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7 Enacting Interactivity: The Role of Presence

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Abstract: The chapter presents a conceptual framework that links the enaction of our intentions to the understanding of other people's intentions through the concept of "Presence", *the feeling of being and acting in a world outside us*. Specifically the chapter suggests that humans develop intentionality and Self by prereflexively evaluating agency in relation to the constraints imposed by the environment (Presence): they are "present" if they are able to enact in an external world their intentions. This capacity also enables them to go beyond the surface appearance of behavior to draw inferences about other individuals' intentions (Social Presence): others are "present" to us if we are able to recognize them as enacting beings. Both Presence and Social Presence evolve in time, and their evolution is strictly related to the three-stage model of the ontogenesis of Self introduced by Damasio (Proto-Self, Core Self, Autobiographical Self). More, we can identify higher levels of Presence and Social Presence associated to higher levels of intentional granularity: the more is the complexity of the expressed and recognized intentions, the more is the level of Presence and Social Presence experienced by the Self. In this framework, motor intentions and mirror neurons are at the basis of the intentional chain, but full intentional granularity requires the activity of higher cortical levels.

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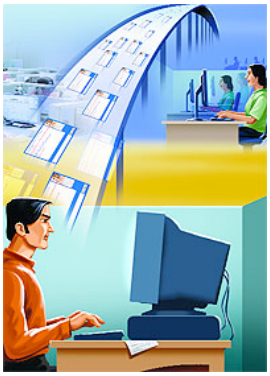

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7.1 Introduction

A central objective of contemporary cognitive science is the explanation of "*Social Cognition*", the information-processing system that enables us to engage in social behavior. Specifically, social cognition addresses how people process social information: its encoding, storage, retrieval, and use in social situations.

An important step towards the understanding of how we handle social information came from the recent discovery of neuronal resonance processes activated by the simple observation of others. Rizzolatti and colleagues found 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 [1, 2].

The general framework outlined by the above results, was used by Simulation Theorists − for example, Lawrence Barsalou, Vittorio Gallese, Alvin Goldman, Jane Heal, Susan Hurley, Marc Jeannerod, Guenter Knoblich and Margaret Wilson − to support their view: the mirror system instantiates simulation of transitive actions used to map the goals and purposes of others' actions [3, 4]. As clearly explained by Wilson and Knoblich [5] this is the outcome of an implicit/covert, subpersonal process:

"*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… The present proposal suggests that, in tasks requiring fast action coordination, the emulator derives predictions about the future course of others' actions, which could be integrated with the actions one is currently planning.*" (pp. 468-469).

In this chapter our aim is twofold: a) we will outline three general arguments against the covert/implicit simulation approach, and (b) we will try to address them within a general framework that links the enaction of our intentions to the understanding of other people's intentions. Specifically we suggest that humans develop intentionality and Self by evaluating agency in relation to the constraints imposed by the environment (Presence): they are "present" if they are able to enact their intentions in an external space. This capacity also enables them to go beyond the surface appearance of behavior to draw inferences about other individuals' intentions (Social Presence): others are "present" to us if we are able to recognize them as enacting beings.

7.2 The simulation approach and the arguments against it

Even if the covert/implicit simulation approach is gaining momentum within cognitive science, different authors raised arguments against it. The main arguments are three:

- *mirror neurons are not enough to explain social cognition;*
- *the covert simulation is not a simulation but a perceptual elicitation;*
- *the covert simulation is not a simulation but a sensory forward prediction.*

The first argument is based on a simple consideration: we are able to "mind read" beliefs, desires, and intentions of others, and such mind reading is our primary and pervasive way of understanding their behavior. How mirror neurons are able to provide the richness required for representing a subject's social intention [6]?

An interesting discussion about this topic, with questions and answers from both sides, appeared in the interdisciplinary conference "*What do mirror neurons means*", available online at the address: http://www.interdisciplines.org/mirror/papers/1).

Usually simulationists answer to this question underlining the role played by the imitation process in understanding behaviors. Meltzoff, in his life-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 [7]: it is as if young infants isolate *what* part of their body to move before *how* to move it (*organ identification*).

To explore the neural correlates of this ability, Chaminade, Decety and Meltzoff [8] 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.

