G. Riva, M.T. Anguera, B.K. Wiederhold and *F. Mantovani* (Eds.)
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3 Being-in-the-world-with: Presence Meets Social And Cognitive Neuroscience

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Abstract: In this chapter we will discuss the concepts of "presence" (Inner Presence) and "social presence" (Co-presence) within a cognitive and ecological perspective. Specifically, we claim that the concepts of "presence" and "social presence" are the possible links between self, action, communication and culture. In the first section we will provide a capsule view of Heidegger's work by examining the two main features of the Heideggerian concept of "being": spatiality and "being with". We argue that different visions from social and cognitive sciences – *Situated Cognition, Embodied Cognition, Enactive Approach, Situated Simulation, Covert Imitation* - and discoveries from neuroscience – *Mirror and Canonical Neurons* - have many contact points with this view. In particular, these data suggest that our conceptual system dynamically produces contextualized representations (simulations) that support grounded action in different situations. This is allowed by a common coding – the motor code – shared by perception, action and concepts. This common coding also allows the subject for natively recognizing actions done by other selves within the phenomenological contents. In this picture we argue that the role of presence and social presence is to allow the process of self-identification through the separation between "self" and "other," and between "internal" and "external". Finally, implications of this position for communication and media studies are discussed by way of conclusion.

Contents

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3.1 Introduction

In this chapter we will discuss the concepts of "presence" (Inner Presence) and "social presence" (Co-presence) within a cognitive and ecological perspective. Specifically, we claim that the concepts of "presence" and "social presence" are the possible links between self, action, communication and culture.

To support this vision, in the first section of the chapter we will provide a capsule view of Heidegger's work by examining the two main features of the Heideggerian concept of "being": spatiality and being with. We argue that different visions from social and cognitive sciences – *Situated Cognition, Embodied Cognition, Enactive Approach, Situated Simulation, Covert Imitation* - and discoveries from neuroscience – *Mirror and Canonical Neurons* - have many contact points with this view.

These data suggest that our conceptual system dynamically produces contextualized representations (simulations) that support grounded action in different situations. This is allowed by a common coding – the motor code – shared by perception, action and concepts. This common coding also allows the subject for natively recognizing actions done by other beings within the phenomenological contents.

However, this picture has some holes in it: if perception, action and concepts share the same language how can we differentiate between them. In particular how can we distinguish between a perceived action, a planned or an executed one?

More, even if imitation has frequently been proposed as the central mechanism mediating the reproduction, spread, intergenerational transmission and stabilization of human cultural forms, our imitation is selective. How and why do we imitate? Finally, developmental psychology clearly shows that our simulative abilities are not the same in the different phases of our life. How and why do they evolve?

In this chapter we suggest that a psychology of presence is a possible answer to these questions. In our vision "Presence" and "Social Presence" have a simple but critical role in our everyday experience: the control of agency and social interaction through the unconscious separation of both "internal" and "external", and "self" and "other". Finally, implications of this position for communication and cultural studies are discussed by way of conclusion.

3.2 "Being-in-the-world-with": the Vision of Heidegger

The German philosopher Martin Heidegger, (born Sept. 26, 1889; dead May 26, 1976) was one of the most significant thinkers of the 20th century. His main interest was to analyze the issue of "being" [Dasein], that is, to make sense of our capacity to make sense of things [1].

In colloquial German "Dasein" ("there" [Da] + "Being" [Sein]) means "everyday human existence." Using this expression Heidegger underlines that a human being cannot be taken into account except as being an existent in the middle of a world amongst other things and other beings [2]. Specifically, in the book "*Being and Time*" Heidegger underlines the following structural (ontological) features of the being [1]:

- *Spatiality*: the space is not around us but within us;
- *Being with*: we exist not on our own terms, but only in reference to others.

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The first assumption is that spatiality is the mode of our existence. In this vision, humans are not "*in*" space, but they do exist in some spatially salient manner. So, the world is mainly a "space-of-action": the human beings are thrown into situations in which they must continually act and interpret [3].

Heidegger identifies three main features of this space-of-action [4]: "de-severance" [*Ent-fernung*], "directionality" [*Ausrichtung*] and "regions" [*Zuhanden*]. De-severance describes the non contemplative nature of being: it exists through concretely acting in the world, by reaching for things and going to places. In this view the being is the result of a process of spatial self-determination, "making things available" to him/herself. As noted by Arisaka [4]:

"When I walk from my desk area into the kitchen, I am not simply changing locations from point A to B in an arena-like space, but I am 'taking in space' as I move, continuously making the 'farness' of the kitchen 'vanish,' as the shifting spatial perspectives are opened up as I go along." (p. 37).

This process is always "directional" [4]: aimed toward something or in a certain direction. The direction is determined by our concern and by specific "regions". In fact regions - the office, the park, the kitchen, etc. - are functional for organizing our activities and contextualizing tools and other beings. Regions are not neutral, container-like space, but are inherently organized by activities, which determine the center of action[3]: our spatial activities determine a "here" related to the objects/beings we deal with. Following this view, "existence" is the main feature of being: a temporally-structured making intelligible of the place in which we find ourselves. As delineated by Heidegger [1]:

"[I]t follows that Being-in is not a 'property' which Dasein sometimes has and sometimes does not have, and without which it could just be just as well as it could be with it. It is not the case that man 'is' and then has, by way of an extra, a relationship-of-Being towards the 'world'--a world with which he provides himself occasionally." (p. 84).

To describe this feature of being, Heidegger introduced the concept of "throwness" [*Geworfenheit*]: he claims that we are limited, and determined to some extent, by conditions and circumstances beyond our control. During the life each human being is "thrown" into existence, into situations in which he/she must continually act and interpret. In this process a critical role is played by moods, described as a unique and primary way of disclosing the being-in-the-world, that is prior to the "cognitive" disclosure [5]. In fact, is not "reason" that gives us our basic access to being, but moods [1]:

"The disclosure-possibilities of cognition fall very short when compared with the primordial disclosure that belongs to moods." (p. 134).

The interaction with objects follows a similar path: when the being is engaged in purposeful actions, "cognitive" representations of objects as tools or equipment do not exist. This means that objects are conceived of according to their usefulness in

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whatever task is currently being performed. This situation is described by Heidegger [1] as "readiness-to-hand" [*Zuhandenheit*]:

"The kind of Being which equipment possesses - in which it manifests itself in its own right – we call "readiness-to-hand"… If we look at Things just 'theoretically', we can get along without understanding readiness-to-hand. But when we deal with them by using them and manipulating them, this activity is not a blind one; it has its own kind of sight, by which our manipulation is guided and from which it acquires its specific Thingly character. Dealings with equipment subordinate themselves to the manifold assignments of the 'in-order-to'. And the sight with which they thus accommodate themselves is circumspection." (pp. 97-98).

In contrast, we may also encounter objects as purely bare "presence-at-hand," [*Vorhanden*], simply alongside us in the world. Typically, this happens in "breakdown" situations. In them the object ceases to be "ready-to-hand" and becomes "present-at-hand," that is, non transparent to the user. As noted by Winograd and Flores [6]:

"[In Heidegger] objects and properties are not inherent in the world, but arise only in an event of breaking down in which they become present-at-hand. One simple example he gives is that of a hammer being used by someone engaged in driving a nail. To the person doing the hammering, the hammer as such does not exist. It is a part of the background of readiness-to-hand that is taken for granted without explicit recognition or identification as an object. It is part of the hammerer's world, but is not present any more than are the tendons of the hammerer's arm." (p. 36).

In the example of hammering, it is only during a breakdown - when the hammer breaks or misses the nail - that the properties of the hammer are revealed and become "present-at-hand." In this process, the being comes across entities [*Seiende*] like himself. It is important to underline that "being-with" [*Mitsein*] is a mode of our existence, too [7]: as the being is never without a world so, too, it is never without others. Heidegger clearly underlines this point:

"Thus in characterizing the encountering of Others, one is again still oriented by that Dasein which is in each case one's own… [Others] are rather those from whom, for the most part, one does not distinguish oneself—those among whom one is too… The world of Dasein is a with-world. Being-in it Being-with Others." (pp. 154-155).

For this reason, the character of being towards others is different from the character of being towards entities ready-to-hand and present-at-hand. This new character is defined "solicitude" [*Fursorge*]: attentive care and protectiveness.

The fourth chapter of "Being and Time" introduces two forms of solicitude [3]: "leaping in" [*Einspringen*] and "leaping ahead" [*Vorspringen*]. "Leaping in" is an inauthentic form of solicitude: in it the being relieves other beings of responsibility, but with the result that they may become dominated by or dependent upon him. Apparently, in "leaping in" the being consider the other being like an object, an extension of him/her. In "leaping ahead" - the authentic form of solicitude - the being helps other beings to become transparent to them. Using transparency only, the being is able to see the truth of his or her condition and become free.

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In summary, in "being-with" we have the possibility of comprehending that we cannot be selves unless it is within our possibilities to relate in a unique way to other human beings: we exist not on our own terms, but only in reference to others [7].

