Chapter 1

Cosmos in the head?

Overview

Chapter 1 contains a criticism of the neuroconstructivist epistemology, according to which phenomenal reality is to be understood as an internal mirroring or a reconstruction of the outer world by means of neuronal processes. As it turns out, the idealistic theory of representation is still the basis of this conception (1.1). The criticism developed in the chapter emphasizes, in contrast, the enactive character of perception which is always connected with the operative capacities of the body. In order to prove that the subjective space of the body is not only virtual, its coextension with the space of the objective body or the entire organism is accounted for in detail (1.2). On this basis, in contrast to the conception of an interior phenomenal world, the objectifying achievement of perception, which brings us into direct connection with things by means of circular interactions, can be recognized (1.3). Finally, taking the example of colors, the claim of the mere virtuality of perceived qualities is rejected (1.4).

The assumption that everything that people experience is, in reality, a construction or even an illusion created by their brains is one of the common convictions of neuroscientists and neurophilosophers. In particular, neuroimaging results, due to their seemingly simple and suggestive presentation, have ignited the enthusiasm of researchers, lay people, and the media alike. Assuming that we can literally watch the brain thinking, perceiving, or feeling, there is hardly a phenomenon, from pain or anger to colors or music and even to love or faith, which is not accommodated somewhere in the brain. The almost taken-for-granted view that reality can be found in the head turns perception, so to speak, into a physiological illusion. Typical descriptions thus read as follows:

> What you see is not what is *really* there, it is what your brain *believes* is there. (Crick 1994, 31)
>
> Multimedia mind-show occurs constantly as the brain processes external and internal sensory events. (Damasio 1999b, 112)
>
> [T]he world around you, with its rich colours, textures, sounds, and scents is an illusion, a show put on for you by your brain [. . .] If you could perceive reality as it really is, you would be shocked by its colorless, odourless, tasteless silence. (Eagleman 2015, 37)

One of the most radical elaborations of such assumptions is found in neurophilosopher Metzinger's "Ego Tunnel":

> Conscious experience is like a tunnel. Modern neuroscience has demonstrated that the content of our conscious experience is not only an internal construct but also an extremely selective way of representing information […] First, our brains generate a world-simulation, so perfect that we do not recognise it as an image in our minds. Then, they generate an inner image of ourselves as a whole […] We are not in direct contact with outside reality or with ourselves […] We live our conscious lives in the Ego Tunnel. (Metzinger 2009, 6–7)[1]

According to this neuroconstructivist conception, the real world is dramatically different from the one that we experience. What we perceive are not the things themselves, rather the mere images that they evoke in us. We find ourselves in a dark room and look at a show projected on its walls by the tireless work of myriads of neuronal brownies. The real world is a rather bleak place of fields of energy and movements of particles, without any qualities whatsoever. The tree in front of me is actually not green, its blossoms are not fragrant, the bird in its branches does not sing melodically: all these are only useful illusory worlds, simulated realities, or models which the brain produces in place of bare, materially kinematic processes. In fact, we remain locked in the hollow of our skulls like Platonic cavemen. Metzinger himself points to this analogy (Metzinger 2009, 22); however, in the case of the brain, the wall of the cave

> is not a two-dimensional surface but the high-dimensional phenomenal state-space of human Technicolor phenomenology. Conscious experiences are full-blown mental models in the representational space opened up by the gigantic neural networks in our heads. (2009, 23)

Thus, we are enclosed in the skull as Plato's prisoners, yet with the cave being our mind itself, or rather a mental projection screen or "phenospace" (Metzinger 2009, 221). Indeed phenomenal experience is nothing else but "an *online* hallucination" (Metzinger 2003, 51).

Of course, even neuroscientists or neurophilosophers continue to live with this insight in the everyday world of "naive realism." And they are well advised to do so; for if the world of our experience were in fact only a virtual product of our brains, how could we ever find out anything about the actual world "out there?" If we were only in contact with a *reality simulation*, a world of mere appearances, how could neuroscientists make any statements about "real brains?" Already in terms of knowledge theory, such a position is obviously untenable.

[1] As Metzinger explains, the metaphor of the "tunnel" signifies that the world-simulation is not only present but also extended in time (2006, 23).

However, the result of the scientific reinterpretation is a creeping virtualization of perception—just as if we could not basically trust our senses, and only physics or neurobiology could enlighten us about the real nature of the world. In any case, we are told to give up our naive notion that in perception we are in contact with the things themselves.

1.1 The idealistic legacy of brain research

Where do such conceptions stem from? As we will see, the epistemology of neuroscience carries the burdensome legacy of its greatest opponent with it, that is, idealism.

In the "Introduction," it was already demonstrated how the reductionist program of the natural sciences has gradually eliminated all qualitative properties of nature. Color, heat, smell, taste, as well as categories such as purposiveness or goal-directedness of living organisms were assigned to the human subject as anthropomorphic constructions. Indeed, the atomism of Antiquity had already carried out this separation—in Democrit's words:

> Sweet exists by convention, bitter by convention, color by convention; but in reality atoms and the void alone exist. (See Soccio 2012, 72)

In modern times, Galilei took up this theory once again:

> To excite in us tastes, odors, and sounds I believe that nothing is required in external bodies except shapes, numbers, and slow or rapid movements. I think that if ears, tongues, and noses were removed, shapes and numbers and motions would remain, but not odors or tastes or sounds. (Galilei, *Il Saggiatore*, 1623; Morton 1997, 59)

John Locke canonized this viewpoint by distinguishing the primary and secondary qualities of perception: only the quantitative categories (volume, shape, number, and movement) are primary or "real," all qualitative characteristics (colors, smell, taste, sound) are secondary or anthropomorphic.

In parallel to this, the modern concept of *consciousness* emerged as that of a container, into which everything qualitative and subjective could be inserted. With the reinterpretation of life as a form of physical process, experience lost its embeddedness in life activity and was banished to its own sphere of the purely "mental." Conceived by Descartes as a refuge of the mind in the face of the sole reign of physics over the material world, consciousness was since then in danger of becoming a closed chamber, a windowless enclosure of the subject. Every possible object of Cartesian consciousness is, namely, an "*idea*"—a thought, a representation, or an image. Moreover, what we perceive are also images and not the things themselves. *Idealism* is the philosophy which, in the wake of Descartes, develops from the image-theory of

perception. For Locke, Hume, and Kant, our perceptions are "impressions," "ideas," or "representations" from which we can only draw problematic conclusions regarding the reality, in which we believe we are living. The idealist sits in the enclosure of his consciousness and receives the "*ideae*" as the delegates and representatives of things which he never gets to see themselves—in Locke's words:

> For, methinks, the understanding is not much unlike a closet wholly shut from light, with only some little openings left, to let in external visible resemblances, or ideas of things without: would the pictures coming into such a dark room but stay there, and lie so orderly as to be found upon occasion, it would very much resemble the understanding of a man, in reference to all objects of sight, and the ideas of them. (Locke, *An Essay Concerning Human Understanding*, vol. I, ch. 11, §17; Locke 1813 151–152)

In Kantian epistemology too, the world is taken into this inner room: space and time are pure forms of intuition and thus produced by the mind. The world is recognizable, but only because we are not actually in it, rather *it is in us*.

