons, which displayed no visual response to food at this far location before training, began to display visual responses after training. A few minutes after tool use was interrupted, the visual receptive fields shrank back to their original size. Consider now cases in which motor abilities are reduced. It has been shown that after 10 hours of right arm immobilization there is a contraction of peripersonal space such that the distance at which an auditory stimulus was able to affect the processing of a tactile stimulus was closer to the body than before (Bassolino et al. 2015).⁴

We can further refine the claim about the function of peripersonal perception and propose that it originally evolved for specific types of behaviour, namely, protective ones. In short, to have a dedicated mechanism specifically tuned to the immediate surroundings of the body and in direct relation with the motor system is a relatively good solution for the purpose of the detection of close threats and of self-defence. It was the Swiss biologist Heini Hediger (1950), director of the Zurich zoo, who first noted that animals do not process space uniformly (see Møller, this volume). In particular, there is a specific zone immediately surrounding their

⁴ There are other factors that can influence the extent of peripersonal space, such as the presence of a transparent screen between the seen object and the subject (Sambo et al., 2013) or anxiety (Lourenco et al., 2011, Sambo and Iannetti, 2013).

body, described as the flight distance, that predators cannot approach without eliciting specific defensive responses in their prey (flight, freeze or fight depending on how close the predator is). Arguably, the flight distance goes beyond peripersonal space. Still the margin of safety constitutes by peripersonal space can be conceived as a last resort. It is encoded in a specific way to elicit protective behaviours as quickly as possible if necessary (Graziano, 2009, 2018). In monkeys, the direct stimulation of neurons involved in peripersonal perception automatically triggers a range of protective responses, such as avoidance behaviour. The injection of bicuculline in peripersonal neurons, which disinhibits them, leads the monkeys to vividly react even for non-threatening stimuli (when seeing a finger gently moving toward the face, for instance). By contrast, the injection of muscimol in peripersonal neurons, which temporarily inhibits their neuronal activity, has the opposite effect: monkeys no longer blink or flinch when their body is under threat. We can now explain the experimental results on visual search presented above in light of this evolutionary hypothesis. Perception must be especially thorough in peripersonal space because partial overlook may be dangerous when the potential threat is next to one's body. One can afford not looking at all the objects for a far away visual scene but one needs to watch closely where one puts one's hand or one's foot. In other words, better safe than sorry when it is close, no matter the cost.

To summarize, peripersonal perception is always prepared to make one move. From a neural perspective, this readiness is made possible by the implementation of peripersonal perception within brain structures involved in action guidance. From a computational perspective, peripersonal perception is always prepared to make one move because it is informed by what one can and cannot do at each instant. From an evolutionary perspective, peripersonal perception is always prepared to make one move because it originally evolved for immediate threat detection and self-defence. However, although peripersonal perception is different from far perception, one may question whether it *feels* different.

1.3 A phenomenological signature?

We saw that there are clear peculiarities of peripersonal processing that show up in behaviour, but it is not clear whether they make a phenomenological difference. As noted by Guterstam et al. (2016, p. 44): “The space close to our hands does not “feel” different than the space outside our reach”. Our perceptual system may be expecting the impact of whatever is close-by but we are not aware of it. Because of its tight link with action, one may be tempted to describe peripersonal perception exclusively in terms of unconscious sensorimotor processing subserved by the dorsal visual stream. It should be noted, however, that the dorsal stream is not exclusively dedicated to sensorimotor processing. Recent evidence indeed indicates that it can also be involved in perceptual identification (such as shape recognition, Freud et al., 2017). The involvement of the dorsal stream thus does not suffice to show that peripersonal perception is exclusively a matter of sensorimotor transformation. Furthermore, if peripersonal processing were sensorimotor, visual discrimination should not be improved in close space but we have just seen that it is (for more details, see Blini et al., this volume). The fact is that the standard experimental paradigm to investigate peripersonal processing is a multisensory *perceptual* task: subjects are asked to give a verbal response about the detection of a tactile stimulus, and one measures to what extent they are influenced by a visual (or auditory) stimulus presented more or less close to them. Hence, peripersonal processing can have an effect on conscious visual (or auditory) experiences.