There is a main criticism to the possible role of imitation in understanding behaviors coming from Gergely and Csibra [9, 10]. 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 [11]. This suggests that imitative learning of novel actions is a qualitatively different process in humans than the imitative copying that has been demonstrated in several other animal species. Specifically, it suggests the existence of some specific processes selecting what to imitate.

The second argument against covert simulation was recently raised by Shaun Gallagher [12]. According to this author, the neuronal resonance processes allowed by mirror neurons instantiate a form of *enactive social perception* − a common bodily intentionality that is shared by the perceiving subject and the perceived other − that is not a simulation. As underlined by Gallagher:

"*The nature of the resonance processes involved in such encounters makes our perception of other conspecifics different from our perception of objects and instruments. But it does not make our perception and understanding of others the result of an implicit simulation. In effect, simulation is a personal-level concept that cannot be legitimately applied to subpersonal processes.*" (p. 363).

The last argument, raised by Csibra and Gergely [10, 13] is strictly related to the previous one. These authors claim that the subject already sees the meaning of the other's actions because the neuronal resonance processes (action mirroring) are generated by some form of action reconstruction (*teleological reasoning*). In brief, Csibra and Gergely [13] suggest that the resonance processes are *not retrodictive*,

− they do not recover the intention that generated the action − but *predictive* − they emulate the action needed to achieve a hypothesized goal.

In sum, in spite the growing neuroscientific evidence that humans are endowed with a mirror system, there is not a shared vision about how our brain makes use of this system. Is it really used for the development of social cognition skills?

The real question, however, is whether there is a different account that can avoid these objections. We turn now to the construction of a possible alternative account, starting from the analysis of the phenomenology of agency.

7.3 What is agency

As we have seen previously, the neurobiological models of the mirror neuron system often state that action understanding is based on mapping the surface properties of observed actions onto the observer's motor system. However, different authors (for example, see Wood et al. [14]) suggest that action understanding must also consist of a mechanism that evaluates action means in relation to goals, and places this analysis into a broader context that entails constraints imposed by the current environmental situation. Following this suggestion, we will start our discussion from a deeper analysis of the phenomenology of agency.

7.3.1 Agency: from intention to action and self

If actions have to be evaluated in relation to their goals, and it is possible to identify different intentional forms [15, 16], it is also possible to categorize actions according to their underlying intentions. This was one of the main efforts of the *Activity Theory*, a psychological approach that aimed to understand humans through an analysis of the genesis, structure and processes of their activities [17].

The Activity Theory is the result of a larger effort to develop a new psychology based on Marxist philosophy, initiated by a group of revolutionary Russian psychologists − Vygotsky, Leont'ev and Luria − in the 1920s and 1930s [18]. For these authors any activity is motivated toward the solution of a problem or purpose (object), and mediated by tools (artifacts) in collaboration with others (community). In particular, Leont'ev [19] distinguished, within the general activity of the subject, *three different levels* (see Figure 1) related to the different *objects* driving it:

- *Activity* is the highest level: the direct answer to a specific objective of the subject. The activity of the subject moves toward the object of a specific need and terminates when it is satisfied. Specifically, an objective is a process characterizing the activity as a whole. For example, in reference to Figure 1, the activity is to obtain a Ph.D. in Psychology. Any objective − e.g. helping anorectic girls − is closely related to a motive − e.g. the need of self actualization − and both have to be considered in the analysis of an activity.
- Each activity is then translated into reality through a specific or a set of *Actions*. Each action is a process performed with conscious thought and effort, planned and directed towards achieving a *goal*. In reference to Figure 1, the activity − obtain a Ph.D. − is translated in a set of actions: going to the library for

searching the sources, preparing an index, discussing it with the tutor, etc. Each action can then be split in sub-activities, each related to a sub-goal: searching for books on eating disorders, writing the first chapter outline, etc.

- Actions and sub-actions are developed through *Operations*: if actions are connected to conscious goals, operations are related to behaviors performed automatically. In reference to Figure 1, the operation of taking notes on an exercise book is done automatically, without a conscious focus on the movement of the fingers. All the operations − e.g. the movements of the fingers to guide the pen − however, are oriented by some *conditions*: specific constrains and affordances related to the characteristics of a given tool − such as the size of the paper, the shape of the pen − that influence the outcome of the operation.