> But appearances are only representations of things that exist without cognition of what they might be in themselves. As mere representations, however, they stand under no law of connection at all except that which the connecting faculty prescribes. (Kant, *Critique of Pure Reason*, B 164; Kant 1998, 263)

Whereas reason is given full authority to structure the world, this happens only within a closed jurisdiction. Goethe already argued against this with the unmistakable eye of the beholding naturalist that idealistic philosophy could never reach the object.[2]

The further development of idealism can only be hinted at here. In his "Wissenschaftslehre" (1794), Fichte seeks an answer to the question: "How do we come to assume that something external to us corresponds to the representations within us?" (Fichte 1992, 87). In his following deduction of how the world is, in principle, produced by the transcendental Ego, the notion of the "external world" (*Außenwelt*) has its first philosophical appearance (1992, 388). The way leads further on from Schopenhauer's "World as will and representation" (1819/1966) to Nietzsche's perspectivism and, finally, to the Radical Constructivism of the present. René Magritte's well-known picture *La condition humaine* (Figure 1.1) illustrates how much the idealistic conception of perception has molded enlightened consciousness in the twentieth century.

[2] Letter to Schultz, 18 September 1831; see Werke, *Hamburger Ausgabe*, Vol. 4, p. 450.

Figure 1.1 *La condition humaine.*

[*The Human Condition*], 1933 (oil on canvas), Magritte, René (1898–1967). National Gallery of Art, Washington DC, USA/Bridgeman Images. © ADAGP, Paris and DACS, London 2017.

The picture shows a painting with a landscape which is undistinguishable from the real landscape behind the painting (and in fact, both *are* paintings!). In a lecture in 1938, Magritte himself explained the picture as follows:

> The problem of the window resulted in *La Condition Humaine*. I placed in front of the window a canvas, which was to be seen from the interior of the room, and which represented precisely that piece of landscape which was hidden by the canvas. The tree which was represented on the canvas thus concealed the tree situated behind it outside of the room. For the viewer, it was thus placed inside the room, on the canvas, and at the same time, through the imagination (*pensée*), outside the room in the real landscape. That is

> exactly how we see the world. We see it outside of ourselves and, nevertheless, we only have a representation of it in us.[3]

Here the doctrine of the "external world," with its strange duplication of reality, is indeed stylized as the *conditio humana* itself. The windows of our soul monads are closed and all that we receive from the outer world are representations—multicolored pictures which the painter of consciousness has created for us.

This idealistic epistemology—truly, under changed circumstances—has also made its way into brain research and the neurophilosophy related to it. For them, too, we only live in a subjective reality which is, however, now constructed or simulated by the brain. In the interior space of consciousness, the subject, the lonely prisoner in his own citadel, watches the pictures of the unreachable outer world. The only thing is that these pictures are no longer constructs of Kantian faculties of understanding, but rather of the underlying brain processes. What corresponds to the Cartesian *ideae* or images are the "neural representations"—specific excitation patterns through which the brain mirrors the structures of the outer world.

As can be seen, the idealistic chamber of consciousness and the neurobiological inner world of the brain match one another surprisingly well. Neuroconstructivism only makes the connection between the two traditions. Thus, materialism and subjective idealism paradoxically extend hands to each other as they ascertain the point they have in common: namely, that the subject has no part in the world. Admittedly, materialism can finally triumph because, with the reduction of the ability to recognize and act on the processes of the brain, the idealistic subject is no longer left even with the power over his own palace.

The picture of the world as an internal construct—this epistemological conception is to undergo a criticism in three steps. It will at heart consist in refuting the picture of a bodiless and worldless subject which underlies the idealistic theory of perception.

1.2 First criticism: embodied perception

1.2.1 Perception and motion

Let us return once again to the supposed "condition humaine." Is Magritte right, and do we, in reality, only see pictures? Of course, we could, in case of doubt, easily ascertain whether there are in fact meadows and trees outside of the window, in the so-called outer world, or whether it is a film set or another type of

[3] My own translation from D. Sylvester (Ed.), *René Magritte. Catalogue Raisonné II: Oil Paintings and Objects 1931–1948*. Antwerpen: Menil Foundations, Fonds Mercator 1993, p. 184.

illusion. We could simply go out and check it with our senses and movements. We never, indeed, perceive "from nowhere," but rather from our situated bodily position. The sight of the window "over there" already includes the possibility of moving to it. The perception of spatial depth itself only emerges in connection with the ability to measure its diameter and to grasp the objects from different aspects depending on our own movement. When we perceive, we are always situated in the same world as the things we perceive, that is, they are perceived *as available for our interaction* with them.

The underlying assumption of neuroconstructivism is that there is an external reality which is only given to us through representations in our mind. This fundamental assumption of an inner mind being separated from external reality is challenged by the current concepts of *embodied and enactive cognition* (Varela et al. 1991, O'Regan & Noe 2001, Thompson 2005, 2007, and others).[4] From an enactive point of view, reality is not something predetermined and external, but is continuously brought forth by a living being's *sensorimotor interaction* with its environment. Hence, the idealistic conception of perception ignores the fact that as embodied subjects we are not locked into our consciousness. Embodiment does not come as an external addition to perception, but, rather, it is constitutive for it. We must be physically in the world, be related to it, be able to move and act in order to perceive anything at all. It is only the dominance of an epistemology based on our visual sense and its metaphors (picture, perspective, representation, etc.) which makes us forget our embodiment. As a matter of fact, there is no "outer world" perceived by a passive, bodiless subject, as Magritte's picture suggests. This is also evidenced by the development of vision.

Half a century ago, Held and Hein (1963) carried out a classic experiment on newborn kittens who are blind at first. Two kittens in each case were placed in a cylinder marked with vertical stripes from which they got visual input (Figure 1.2). One kitten could walk around in the cylinder of its own accord, while the second kitten was riding in a gondola harnessed to the first and attached to the central axis. After some weeks of intermittent exposure to this procedure, the kittens of the first group were freed from their harness and they moved perfectly normally. In contrast, the other kittens who had remained passive in their gondola were incapable to orientate in space and to recognize objects, they stumbled and bumped helplessly against objects. In terms of visual input, they had received the same stimuli as the kittens of the first group but, nevertheless, remained blind to the structure and spatiality of their surrounds. This means that only a sensing and moving organism forms experienced space, namely from the coherently connected visual, motor, and vestibular patterns it receives.

[4] Concepts of enactivism will be more thoroughly dealt with in Chapters 3 and 4.