3.3. The "Being-in-the-world" for Cognitive Neuroscience

In our capsule view of Heidegger's work, we discussed the two faces of his concept of being. On one side, the main features of "being-in-the-world" are spatiality and throwness. On the other side, the "being-in-the-world-with" is characterized by the reference to others and solicitude. Further, both sides are ontologically connected in our existence.

Even if this is a philosophical vision, there are strict links with the more recent outcomes of cognitive science. In the next paragraphs we will try to outline these links, starting from the "being-in-the-world".

3.3.1 Embedded Cognition

A critical part within Heidegger's reflection is the concept of "throwness", as original state in which the being must continually act and interpret.

However, for a long time cognitive science considered action, perception, and interpretation as separate activities. As provocatively outlined by Prinz [8]:

"We had perception on one side, which is in the business of representing inputs from the external world. Then we had action, on the other side, which controls an organism's outputs, or behavior. Nestled between these "peripheral systems" when had central systems, which were presumed be the main engines of "cognition" or "thinking." Each of these systems was supposed to work independently, like separate committees in a great corporation, only vaguely away of what the others are up to. In cogsci lingo, each system was supposed to use proprietary rules and representations." (p. 19).

A recent trend in cognitive science is instead seeing cognition as *embedded*, or *situational*. This is a rethinking of the idea that cognition is primarily a matter of performing formal operations on abstract symbols and has little or nothing to do with the environment in which it occurs [9]. Countering it, *Embedded Cognition* takes as its starting point the idea that cognition occurs in specific environments, and for specific ends [10-12]. The main approaches related to this trend are *Situated Cognition, Distributed Cognition* and *Embodied Cognition*.

3.3.1.1 Situated and Distributed Cognition

The *Situative* perspective shifts the focus of analysis from individual activity to larger systems that include behaving subjects interacting with each other and with other subsystems in the environment [13].

Within it, the *Situated Cognition* approach includes a family of research efforts [14-17] explaining cognition - including problem solving, sense making, understanding, transfer of learning, creativity, etc. - in terms of the *relationship between subjects (agents) and the properties of specific environments (affordances/constrains)*. This is

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possible, because the inside/outside relationship between subject and environment is replaced by a part/whole relationship [18]. As noted by Clancey [19]:

"Situated activity is not a kind of action, but the nature of animal interaction at all times, in contrast with most machines we know. This is not merely a claim that context is important, but what constitutes the context, how you categorize the world, arises together with processes that are coordinating physical activity. To be perceiving the world is to be acting in it - not in a linear input-output relation (act>observe>change) -but dialectically, so that what I am perceiving and how I am moving co-determine each other." (p. 88).

The final outcome of this view is that action is highly dependent upon its material and social circumstances. As noted by Norman [20], any activity is "intrinsically" connected to the particular setting in which the subject acts. Its course is influenced by the physical, social and cultural space (context) in which it happens (situation).

In particular it depends on the natural and contextual characteristics (*affordances* and *constrains)* of the situation. It is important to note that the characteristics of the situation may be perceived or not by the subject. For the action of the subject, *the only relevant characteristics are the ones he/she is able to identify*.

Strictly related to this approach is the one of *Distributed Cognition*. As for Situated Cognition, the analysis is moved from the subject to the his/her relationship with the environment [18]. However, it focuses mainly on three kinds of distributed cognitive processes:

- *Social processes*: across the members of a social group;
- *Processes related to material environment*: across internal and external (material or environmental) structures;
- *Distributed cognition in time*: how the products of earlier events can transform the nature of later events.

3.3.1.2 Embodied Cognition

Within the paradigm of *Embedded Cognition*, the *Embodied Cognition* approach underlines the central role of body in shaping the mind [10, 21-26]. Specifically, the mind has to be understood in the context of its relationship to a physical body that interacts with the world. Hence human cognition, rather than being centralized, abstract, and sharply distinct from peripheral input and output modules, has instead deep roots in sensorimotor processing.

Although this broad claim is enjoying increasingly support, there is in fact a great deal of diversity in the subclaims involved and the degree of controversy they attract. Wilson [27] recently identified six different definitions of *Embodied Cognition*, of which, however, only one explicitly addresses the role of the body (p. 626):

1. *Cognition is situated*. As in *Situated and Distributed Cognition*, the cognitive activity takes place in the context of a real-world environment;
2. *Cognition is time pressured*. As in *Situated Cognition*, the cognitive activity is constrained by the pressures of real-time interaction with the environment;
3. *We off-load cognitive work onto the environment*. As in *Distributed Cognition*, the limits in our information-processing abilities (e.g., limits on working memory) forces us in exploiting the environment to reduce the cognitive

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workload;
4. *The environment is part of the cognitive system*. As in *Distributed Cognition*, the mind alone is not a meaningful unit of analysis;
5. *Cognition is for action*. As in *Situated and Distributed Cognition*, the main function of the mind is to guide action;
6. *Off-line cognition is body based*. The activity of the mind is grounded in mechanisms that evolved for interaction with the environment.

One of the first authors to address the last point was George Lakoff [23, 25, 28]. Since the publication of *Metaphors We Live By* [23] he has suggested that almost all of human cognition depends on the sensorimotor system. Particularly he underlined the role of metaphors in the development of thought and their link with spatial relationships.

To explain this point Anderson used the metaphorical mapping "Purposes are Destinations," [29]:

"We imagine a goal as being at some place ahead of us, and employ strategies for attaining it analogous to those we might use on a journey to a place. We plan a route, imagine obstacles, and set landmarks to track our progress. In this way, our thinking about purposes (and about time, and states, and change, and many other things besides) is rooted in our thinking about space. It should come as no surprise to anyone that our concepts of space—up, down, forward, back, on, in—are deeply tied to our bodily orientation to, and our physical movement in, the world." (p. 105).

This example underlines two points. First, metaphors allow the understanding of a conceptual domain in terms of another one through a process of *mapping*: to know a conceptual metaphor is to know the mappings that applies to a given source-target pairing. Second, at the core of this process there are some pre-linguistic schemas concerning space, time, moving, controlling, and other core elements of our bodily experience. These reflections pushed different researchers to better explore the *link between body and experience*. If we look at the features of the phenomenal level - the level of description in science which deals with immediate experience – it is possible to distinguish [30] between four ones (pp. 33-34):
1. *Location*: all the experience have a spatial location within the sphere of our subjective experiences;
2. *Duration*: An experience comes into existence at some point in time and it ceases to exist at some later point;
3. *Intensity*: Experiences vary along a dimension of strength;
4. *Quality*: Any experience has a qualitative feature that makes it the kind of experience it is.

Nevertheless, even if it is possible to decompose the features of the phenomenal level, our phenomenal experience is just one. What does it unify the phenomenal level as a whole? The answer suggested by many cognitive researchers and philosophers of mind is surprisingly similar to the Heidegger's one: *phenomenal space* is the basic unifying feature of human consciousness.

To support this point Metzinger [31] underlines how, in human beings, sensory and motor systems are physically integrated within the body of a single organism:

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"This singular 'embodiment constraint' closely locates all our sensors and effectors in a very small region of physical space, simultaneously establishing dense causal coupling… The persistent functional link just mentioned has many theoretically relevant aspects. One of them is that it firmly ties all activities of the organism (be cognitive, attentional, or behavioral) into an internal context." (p. 161).

Recent studies suggest that proprioceptive awareness is the very first kind of consciousness to emerge in the nervous system [32, 33]: it exists prenatally and is sufficiently developed at birth for neonate imitation [34]. As underlined by Gallagher [26]:

"Conscious experience is normally of an intermodally seamless spatial system… One of the important functions of the body in the context of perception and action is to provide the basis for an egocentric [body-centered] spatial frame of reference. Indeed, this egocentric framework is required for the very possibility of action, and for the general structure of perceptual experience. The fact that perception and action are perspectivally spatial (for example, the book appears to my right or to my left, or in the center of my perceptual field), is a fact that depends precisely on the spatiality of the perceiving and acting body." (p. 59).

Supporting this position, Revonsuo suggests [30]:

"Each distinct phenomenal coordinate system defines a different subject: the global bundles of phenomenal features synchronously present within each coordinate system are the momentary phenomenal contents of one subject… Empirically based phenomenology should be built on a model that takes the spatiality and centeredness of consciousness as its fundamental structural and organizational property. The phenomenal level is based on an egocentric, bounded coordinate system whose regions can instantiate qualitative features. " (pp. 178-179).

It is important to underline that - as predicted by Heidegger - the phenomenal space is different from the "real" and "physical" space that surrounds us: phenomenal spatiality is directly present in experience whereas the "physical" space is an abstraction, not experienced directly.

3.3.2 Action in perception

An emerging trend within embodied cognition is the *analysis of the link between action and perception*. According to it, action and perception are more closely linked than has traditionally been assumed. This view is strongly influenced by (and in many respects, very similar to) a number of earlier proposals. Both Husserl, Merleau-Ponty, and Poincaré suggested that spatial content may be acquired from knowledge of possible movements. In psychology of perception, the *ecological approach* presented by Gibson [35, 36] shares many similarities to this vision.