One can further note that in some situations at least, proximity is associated with a specific feeling. Imagine that you are seated alone on a long bench in a waiting room and a perfect stranger comes to sit next to you and gets closer and closer. There is a distance at which you will start feeling uncomfortable. This feeling has been used as the key measure of what is called personal space in social psychology, and more recently in social neuroscience (e.g.

Hall, 1966; Iachini et al., 2014). Hence, the perception of proximity – or at least of social proximity – can induce a distinctive affective feeling. However, this unpleasant feeling does not seem to generalize outside the social domain. We are constantly surrounded by objects that are very close to us and yet their proximity does not make us feel uncomfortable. The question then is whether there are non-social examples of the phenomenological impact of proximity.⁵ From now on, I shall argue that peripersonal perception gives rise to a sense of here-ness.

2. Here-ness

Consider the following examples. My book is here, in my bag. The subway station is there, at the next corner. It is raining here, in Paris. I have left my bag there, in my office. In all these cases, I describe my spatial relation to events or objects and use two different indexicals to refer to what is close and what is far. The distinction between ‘here’ and ‘there’ can be found almost in all languages⁶ and constitutes the most universal example of spatial deixis (Levinson, 2004). In a nutshell, ‘here’ is a marker of proximity, which normally refers to a region that includes the speaker (where I am).⁷ On the other hand, ‘there’ refers to what is farther away, a distal region more remote from the speaker (where I am not). What characterizes indexicals is that they do not have fixed referents. Many different particular locations can, on occasion, be picked out as ‘here’ or ‘there’, unlike the words ‘Paris’ or ‘New-York’. Depending where I am, the token ‘here’ will refer at different locations. This is a general rule of indexicals, such as here, there, I, you or now. Still there are differences among

⁵ One case comes from what is called the magnetic field illusion (Gutesrtam et al., 2016). Brushstrokes are applied on the participants’ hidden hand and *in mid-air at some distance above* a fully visible rubber hand. Participants then report feeling a “repelling magnetic force”, a “force field”, or an “invisible rays of touch” (Guterstam et al., 2016, p. 45). However, the magnetic field feeling can simply be the result of the mislocalisation of their tactile feeling and it is not clear that it really concerns peripersonal perception.

⁶ Some languages, such as Japanese, include a third term and distinguish between the space around the speaker (*koko*), the space around the interlocutor (*soko*) and the space away from both (*asoko*).

⁷ Still, one should note that technology (such as an answering machine) can distort this rule. See Perry (2001) for discussion.

them. The first person depends on who the speaker is but it normally does not depend on the speaker's communicative intention: I am always the person I refer to when I say 'I'. Unlike the first person, which automatically refers to the speaker, 'here' and 'there' are what Perry (2001) calls intentional indexicals. The extent of the region that they refer to depends on the speaker's intentions and the interlocutor needs additional information to understand what they refer to. By 'here' I can mean my office, Paris, or France. By 'there', I can mean the back of the room (when I stand in front), Marseille (when I am in Paris), or the United States (when I am in France). Still 'here' respects some constraints given by the context: it always depends on where the speaker is located. By contrast, 'there' can refer to any region as long as the speaker is not located there.⁸

What is interesting for us is that this distinction is not only at the linguistic level but also at the cognitive level. Consider the following example adapted from Perry (1990) and compare the following three scenarios:

- a) You see that it is raining but you do not know where you are, you only know that it is raining here.
- b) You believe that it is raining in Grand Island but you do not know that it is the city you are in.
- c) You believe that it is raining there.