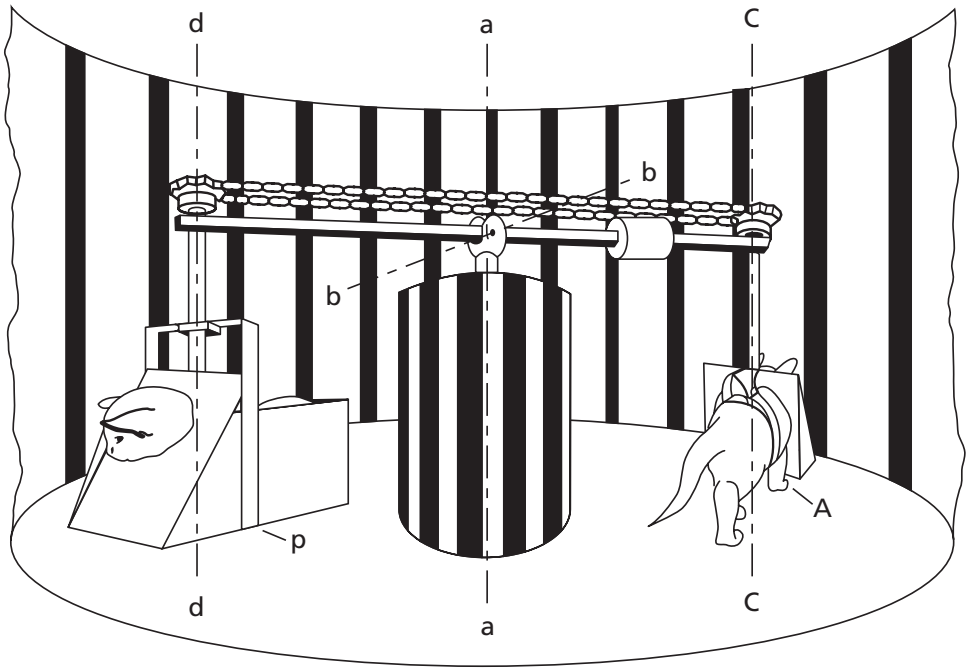

Figure 1.2 Spatial arrangement in Held and Hein's experiment (1963).
Reproduced from Richard Held and Alan Hein, Movement-produced stimulation in the development of visually guided behavior, *Journal of Comparative and Physiological Psychology*, 56 (5), pp. 872–876. http://dx.doi.org/10.1037/h0040546, Copyright © 1963, American Psychological Association.

Cataract surgery restoring vision in persons who had become blind early in their life led to comparable results: even though their retinas could now receive light, what they experienced was only a chaotic flickering of stimuli, no regular vision, and in particular no depth perception. Even after years of training, vision remained severely impaired in most cases, for beyond adolescence the brain could no longer adequately adapt to the unfamiliar input (von Senden 1960, Thinus-Blanc & Gaunet 1997).

From these observations it follows that something as basic as spatial perception is only possible for embodied and active beings.[5] If we were from birth unable to interact with the world in any way, we would never become able to

[5] This connection between visual perception and self-movement has been aptly analyzed by Hans Jonas (1966/2001, 152–156): "We may therefore say that the possession of a body in space, itself part of the space to be apprehended, and that body capable of self-motion in counterplay with other bodies, is the precondition for a vision of the world" (Jonas 2001, 156).—Moreover, in his ecological theory of perception, Gibson (1979) has demonstrated the dependence of perception on an organism acting within its environment: What we perceive is primarily what we can interact with, and what provides options or "affordances" for our action.

see. Vision is, like all other abilities to perceive, only an extension of the bodily basis of all experience. In perception, a living being is not in opposition to the world, but always already involved and entangled in it—as it is obvious from the very meaning of "perception" (from the Latin *capere* = to catch). Thus, our perceptual capacities develop in the course of our interaction with the world, implying the continuous circularity of perception and motion. We would not be able to recognize abstractly what the meaning of "long," "deep," "soft," "heavy," "hot," or other qualities is—we have to experience them as bodily beings. Likewise, the perception of doors and windows, meadows and trees, and humans and animals depends on our sensorimotor dealings with them. Perceiving has always meant taking part in the world, touching it and being touched by it. It is based on *embodied practice*.

Now, we may perhaps concede the embodied nature of perception—but is not the bodily subject itself only a construct? The spatial body schema, touch, proprioception, kinesthesia, and visceroception are these not all produced in certain well-known areas especially of the parietal cortex and projected into the virtual space construed by the brain? The phantom limb of amputated patients and related experiences of healthy persons, in which bodily feelings are localized outside the limits of the body, seem to prove amply that our subjective body is nothing more than a habitual phantom body, a simulation or construction of the brain. To demonstrate this, neuroscientist Ramachandran also points to the well-known rubber hand illusion (Botvinik & Cohen 1988, Ehrsson et al. 2004): if the concealed hand of a person is touched in the same rhythm as a rubber hand visibly lying before him or her on the table, then after some strokes the subject will feel the rubber hand actually being "touched" as if belonging to his own body. From this and similar body illusions, Ramachandran concludes: "*Your own body* is a phantom, one that your brain has temporarily constructed purely for convenience" (Ramachandran & Blakeslee 1998, 58).

The subjective body would thus also be a construct of the brain like the complete experienced reality. The result is a split between the organic body and the subjective body, as if these belonged to two different worlds—one to the physical world and the other to a virtual "inner world" of consciousness construed by the brain. This would apply to all bodily sensations:

> Pain itself is an illusion—constructed entirely in your brain like any other sensory experience. (Ramachandran & Blakeslee 1998, 58)
>
> You can reach out and touch the material of the physical world […] But this sense of touch is not a direct experience. Although it feels like the touch is happening in your fingers, in fact it's all happening in the mission control center of the brain. It's the same across all your sensory experiences […] your brain has never directly experienced the external world, and it never will. (Eagleman 2015, 40f)

Now certainly the brain has never experienced the external world, for it cannot in principle experience anything. But what about myself? Is my spatial sense of touch in my fingers or pain in my foot only an illusion? If perception is intended to convey more than a virtual world, apparently the alleged virtuality of bodily experience must be refuted. As we will see, the fundamental Cartesian division between subjective and objective body is indeed unable to withstand a closer analysis.

1.2.2 **The coextension of lived body and physical body**

Let us first envision the fact that we normally experience the subjective or lived body (*Leib*) and the organic body (*Körper*) as *coextensive*. The pain felt is located where the needle pierced the physical body. The potter feels the clay exactly where his hand, in fact, presses and forms it. Indeed, if a patient shows the doctor his painful foot, the latter will also look there for a cause. If the subjective experience of the lived body were only an illusion, he could ignore the statement of the patient and, instead of that, examine his brain. There is thus a spatial correspondence or *syntopy* of the lived body and the physical body. This syntopy was already analyzed by Husserl (1989), using the example of the hand feeling the touching of an object that simultaneously moves over the skin. In this "co-apprehension" of what is given in the subjective and the objective attitude, the body manifests itself as a unity:

> Thus there lies in the sensations an order which "co-incides" with the appearing extension […] From the very outset, it [the hand] is apperceptively characterised as a hand with its field of sensation, with its constantly co-apprehended state of sensation which changes in consequence of the external actions on it, i.e. as a physical-aesthesiological unity. (Husserl 1989, 162–163)

Although the phenomenon of phantom pain shows us that the organism and brain can also induce a sensation of pain without the respective limb, this does not make the normal case any less astonishing. How is it actually possible that we feel the pain in reality where the matching wounded part of the body is situated, too, and not in the brain?