In sum, any human activity is directed toward a specific object. More, it is possible to identify three different levels of human activity (see Figure 1) − *Activity, Action, Operation* − according to their specific object − *Motive, Goal, Condition*. Further, any activity level can move both up and down − e.g., an Operation can become an Action − according to learning and environmental conditions.

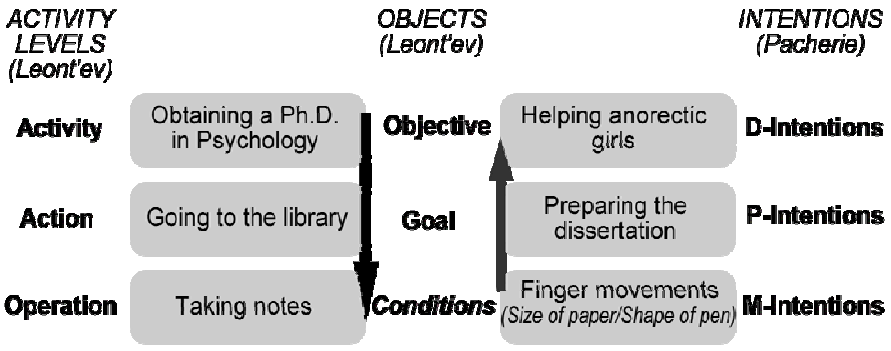

Figure 1: The structure of agency

The structure of agency suggested by the Activity Theory has many similarities with the *Dynamic Theory of Intentions* presented by Pacherie [16, 20]. According to this author, it is possible to identify three different categories or forms of intentions using their different roles and contents (see Figure 1): distal intentions (D-intentions), proximal intentions (P-intentions) and motor intentions (M-intentions):

- *D-intentions (Future-directed intentions)*. These intentions are terminators of practical reasoning about ends and have conceptual and descriptive contents. They also act both as intra- and interpersonal coordinators, and as prompters of practical reasoning about means and plans. D-intentions almost overlap objectives as defined by the Activity Theory: in the activity described in Figure 1, "helping anorectic girls" is a D-intention.
- *P-intentions (Present-directed intentions)*. These intentions are responsible for high-level (conscious) forms of guidance and monitoring. More in detail, they

have to ensure that the imagined actions become current through situational control of their unfolding. P-intentions are similar to goals as defined by the Activity Theory: in the activity described in Figure 1, "preparing the dissertation" is a D-intention.

- *M-intentions (Motor intentions).* These intentions are responsible for low-level (unconscious) forms of guidance and monitoring: we may not be aware of them and have only partial access to their content. Further, their contents are not propositional. As before, M-Intentions are quite similar to conditions, as defined by Activity Theory: in the activity described in Figure 1, the motor representations required to move the pen are M-intentions.

In sum, any intentional level has its own role: *the rational (D-intentions), situational (P-Intention) and motor (M-Intention) guidance and control of action.* More, as suggested by the Activity Theory, they form an intentional cascade [16, 20]: *higher intentions generate lower intentions.*

Activity Theory also suggests that human activity should be analyzed in the context of development. Specifically, Vygotsky [21, 22] states that internalization and externalization are the dialectical mechanisms behind the development of the Self. 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).

It is interesting to note that the three-level structure of agency suggested by the Activity Theory is very close in certain respects to the three-stage model of the ontogenesis of Self introduced by Damasio (Figure 2). This author distinguishes between a preconscious precedent of Self and two distinct notions of self-consciousness [23, 24]:

- *the Proto Self*: a coherent collection of neural patterns that map, moment by moment, the physical state of the organism;
- the *Core Self*: a transient entity which is continuously generated through encounters with objects;
- the *Autobiographical Self*: a systematic record of the more invariant properties that the organism has discovered about itself.

In this vision, the basis for a conscious Self is a feeling state that arises when organisms represent a non-conscious Proto-Self in the process of being modified by objects. In essence, the sense of self depends on the creation of a second-order mapping, in certain brain regions (brainstem nuclei, hypothalamus, medial forebrain and insular and somatosensory cortices), of how the Proto Self has been altered [23]. However, it is only the Autobiographical Self that generates the subjective experience of possessing a transtemporal identity.