In the scenario (a), your belief is sufficient to motivate you to take an umbrella. The spatial indexical 'here' has a distinctive cognitive significance, similar to the significance of the first person. It is because you know that the fact that it is raining is relevant *for you* that you act in the appropriate way. Perry thus suggests that we have a specific mental notion that encodes information about what is conceived as here, which is tightly connected to action: "Let's call

⁸ According to Kaplan (1989), only 'here' qualifies as an indexical, whereas 'there' is comparable to demonstratives such as 'this' or 'that' because it could almost refer to anywhere (with the notable exception of where the speaker is).

a notion a “here-notion” if it is associated with a self-notion and the idea of being-in.” (Perry, 1990).

By contrast, in the scenarios (b) and (c), your belief does not motivate you to take an umbrella, precisely because you do not know whether it is raining where you are. Still there is a difference between (b) and (c). There is no reference to the subject in scenario (b): your belief is simply about Grand Island. By contrast, when you believe that it is *there*, you explicitly acknowledge that it is not where you are in, which is different from simply not knowing whether this is the case or not. There is thus a first-personal content, though negative. In short, there is a “not-here” mental notion. One way to characterize it is to claim that there is a there-notion if it is associated with a self-notion and the idea of *not* being-in.

Now one may ask about the relation that the spatial notions ‘here’ and ‘there’ that hold with perception, and more specifically with peripersonal perception. At first sight, it may seem that what one sees in peripersonal space is here but the here-notion can cover a much larger area. In some sense, there is no spatial limit to the referent of ‘here’, which can even be the solar system. Hence, it goes far beyond what one perceives in peripersonal space, at least if one conceives of here-ness at a relatively high cognitive level. There may be, however, a more primitive here-notion, which is exploited by action. Imagine that you are hiking in the mountains and you can see the peak that you plan to reach. At the cognitive level, you can judge that you are here, meaning that you are in the Alps. ‘Here’ refers to the region you are in and includes the end of the trail. But at the agentive level, the peak that you want to reach and that you can already see appears to you as being *there*, where you are not. It is precisely because it is only there that you do not experience that you have achieved what you wanted to do and that you keep walking. From the point of view of the motor system, ‘there’ refers to the location of the goal while ‘here’ refers to the location of your body.

This notion of here-ness, which appears as only weakly cognitively demanding, does not require a self-notion. In particular, it is conceivable that animals that have what Peacocke (2014) calls a degree 0 of self-representation can have at least a primitive version of the here-notion:

This creature remains at Degree 0, however, because it never represents anything as standing in certain relations to itself. None of its perceptual states have *de se* contents of such forms as *that thing is that direction from me*. Rather, they have *here*-contents, such as *that thing is that direction from here* (...). Its map has, so to say, not a *de se* pointer I am here, but rather one saying this place on the map is here. (Peacocke, 2014, p. 30)

Instead of self-location, it is sufficient for this primitive here-ness to be based on body location. Here-ness then refers to the place in which the body is. However, even this primitive definition of here-ness may still be too sophisticated. It indeed implies that the creature is able to represent the various segments of the body as belonging to a unified whole. One may then propose a fragmented notion of here-ness, which refers to *the places in which the various body parts are*. What is here, then, is any object or event whose felt location is encoded in its relation to these body parts. This can be a pain that you feel to be located in your left foot. This can be your hat that you feel on your head. This can also be the mosquito buzzing next to your right hand. In all cases, the frame of reference that is used is centred on the corresponding body part. The reference of the primitive notion of here-ness thus goes slightly beyond the exact location of body parts to include peripersonal space. As described earlier, the perceptual system constantly anticipates peripersonal space to become bodily space. The relation to the environment keeps changing either because the surrounding objects move or because one moves. For now, the mosquito is 5 cm from your hand but in two seconds it may well be *on* your hand. This is why objects and events perceived in peripersonal space are

localized relatively to the various parts of one's body. Put it another way, peripersonal space is always 'here'; it is never 'there'. Peripersonal space is thus the space in which the body could be.