The coextension of the lived body and the organic body cannot be explained by a "projection" of bodily sensations into the space of the latter, for the objective space of the organic body would have no existence in a virtual subjective world. There cannot be a projection "towards the outside" if this outside is, according to the assumption, merely an interior world constructed by the brain. The projection concepts, which were rather common formerly, were thus largely replaced in the cognitive neurosciences by a unified virtual-phenomenal space, or a "phenospace" (Metzinger 2009, 221). Consequently, then, the perceived prick of the needle too, which causes the pain, must be declared a virtual construct or a simulation of the brain. We would then have absolutely no access to actual reality.

However, as soon as we enter an *intersubjective* situation as the patient already mentioned at a doctor's visit, it becomes immediately clear that the subjective experience and the objective situation, the sensation of pain and its observable physical cause, in no way belong to two separate worlds. The syntopy or the coincidence of the place of pain and injury now, indeed, involves the body perceived by both the doctor and the patient. Just there where the patient feels the pain and where he points to is where the doctor also finds its cause. *Both see the same foot which subjectively hurts and is objectively injured.* How is this possible?

Here we first have to ascertain that a reference to the respective "phenospaces" of doctor and patient is no longer possible—if talk about a reality of the body is to have any sense at all, then in the intersubjective situation. For in this context the subjective spaces of both persons coincide in a way *which cancels their mere subjectivity.* The argument goes as follows:

> Since, according to the neuroconstructivist premise, every brain only produces its own virtual space, there cannot be any "shared phenospace" of doctor and patient. For if perception could, without remainder, be described and explained as a physical process happening between an object and a brain, *then two persons could never observe one and the same object.* The two processes would run, starting from the object, in different directions and remain strictly separated from one another. Both persons would thus be locked in their particular world, all the more since they remained themselves only simulations for each other—in the end leading to a *neuro-solipsism.* To the extent, however, that the intersubjectively constituted space possesses objectivity—if it did not possess it, it would not be possible to agree on an understanding of mutually perceived objects, indeed not even on a simple exchange of goods as during shopping—it also shows that the particular subjectively experienced spaces, on the basis of which it is constituted, are *not only virtual.* The subjective view is thus, admittedly, an *individual, perspectival view*. It is, however, not "only subjective" in the sense as if what was seen was only "in the subject." When we see, we are always already in a space shared with other persons.

The body perceived by both doctor and patient in agreement can thus no longer be a merely subjective specter—rather, it is located in the shared, intersubjective and, as such, objective space. Now, the subjective place of the patient's pain concurs with the objective place of the body part. Hence, the subjective-bodily and the objective space *in reality* coincide and we must repeat the question: how is it possible that the patient feels the pain *there* and not, for example, in the brain?

The direction of the question admittedly shows that we in the Cartesian tradition are still used to categorically separating subjectivity from the living organism. It is completely different in evolutionary terms: originally the whole body was, in a sense, a sensing and feeling organ. Precisely at its surfaces which border on the environment, the organism is irritable, sensitive, and responsive. *Elementary sensitivity begins at the periphery of the body.*[6] The development of a central nervous system does not remove peripheral sensitivity, but *integrates* it by means of the peripheral nervous system spread over the whole body. The fact that bodily consciousness does remain coextensive with the organism shows that it does not spring up from it as a separate entity, like Athena from the head of Jupiter. Rather, it is, from the very beginning, an *embodied and extended consciousness.* It presents the "*integral*" *over the living organism altogether*, not a phenomenon encapsulated in the brain.

Seen in this way, the coextension of the subjective, lived body and the material organic body is no longer surprising. It is, however, functionally meaningful too: conscious experience is where the interactions with the environment take place—in the periphery, not in the brain. After all, the body is the actual "player on the field." That is why it is meaningful that its borders, positions, and movements in the environment are experienced in "analog" form, that is, in the space of the lived body, not only cognitively registered.

It would also be theoretically conceivable that pains would become conscious in a placeless manner, such as thoughts or memories. However, without the coincidence of the two spaces, we would only have our body as an external tool to be plied and would not be "incarnated" in it. Only because consciousness is *in the painful hand*, it is withdrawn involuntarily from the pricking needle.[7] Only

[6] This is in agreement with Antonio Damasio's opinion that perception in its evolutionary primal form consisted in experiencing "*the outside world in terms of the modification it causes in the body proper*" (Damasio 1995, 230). "In the beginning, there was no touching, or seeing, or hearing, or moving along by itself. There was, rather, *a feeling of the body* as it touched, or saw, or heard, or moved" (p. 232). The body is thus the mediating organ whose peripheral sensations, by becoming "transparent," enable to perceive the environment.

[7] This was even clearly recognized by Descartes in his "Meditations" (ch. VI). Granted, he writes, the stimulation of pain fibers in the foot only leads us to sense the pain "as though" they were in the foot. Nevertheless, this illusory local sensation is meaningful, for it lets us withdraw the foot or in another way remove the cause of the pain we are feeling there: "It is true that God could have constituted the nature of man in such a way that this same movement in the brain would have conveyed something quite different to the mind; for example, it might have produced consciousness of itself either in so far as it is in the brain, or as it is in the foot, or as it is in some other place between the foot and the brain; but none of all this would have contributed so well to the conservation of the body" (Descartes 1993, 99). Descartes only refuses to draw the necessary conclusion, namely to conceive of the subject of pain *as bodily and spatial*.

because the feeling of the potter is *in the touching hand* by which he feels the structure of the clay can he also mold it skillfully. A mere "central processing" in the brain could never achieve what the immediate presence of the subject in his hand makes possible, that is, the linking of perception, movement, and objects into *a common, intermodal action space*: "My body is wherever there is something to be done" (Merleau-Ponty 1962, 224). We can thus speak of a not merely embodied, but also an extended or "*ecological subjectivity*" (Bateson 1972, Neisser 1988).

Therefore, if I grope for something, I move *and I feel* not a virtual, but a real hand which, for its part, touches a real object. That becomes possible by the fact that the subjective bodily space *is embedded in the objective space of the organism in its environment*. This means: we are actually in the world as bodily beings (*leibhaftig*)—we are not beings who only have the illusory feeling of inhabiting their body.

Admittedly, the extension of the subjective, lived body is flexible—that is, corresponding to the particular functional requirements. It does not always square exactly with the limits of the objective body. That is why instruments can also be integrated in the subjective body schema: When groping with a walking cane, one does not feel the resistance of the surface being groped for in one's hand, but rather at the cane's tip.[8] The trained driver notices the quality of the street coating literally under the tires of his car. A person who has had a limb amputated learns to "incorporate" his prosthesis by adapting to it, so that it becomes a new body limb for him. In fact, even a rubber hand can temporarily connect to the felt body if it is included in the loops of sensation, perception, and movement in a coordinated manner—in just the same way as in ventriloquism the speaker's disguised voice is attributed to a dummy. In all these cases, far from being "merely illusions," the *optimal coherence* of the various sensory and kinesthetic modalities is established within the intermodal action-perception space of the body.[9]

[8] 'The blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch' (Merleau-Ponty 1962, 127). See also Gallagher and Zahavi (2008, 141–148).