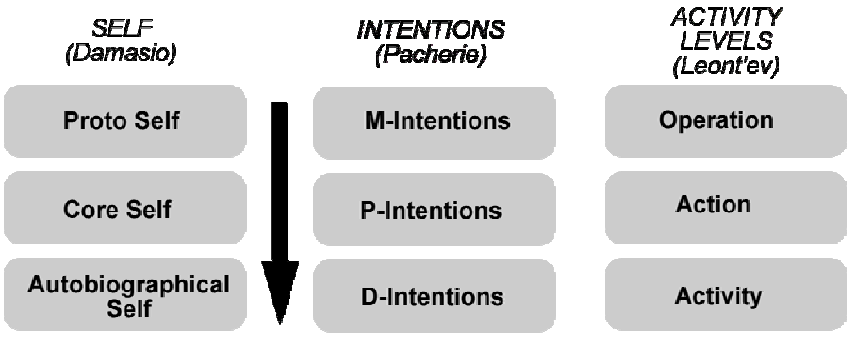

Figure 2: From self to agency

7.4 From intention to agency*:* the role of presence

Integrating the previous theories, the goal of this paragraph is to outline a conceptual framework directly linking Self, intentions and activity through the concept of "Presence", *the feeling of being and acting in a world outside us*. One key assumption guiding this attempt is that the three levels of Self identified by Damasio can be directly connected (see Figure 2) to specific intentional forms and activities (*intentional granularity*).

More in detail, we suggest that *humans develop intentionality and Self by evaluating prereflexively their agency in relation to the constraints imposed by the environment*: they are "present" if they are able to enact their intentions.

This capacity also *enables them to go beyond the surface appearance of behavior to draw inferences about other individuals' intentions*: others are "present" to us if we are able to recognize them as enacting beings.

The next sections will deepen these points. In Section 1 we will introduce the concept of "Presence" by describing the link between action and perception. Section 2 will introduce the phenomenology of Presence, by differentiating between Presence-as-process and Presence-as-feeling. In Section 3 we will discuss the concept of "*Proto Naked Intentionality*", the innate human ability of recognizing M-intentions within the perceptual field. And in Section 4 we will introduce "Social Presence" a cognitive process that evaluates intentions using the same predictive model used by Presence.

7.4.1 The concept of presence

In its more general use the term "Presence" has referred to a widely reported sensation experienced during the use of virtual reality or other media [25-27]. However, a growing number of researchers consider Presence as a neuropsychological phenomenon, evolved from the interplay of our biological and cultural inheritance whose goal is to produce a strong sense of agency and control [28-33]: *Presence as the feeling of being and acting in a world outside me*.

To understand the relationship between Presence and action we have to start from the *link between percept and behavior*: recent neuropsychological research showed that the contents of subject's perception guide action in space and locate

the subject in the perceived world [34, 35]. In other words, as suggested previously by Piaget (*assimilation*) and Gibson (*affordance*), *we conceive places in terms of the actions we could take towards them*: the subject has not a separate knowledge of the place's location relative to him/her, what he/she can do in it, and his/her purposes. Extending this vision, Waskan [36] suggests that we represent phenomena by thinking in terms of the mechanisms by which the phenomena may be produced.

An example can help in understanding this point. Retrieving an occluded object − e.g. when we lift a book to retrieve a pen from under it − is an action taken on the basis of a belief about where the pen is located relative to the Self. In sum [36], "one cannot see a place as being *there1* rather than *there2* without knowing what it would be to act *there1* rather than *there2*." (p. 170, our italics).

It follows that to know that the pen exists when it is occluded is a matter of knowing what can be done to make the pen visible. More, if I want to grab the pen, its spatial position will be represented in terms of the movements needed to reach for it. Further, its shape and size will be represented in terms of the type of handgrip it affords. In other words [36], "*humans harbor and manipulate specific, intrinsic, cognitive models of complex, inter-dimensional, worldy constraint*s" (p. 195).