This is well illustrated by the spatial constraint that operates on the rubber hand illusion. This illusion, in which one experiences a rubber hand as being part of one's own body, works only as long as the rubber hand is presented within the limit of peripersonal space. Participants look at a left rubber hand presented in front of them, while their own left hand is hidden behind a screen. The experimenter then simultaneously strokes both the participants' hand and the rubber hand. After synchronous stimulations, participants describe that they feel as if the rubber hand was their hand (Botvinick and Cohen, 1998). Of special interest for us is that there is not a slow linear decrease of the illusion with the separation increasing between the real hand and the rubber hand. Instead, there is a drop in the illusion when the rubber hand is positioned beyond the boundaries of the peri-hand space (Lloyd, 2007).

One may be tempted to reply that there are many objects outside peripersonal space that one can perceive in relation to one's body, objects that one represents in egocentric coordinates. For instance, I can see the Eiffel tower on the other side of Paris as being on my left. Yet the Eiffel tower does not fall under the scope of the embodied notion of here-ness that I am developing. It is important to clearly distinguish the somatotopic frame of reference from the egocentric one.⁹ Consider the following example. There is a ladybug on my right next to my right hand. The egocentric perspective of my visual experience is given relative to the posture of my head and of my torso and if I cross my hands, my visual experience stays the same: it still presents the ladybug on my right. By contrast, the somatotopic coordinates of the ladybug have changed: it was in my peri-right hand and it is now in my peri-left hand.

⁹ It should be noted that there are more than one definition of the egocentric frame. I shall use here a relatively neutral one. Within an egocentric frame of reference, a perceived object is located at a specific point relative to some axes (vertical, horizontal, longitudinal) centred on some key parts of the body (such as the head or the torso).

Now imagine that the ladybug follows my right hand. Then the egocentric coordinates of my visual experience change (on my left), but not its somatotopic coordinates (in my peri-right hand). The hypothesis is that peripersonal perception spatially singles out specific spatial areas within the large egocentric space, the areas in which one represents one's body parts to be located. On the primitive embodied definition, they correspond to the region of here-ness. There is no need for self-referential capacities, and thus many animals can enjoy this embodied here-notion thanks to their peripersonal processing.¹⁰

3. A sense of presence

The proposal is two-fold. First, there is a sense of here-ness that expresses that what one sees or hears is here, namely, where one's body parts are located. Secondly, the sense of here-ness is grounded in peripersonal processing and restricted to visual experiences of one's immediate surrounding. From now on, I shall refer to this notion as being peripersonally here (or here_{pp}). My claim is that it can enter perceptual phenomenology. For some, however, the sense of peripersonal here-ness may still appear as an elusive entity and they may even doubt of its existence. However, as frequently the case, some of those doubts may evaporate when considering crucially differentiating cases in which the sense of here-ness_{pp} is either illusory, as in virtual reality, or disrupted, as in the syndrome of depersonalisation.

3.1 Being there or being here?

¹⁰ Peripersonal processing appears to be shared by a large range of animals, and not only by primates. For instance, in rats and mice, whiskers seem to obey exactly the same predictive function as peripersonal vision: they are sensitive to remote air displacement within peripersonal space (Shang et al. 2018). Even insects and zebrafish can display stereotyped flight responses triggered by the detection of looming visual stimuli and influenced by the size of the stimulus (Rind and Santer 2004; Tammero and Dickinson 2002). I would like to thank Suliann Ben Hamed for her useful insight on this question.

One of the main challenges of virtual reality and telepresence is to induce in the subject the illusion of being present in the virtual environment or at the remote location, instead of her actual physical surrounding. Presence is conceived of as a behavioural (objective) and phenomenological (subjective) response to the degree of immersion of the technology (Slater and Wilbur, 1997). In particular, it is measured by questionnaires that assess how much one experiences a sense of “being there” (Sanchez-Vives and Slater, 2005). However, one should rather ask to what extent one experiences a sense of being *here*, meaning here in the virtual environment.¹¹ This is well described by Howard Rheingold, an American writer who was especially influential in the development of virtual communities. While wearing head-mounted displays connected to a remotely controlled robotic head, he saw his own physical body and he reported:

He [Rheingold’s physical body] looked like me and abstractly I could understand he was me, but I know who me is and *me is here* [in virtual environment]. He, on the other hand, was *there*. (Rheingold, 1991, my underline)

One way to characterize the sense of presence in VR is in spatial terms. It corresponds to what Slater calls the place illusion, which he defines as the feeling of “being in the place depicted by the VE [virtual environment]” (Slater et al., 2010, p. 92). This dimension of presence has to be distinguished from what he calls the plausibility illusion, also found in VR, which he defines as the feeling of “what is apparently happening is really happening” (Slater et al., 2010, p. 92). The two illusions can come apart: one can experience the place illusion (one experiences oneself as being present in this virtual environment), without experiencing the plausibility illusion (one does not experience the virtual environment as being real). Furthermore, both illusions are cognitively impenetrable. Participants in VR are fully aware

¹¹ Questionnaires are always given *after* the experiment. There-ness should be interpreted temporally and not spatially.

that they are not located in the same place as the virtual cliff. And yet they experience the edge of the cliff as being just right here and they step back from it (Sanchez and Slater, 2005).

This dual characterization of the sense of presence can also be applied outside discussions on virtual reality to contrast visual experiences of real-life scenes with visual experiences of paintings (Noë, 2005; Matthen, 2005; 2010; Dokic, 2010). You see a tree. You see the painting of a tree. Only in the former case do you experience the tree as being present. But what do we mean by that? Most literature on the sense of presence outside VE takes the sense of presence as a unified phenomenon (for exception, see Dokic and Martin, 2017). Nonetheless, there are, at least conceptually, two different interpretations. The sense of presence can simply assert that one is spatially connected to the tree (sense of *spatial* presence). As Matthen (2010, p. 115) describes it, “The_[SEP] Feeling_[SEP] of_[SEP] Presence_[SEP] which_[SEP] defines_[SEP] normal_[SEP] scene_[SEP] vision_[SEP] is_[SEP] among_[SEP] other_[SEP] things_[SEP] a_[SEP] visual_[SEP] feeling_[SEP] of_[SEP] spatial_[SEP] connection”. So far there is no ontological commitment. The sense of presence can also assert that the tree actually exists (sense of *real* presence). Then only does it express that what one perceives exists materially or independently of one’s perception of it. The centre of our interest here is only the sense of spatial presence (involved in the place illusion), which is less committing than the sense of real presence (involved in the plausibility illusion).

Now consider how Matthen (2005, p. 316) describes the visual experiences that we have when seeing a painting.

Your space stops just where the space of the depicted object begins. The picture is *there*, right in front of you, but the men it depicts are not (...) The space in the picture lacks, if you will, a *here*. (Matthen, 2005, p. 316).

Interestingly, in the way Matthen describes the situation, he does not seem to make a distinction between ‘here’ and ‘there’. This can be understood in so far as the sense of spatial

presence only involves the awareness of being spatially connected and one can be spatially connected even with distant objects. More precisely, Matthen (2010) argues that the sense of presence is anchored in near-space (i.e. 10 feet away) but it extends to far away objects that are connected to objects in near-space by visible paths. Still he also claims:

Our grasp of spatial relations in a distant mountain range is likely very little different from that of objects in a picture. (Matthen, 2005, p. 323)

The question thus arises: how far do we experience the sense of spatial presence? I do not want to claim that the sense of spatial presence is restricted to what is immediately surrounding me. Clearly I experience the person on the other side of the room as being present. Instead, I propose that when this person is next to me, I experience her not only as being present but also as being *here_{pp}*. There is a specific type of spatial presence, a sense of peripersonal here-ness, whose definition is narrower than the sense of spatial connection. It consists in the awareness of the object as being in the place at which the various parts of the body are felt to be located.¹²