[9] On the one hand, one may call the rubber hand experience an illusion—after all, one's hand is actually being touched under the table. "But in another sense there's no illusion—or rather, the mechanisms at work in this illusion, if we want to call it that, are those of normal, successful perception" (Noë 2009, 74). Hence, such illusions do not prove perception *as such* to be illusory or merely a "veridical hallucination"; on the contrary, they point to the synthetic or gestalt-forming activity of perceiving which renders the environment available and viable for a moving and acting being. For experimental studies on this formation of intermodal coherence ("dynamic capture"), see Soto-Faraco et al. (2004).

Instead of being only a central construct, the subjective space of the lived body is thus modified depending on the particular border at which the real interaction with the environment takes place. This is, in turn, functionally appropriate: the physical contact with the actual resistance of the surrounds must feed into the person's subjective experience, so that adequate handling of objects and tools is made possible. The supposed illusions which arise from this are, in reality, highly useful extensions of our subjective body schema in flexible contact with the environment (Gallagher 2005, 142–146). As Merleau-Ponty remarked, the spatiality of the lived body is not "a *spatiality of position*, but a *spatiality of situation*" (1962, 100). This means that the objective space of the physical organism and the subjective space of bodily experience are intertwined and mutually modify one another.

Granted, the phenomenon of phantom limbs or phantom pain shows that the habitual body schema (anchored in the somatosensory cortex of the brain) is part of the subjective bodily space. As a consequence, the latter's extension may sometimes deviate from the objective or physical body to a surprising extent. However, just like the phenomena of extension in tool use mentioned before, such exceptions do not contradict the *basic syntopy*, that is, the coextensive spatiality of living and organic body—on the contrary, they even confirm it. If *Leib* and *Körper* would not be coextensive normally, a person with an amputated limb would not even notice his phantom limb as such, for there would not arise any discrepancy between both types of space. However, only the fundamental syntopy is at stake here, if we want to refute the illusion thesis or the idea of a mere "phantom body."

In order to make this central point for the further investigation quite clear, we ask once again: where is the pain now when my foot hurts me? According to common neuroscientific belief, it is where it is produced, that is, in the brain. Even John Searle, a prominent critic of neurobiological reductionism, is of this opinion:

> Common sense tells us that our pains are in physical space within our bodies, that for example, a pain in the foot is literally inside the area of the foot. But we now know that is false. The brain forms a body image, and pains, like all bodily sensations, are parts of the body image. The pain-in-the-foot is literally in the physical space of the brain. (Searle 1992, 63)

However, the brain does not feel pains, nor does it contain them. It does not produce a "body image" either, for the experienced body is not an image of a body, it is rather *the body itself as felt*. The only thing that can be found in the brain *when* somebody feels pain are neuronal activations in the somatosensory

cortex and in the cingulate gyrus, and however much these may have to do with the pains—they *are not* the pains.[10]

The pain-in-the-foot is thus *neither* in the physical space of the foot, *nor* is it in the physical space of the brain, for pains are, after all, neither anatomical things such as sinews, bones, or neurons, nor are they physiological processes such as charge-transfers at neuronal cell membranes. Where is the pain then? It is in the "foot as a part of the living body," for this unified living body also produces—not least by means of the brain—a *spatially extended body subjectivity.* The fact that I can state meaningfully: "I have pains in my foot" and can also show the doctor the same foot presupposes that the subjective space of my pain and the objective space of my foot do not belong to two separate worlds which are only connected with one another in a causal way (namely via physiological processes in the brain). It presupposes *that the subjective and the objective space of my body syntopically coincide.*

This is certainly difficult to accept for a physicalist thinking. Is it not true that the "ghost in the machine" (Ryle 1949) is here being wakened again? Is it intended to allow the soul a secret readmission into the physically cleansed world? Indeed, it was a self-evident part of Aristotelian and Pre-Modernist belief that the soul was indivisible and, nevertheless, coextensive with the organic body.[11] Even Kant still wrote in his pre-critical period:

> I would, therefore, keep to common experience, and would say, provisionally, where I sense, there I am. I am just as immediately in the tips of my fingers, as in my head. It is myself who suffers in the heel and whose heart beats in affection. I feel the most painful impression when my corn torments me, not in a cerebral nerve, but at the end of my toes. No experience teaches me to believe some parts of my sensation to be removed from myself, to shut up my Ego into a microscopically small place in my brain from whence it may move the levers of my body-machine, and cause me to be thereby affected. Thus I should demand a strong proof to make inconsistent what the

[10] Of course, identity theory claims exactly this. Although the coextension of subjective and objective bodily space is incompatible with an identity of consciousness and brain processes, identity theory cannot be criticized extensively here (on this, see mainly sections 2.2.1 and 6.2). But even if one would assume an identity of neural processes with pain sensations (however this identity might be conceived), it would still not be possible to locate the pain *as pain* in the physical space of the brain. Searle's statement therefore commits a category error.

[11] See Aristotle, *De Anima* 411 b 24: "In each of the bodily parts there are present all the parts of the soul." Similar statements are found, for example, in Meister Eckhart: "The soul is one and indivisibly complete in the foot, and complete in the eye, and complete in every limb" (Meister Eckhart 1958, sermon 10, 161–165), or in Thomas Aquinas: "*Anima hominis est tota in toto corpore et tota in qualibet parte ipsius*" (Thomas Aquinas 1953, I q 93 a 3).

> schoolmasters say: my soul is as a whole in my whole body, and wholly in each part. (Kant 1766/1900, 49)

If the phenomenal experience of lived body space is related to intersubjective and, hence, objective space, this is, in fact, linked to some extent to the doctrines of a coextensivity of "soul" and "body," admittedly with quite a different terminology. Descartes argued against this, saying the body was only a machine of parts and thus divisible like a corpse, whereas the soul represents an indivisible whole.[12] It is, however, not necessary to reanimate Descartes's independent soul substance, in order to reconcile the experience of our lived bodily being-in-the-world with an objective view of the physical body. The pre-condition is much rather *an adequate concept of life*: the organism itself represents, namely, a functional whole which is, as such, indivisible and, at the same time, extended in physical space—in parallel to the subjective body and its indivisible extension.[13] The fact that this whole living organism can become the bearer of a likewise spatially extended subjectivity does not add any new entity to the *purely physically* describable world, and thus does not contradict physical laws. However, it means a fundamental change for ourselves as living beings: we are no longer self-contained monads, to whom an image of the world is feigned, but rather *we inhabit our body and, by means of that, the world.* Phenomenology can thus put our primary experience in its rightful place again, namely to be in the world as incarnated beings.

Let us summarize for the time being: we started from the deliberation that perception does not mean recording images passively in an otherworldly consciousness. All perception is much rather embodied: it is based on sensorimotor interaction with things, on *concrete bodily practice.* It was further shown

[12] "[T]here is a great difference between mind and body, inasmuch as body is by nature always divisible, and the mind is entirely indivisible. […] and although the whole mind seems to be united to the whole body, yet if a foot, or an arm, or some other part, is separated from my body, I am aware that nothing has been taken away from my mind" (Descartes, *Meditations VI*; 1993, 97). However, Descartes neglects that the *life* of the body does not consist of parts that could be severed ad libitum (*partes extra partes*).