Gibson introduced a shift of focus in perception: from how the visual system actually detect the forms, to the invariants - optical flow, texture gradient, and affordances - that visual systems detect in the dynamic optical array.

This approach underlines that perception requires an *active* organism. On one side, the act of perception depends upon an interaction between the organism and the

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environment. On the other side, perceptions are made in reference to body position and functions: *the awareness of the environment derives from how it reacts to our movements*. In his own words [35]:

"*Locomotion and manipulation… are controlled not by the brain but by information… Control lies in the animal-environment system… The rules that govern behavior are not like laws enforced by an authority or decisions made by a commander; behavior is regular without being regulated." (p. 225).*

In the next two paragraphs we will discuss the two positions – the *Enactive View* and the *Theory of Event Coding* – that are a step towards the understanding of the link between action and perception. Further, we will focus on the outcomes of different neuroscience researches that investigated the functioning of the motor system.

3.3.2.1 Enactive view

According to the *Enactive Approach*, the human mind is embodied in our entire organism and embedded in the world, and hence is not reducible to structures inside the head. Specifically, Thompson defines any autonomous and self-determining organism as an *autopoietic* system [37, 38]: a system whose component processes must recursively depend on each other for their generation and their realization as a system, so that they constitute the system as a unity in whatever domain they exist.

Any such system, in defining itself as a unity, also defines (*enacts*) its environment as a domain of meaning, and defines things in its environment as meaningful within that domain (in the way that, for instance, sugar is meaningful for bacteria). This process involves three permanent and intertwined modes of bodily activity – self-regulation, sensorimotor coupling, and intersubjective interaction [38]. As noted by Varela [39]:

"Cognition is not the representation of a pre-given world by a pre-given mind but is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs" (p. 9).

Within this general approach, the *Enactive View's* main claim is that *perceptual experience depends on the acquisition and exercise of sensorimotor knowledge*. This knowledge include different elements, some having to do with the expected effects of our own movement on the input, others concerning the way some external conditions, like sun or wind, will affect the input.

As provided by Noë in his book "Action in Perception" [40]:

"The main idea… is that perceiving is a way of acting. Perception is not something that happens to us, or in us. It is something we do… Perceptual experience acquires content thanks to our possession of bodily skills. What we perceive is determined by what we do (or what we know how to do); it is determined by what we are ready to do. In ways I try to make precise, we enact our perceptual experience; we act it out." (p. 1).

In this view, bodily skills are intrinsically tied to perception: *to perceive is to understand how sensory stimulation varies as we act*.

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The *Enactive View* has different corollaries.

- *The differences in our perceptual experience correspond to differences in the sensorimotor expectations associated with certain objects or properties*: Two objects are perceived differently, because in encountering them we bring to bear different sets of sensorimotor expectations.
- *The very same real property (e.g. shape) may be apprehended differently – e.g. by touch or vision*: the mode of sampling varies dramatically, and with it the associated sensorimotor contingencies.
- *Despite specific differences, many objects will share large parts of the sensorimotor signatures*: It is these commonalities that make the experiences sensorially characterized: visual rather than, auditory or tactile.

Even if the *Enactive View* is a promising theoretical approach, the actual formulation is not immune to criticisms [8, 41, 42]. As underlined by Clark:

"I have raised three challenges for Noë-style sensorimotor contingency theory. The first challenge is to find a safe haven between two unsatisfactory readings of the central claim that perceptual experience is conditioned by expectancies concerning sensory stimulation. One reading looks circular, since it depicts the expectancies as already operating in the realm of experience… The second challenge is to fix the intended force of the central claim. Is the claim that there is a conceptual connection between sensorimotor knowing and the contents of perceptual experience?... The third, and perhaps most serious, challenge is to accommodate (or give principled reasons to reject) the fairly extensive empirical data suggesting that the contents of conscious visual experience are optimized for selection, choice and reason rather than the fine guidance of action." (p.8).

3.3.2.2 The Theory of Event Coding

The *Theory of Event Coding* [43], is a broad framework for understanding relationships between perception, cognition, and action planning that shares many similarities with the *Enactive View*.

According to the *Theory of Event Coding* [43] the cognitive representations for perceived events (*perception*) and intended or to-be generated events (*action*) are formed by a common representational domain.

From this broad position it is possible to identify three different corollaries (pp. 860-861):

- *Common coding of perceptual content and action goals*: perceiving and action planning are functionally equivalent, inasmuch as they are merely alternative ways of doing the same thing: internally representing external events;
- *Feature-based coding of perceived and produced events*: If actions are represented in a way that is at least very similar to how visual objects are represented, the principles underlying the organization of perceptual and action-related information should be comparable;
- *Distal coding of event features.* The cognitive codes that represent perceptual objects are identical to those representing action plans because both kinds of code refer to external (distal) events.

This position, too, has raised many concerns. In particular, as underlined by the same

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authors, the theory does not consider the complex machinery of the 'early' sensory processes that lead to them. Thus, the *Theory of Event Coding* is meant to provide a framework for understanding linkages between (late) perception and (early) action, or action planning, only.
However, within the *Theory of Event Coding,* the most important part for our discussion is the one related to the common coding (*Common Coding Theory*): *actions are coded in terms of the perceivable effects they should generate*. More in detail, when an effect is intended, the movement that produces this effect as perceptual input is automatically activated, because actions and their effects are stored in a common representational domain. As underlined by Prinz [44]:

"Under conditions where stimuli share some features with planned actions, these stimuli tend, by virtue of similarity, either to induce those actions or interfere with them, depending on the structure of the task at hand. This implies that there are certain products of perception on the one hand and certain antecedents of action on the other that share a common representational domain. This is the common coding principle. The second conclusion is that actions are planned and controlled in terms of their effects; that is, that representations of action effects play an important role in the planning and the control of these actions." (p. 152).

The *Common Coding Theory* may be considered a variation of the *Ideomotor Principle* introduced by William James [45]. According to James, imagining an action creates a tendency to its execution, if no antagonistic mental images are simultaneously present. Prinz [44], suggests that the role of mental images is instead taken by the distal perceptual events that an action should generate. When the activation of a common code exceeds a certain threshold, the corresponding motor codes are automatically triggered.
Further, the *Common Coding Theory* extends this approach to the domain of event perception, action perception, and imitation. The underlying process is the following [46]: first, common event representations become activated by the perceptual input; then, there is an automatic activation of the motor codes attached to these event representations; finally, the activation of the motor codes results in a prediction of the action results in terms of expected perceptual events on the common coding level. We will discuss more in depth this "simulative" process later.

3.3.2.3 The Converged Zone and Situated Simulation Theories

The motor system was considered to play a very specific role within our cognitive processes: the control of movement. However, recent neurophysiological findings convey a totally different picture: the motor system controls *actions*.
As we will see below, recent data showed that cortical premotor areas contain neurons that respond to visual, somatosensory, and auditory stimuli. Further, posterior parietal areas, turned out to play a major role in motor control. Finally, the premotor and parietal areas, rather than having separate and independent functions, are neurally integrated not only to control action, but also to serve the function of building an integrated representation. In particular, as underlined by Gallese [47] *"the so-called 'motor functions' of the nervous system not only provide the means to control and execute action but also to represent it." (p. 23).*
This conclusion - that is very close to the claims of both the *Enactive View* and the

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Theory of Event Coding - is the outcome of a long series of experiments of single-neuron recordings in the premotor cortex of behaving monkeys [48, 49]. In particular, Rizzolatti and colleagues discovered that a functional cluster of premotor neurons (F5ab-AIP) contains "*canonical neurons*", a class of neurons that are selectively activated by the presentation of an object in function of its shape, size, and spatial orientation [50-52]. Specifically, these neurons fire during the observation of objects whose features - such as size and shape - are strictly related to the type of action that the very same neurons motorically code.

Further, the *canonical neurons* are activated not only observing the same object, but also observing a group of objects that have the same characteristics, in terms of the type of interaction they allow.

Two aspects of these neurons are important [25, 53]. On one side, what correlates to their discharge is not simply a movement (e.g. opening the mouth), but an action, that is, a movement executed to achieve a purpose (e.g. tear apart an object, bring it to the mouth). Second, the critical feature for the discharge is the purpose of the action, and not some dynamic details defining it, like force, or movement direction.

In a different cluster (F4-VIP) Rizzolatti and colleagues [50, 54] identified a class of neurons that are selectively activated when the monkey heard or saw stimuli being moved in its peri-personal space. The same neurons discharge when the monkey turns its head toward a given location in peri-personal space.

A possibility to explain the dual activation is that these neurons simulate the action (head-turning) in presence of a possible target of action seen or heard at the same location [25]:

"We maintain that what integrates these sensory modalities is action simulation. Because sound and action are parts of an integrated system, the sight of an object at a given location, or the sound it produces, automatically triggers a "plan" for a specific action directed toward that location. What is a "plan" to act? We claim that it is a simulated potential action." (p. 460).