Recently Proffitt [37] provided an experimental support to this vision: his data showed that under conditions of constant visual stimulation, the apparent dimensions of surface layout expand and contract with changes in the energetic costs associated with intended actions. In sum, the explicit awareness of spatial layout varies not only with relevant optical and ocular-motor variables, but also as a function of the costs associated with performing intended actions. This experimental result is backed by the discovery of two different visual systems [38]:

- *Vision for Action*. It extracts from the visual stimuli information used to build motor representations used in effecting rapid visuo-motor transformations;
- *Vision for Semantical Perception*. It allows the identification and recognition of objects and scenes.

In sum, the subject locates himself/herself in an external space according to the action he can do in it. In other words, the subject is "*present*" in a space if he/she can act in it. More, the subject is "*present*" in the space − real or virtual − where he/she can act in.

According to this vision, Presence has a simple but critical role in our everyday experience: the control of agency (*enaction of intentions*) through the unconscious separation of "internal" and "external" [39, 40]. Within this view, *Presence is defined as the non mediated (prereflexive) perception of successfully transforming an intention in action (enaction) within an external world* [41].

The recent research of Haggard and Clark [42, 43] on voluntary and involuntary movements provides a direct support to the existence of a specific cognitive process binding intentions with actions. In their words [43]:

"Taken as a whole, these results suggest that the brain contains a specific cognitive module that binds intentional actions to their effects to construct a coherent conscious experience of our own agency." (p. 385).

7.4.2 The phenomenology of presence

From a phenomenological viewpoint, 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. As clarified by Russell [44] and in agreement with Gallagher:

"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).

From the computational viewpoint, this is achieved through a forward-inverse model:

- first, the agent produces the motor command for achieving a desired state given the current state of the system and the current state of the environment;
- second, an efference copy of the motor command is fed to a forward dynamic model that generates a prediction of the consequences of performing this motor command;
- third, the predicted state is compared with the actual sensory feedback. Errors derived from the difference between the desired state and the actual state can be used to update the model and improve performance.

As result, when we move much of what we perceive as action is tagged to our intention to move rather than to our perception of what has happened as a result of movement. For instance, Fourneret and Jeannerod [45] have shown that, in a reaching task, we are more aware of where we direct movement of the arm and hand (and where it appears to go) than to where the hand actually moves.

For this reason, the Presence-as-feeling − *the non-mediated (prereflexive) perception that agent's intentions are successfully enacted* − is not separated by the experience of the subject but *it is directly related to it*. It corresponds to what Heidegger [46] 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 [32]. More, the agent perceives directly only *the variations* in the level of Presence-as-feeling: *breakdowns* and *optimal experiences* [41].

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

7.4.3 Proto naked intentionality: the innate ability to recognize m-intentions

In the previous section we suggested that Presence allows the subject to monitor the enaction of his/her intentions. However, how we can recognize them in others: how can we distinguish between a blink and a wink?

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 their caregivers [47]. Trevarthen [48, 49] argues that an infant is conscious, from birth, of others' subjectivity: he/she is conscious of other's mental states and reacts in communicative, emotional ways so to link each other's subjectivity. Meltzoff goes further [7, 50-52] proposing the existence of a biological mechanism allowing infants to perceive others "like them" at birth.

Extending this vision Tirassa and colleagues [53] argue 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 his/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. A more radical position was recently suggested by Jeannerod and Pacherie [54]. In their view infants have a direct ability − "naked" intentionality − of recognizing intentional behaviors in their perceptual field. Specifically, these intentions are "naked", not directly attributed to a subject:

''Our contention is that this [premotor] cortical network provides the basis for the conscious experience of goal-directedness – the primary awareness of intentions – but does not by itself provide us with a conscious experience of Self- or Other- agency… We can be aware of an intention, without by the same token being aware of whose intention it is... something more than the sole awareness of a naked intention is needed to determine its author…." (p.140).

However, other scholars have proposed different arguments and explanations against this position. For instance, Gallagher [12] argued that:

"Phenomenologically (experientially) intentions in almost all cases come already fully clothed in agent specification. The ''who'' question does not come up at the level of experience, because the neural systems have already decided the issue. The wonderful thing about the ''Who system'' is that it is completely neurological and subpersonal." (p. 358).