[13] The organism as a functional whole is indivisible, for as Aristotle already remarked, an amputated hand is no longer a *hand* in the functional sense of the word (Aristotle, *Metaphysics*, Z 11, 1036 b 30ff). Here, the parts only exist as parts of a whole (on this, see 3.2.1). Likewise, the *subjective body* is indivisibly extended too, inasmuch as all spatially distributed bodily sensations nevertheless pertain to one and the same subject and are integrated in the body schema. In feeling one's own body parts with eyes closed this may easily be verified: one's felt arm and felt leg belong to an integrated whole of proprioception. Likewise spatial and yet indivisible are the feelings of vigor, tiredness, or sickness, which extend over the whole body.

that the subject of perception is extended over bodily space, and this is not in the form of a phantom entity, a mere construct of the brain, but rather as *an embodied subjectivity* incorporated in a living body, continuously growing out of, and coextensive with it. The somatosensory and motor structures in the brain are, admittedly, necessary requirements for this subject experience. However, that does not mean that the bodily subject could be localized in the brain like Descartes's soul in the pineal gland. The peripheral and autonomic nervous system, the senses, the skin, the muscles, the heart, the viscera—all these are carriers of subjectivity too. We belong to the world, with skin and hair—we are bodily, living, and thus more "organic" beings than neuroscientific cerebrocentrism would have us believe.

1.3 Second criticism: the objectivity of the phenomenal world

1.3.1 The space of perception

What was shown for the awareness of one's body is now to be extended to perception as a whole. Is the illusion-thesis true for this? Do we see in reality only pictures appropriately constructed and projected onto the mental screen of our consciousness by the *camera obscura* of the brain?

Of course, it works quite differently in phenomenal terms. When looking, as with every other sensory perception, we are not in our head but in the world, coexisting with the objects. Perception does not take place in a vessel called consciousness, into which sensory stimuli are imported from outside. I do not, in fact, perceive "visual sensations," pictures, or representations, but rather the writing desk, the window, or the sky. I do not hear "sound sensations," but voices or music. Perception establishes a direct relation between the perceiving person and the perceived object. Is this immediacy of our world experience really only an illusion?

The problem of how a phenomenal world arises at all, and what function it has, also occupies the neuroscientists. For example, neuropsychologist Prinz (1992) raised the question: why do I not perceive the visual stimuli of my retina, the action potentials of my optic nerve, or else my brain states directly if they are in reality the substratum of my perception? And why do I plan actions and not directly the corresponding neuro-muscular processes of my body? In other words: why are there "distal" and not "proximal representations" at all? The world of experience, as Prinz's answer goes, presents a "virtual space," in which the various sensory and motor "data formats" are made compatible with one another and integrated. In this space, we can perceive and act, without being burdened by knowledge about the physiological processes actually taking place.

Of course, Prinz's question as such displays a category error, namely a confusion of the causal and intentional level: we perceive light waves just as little as excitations in the nerves because they only represent physical carrier processes necessary for perception, and not perception itself. What forms the mediating substratum of perception can hardly become its object. Moreover, Prinz, with his answer, recognizes that it is precisely the phenomenal world which enables our orientation and action in the world. It only remains incomprehensible why he then terms it a "virtual space." After all, by integrating perception and movement *in the same space*, it allows us to jump over a ditch in such a way that our feet actually come down at the other side. The phenomenal world is formed by an intermodal integration, that is, a *sensus communis* or common framework for the various senses and movements. Thus the person whom I see, his voice which I hear, and his hand which I shake, are included in a unified space—and this unity is undoubtedly actually the case.[14] For an "illusory world," the world of experience disposes therefore of an amazing amount of objectivity. Let us look at this more closely.

1.3.2 **The objectivizing achievement of perception**

What we perceive are neither pictures nor models, rather things and people. This can initially not be taken for granted: if, for example, I perceive a house, I only actually see *one* aspect of it, perspectivally limited. Nevertheless, we certainly see the house itself, the full object. How does perception overcome its own restricted perspective?

As Husserl has shown, perception cancels its tie to one perspective by integrating further *possible* aspects of things (Husserl 1950, 91–94). Thus, we perceive the house not just by looking at its visible side, but also by implicitly co-perceiving its invisible aspects, which we anticipate to see once we move around the house. Likewise, we co-perceive its materiality, its solidity, as well as its "affordances" or possibilities for action, which would be available to our reaching, grasping, handling, etc. All this implicit content of perception is derived from earlier experiences that enable our skillful dealing with the object (e.g., moving towards the house, opening the door, going upstairs, and so on). Therefore, my experience of an object depends on a *horizon of possible further experiences of this object*—a horizon that is derived from my former dealings with it, but which is now implicitly given or "appresented."

[14] The problem of the *sensus communis*, which should integrate the different senses into one unified perception of objects, was first raised by Aristotle in *De Anima*. Today it is discussed under the terms of "intermodal perception," and of the "binding problem" in neuroscience.

In other words, it is my embodied engagement in the world, which enables me to see *the house itself* and not a mere sensory impression or a subjective picture.

However, there is still another level of objectivity which is characteristic of human perception. For in perceiving the house, we experience it not only as an object of our possible engagement or skilled coping, but also as *independent* of our present perception. The objects are not only there "for me," in the immanence of my subjectivity, they are given *as such*. How is this independence possible? Husserl's later answer referred to the intersubjectivity of perception: The house that I see is also *a possible object for others* who could see it simultaneously from other sides. Thus, the object gains its actual objectivity, that is, its independence from my own perspective, through the *implicit presence of a plurality of other perspectives*. Husserl also speaks of an "apperceptive horizon of possible experiences, my own and those of others" which turns the mere subjectivity of my experience into an "*open intersubjectivity*" (Husserl 1973b, 107, 289; see also Zahavi 1996). Thus, there is again a horizon of perception, but one that is shared with others. The plurality of possible subjects corresponds to the plurality of aspects that the objects afford. In perceiving, we always enact and inhabit a space that we share with others.

As we can see, the perspectivity of perception does not mean mere subjectivity or even virtuality. On the contrary, through interacting with the objects and through our interactions with others, we are able to overcome our primary subjectivity. Gestalt psychology, moreover, has shown that perception completes fragments to wholes (e.g., missing letters are added to a word) and produces color- or size-consistency even where the field of perception is discontinuous or distorted (a square looked at from an angle shows not as a rhombus, rather still as a square). Indeed, even the illusions of perception are based on its inherent tendency to compensate for expectable aberrations, which serves the purpose to provide a constant and viable experience of the environment. Neuroconstructivists are usually happy to point out such illusions in order to prove the virtuality of perception. Actually it works the other way around: it is precisely the gestalt-oriented, actively shaping, and intentional structure of our perception that enables us to recognize *real things* instead of receiving one-to-one mappings of mere stimuli.