The existence of these functional clusters of neurons suggests, as predicted by Heidegger, that a constitutive part of the representation of an object is the type of interaction that is established with the object itself (*readiness-to-hand*). In other words, different objects can be represented in function of the same type of interaction allowed by them. As underlined by Gallese [47]:

"If this interpretation is correct, objects are not merely identified and recognized by virtue of their physical 'appearance', but in relation to the effects of the interaction with an agent. In such a context, the object acquires a meaningful value by means of its dynamic relation with the agent of this relation. This dynamic relation is multiple, as multiple are the ways in which we can interact with the world by acting within it. The object-representation ceases to exist by itself. The object phenomenally exists to the extent it represents the target of an action." (p.31).

These experimental data match well with the *Converged Zone Theory* proposed by Damasio [55]. This theory has two main claims. First, when a physical entity is experienced, it activates feature detectors in the relevant sensory-motor areas. During visual processing of an apple, for example, neurons fire for edges and planar surfaces, whereas others fire for color, configural properties, and movement. Similar

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patterns of activation in feature maps on other modalities represent how the entity might sound and feel, and also the actions performed on it.

Second, when a pattern becomes active in a feature system, clusters of conjunctive neurons (*convergence zones*) in association areas capture the pattern for later cognitive use. As shown also by the data collected by Rizzolatti, cluster of conjunctive neurons codes the pattern, with each individual neuron participating in the coding of many different patterns.

Damasio assumes the existence of different convergence zones at multiple hierarchical levels, ranging from posterior to anterior in the brain. At a lower level, convergence zones near the visual system capture patterns there, whereas convergence zones near the auditory system capture patterns there. Further, downstream, higher-level association areas in more anterior areas, such as the temporal and frontal lobes conjoin patterns of activation *across* modalities.

A critical feature of convergence zones underlined by Simmons and Barsalou is *modality-specific re-enactments* [56, 57]: once a convergence zone captures a feature pattern, the zone can later activate the pattern in the absence of bottom-up stimulation. In particular, the conjunctive neurons play the important role of reactivating patterns (*re-enactment*) in feature maps during imagery, conceptual processing, and other cognitive tasks. For instance, when retrieving the memory of an apple, conjunctive neurons partially reactivate the visual state active during its earlier perception. Similarly, when retrieving an action performed on the apple, conjunctive neurons partially reactivate the motor state that produced it. This process has two main features:

- *It is similar, but never constitutes a complete reinstatement of the original modality-specific state*: even if some semblance of the original state is reactivated, a re-enactment is always partial and potentially inaccurate.
- *It is not necessarily conscious*: Although conscious re-enactment is viewed widely as the process that underlies mental imagery, re-enactments need not always reach awareness.

The process of re-enactment is at the core of the *Situated Simulation Theory* proposed by Barsalou [56]. For this author, conceptual representations are contextualized and dynamical multimodal simulations (re-enactments) distributed across modality-specific systems. As suggested by Barsalou [56]:

"A concept is not a single abstracted representation for a category but is instead a skill for constructing idiosyncratic representations tailored to the current needs of a situated action… More than the focal category is represented in a given simulation. Additional information as background settings, goal directed actions and introspective states are also typically included in these simulations, making them highly contextualized." (p. 521).

According to this view, a fully functional conceptual system can be built on reenactment mechanisms. As shown by Barsalou and his group [56, 58, 59] using these mechanisms, it is possible to implement the type-token distinction, categorical inference, productivity, propositions, and abstract concepts.

The *Situated Simulation Theory* fits well with the *Common Coding Theory:* first, modality-specific sensorimotor areas become activated by the perceptual input (an apple) producing patterns of activation in feature maps; then, clusters of conjunctive

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neurons (convergence zones) identify and capture the patterns (the apple is red, has a catching size, etc.); later the convergence zone fire to partially reactivate the earlier sensory representation (I want to take a different apple); finally this representation reactivate a pattern of activation in feature maps similar, but not identical, to the original one (re-enactment) allowing the subject to predict the action results.

The final outcome of this vision is the idea of a spatial-temporal framework of virtual objects directly present to the subject: *an inner world simulation in the brain*. As described by Barsalou [59]:

"In representing a concept, it is as people were being there with one of its instances. Rather than representing a concept in detached isolated manner, people construct a multimodal simulation of themselves interacting with an instance of the concept. To represent the concept they prepare for situated action with one of its instances." (p. 9).

3.4 The "Being-in-the-world-with" for Social and Cognitive Neuroscience

In the picture described by Heidegger the second ontological features of the being is "being-with", the being is always a "being with others". In this paragraph we will discuss this assumption in the view of the results coming from social and cognitive neuroscience.

3.4.1 Mirror Neurons in Social Neuroscience

Recently, research in the neurosciences has focused its attention to understand social cognition. With the term "*social cognition*" is usually defined the information-processing system that enables us to engage in social behavior. Specifically, social neuroscience is interested to understand whether the processes that give rise to social cognition are a subset of more general cognitive processes or whether specific social-cognitive processes exist [60].

In responding to this question, social neuroscience has three assumptions [61]:

- the mechanisms underlying mind and behavior will not be fully explicable by a biological or a social approach alone;
- a multi-level integrative analysis may be required;
- a common scientific language, grounded in the structure and function of the brain, can contribute to this endpoint.

A significant step towards this common language comes from the *Common Coding* and *Situated Simulation* theories. Specifically, a consequence of the link between perception and action is that *observing actions or action effects produced by another individual may also activate a representation of one's own actions*.

This assumption, too, has been recently confirmed from the outcome of single-neuron recordings in the premotor cortex of behaving monkeys [48, 49]. Specifically, Rizzolatti and colleagues discovered that a functional cluster of premotor neurons (F5c-PF) contains "*mirror neurons*", a class of neurons that are activated both during the execution of purposeful, goal-related hand actions, and during the observation of similar actions performed by another individual [48, 62, 63]. Different brain-imaging experiments demonstrated in humans the existence of a mirror system in the premotor

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and parietal areas - similar to that observed in monkeys - matching action observation and execution [64-66].

Further, a recent study showed that a similar process happens with emotions [67]. In the experiment, a group of male subjects observed video clips showing the emotional facial expression of disgust. Both observing such faces, and feeling disgust, activated the same sites in the anterior insula and to a lesser extent in the anterior cingulate cortex.

Finally, the results of three studies by Keyser and colleagues [68] showed that the first-person subjective experience of being touched on one's body activates the same neural networks in the secondary somatosensory cortices activated by observing the body of someone else being touched.

3.4.2 Embodied Simulation

The general framework, outlined by the above results, suggests the sensory-motor integration supported by the mirror matching system instantiates simulations of transitive actions utilized not only to generate and control goal-related behaviors, but also to map the goals and purposes of others' actions, by means of their simulation [25, 52, 56, 69].

This process, as predicted by Heidegger, establishes a direct link between the being and the other beings, in that both are mapped in a neutral fashion: the observer uses her/his own resources to directly experience the world of the other by means of an unconscious process of motor simulation. To summarize, *action observation constitutes a form of embodied simulation of action [69]*. As suggested by Gallese [52]:

"First, the same neural structures modeling the functions of our body in the world also contribute to our awareness of our lived body in the world and of the objects that the world contains. Embodied simulation constitutes the functional mechanism at the basis of this dual property of the same neural circuits… Second, there are neural mechanisms mediating between the multi level personal background experience we entertain of our lived body, and the implicit certainties we simultaneously hold about others. Such personal body-related experience enables us to understand the actions performed by others, and to directly decode the emotions and sensations they experience." (p. 42).

However, the *Embodied Simulation* approach, at least in this broad formulation raised a critical concern (for a detailed description see the full text of the interdisciplinary conference "*What do mirror neurons means*", available online at the address: http://www.interdisciplines.org/mirror/papers/1): the activity of mirror neurons alone is not enough to provide the richness required for representing a subject's social intention. Jacob and Jeannerod [70] clearly detailed this point:

"The firing of MNs is a social cognitive process only in a very weak sense. When MNs fire in the brain of a monkey during action execution, the discharge is not a social cognitive process at all. When MNs fire in the brain of a monkey watching another grasp a fruit, the discharge is a weakly social process: the two monkeys are not involved in any kind of non-verbal intentional communication. The agent intends to grasp a fruit, not to impart some information to his conspecific. Nor does the

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observer's understanding of the action require him to understand the agent's communicative intention (because the agent has none)." (pp. 22-23).

Another criticism related to this approach is the limited role of imitation in our interpersonal relationships [71]: imitation is not a very common response to watching other people. Indeed, Baldissera and colleagues [72] found evidence of spinal "inverted mirror" behavior: structures in the spinal cord specifically inhibit undesired imitative action.

3.4.3 Imitation in Social Cognition

As we have seen, one of the main criticisms to the *Embodied Simulation* approach is that mirror neurons alone are not enough to provide the richness required for representing a subject's social intention. But what are the main features of human social cognition?