Further, Legrand [55] underlines that:

"Mechanisms of identification and attribution are necessary in order to disambiguate "naked intentions" and attribute the action/intention to an identified agent. However, this implies focusing exclusively on consciousness of the agent-as-object leaving aside its foundation: the primary experience of oneself as an agent-as-subject, at a pre-reflective level." (p.475)

In general, we agree with both remarks. It is true that our direct perception is highly reliable in discriminating between Self and non-Self. Further, it is true that this discrimination is completely neurological and sub-personal. Finally, we agree that the experience of the *agent-as-subject* remains prior to any intentional process of self-identification.

In fact, we take a related but different position. Following Jeannerod and Pacherie [54] we believe that infants have a direct ability of recognizing

intentional motor behaviors in their perceptual field. However, there are two critical differences between our position and the one presented by these authors:

- *Only M-Intentions are naked at birth, because they are the only ones available at that time.*
- *Is through Presence that neonates differentiate between internal and external intentions, between their actions and those of others.*

In sum, infants have *"naked" proto-intentionality*: a primitive and innate mental state type, which can be characterized in the following terms: *to be able to recognize a motor intention (M-intention) without being aware of whose intention it is*. This position is not so far from what suggested by Meltzoff and Brooks [56]:

"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 directedness 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).

More, is through Presence, through the development of a common spatial and temporal framework with external objects [57], that the agent becomes a self, able to differentiate between internal and external intentions/actions. However, the emergence of the *Self* also leads to the recognition of the "Other" as "another intentional Self".

7.4.4 From presence to social presence

Even if Presence allows the identification of the Other as another intentional Self, we need a new cognitive process (*Social Presence*), different but directly connected to the Presence one, tracking the behavior of the Other to understand his/her intentions. In fact, *naked proto-intentionality* allows infants to detect *intentionality* − they recognize that a M-intention is being enacted − but neither to detect higher level intentions − they do not recognize D-intentions and P-intentions – nor to identify the *motives* of motor behaviors − they do not recognize why the specific M-intention is being enacted.

More in detail, we define as *"Social Presence" the non mediated (prereflexive) perception of an enacting Other within an external world*.

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 Other's intentions within the perceptual field. So, it can be described as a sophisticated form of monitoring of others' actions transparent to the Self but critical for its social abilities.

Following Csibra and Gergely [10], we suggest that this processes is not retrodictive, − it does not recover the intention that generated the action − but *predictive* − it emulates the action needed to achieve a hypothesized goal. From the computational viewpoint, it follows the same approach used by the Presence-as-process:

- first, the agent recognizes the motor command, the current state of the other

agent and the current state of the environment;
- second, an efference copy of the motor command is fed to a forward dynamic model that generates a prediction of the consequences of performing this motor command;
- third, the predicted state is compared with the actual sensory feedback. Errors derived from the difference between the predicted state and the actual state can be used to update the model and improve performance.

Supporting this vision, Oztop and colleagues [58] showed that the motor modules of the observer can be used in a "predictive mode" to infer the mental state of the actor. According to their model, mirror neurons can be involved in the sensory forward prediction of goal-directed movements, which are activated *both* for mental simulation during action observation and for feedback-delay compensation during movement.

Recently, Kilner and colleagues [59] introduced a predictive coding framework for mirror neurons on the basis of a statistical approach known as empirical Bayesian inference. Within this scheme, the most likely cause of an observed action can be inferred by minimizing the prediction error at all levels of the cortical hierarchy that are engaged during action observation.

From an evolutive viewpoint this approach has two strengths. First, it can be seen as the brain's attempt to minimize the free energy induced by a stimulus by encoding its most likely cause [59]. More, the recognition of others' intentions using a forward model allows interpretation without prior experience since, as long as an intentional movement or behavior is in the repertoire of the Self, it will be interpretable without any training.

Social-Presence-as-feeling is instead *the non mediated perception of others' intentions*. The concept of Social-Presence-as-feeling is similar to the concept of "*intentional attuning*" suggested by Gallese [60, 61]: 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 his/her social interactions. The Self experiences reflexively the *Social-Presence-as-feeling* only when the quality of his experience is modified during a social interaction: 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 [62].