It is not the physical elementary events taking place between the objects, our sensory receptors, and the brain that are the "actually real" events in perception. This complete cascade of physical and physiological processes is only its material basis. There would be no world of meadows, trees, cats, or human beings for

us and, of course, no adequate action in this world if perception had not long since integrated the elementary processes or individual stimuli into meaningful forms and gestalts. Perception means an action-directed openness to the world, not a photograph. We do not perceive stimuli or images, rather gestalt units, meanings and affordances. Perception avails itself of the mediating processes, in order to establish a direct relation to things—in other words, a *mediated immediacy.*[15]

I must thus be happy not to be able to perceive my brain states because they themselves could not give me the faintest inkling about reality—just as radio waves themselves could not allow the music they transmit to be heard. That is why neuronal processes are not in any way "more real" than the perceptions of things which they convey. This becomes irrefutable no later than *when it is connected with my fellow human beings.* If physical reality were the "actual one," they would ultimately only be forms of matter- and energy-states. My integrating, gestalt-forming perception displays other people for me as *what they are in reality, too*—or should we still speak about "constructs," "images," and "simulations" when we, as human beings, look at one another? Here, too, neuroconstructivism can only be maintained as long as one ignores interpersonal relationships. Perception is, of course, not a pure copy of stimuli constellations, for it selects, shapes, and integrates what is to be perceived. However, it is therefore not a mere construct—it rather presents things and people to us *as themselves*, and *in their relation to us.*

Here a decisive quality of perception becomes clear which cannot be found on the physical or physiological level: it produces a *coexistence* between the perceiving person and the perceived thing. If I see the other human being, I also see him in relation to me, within a shared space. Indeed, only to the extent that the phenomenal world presents itself as accessible, comprehensible, and relevant to us, can it become reality for us at all. That becomes above all possible by our having always been part of the world as embodied subjects. The supposedly only subjective or virtual space of phenomenal experience is thus anything but an inner world to be localized in the skull, or a brain-generated "out-of-the-brain-illusion" (Revonsuo 2003). On the contrary, it is the space of our *being-in-the-world*—the space of our relationship to everything that gains relevance and importance for us.

[15] This important notion was introduced by Hegel in his "Science of Logic" (*Wissenschaft der Logik,* vol. 1). The German philosopher Helmuth Plessner regarded this as a fundamental structure of life processes, in particular of perception (Plessner 1975, 48, 168, 321–325). I will come back to this in section 4.2.6.

1.4 Third criticism: the reality of colors

But, finally, what about the qualities which we experience when perceiving—the colors, sounds, and smells of our world? All those things which make the world familiar and inhabitable, are these only internal constructs that have no existence outside of our brain or consciousness? At least, this is what neuroconstructivism suggests:

> It is unsettling to discover that there are no colours out there in front of your eyes. The apricot-pink of the setting sun is not a property of the evening sky; it is a property of the internal model of the evening sky, a model created by your brain. The evening sky is colourless. […] It is just as your physics teacher in high school told you: Out there, in front of your eyes, there is just an ocean of electromagnetic radiation, a wild and raging mixture of different wavelengths. (Metzinger 2009, 20)

I have already mentioned the aim of the natural-scientific program to cleanse nature of all non-mathematical properties by shifting qualities into the perceiving or feeling subject. Colors—I choose these qualities as an example—no longer appear in this reduced world. Let us assume that a person sees a green tree in front of her in the meadow: even a comprehensive physical examination and description of all of what happens outside and inside the person's body would not allow any statement about her perception of color as long as she remained silent about it. Without our experience of color science would have no reason to even suspect its existence. Although we could learn from the person that she did, in fact, see a green tree, the physical description could not contribute in the least to the explanation of this perception, for, according to the data, the person could equally see any other color or none at all. Color cannot be physically explained or reduced—that is why, from this viewpoint, it suggests itself that they be eliminated from the inventory of the real world.

Moreover, a neuroscientist too can only ascertain that during the act of perceiving the color green, the light of a certain wavelength falls on the retina and triggers off a cascade of neuronal processes, arriving at area V4 of the occipital lobe, which he knows is necessary for color perception (Zeki 1992). But however carefully he follows the neural signals from the retina along the optic nerve and across the brain, nowhere will he come across anything like a color itself, or anything that explains color perception *as such*—as little as the observations of the physicist outside of the body. Undoubtedly, it needs the light waves which, reflected by an object, stimulate the retina and optic tract, *in order for us to see* colors, or the sound waves which cause our eardrum to vibrate, *so that we hear* tones. However, we do not see any light waves and do not hear any sound waves, rather colors and tones. Should we regard this as an illusion created by the brain?

Of course, the existence of sensory qualities in the perceived environment cannot simply be refuted. But colors are obviously of a different type than, for example, the size or mass of an object. The green of the tree fades in the evening light and vanishes at night, whereas his height remains the same. Hence, already on the physical level, colors are dependent on light, that is, on the respective interaction of object and illumination. But even then the wavelength of the emitted light may be only approximately correlated with the perceived color. The same wavelength, for example, will give rise to quite different colors if the surrounding environment is different—color consistency or color illusions demonstrate this well enough. Obviously an *interaction of object, light, and perceiving organism* is required in order for a certain color to appear in the world. Yet from a physical or neurobiological point of view, only *conditions or correlates* of color perception may ever be ascertained, which may neither explain nor predict it *as such* (Stroud 2000).

Now the physicist need not worry if the tree, apart from its structure of particles, is green in addition or not. This question simply no longer arises for his measurements and the formation of his theories. The denial of qualities in the world thus emerges not from a scientific necessity. In fact, it rather emerges from a *physicalist world view* which hypostasizes to "actual" reality the quantifiable extracts of reality, originally chosen by science for certain aims, and the theoretical constructs (atoms, photons, electromagnetic fields, etc.) derived from it. Physical descriptions, explanations, and constructs are now alleged to be valid for all areas of the lifeworld. Then the green tree is now only a big stack of molecules, the nightingale's song in its branches is only an irregular sequence of air pressure variations, and the joy of the wanderer who listens to it only a certain neuronal excitation pattern in his brain.

However, this scientistic worldview is by no means inescapable. The fact that light waves are not colored or sound waves not loud themselves is no reason to refute the reality of colors and tones. After all, there is a host of other characteristics of reality which likewise fall through the coarse grid of physical descriptions—for example, the fruitfulness of fruit trees, the brood care behavior of gray geese, a debate in the British Parliament, or the German trade surplus in the year 2017. Should all that not be described as reality just because physics has nothing to say about it? Physicalism claims that everything we can state about the world is reducible to physical facts (see Quine 1960). Of course, at least this does certainly *not* apply to this statement itself: for the knowledge of *what a physical fact is in the first place* cannot be contained in the set of all physical facts. But the phenomena to be reduced—perceived colors, sounds, or smells—cannot be contents of physical statements either, for they belong to the realm of psychological facts. The physicalist reductionist is faced with

phenomena which he *cannot even describe* in what he presumes to be the only valid language, let alone is able to reduce.

Of course, in a purely physical world, there would be no sense in speaking about colors and tones. However, such a world is only a conceived abstraction of the world, which we as living beings dwell in and experience. In this world our organism makes qualitative distinctions which cannot be found on the physical level, and thus structures the environment into the meaningful and the relevant in order to sustain itself in it. In this way, it becomes possible that things and living beings *show themselves* and *enter into a relation with us*, that is to say, in colors, sounds, and odors. To that extent, the sense qualities are the results of the relation of a living being to its environment. But this relation has a world-disclosing quality and, insofar, a thoroughly objective character. Even the so-called primary qualities of physics can only become accessible to us via the secondary ones.