What is the nature of the sense of peripersonal here-ness? To answer this question, we first need to ask whether it makes a phenomenological difference to see objects and events in peripersonal space. Despite the evidence that I reviewed earlier, one may indeed still claim that there are no phenomenological consequences of the sensory specificities of peripersonal perception. If so, there is no specific phenomenology associated with the sense of peripersonal here-ness. One merely entertains the *thought* that objects and events are *here_{pp}* but one does not experience them as being *here_{pp}*. However, this intellectual account may

¹² Interestingly, the place illusion in virtual reality works better when participants have a virtual body that visually substitutes their real body - as seen from a first-person perspective (i.e. while looking down, they see an virtual body). This can be taken in favour of the sense of embodied here-ness. It has been further shown that the immediate surrounding of the virtual avatar can be processed as being peripersonal (Noël et al., 2015).

seem at odds with the low level of cognitive sophistication that is required by the embodied notion of peripersonal here-ness. Alternatively, one may argue that one *experiences* what one sees as being here_{pp}. This view is in line with the general experiential interpretation given to presence: there is a *feeling* of presence. It may come from the mode of presentation of the visual content (Matthen, 2005) or it may constitute a distinct quasi-affective experience associated with the visual experience (Dokic and Martin, 2015), but in all cases, one experiences the world as being present. One may similarly suggest that one experiences the immediate surroundings as being here_{pp}. Put it another way, it makes a phenomenological difference to see objects and events in peripersonal space. This then raises a second question: what phenomenal property accounts for this difference? One possibility is that there is a distinctive phenomenal property of peripersonal here-ness that is part of our peripersonal phenomenology and on the basis of which one can judge that what perceives in one's immediate surroundings is here. Another possibility, which is more deflationary, is that there is phenomenal property that grounds the sense of peripersonal here-ness, this property not being peripersonal here-ness as such, but a different one, which follows from the sensory specificities of peripersonal perception. In particular, one can propose that the readiness for impact that characterizes peripersonal perception gives rise to the experience that what one perceives is here_{pp}. On this latter view, there is no additional quality of peripersonal here-ness. We thus have the following three options: (i) no phenomenology of peripersonal here-ness, (ii) a phenomenology of peripersonal here-ness involving a distinctive phenomenal property of peripersonal here-ness, and (iii) a phenomenology of peripersonal here-ness involving other phenomenal properties, which result from the specificities of peripersonal perception. I shall not settle this debate here. I shall only argue that the absence of peripersonal here-ness, as displayed in the psychiatric syndrome of depersonalization, has a phenomenological impact.

3.2 Neither here, nor there

Patients with depersonalisation report that they feel detached from the world, from their body, and from their own mental states, as if they were external observers. Of special interest to us is what is known as the derealisation symptom¹³: patients complain that they experience a sense of alienation from their surroundings:

It felt as if I was carried extremely far away from this world, and really far.
(Dugas and Moutier, 1911, p. 22, my translation)

I felt as if I was almost entirely separated from the world and as if there was some barrier between me and it. (Dugas and Moutier, 1911, p. 24)

I feel detached and isolated from the world and the people in it. I feel like I am in a box of very thick glass which stops me from feeling any atmosphere. At times it is like looking at a picture. It has no real depth. (Sierra, 2009, p. 51).

I didn't feel dreamy but as if I was physically not quite there. It was as if I was looking through a pane of glass or out of a television screen. (Sierra, 2009, p. 52)

The phenomenology of derealisation includes at least three dimensions: (i) a feeling of unreality; (ii) a feeling of unfamiliarity; and (iii) a feeling of disconnection. The first aspect has attracted most attention but it is the last one that is directly relevant for our discussion: patients feel cut-off from their surrounding (Mayer-Gross, 1935). One can relate their experience with what individuals suffering from migraine can also report: "Shortly after that my vision becomes 'distant'. It is somewhat like seeing the world projected on a screen." (Podoll, 2005, in Sierra, 2009, p. 92). They do not feel that they share the same space with what they see and hear. Instead, they feel that the objects that they see are located where they

¹³ Some have argued that derealization is a separate syndrome from depersonalisation but I shall not engage into this debate, which has little relevance for what I will discuss.

are not. This is so although they are fully aware that they are next to them and they can act on them. As one patient well described, “it was a permanent struggle between the involuntary impressions and my judgment” (Dugas and Moutier, 1911, p. 5, my translation). In my terminology, these patients fail to experience what surrounds them as being here_{pp} although they know that it is here_{pp}.