7.5 The evolution of presence, intentions and self

A key assumption of the model we just presented is a strict link between intentions, Self and Presence. Here we try to add a broader claim: *Presence and Social Presence evolve in time, and their evolution is strictly related to the evolution of Self*. Specifically, following the three-stage model of the ontogenesis of Self (Proto-Self, Core Self, Autobiographical Self) proposed by Damasio [24], we can identify higher levels of Presence and Social Presence associated to higher levels of intentional granularity.

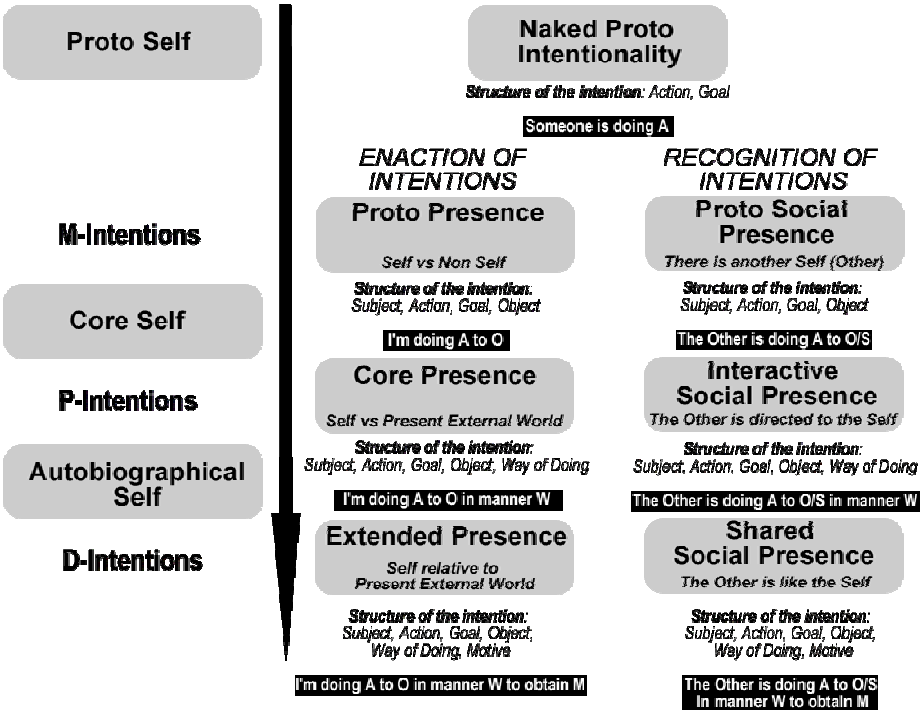

Figure 3: The evolution of self, presence and social presence

As showed in Figure 3, the higher is the complexity of the enacted and recognized intentions, the higher is the level of Presence and Social Presence experienced by the Self. In *proto naked intentionality* the structure of the intention includes action and goal only. When the Self experiences the highest level of Presence and Social Presence he is able to express, enact and recognize complex intentions including Subject, Action, Goal, Object, Way of Doing and Motive. In sum, the enaction and recognition of high-level intentions − D-Intentions − requires higher levels of Presence and Social Presence. In the next two sessions we will introduce them (for a broader and more in-depth description of the layers and their interaction see [39, 41]).

7.5.1 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 phylogenetically different, and strictly related to the evolution of Self [24]:

- *Proto Presence* (Self vs. non Self – M-Intentions);
- *Core Presence* (Self vs. present external world – P-Intentions);
- *Extended Presence* (Self relative to present external world – D-Intentions).

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. Proto Presence allows the enaction of M-Intentions only.

"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 processes, the more it is able to identify the present moment and its current tasks, increasing its probability of surviving. Core Presence allows the enaction of M-Intentions and P-Intentions only.

The role of "Extended Presence" is to *verify the relevance to the Self of experienced events in the external world (Self relative to the present external world)*. The more the Self is present in relevant experiences, the more it will be able to reach its goals, increasing the possibility of surviving. Following the Sperber and Wilson approach [63], an input is relevant when its processing yields a positive cognitive effect: a worthwhile difference to the Self's representation of the world. Only with Extended Presence the agent is able to enact all the three levels of intentions.