According to Tomasello and colleagues [73, 74] it is possible to identify three different levels of social understanding:

- *Perception of the behavior of animate beings*: this level allow the subject to predict the consequences of the observed behavior. In particular this level allows for both *Motor Empathy* - the tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person – and *Emotional Empathy* – the response to the emotional displays of others [75];
- *Understanding that others' behavior is goal-directed*: on this level, other individuals are conceived of as intentional agents whose behavior and attention are purposive.
- *Theory of Mind (ToM):* on this level, other individuals are conceived of as agents whose thoughts and beliefs may differ from those directly inferred from their perceived behavior. This level allows *Cognitive Empathy*, the ability to represent the mental states of others, i.e., their thoughts, desires, beliefs, intentions, and knowledge.

Apparently, mirror neurons have a critical role in the first level only. So, what is missing is an explanation for how a neural mirror system begets a theory of mind. According to Meltzoff and colleagues [76-80], the starting point for such an explanation is the imitation process.

Meltzoff, in his thirty-year-long research about infant imitation, found that newborns – even only 42 minutes old - demonstrate successful facial imitation. Moreover he found that 12–21-day-old infants can imitate four different adult gestures: lip protrusion, mouth opening, tongue protrusion and finger movement. Interestingly, the newborns' first response to seeing a facial gesture is the activation of the corresponding body part [77]: apparently young infants isolate *what* part of their body to move before understanding *how* to move it (*organ identification*).

The developmental work shows that infants not only imitate but also know when they are being imitated by others (recognition of goal-directed behavior). However, data show an important difference between the younger and the older infants [78]: younger infants increase the particular gesture being imitated, but do not switch to mismatching gestures to see if they will be copied. Specifically, older infants both recognize the difference between them and the other, and seem to be exploring the

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sense of agency involved—exploring who is controlling whom.

Decety and colleagues [80] investigated using a PET the brain regions involved in this process. The data showed the involvement of the inferior parietal cortex. In particular, the right superior temporal gyrus was involved in visual analysis of the other's actions, while its homologous region in the left region was concerned with analysis of the other's actions in relation to actions performed by the self.

Meltzoff investigated, too, the earliest developmental roots of decoding the goals and intentions of others [78]. His research showed that 18-month-old infants distinguish between what an adult means to do and what he actually does. The infants linked goals to human acts inferring the goal even when it was not attained. The infants in these experiments were already exhibiting a fundamental aspect of our adult framework: the acts of persons (but not the motions of objects) are based on goals and intentions.

To explore the neural correlates of this ability, Chaminade, Decety and Meltzoff [81] designed a functional neuroimaging experiment. The results show that, when subjects imitated either the goal or the means to achieve it, overlapping activity was found in the right dorsolateral prefrontal area and in the cerebellum. Moreover, on one side, imitating the goal was associated with increased activity in the left premotor cortex. On the other side, the imitation of the means was associated to specific activity in the medial prefrontal cortex that is known to have a role in inferring others' intentions and is involved in mentalizing tasks.

This activation of the medial frontal region suggests that observing the means used by an actor prompts the observer to construct/infer the goals whereto this human agent is aiming [78]. This inference is consistent with the proposal by Moses [82] that ToM is intimately bound with the advances of the children in executive functioning: the skills and processes implicated in the monitoring and control of action.

3.4.4 The Covert Imitation Theory

Given the critical role of imitative abilities in the development of social skills, Wilson and Knoblich [71, 83] introduced a different simulation theory based on imitation: the *Covert Imitation Theory*. For these authors *covert imitatio*n functions as *an automatic action emulator*, tracking the behavior of other subjects in real time to generate perceptual predictions. As explained by Wilson and Knoblich:

"The various brain areas involved in translating perceived human movement into corresponding motor programs collectively act as an emulator, internally simulating the ongoing perceived movement. This emulator bypasses the delay of sensory transmission to provide immediate information about the ongoing course of the observed action as well as its probable immediate future. Such internal modeling allows the perceiver to rapidly interpret the perceptual signal, to react quickly, to disambiguate in situations of uncertainty, and to perceptually complete movements that are not perceived in their entirety." (p. 468).

This theory can be considered a social extension of the *Situated Simulation* and *Common Coding* theories. Earlier we presented the construct of re-enactment as the underlying mechanism behind them. However, this simple construct is not sufficient alone to implement *covert imitation*. As suggested by Barsalou and colleagues [58]

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covert imitation may involve two further mechanisms: *selective attention* and *memory integration*.

First, the capture process does not operate on entire perceptual states but only on components of them. On viewing someone catching an apple, for example, the brain does not capture the entire scene. Instead, as attention focuses on the specific action, such the moving hand, an associative area captures the neural state that represents it.

Second, once attention selects a component of experience, a memory of the component becomes integrated with memories of similar components, via content addressable memory. When focusing attention on the moving hand, for example, the active neural state in the visual system becomes integrated with similar visual patterns captured previously.

In this occasion, a subset of mirror neurons produces one particular simulation in the visual system. The content of the simulation depends on which subsets of stored information become active. Possible outcomes are a given instance, an average of several instances, or a variety of other possibilities. Moreover, re-enactments typically occur on multiple modalities simultaneously, producing a multimodal simulation of the action including not only sensory states but also motor and mental states. In this view a simulator is a "distributed collection of modality-specific memories captured across a category's instances" [58].

Neuro-physiological evidences support the *Covert Imitation Theory*. On one side, the mirror neurons within the F5c-PF functional cluster of premotor neurons already discharge in early phases of the movement [84]. Moreover, the pre-motor cortex, the posterior parietal cortex, and the cerebellum are activated during action generation, action imagination, and action observation [66, 85].

There is a main criticism to this view coming from Gergely and Csibra [86, 87]. Gergely and colleagues showed that a novel response – illuminating a box by touching it with the head - imitatively learned from the demonstration of a human model is retained by infants in spite of the availability and production of more readily accessible and rational response alternatives – the use of the hands - that also produce the same effect [88]. This suggests that imitative learning of novel actions is a qualitatively different process in humans than the imitative copying of new and reinforcing behavior of observed conspecifics that has been demonstrated in several other animal species. Specifically, it suggests the existence of some specific processes selecting what to imitate.

Another issue is raised by Lyons and colleagues [89]. They note that macaque monkeys, who have mirror neurons, simply do not imitate. So, what are mirror neurons for in monkeys? In their opinion, their mirror neuron system is tuned to extract the goal structure of observed action, as opposed to the lower-level kinematic features of the action. In other words, "mirror neurons enable non-human primates to infer the intentions of other agents" (p 231).

The difference between humans and primates appears to be related to the level of intentional granularity: the human mirror system is capable of extracting not only high-level goals (*do x*) but also more subtle, subsidiary goals (*do x in manner y*). This could account for human ability to reproduce not only the overall results of observed actions but also the specific means that were used to achieve them.

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3.5 The Missing Links: Presence and Social Presence

After this long analysis of the recent outcomes of the social and cognitive neuroscience it is possible to underline an overall scenario: our conceptual system dynamically produces contextualized representations (simulations) that support situated action in different situations. This is allowed by a common coding – the motor code – shared by perception, action and concepts.

On one side, the vision of an object immediately activates the appropriate hand shape for using it: seeing a red apple activates a precision grip for grasping and turning. On the other side, thinking an apple produces the simulation of an action related to the apple in a specific context of use.

This common coding also allows the subject for natively recognizing actions done by other beings within the phenomenological contents. Further, the subject predicts the outcome of the identified action using the same simulation mechanism described above: seeing someone grasping an apple produces a contextualized simulation of the full course of the action.

However, this picture has some holes in it: if perception, action and concepts share the same language how can we differentiate between them. In particular how can we distinguish between a perceived action, a planned or an executed one?

More, even if imitation has frequently been proposed as the central mechanism mediating the reproduction, spread, intergenerational transmission and stabilization of human cultural forms, our imitation is selective. How and why do we imitate? Finally, developmental psychology clearly shows that our simulative abilities are not the same in the different phases of our life. How and why do they evolve?

In this chapter we suggest that a psychology of presence is a possible answer to these questions. In our vision "Presence" and "Social Presence" have a simple but critical role in our everyday experience: the control of agency and social interaction through the unconscious separation of both "internal" and "external", and "self" and "other".

Below are summarized the key ideas behind this vision that will be deepened in the next paragraphs:

- We claim that human beings at birth have "*naked intentionality"*: they have the direct ability of recognizing intentions but lack self-identification. As suggested by Jeannerod and Pacherie [90] in this condition intentions are "naked", unattributed: *the infant recognizes an intention without being aware of whose intention it is*. Different neurological disorders - like the *echopraxia*, or the *anarchic hand* - support the existence of *naked intentionality* [30, 90].

- The need for self-identification and attribution requires a specific neuropsychological process (presence-as-process) embedding sensory-referred properties into an internal functional space [91]. This is achieved by separating both "self" and "other," and "internal" and "external" within different kinds of afferent and efferent motor codes. The presence-as-process can be divided in three different layers/subprocesses phylogenetically different, and strictly related to the evolution of self: *proto presence (self vs. non self)*, *core presence (self vs. present external world)*, and *extended presence (self relative to present external world)*.