How to account for such a disruption? Billon (2017) explains all the symptoms in depersonalisation by a general loss of the sense of myness, that is, an inability for the patients to relate what happens to their body and to the external world to them. A patient, for instance, reported: “it is not me who feels. I am not interested in what I appear to be feeling, it is somebody else who feels mechanically” (Janet, 1908, p. 515). According to Billon, depersonalised patients fail to feel their visual, auditory and bodily experiences as being their own. Consequently, whatever is represented by these experiences has no direct relevance for them: a visual experience of a tree can inform a subject of the presence of the tree in front of her only if this is *her* visual experience.

The problem with this view is that the primitive notion of peripersonal here-ness does not require the use of the first person. A deficit of subjectivity should then have no effect on it. A better explanation seems to be in terms of bodily awareness. I argued earlier that peripersonal here-ness is anchored on body location and patients with depersonalization frequently describe how they feel that their body has disappeared:

I do not feel I have a body. When I look down I see my legs and my body but it feels as if they were not there (...) it feels as if I have no body; I am not there.

(Sierra, 2009, p. 28)

Such a bodily disorder may thus explain the disruption of peripersonal here-ness. In brief, to know what place here_{pp} corresponds to, one needs to know where one’s body is, which presupposes being aware that one has a body. At this point, one may object that the sense of

disconnection does not affect only what is close to the patients, but their entire environment. Objects and events are not experienced as being here_{pp}, but they are neither experienced as being there_{pp}. They are experienced as being in a different world, a world from which one is cut off. There are, however, two possible replies. First, one can assume two distinct deficits, a disruption of bodily awareness that explains the local loss of peripersonal here-ness and a disruption of subjectivity that explains the general loss of the sense of spatial presence. Alternatively, one can propose that the sense of spatial presence also requires to be anchored in the body and if one feels disembodied – as depersonalised patients do – one can no longer relate anything to one’s body, wherever they are. If this is the correct interpretation, then it appears that the ability to experience peripersonal here-ness plays a necessary role for anchoring the sense of spatial presence in general. Bodily awareness and peripersonal awareness are indeed two sides of the same coin: one cannot lose one without losing the other. The hypothesis (to be tested) then is that depersonalised patients fail to process their environment as being peripersonal.¹⁴ This leads them to fail to experience their immediate surrounding as being here_{pp}, and more generally to feel disconnected from the world.

4. Conclusion

In this chapter, I argued that seeing objects and events in the immediate surrounding of one’s body involves being aware that these objects and events are here. Being here then simply means being at the place at which the world and the various parts of the body can collide. The

¹⁴ No sensory or motor deficits have been discovered so far in depersonalization, but since peripersonal space has never been directly tested in depersonalisation, it remains an open empirical question. Furthermore, Sierra (2009), one of the leading experts on depersonalisation, provides an evolutionary account that is compatible with a specific deficit of peripersonal processing. He proposes that the emotional and sensory numbing found in depersonalisation results from an unwarranted activation of a hard-wired response to extreme anxiety in case of global danger, for which one is powerless. For instance, in case of earthquake, there is no point in localizing danger because it is everywhere and there is little you can do about it. This is completely different when there is a snake crawling towards you. You need to localize it so that you can retrieve your foot. This is precisely the reason for which peripersonal perception evolved: to be better prepared to react to localized threats. What Sierra describes as emotional and sensory numbing may then be nothing more than the “unplugging” of peripersonal processing. Roughly speaking, it is pointless to be ready to react because danger is overwhelming.

sense of here-ness is thus relatively primitive, devoid of first-personal content. Still it is fundamental for one to feel spatially connected with the world, and thus for the world to feel present.

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