7.5.2 The layers of social presence

The study of infants and the analysis of their ability of understanding and interacting with people suggest that also Social Presence, on the process side, includes three different layers/subprocesses phylogenetically different, but mutually inclusive:

- *Proto Social Presence* (there is an other intentional Self);
- *Interactive Social Presence* (the intention of the Other is toward the Self);
- *Shared Social Presence* (the Self and the Other share the same intention).

More precisely we can define *"Proto Social Presence"* the process allowing the identification of other intentional selves in the phenomenological world (there is an other intentional Self). The more the Self is able to identify other selves, the more it is the possibility of starting an interaction, thus increasing its probability of surviving. Proto Social Presence allows the recognition of M-Intentions only.

"Interactive Social Presence" can be described the process allowing the identification of communicative intentions 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. Interactive Social Presence allows the recognition of M-Intentions and P Intentions only.

Finally, the role of *"Shared Social Presence"* is to allow the identification of intentional congruence and attunement in other selves (the Self and the other share the same D-intention). The more the Self is able to identify intentional attunement in other selves, the more it is the possibility of conducting an interaction, thus increasing its probability of surviving.

7.6 Conclusions

In this chapter we tried to show that the concepts of "Presence" – *the non mediated (prereflexive) perception of successfully transforming an intention in action*

(enaction) within an external world − and "Social Presence" − *the non mediated perception of an enacting Other within an external world* – can offer a conceptual framework for understanding the link between the enaction and the recognition of intentions.

Through Presence, the agent *prereflexively* controls his/her action through a forward-inverse model: the prediction of the action is compared with perceptual inputs to verify its enaction. Through Social Presence, the agent *prereflexively* recognizes and evaluates the action of others using the same forward-inverse model: the prediction of the action is compared with perceptual inputs to verify its enaction.

Both *Presence and Social Presence evolve in time, and their evolution is strictly related to the evolution of Self*. Following the Damasio's three-level model of Self (Proto-Self, Core Self, Autobiographical Self) we can identify higher levels of Presence and Social Presence associated to higher levels of intentional granularity. In this framework, motor intentions are at the basis of the intentional chain but inherit their goal from higher level intentions. In other words, mirror neurons have a direct role in the enaction and recognition of M-intentions only.

On one side, mirror neurons are activated in P-intentions and D-intentions only within the intentional/activity chain generated by high-level intentions. Recently, Cheng and colleagues [64] provided a first empirical support to this vision. They used a functional magnetic resonance experiment to demonstrate that motivation can influence activity in the human mirror-neuron system. They state:

"[The results] indicate that the motivational state of the organism affects neural systems involved in perception-action coupling mechanism. We speculate that the signals arising from the neural systems involved with drive (orbitofrontal cortex) and motivation (amygdala) enhance the activity in the mirror-neuron system to prepare the organism to behave." (p. 1983).

On the other side, mirror neurons are not directly involved in the recognition of P-Intentions and D-Intentions. As recently showed by Brass and colleagues [65] the description of the *goal* (P-intention) of an observed action (*the operation of a light switch with the knee*) is not encoded by the mirror neuron system. However, as predicted by our framework, the mirror neuron system encodes its *conditions* (M-intention), the short-term intentions necessary to enact the goal. Within this view, signals encoding higher-level attributes of an observed action are probably expressed by the activity in higher cortical levels, whereas those encoding lower-level attributes, such as the goal and the kinematics of the movement, may be expressed in lower cortical levels. Finally, the prediction of others' intentions is strictly related to the enaction of my ones: *I can predict what I can enact*. A strong experimental support to this claim comes from a recent study by Calvo-Merino and colleagues [66] comparing dancers and non-dancers. In their study, the dancers' mirror neurons showed more activity when they saw movements they had been trained to perform than when they observed movements they hadn't been trained to perform. More, the mirror system in the non-dancers showed appreciably less activity while watching the videos than either of the dancers' mirror systems.

Obviously, this chapter has its limitations: the framework here introduced is still in progress and some of the claims presented require additional theoretical work and an empirical confirmation. Nevertheless, quite independently of the intricacies

of terminology and conceptualizations, we hope that the Presence framework will help to disentangle the variety of claims and theories that characterizes intersubjectivity research.

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