Is the tree in fact green then? It depends on whether we look at it as a part of our shared lifeworld—then we can agree on its color, and it is thus not "only subjective"—or whether we descend in a physical construct world, in which, according to its premise, none of the lifeworld qualities can be found any longer. Color is neither an objective characteristic of the material world ("naive realism"), nor is it a mere product of an inner world (neuroconstructivism). Colors and other sensory qualities are rather the expression of a *complementarity* of living beings and their environment. They emerge in the interaction of an organism's perceptual capacities and the characteristics of objects. Thus, it can be shown that the development of color patterns in flowering plants took place in constant interaction with the development of color vision in insects. The property and its perception arose in various species co-evolutionarily in the context of a comprehensive ecological system (Ehrlich & Raven 1964).

Similarly, it is true for life as a whole: the world also changed with its development; new, systemic relations and corresponding relational properties emerged. Living beings produce qualitative differences from quantitative ones and, by this means, they transform the world, for the specific relationship between color property and color perception now *belongs as such to its objective features*. This transformed world is our lifeworld. As long as we are not blind, we all see colors, and we can compare our perception of them with that of others. We dress in certain tones of color, in order to appeal to others, and painters design the canvas with colors, in order to invoke certain impressions in us. That is why our world contains colors and other qualities just as necessary as it contains fruits, trees, animals, and human beings—we cannot deny the one and let the other exist.

1.5 **Summary**

We started from the neuroconstructivist thesis that the ontological status of experienced reality is that of a subjective image or a virtual model which is constructed by the brain. This thesis is ultimately based on a still dualistic division of the world into a bodiless and worldless subjectivity on the one hand, and a physically reduced material world on the other hand. Subjectivity is conceived of idealistically—though in the new robe of constructivism—while it is, at the same time, ascribed as a construct to purely material processes in the brain. The result is a peculiarly hybrid doctrine, composed of a disembodied mind and a disembodied brain, which could rightly be called "Cartesian materialism" (Rockwell 2005). It is connected with the assumption that there is an external physical reality as such, which is only given to us through representations in our mind.

In the criticism I have shown that perception is not to be understood as an internal representation, model, or construct, but rather as *the active relation of an embodied subject to its environment.* When we perceive, we are not enclosed in the skull to see pictures from the world outside. On the contrary, we interact with the world as embodied beings, coexisting with things and other persons in a shared space. Human perception is thus based on interaction in a twofold sense:

1. According to the enactive approach, living beings generally do not passively receive information from their environment which they then translate into internal representations. Rather, they constitute or *enact* their world through a process of *sense-making* (Varela et al. 1991, Thompson 2007, Di Paolo 2009): by actively searching and probing the environment for relevant cues—moving their head and eyes, touching a surface, walking towards a goal, grasping a fruit, etc.—they make sense of their surroundings. In other words, they constitute their experienced world or *Umwelt* (von Uexküll 1920) through their ongoing sensorimotor interaction and embodied coping with the environment.
2. In addition, through their *social interactions* and implicit relation to others, human beings are able to transcend their primary perspective and gain access to a shared, objective reality. From early childhood on, experiences of joint attention, pointing towards objects, shared reference to situations, mutual understanding, and cooperative practice result in a *participatory sense-making* (De Jaegher & Di Paolo 2007). In this way, a shared reality is constituted, which becomes an implicit part of our relation to the world. This is why we perceive a given experiential object as transcending its momentary appearance: it could also be seen by others. The objects are not

only there "for me": even Robinson Crusoe on his island always perceived his surroundings "with others' eyes," already before Friday appeared on the scene. This is also what enables us to see things *as such*, objectively, or in independence from our momentary perception. For objectivity ultimately indicates that the objects are experienced as intersubjectively accessible, in the co-presence of possible other subjects, or "as actually there for everyone" (Husserl 1960, 91). Human reality is therefore always *co-constituted* or, as we might say, "*interenacted*."

Hence, human perception is anything but a parade of images in a disembodied, worldless, and solitary mind. Rather, it is an activity that transcends the boundaries of the body and the centrality of the subjective perspective through interactions on two levels:

1. On the first level, the *sensorimotor interaction* of the mobile body with the environment implies a constant changing of perspectives that relativizes the momentary relation of organism and environment: each perception is enriched by a history of former experiences and a horizon of possible further interactions with the object.
2. On the second level, the *social interaction* with others implies a shared reference to objects as well as a contrast and alignment of perspectives which helps to overcome a merely subject-centered worldview through participatory sense-making. The capacity to share one's perceptions with others in principle results in an *increased distance* of the subject from the object of perception, that is, in an objectification.

Thus, we live in a world of real objects, because we are involved in its constitution through our sensorimotor engagement. And we live in a shared objective reality because we continuously "interenact" it through our joint activities and participatory sense-making.

The acid test of every epistemology is, when all is said and done, the intersubjective relationship. When it is a matter of another person, we cannot simply withdraw to a radical constructivist viewpoint. The reason for this is that we would not only declare their very presence a virtual one; we would rather also remove the necessary *limitation* which the other represents for our own self-being. The other is real for me—and it is only through him that I gain reality myself. I can no longer be a solipsistic or constructed being. At the same time, it is the *consensually* apprehended reality which guarantees the reality of my perceptions and embeds my subjective bodily space into an objective one—into the shared space of "open intersubjectivity" (Husserl 1973b).

On this condition we were able to restore its objectivity to perception, as well as its qualities to nature, without thus falling back into a "naive realism."

Certainly, perception is not a one-to-one mapping of the physically described world. But we have seen that it is precisely the active, gestalt-like, and intentional characteristics of perception which allow us to see the *things as such*. Physicalism, with its extremely reduced data basis, eliminates all qualitative and gestalt-like perceptions from the definition of the real. The primacy of the lifeworld counters that: it is only in the latter that things, living beings, and persons show themselves *as what they really are*. Perception thus presents us truly more than the mere stimulus configurations contained in the perceptual field. Nevertheless, it does not thus present any constructs, rather the real world—of course, not as "world in itself," rather *as the world in its relation to us*, the perceiving persons.

We may finally ask why this conflict is actually so important. Would it be so bad if we acknowledged subjective reality as a construct of the brain from a natural scientific perspective—as long as we, nevertheless, in our everyday life continue to work from the adequacy of our perception? The answer is: whatever we declare to be a mere semblance, we also gradually look on as no longer relevant and meaningful. It is given a subordinate and derivative existence and is devalued in its meaning. Moreover, our own judgement and trust in the world is fundamentally undermined: after all, we are trapped in a cave watching shadows on the wall while reality is outside, beyond our grasp, and even knowledge. We all live in error and need the authority of science to enlighten us about what reality is really like. It feels as if we are being blamed, or condescended to, for not perceiving things as science thinks we ought to. If we thus declare our shared reality to a virtual construct, we rob ourselves of the basis of our autonomy and self-confidence. In the last analysis, the question of what is "really real"—physical matter instead of animated bodies, brains instead of selves, neural computation instead of conscious experience—is an ethical question.