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- The outcome of this process is the *presence-as-feeling*: the non mediated perception that an intention is being enacted successfully. This feeling is experienced indirectly (prereflexively) by the self through the characteristics of action and experience. In fact the self perceives directly only the *variations* in the level of presence-as-feeling: breakdowns and optimal experiences (flow).

- The development of the self allowed by presence leads to the recognition of the "other" as "another intentional self". This requires a specific neuropsychological process (social-presence-as-process) tracking the behavior of the other to understand the characteristics (content and motive) of his/her intentions. This process is based on *covert imitation*: an automatic action emulator, tracking the behavior of other subjects in real time to generate perceptual predictions [71, 83]. The social-presence-as-process can be divided in three different layers/subprocesses phylogenetically different, but mutually inclusive: *proto social presence (the intention of the other is toward the self)*, *joint social presence (the self and the other have the same intentional focus)*, *shared social presence* (*the self and the other share the same intention*).

- The outcome of this process is the *social-presence-as-feeling*: *the non mediated perception of other's intentions*. It is not separated by the experience of the subject but it is related to the quality of his/her social interactions. In fact, a higher level of social-presence-as-feeling is experienced prereflexively as empathy and communicative synchrony. The self experiences reflexively the *social-presence-as-feeling* only when the quality of his experience is modified during a social interaction. More in detail, the self perceives directly only the variations of *social-presence-as-feeling*: intentional opacity and attunement/empathy.

- Presence and social presence converge within the social and cooperative activities. Specifically, these activities are created and governed by a reciprocal intentional game between the communicators regulated by the level of presence and social presence experienced by the interactants [92]: the display and ostension of a given intention by the speaker ("intentionalization" process) and the ascription and attribution of a certain intention to him/her by the addressee ("re-intentionalization" process).

- Another important role of presence and social presence is related to the processes of internalization and externalization. As suggested by Vygotsky [93, 94], on one side external activity transforms internal cognitive processes (internalization). On the other side, knowledge structures and moments of internal activity organize and regulate external social processes (externalization). We claim that the processes of internalization and externalization are influenced by the experienced presence and social presence in actions and interactions: *the more is the presence and social presence, the more is the possibility that the contents of the action/interaction will be internalized/externalized.*

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3.5.1 Naked Intentionality in Infants

The starting point of the Presence theory is the situation of infants at birth. There is a large body of evidence underlying that infants, even in the first months of life, show a special sensitivity to communication and participate in emotional sharing with the caregivers [95].
To explain these processes, different authors underlined the innate ability of infants to identify with conspecifics. As we have just seen, Meltzoff [76-79] suggested the existence of a biological mechanism allowing infants to perceive others "like them" at birth. Specifically, Meltzoff and Brooks suggest [96]:

"Evidently, infants construe human acts in goal-directed ways. But when does it start? We favor the hypothesis that it begins at birth… The hypothesis is not that neonates represent goal directdness in the same way as adults do. In fact, neonates probably begin by coding the goals of pure body acts and only later enrich the notion of goals to encompass object directed acts." (p. 188).

Trevarthen [97, 98] goes further, arguing that the infant is conscious, since birth, of the others' subjectivity: he is conscious of other's mental states and react in communicative, emotional ways so to link each other's subjectivity. Extending this vision, Tirassa and colleagues [99] suggest that infants are in a particular state that they define "sharedness": the infant's capability to take it for granted that the caregiver is aware of her mental states and will act accordingly. In this vision the infant considers his own mental states as mutually and overtly known to the caregiver.

Here we take a related but different position. We believe that infants have a direct ability – "naked" intentionality – of recognizing intentional behaviors in their phenomenological contents. We define *"naked" intentionality* as a primitive and innate mental state type which can be characterized in the following terms: *to be able to recognize an intention without being aware of whose intention it is*. Following this point we claim that in humans, *intentionality* – the ability to recognize purposeful actions – appears before *intention* – the agent's mental state that represents such actions. Specifically, is the need to separate between "internal" and "external" intentions forcing the nervous system to identify a "self".

Naked intentionality is allowed by the activity of "*mirror neurons*", the functional cluster of premotor neurons (F5c-PF) that, as we have just seen, are activated both during the execution of purposeful, goal-related actions, and during the observation of similar actions performed by another individual [48, 62, 63].

Apparently, the concept of *naked intentionality* is counterintuitive. However, it includes - and can be considered the *precursor* of - the two different definitions of intention found in literature [100]:

a) intention as a *property of all mental state*s. In such a perspective any subjective, conscious experience – no matter how minimal – is an experience *of* something.
b) intention as an *act concerning and directed at some state of affairs in the world*. In this sense, individuals deliberately perform an action in order to reach a goal.

Further, the existence of *naked intentionality* is supported by the recent outcomes of

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neuroscience research. As underlined by Jeannerod and Pacherie [90]:

"*Our contention is that this [premotor] cortical network provides the basis for the conscious experience of goal-directdness – the primary awareness of intentions – but does not by itself provide us with a conscious experience of self- or other- agency.*" (p.140).

Finally, different neurological disorders suggest the existence of *naked intentions* [30, 90]. For instance, in *anarchic hand*, patients seem to be aware of the actions of their anarchic hand but do not attribute to themselves its intentional behavior: the complex movements of one hand are apparently directed towards a goal and are smoothly executed, yet are unintended [101]. This condition seems to demonstrate that the recognition of an intentional action can be separated from the awareness of its authorship: the patients affected are aware of the intentional actions of their anarchic hand, which they know to be their hand, yet they disown them.

In another disturbance – *echopraxia* - found in demented patient, the subject has an impulsive or automatic imitation of other's people gestures. The imitation is performed immediately - irrespective of the meaning or the nature of the gesture - with abruptness and speed of a reflex action. This condition suggests that the patient, who recognized an intentional action in the other, mistakenly attributed it to himself.

It is also important to note that *naked intentionality* allows a simple form of imitation found in newborns, *resonance behavior*: the tendency to reproduce, immediately or with some delay, movements, gestures or actions made by another individual.

3.5.2 From Naked Intentionality to Presence

If intentionality in neonates is naked, they require a specific mechanism to differentiate between internal and external intentions, between their actions and the other's ones: *(Inner) Presence*.

Presence is described here as a defining feature of self allowing the nervous system to solve a key problem for its survival: *how to differentiate between internal and external* (see also the next chapter by Waterworth and Waterworth). In other words, is presence that transforms *intentionality* – the ability to recognize purposeful actions – in the ability of producing an *intention* – the agent's mental state that drives such actions.

In this vision it is critical to distinguish between presence-as-process and presence-as-feeling. The presence-as-process is the continuous activity of the brain in separating "internal" and "external" within different kinds of afferent and efferent signals. So, presence-as-process can be described as a sophisticated form of monitoring of action and experience, transparent to the self but critical for its existence. As clarified by Russell [102]:

"Action-monitoring is a subpersonal process that enables the subjects to discriminate between self-determined and world-determined changes in input. It can give rise to a mode of experience (the experience of being the cause of altered inputs and the experience of being in control) but it is not itself a mode of experience." (p.263).

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For this reason, the presence-as-feeling – the non mediated (prereflexive) perception that an intention is being enacted successfully - is not separated by the experience of the subject but *it is related to the quality of our actions*. It corresponds to what Heidegger [1] defined "the interrupted moment of our habitual standard, comfortable *being-in-the-world*". In fact, a higher level of presence-as-feeling is experienced by the self as a better quality of action and experience [103, 104].

Further, the self becomes aware of the presence-as-feeling separated by our *being-in-the-world* when its level is modified. More in detail, the self perceives directly only *the variations* in the level of presence-as-feeling: *breakdowns* and *optimal experiences.*

On one side we have optimal experiences. According to Csikszentmihalyi [105, 106], individuals preferentially engage in opportunities for action associated with a positive, complex and rewarding state of consciousness, defined "*optimal experience*" or "*flow*". Here we argue that flow is the result of the link *between the highest level of presence-as-feeling, with a positive emotional state*. In fact, it is also possible to experience high levels of presence in negative emotional states: e.g. in the battlefield during an attack from the enemy.

On the other side we have breakdowns. Winograd and Flores [6] refer to presence disruptions as *breakdowns:* when, during an action, an object or an environment becomes part of our consciousness then a *breakdown* has occurred. Why do we experience these breakdowns? Our hypothesis is that breakdowns are a sophisticated evolutionary tool used to control the quality of experience: the more the breakdown, the less is the level of presence-as-feeling, the less is the quality of experience, and the less is the possibility of surviving in the environment.

At this point we can argue that is the *feeling of presence that provides to the self a feedback about the status of its activity*: the self perceives the variations in the feeling of presence and tunes its activity accordingly. Specifically, the self tries to overcome any breakdown in its activity and searches for engaging and rewarding activities (optimal experiences).

3.5.2.1 The Layers of Presence

Even if presence is a unitary feeling, the recent neuropsychological research has shown that, on the process side, it can be divided in three different layers/subprocesses (for a broader and more in-depth description see [91] and the next chapter by Waterworth and Waterworth), phylogenetically different, and strictly related to the evolution of self [107]:

- *proto presence* (self vs. non self);
- *core presence* (self vs. present external world);
- and *extended presence* (self relative to present external world).

More precisely we can define *"proto presence"* the process of internal/external separation *related to the level of perception-action coupling (self vs. non-self)*. The more the organism is able to couple correctly perceptions and movements, the more it differentiates itself from the external world, thus increasing its probability of surviving.

"Core presence" can be described as *the activity of selective attention made by the self on perceptions (self vs. present external world)*: the more the organism is able to focus on its sensorial experience by leaving in the background the remaining neural

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processes, the more it is able to identify the present moment and its current tasks, increasing its probability of surviving.

Finally, the role of *"extended presence"* is to *verify the significance to the self of experienced events in the external world (self relative to the present external world)*. The more the self is present in significant experiences, the more it will be able to reach its goals, increasing the possibility of surviving. Extended presence requires emotionally or culturally significant content.

3.5.3 From Presence to Social Presence

The development of the self also leads to the recognition of the "other" as "another intentional self". This requires a specific neuropsychological process (social-presence-as-process) tracking the behavior of the other to understand his intentions. In fact, *naked intentionality* allows infants to detect *intentionality* – they recognize that an intention is being enacted – but neither to detect the *content* of the other's intention – they do not recognize which specific intention, or set of intentions is being enacted – nor to identify the *motives* of such content – they do not recognize why the specific intention, or set of intentions is being enacted.

So, *social presence* is described here as a defining feature of self *allowing the detection of the content and motives of other's intentions*. Without the emergence of the sense of social presence it is impossible for the self to develop a theory of mind allowing the comprehension, explanation, and prediction of behavior and, in general, the management of the social interactions.

As for Presence, we distinguish between *social-presence-as-process* and *social-presence-as-feeling*. The *social-presence-as-process* is the continuous activity of the brain in identifying intentions within the perceptual field. So, it can be described as a sophisticated form of monitoring of the others' actions transparent to the self but critical for its social abilities. As we have seen previously, this process is based on *covert imitation*: an automatic action emulator, tracking the behavior of other subjects in real time to generate perceptual predictions [71, 83].

Social-presence-as-feeling is instead *the non mediated perception of other's intentions*. The concept of social-presence-as-feeling is similar to the concept of "*intentional attuning*" suggested by Gallese [69, 108]: our capacity to prereflexively identify with others. In fact the social-presence-as-feeling is not separated by the experience of the subject but it is related to the quality of our social interactions. In fact, a higher level of social-presence-as-feeling is experienced prereflexively as empathy and communicative synchrony.

The self experiences reflexively the *social-presence-as-feeling* only when the quality of his experience is modified during a social interaction. More in detail, the self perceives directly only the variations of *social-presence-as-feeling*.

As underlined by Anolli [92] intention does not constitute by itself an "on–off" process, but it is characterized by an articulated graduation and differentiation within itself:

"First of all, in everyday life, intentionality is regulated by continuous variations of intensity and precision. This intentional gradability allows communicators to manage the focusing of different communicative acts during everyday life…Moreover, a single communicative act can be governed by a plurality of intentions, embedded in each other and hierarchically organized. Such a choice and

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continuous gradation of communicative intentions make the communicative act particularly complex, since, on the one hand, it needs a precise cognitive and emotional direction; on the other, it can give rise to communicative uncertainties and difficulties." (pp. 36-37).

So according to the level of social presence experienced by the subjects, they will experience *intentional opacity* on one side, and *communicative attuning and synchrony* on the other side [109].

3.5.3.1 The layers of Social Presence

The study of infants and the analysis of their ability of understanding and interacting with people suggest that social-presence-as-process includes three different layers/subprocesses phylogenetically different, but mutually inclusive [110]:

- *proto social presence* (the intention of the other is toward the self);
- *joint social presence (*the self and the other have the same intentional focus).
- *shared social presence* (the self and the other share the same intention).

As we have seen, presence allows the identification of other intentional selves in the phenomenological world (there is an other intentional self). From an evolutionary viewpoint, the more the self is able to understand other selves, the more it is the possibility of starting an interaction, thus increasing its probability of surviving.

Within this context *"Proto Social Presence"* can be described as the process allowing the identification of an interactive intention in other selves (the intention of the other is toward the self). The more the self is able to identify a communicative intention in other selves, the more it is the possibility of starting an interaction, thus increasing its probability of surviving.

As suggested by Reddy [110] infants are aware of the directedness of others' attention in the first months of life:

"I will argue that mutual attention in the first months of life already involves an awareness of the directedness of attention. The self is experienced as the first object of this directedness followed by gradually more distal 'objects'. This view explains early infant affective self-consciousness within mutual attention as emotionally meaningful, rather than as bearing only a spurious similarity to that in the second and third years of life. Such engagements precede and must inform, rather than derive from, conceptual representations of self and other, and can be better described as self–other conscious affects." (p. 397).

The role of *"joint social presence"* is to allow the identification of a common intentional focus in other selves (the self and the other have the same intentional focus). The more the self is able to recognize a common intentional focus in other selves, the more it is the possibility of having an interaction, thus increasing its probability of surviving.

The first expression of joint social presence appears at the end of the first year of age as infants are beginning to engage with caregivers in activities that are triadic in the sense that they involve child, adult, and some outside entity – *joint attention* - toward which they both direct their actions. By 12 to 14 months of age, then, the triadic interactions of child and adult around external entities appear more

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coordinated since the child can do such things as reverse roles and help the adult in her role if needed – both necessary for engaging in joint actions embodying joint intentions [111].

Finally, the role of *shared social presence* (the self and the other share the same intention) is to identify "others that are *like* the self", sharing intentions and emotions (*intentional attunement*). The more the self is able to identify intentional attunement in other selves, the more it is the possibility of successfully conducting an interaction, thus increasing its probability of surviving.

3.5.4 From Presence and Social Presence to Communication

Till now we considered presence and social presence separately. However, they converge and interact within the social and cooperative activities. In particular, is *through their interaction that the self improves his intentional action and interaction*: the higher is the level of presence and social presence experienced by the self, the higher is the complexity of the expressed and recognized intentions.

In naked intentionality the structure of the intention includes *action* and *goal* only. When the self experiences full presence and social presence he is able to express and recognize complex intentions including *subject*, *action*, *goal*, *way of doing* and *motive*.

According to Bratman [112] joint cooperative activities have three critical features that distinguish them from social interaction in general: (1) the interactants are mutually responsive to one another, (2) there is a shared goal in the sense that each participant has the goal that we (in mutual knowledge) do X together, and (3) the participants coordinate their plans of action and intentions some way down the hierarchy – which requires that both participants understand both roles of the interaction (*role reversal*) and so can at least potentially help the other with his role if needed.

To achieve it, the self need to separate himself from the other (proto presence), to differentiate between his action and his planned action (core presence), to recognize the communicative intention of the other (proto social presence), to share with him the intentional focus (joint social presence), to identify intentional attunement (shared social presence) and to evaluate it as significant for himself (extended presence).

In this way the social and communicative exchange is created and governed by a reciprocal intentional game between the communicators regulated by the level of presence and social presence experienced by the interactants [92, 113]: the display and ostension of a given intention by the speaker ("intentionalization" process) and the ascription and attribution of a certain intention to him/her by the addressee ("re-intentionalization" process).

For instance, when self perceives a reduction in the extended presence – e.g. the communication is no more interesting - he can activate a new behavior – e.g. asking for a new question – to improve it. At the same way, the self can use his perception of other's intentions to tune the communication. A similar mechanism is probably behind the imitation process: without an elevated level of presence and social presence the infant does not imitate.

The interaction between the lowest levels of presence and social presence also allows the identification of the *enemy/stranger*: the other who is not a self [114]. According to Karl Schmitt the specific political distinction to which political actions and motives can be reduced is the one between friend (*amicus*) and enemy (*hostis*). In

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fact the *hostis* is, in a specially intense way, existentially something different and alien so that, in the extreme case, conflicts with him are possible.
Finally, another important role of presence and social presence is probably related to the processes of internalization and externalization. Vygotsky [93, 94] states that internalization and externalization are the dialectical mechanisms that allow an individual to construct higher psychological structures. On one side external activity transforms internal cognitive processes (*internalization*). On the other side, knowledge structures and moments of internal activity organize and regulate external social processes (*externalization*).

According to Vygotsky [93], internalization is social by its very nature: is not just copying but rather a transformation or reorganization of incoming social information and mental structures based on the individual's characteristics and existing knowledge. The opposite process of internalization is externalization. Mental processes manifest themselves in external actions performed by a person, so they can be verified and corrected, if necessary. This dialectical process also leads to the production of new tools.

Here we suggest that the processes of internalization and externalization are influenced by the experienced presence and social presence in actions and interactions:

- *the more is the presence and social presence experienced during an interaction, the more is the possibility that the contents of the interaction will be internalized;*
- *the more is the level of presence experienced during an activity, the more is the possibility that the content of the activity will be externalized.*

3.5.5 From Inner Presence to Media Presence

As discussed in detail in the previous chapter by Coelho and colleagues the research work on virtual reality produced two coexisting visions of presence: the rationalist and the psychological/ecological points of view. The researchers agreeing with the rationalist approach describe the sense of presence as a function of the experience of a given medium (*Media Presence*). The main outcome of this vision is the definition of presence as the *perceptual illusion of non-mediation* [115], produced by means of the disappearance of the medium from the conscious attention of the subject. The main advantage of this approach is its predictive value: the level of presence is reduced by the experience of mediation during the action. The main limitation of this vision is what is not said. What is presence for? What is not mediated?

In contrast, the psychological/ecological point of view presented in this chapter considers presence as a neuropsychological phenomenon, evolved from the interplay of our biological and cultural inheritance, whose goal is the expression and recognition of self/other intentionality (*Inner Presence*).
However, the difference between *Inner Presence* and *Media Presence* is not so much: rationalists define the feeling of presence as the "perceptual illusion of nonmediation" [115]; we defined it as the "non-mediated (prereflexive) perception that an intention is being enacted successfully". Where is the difference?
Apparently the main difference is in what is "non-mediated" by presence. In this paper we clearly indicated successful intentions as the non-mediated content. Lombard and Ditton suggest that a person is present when his/her response to the medium is not mediated:

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"An illusion of nonmediation occurs when a person fails to perceive or acknowledge the existence of a medium in his/her communication environment and responds as he/she would if the medium were not there. ... Presence in this view can not occur unless a person is using a medium."
(online: http://jcmc.indiana.edu/vol3/issue2/lombard.html).

Are these positions so far? According to Searle the answer maybe no. For this author [116], an action is "a causal and Intentional transaction between mind and the world" (p. 88). Specifically, any action is composed of two parts: an intention, and a movement. When the action is premeditated, it is caused by a "prior intention": an intention to act formed in advance of the action itself.

However, in most everyday actions there is not a prior intention. These actions are caused by an "intention-in-action": an intention not formed in advance of the action. The basic intentional content of the intention-in-action is self-referential causality: its success or satisfaction can come about only if it (and not some other force) is the cause of the movement whose mental component it is. In short, intentions-in-action drive the movement prereflexively, without the need of a prior intention.

This is possible because, as suggested by the *Common Coding Theory*, actions are coded in terms of the perceivable effects they should generate. More in detail, when an effect is intended (intention-is-action), the movement that produces this effect as perceptual input is automatically activated, because actions and their effects are stored in a common representational domain [44].

This is the typical case of synchronous mediated communication when the user masters the medium: the fingers of an expert chatter or the hands of a Doom III cooperative player are driven by intentions-in-action. Following Heidegger [1], the medium is "ready-to-hand". Only when there is a breakdown, a problem - the keyboard is no more responsive or the screen disappears – the user needs to plan a new action (prior-intention) to solve the problem.

For Lombard and Ditton the Doom cooperative players are present in the game "if this does not draw attention to itself reminding them that they are having a mediated experience". For us, the players are present in the virtual environment if they are able to drive successfully and prereflexively their interaction. If we substitute in our definition of presence the word "intention" with the one "intention-in-action" we have an almost perfect match with the Lombard and Ditton's position: *the non mediated (prereflexive) perception of successful intentions-in action.* The main difference is that this definition works for experiences not related to media, too.

To make this concept clearer two examples may help. A stroke patient with a left hemiplegia is no more "present" in the left part of his body: using his left hand he is not able to translate an intention-in-action in a purposeful behavior.

But it is not only, or not mainly, the body to be not "present" – or not "ready-to-hand" - to the self. I'm in a restaurant for a formal dinner with my boss and some colleagues, but I don't know how to directly use (intention-in-action) the many different strange forks I have around my dish. In this situation I'm physically there, but the lack of knowledge puts me outside, at least partially, from the social and cultural space of the "formal dinner". The result is a reduced presence and a limitation in my agency: I don't use the forks to avoid mistakes. These examples show clearly how both physical boundaries (body, wall, obstacles, etc.) and social

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and cultural boundaries have a strong influence on the possibility of action and the experienced presence of the subject.

In this context, *a breakdown* occurs when, during our activity, we are forced to stop the use of intentions-in-action. To illustrate, imagine sitting in a balcony engrossed in reading a book on a pleasant evening. As the sun sets and the light diminishes one continues reading (intention-in-action), engrossed in the story until one becomes aware that the light is no longer suitable for reading. In such conditions, before any overt change in behavior, what we experience is a breakdown in reading and a shift of attention from the book to the light illuminating the book. At that stage we are not present anymore in the reading and we have to reflexively plan an action (prior intention) to switch on the light on the balcony.

This vision has two important suggestions for media developers:

- it is also "external" to the subject what is not related to his/her activities, interests and values.
- to be more "present" in the situation (social and cultural space) defined by a symbolic system, the user has to be aware of its meaning. Only "making sense there", the user really experiences a full sense of presence [104, 117].

3.6 Conclusions

The German philosopher Martin Heidegger, underlined in his writings the following structural (ontological) features of the being:

- *Spatiality*: the space is not around us but within us;
- *Being with*: we exist not on our own terms, but only in reference to others.

As we have discussed in the chapter, the recent outcomes of cognitive science support this vision. In particular we showed how different theories from social and cognitive sciences – *Situated Cognition, Embodied Cognition, Enactive Approach, Situated Simulation, Covert Imitation* - and discoveries from neuroscience – *Mirror and Canonical Neurons* - have many contact points with this view.

The overall picture we depicted is different from the traditional view of cognition. Cognition is no more the simple performance of formal operations on abstract symbols, but has instead deep roots in sensorimotor processing.

Specifically, our conceptual system dynamically produces contextualized representations (simulations) that support grounded action in different situations. These simulations include not only sensory states but also motor and mental states. This is allowed by a common coding – the motor code – shared by perception, action and concepts. On one side, the vision of an object immediately activates the appropriate hand shape for using it: seeing a red apple activates a precision grip for grasping and turning. On the other side, thinking an apple produces the simulation of an action related to the apple in a specific context of use.

This common coding also allows the subject for natively recognizing actions done by other beings within the phenomenological contents. Specifically, the subject predicts the outcome of the identified action using the same simulation mechanism described above: seeing someone grasping an apple produces a contextualized simulation of the full course of the action. This covert imitation functions as an automatic action emulator, tracking the behavior of other subjects in real time to generate perceptual predictions.

However, this picture has some holes in it: if perception, action and concepts share

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the same language how can we differentiate between them. In particular how can we distinguish between a perceived action, a planned or an executed one?

More, even if imitation has frequently been proposed as the central mechanism mediating the reproduction, spread, intergenerational transmission and stabilization of human cultural forms, our imitation is selective. How and why do we imitate? Finally, developmental psychology clearly shows that our simulative abilities are not the same in the different phases of our life. How and why do they evolve?

In the chapter we suggested that a psychology of presence is a possible answer to these questions. In our vision "Presence" and "Social Presence" have a simple but critical role in our everyday experience: the control of agency and social interaction through the unconscious separation of both "internal" and "external", and "self" and "other". Specifically, Presence allows the recognition of the intentions of the self and Social Presence allows the recognition of the intentions of the other.

For this reason, Presence and Social Presence converge within the social and cooperative activities. Particularly, these activities are created and governed by a reciprocal intentional game between the communicators regulated by the level of presence and social presence experienced by the interactants [92]: the display and ostension of a given intention by the speaker ("intentionalization" process) and the ascription and attribution of a certain intention to him/her by the addressee ("re-intentionalization" process). For instance, when self perceives a reduction in the extended presence – e.g. the communication is no more interesting - he can activate a new behavior – e.g. asking for a new question – to improve it. At the same way, the self can use his perception of other's intentions to tune the communication. A similar mechanism is probably behind the imitation process: without an elevated level of presence and social presence the infant does not imitate.

Another important role of presence and social presence is related to the processes of internalization and externalization. As suggested by Vygotsky [93, 94], on one side external activity transform internal cognitive processes (internalization). On the other side, knowledge structures and moments of internal activity organize and regulate external social processes (externalization).

We suggest that the processes of internalization and externalization are influenced by the experienced presence and social presence in actions and interactions: the more is the presence and social presence, the more is the possibility that the contents of the action/interaction will be internalized/externalized.

Obviously, this chapter has its limitations: the psychology of presence here introduced is still in progress and some of the claims presented require an empirical confirmation and additional theoretical work. Specifically, given space limitation – as well as the preliminary state of the model in my mind – further details of the psychology of presence remain to be specified elsewhere.

More, no clear indications are provided about how to measure presence. Related to this point, some suggestions may come from the chapters by Magnusson, and Agliati and colleagues in this book (see also [118]). Finally, additional studies are needed to understand the links between presence and classical cognitive processes like attention, emotions or memory. Nevertheless, quite independently of the intricacies of terminology and conceptualizations, we hope that the model presented here will help to disentangle the large variety of claims, notions and theories that currently characterizes research in this area.

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