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Layers of awareness in development

Philippe Rochat *

Emory University, USA



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ABSTRACT

Distinct layers of awareness about objects, people, and the self grow from an implicit biologically given core at birth. Each added layer of subjective experience would correspond to major qualitative shifts: the emergence of a contemplative stance by 2 months, self-consciousness from around 21 months and the manifestation of an ethical stance by 3–5 years. This new “onion” way of looking at psychological experience is meant to capture the fact that a new emerging layer of awareness does not block, re-construct, or fundamentally re-structure “à la Piaget” the expression of those ontogenetically anterior via bounding up equilibration and other reflective abstraction “bootstrapping” mechanisms. In contrast to Piaget’s overall representational re-organization, what is proposed here with the onion metaphor model is a multilayer view on consciousness in development, each layer offering a particular zone of awareness through which we constantly navigate depending on the mind state of our being in the world: dozing and dreaming, implicitly or explicitly aware, co-aware, conscious, or co-conscious. The model is illustrated using facts on the early development of pictorial understanding, mirror self-experience, self-consciousness, interpersonal awareness, and sharing awareness in development. The main purpose of the theory is to show that what develop in children between birth and 5 years are ultimately additional ranges of subjective experience, new possibilities of being aware in the world.

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* Emory University, Department of Psychology, 36 Eagle Row, Atlanta, GA 30322, USA. Fax: (404) 727 2979.

E-mail address: psypr@emory.edu.

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Introduction

The rebirth of nativist and evolutionary views on development was an important part of the burst of infancy research that followed the cognitive revolution of the 1960s. The mainstream theoretical intuitions regarding development followed the footsteps of Chomsky in the realm of linguistics, progress in evolutionary psychology and the modular views of emerging cognitive neuroscience research of the 1980s. Despite strong antagonist views like the ecological approach to perceptual learning, information processing based learning or the dynamic systems approach to development, neo-nativist and innate modular views that are grounded in phylogeny have prevailed. This is evident when looking at today's developmental research literature, infused with new facts presumed to be innate and long thought to be products of learning and active construction in development. These facts pertain to innate physical reasoning, innate concept formation, precocious pro-social inclinations and naïve sociology, pre-verbal theories of mind, and also presumably an innate moral sense. This new wave of infancy research continues to debunk many long held assumptions regarding the origins and putative mechanisms underlying the emergence of human consciousness, namely the ability to speak, transmit knowledge, the capacity for recursive thinking, implicit and explicit metacognition, notwithstanding the capacity to be self-conscious and having an objectified sense of self. However, renewed nativist and evolutionary looks at the origins of human consciousness tend to elude what might be major first person experiential changes occurring in early development. The model proposed here is intended to do so, combining recent infancy research discoveries with rapid changes in young children experience of the world as well as their own embodied self.

The article is organized as follows. After presenting the intuition behind the proposed model and in order to substantiate the general idea of developing layers of awareness emerging between birth and 5 years, the example of pictorial understanding is first used as a general empirical illustration, primarily because it is the context in which the intuition for the model first came to the mind of the author. Next, various general mind states that would correspond to layers of possible awareness emerging chronologically in early development. The intent here is to propose a general blueprint of awareness in development that we assume would be domain general. For the rest of the article I present more detailed empirically based observations to illustrate further multi-layer awareness in development, using my own research on the development of self and others' awareness, in particular (1) mirror self-experience; (2) self-consciousness; (3) interpersonal (inter-subjective) experience with others, and (4) the development of sharing awareness. We conclude with a recap of the main points behind the proposed multi-layer awareness model based on the conceptual and empirical illustrations that form the core of this article.

Intuition behind the model

In nature, most things grow by layers, typically piling on top of each other like geological strata, molecular structures that progressively coalesce to form organs like our brain in the course of embryogenesis. This highly, genetically pre-programmed growth process swiftly adds cell layers over cell layers. Because it is so pervasive in nature, "layer building" is an apt metaphor to capture the development of our awareness of the world, including ourselves. This analogy is obviously oversimplifying but helpful in trying to capture an aspect of consciousness in development that is arguably not sufficiently considered, despite the fact that it is an essential feature of human conscious life. As captured by William James and much earlier by Heraclitus, with their notion of consciousness as being primarily a dynamic stream, the mind works by constantly fluctuating from implicit to explicit functioning; highly emotional and irrational decision making, to highly rational and cold minded strategic reasoning; from highly moral and ethical conducts, to automatic gut instincts often contradicting explicitly defended moral norms.

The model proposes that in development, layers of awareness are added in a cumulative fashion. This accumulation increases the experiential range of the child, constantly navigating through these layers while awake and conscious. In other words, the model proposes that in development, layers of distinct experiential awareness build up in successive layers, each corresponding to a new variety of possible mind state. However, contrary to the constructionist, stage-like view à la Piaget, a new added

layer does not change or re-structure other already existing layers. This new “onion” way of looking at psychological experience is meant to capture the fact that a new emerging layer of awareness does not block, re-construct, or fundamentally re-structure “à la Piaget” the expression of those ontogenetically anterior via bounding up equilibration and other reflective abstraction “bootstrapping” mechanisms. It is contrary to Piaget’s basic precept of “bounding up equilibration” (l’équilibration majorante) driving cognitive progress. Piaget describes this mechanism as essentially a re-organization process leading to more accurate representational systems, hence “superior” conscious operations. In one of his latest books (*Equilibration of Cognitive Structures*), Piaget describes cognitive (i.e., conscious) progress as a general “re-organizing” amelioration of equilibration. Within his stage-like, discontinuous and structuralist view on development, progress arises “from the fact that a superior system is the source of novel regulations (...). These novel regulations are richer than the preceding, because reflective abstraction leads to more mental compositions. This growing wealth ameliorates the guidance of prior regulations. (...) It results in a hierarchy of cognitive regulation of regulations (...), constraining an integration of superior rank” (Piaget, 1975; p. 172; translated from French by the author). In contrast to Piaget’s overall representational re-organization, what is proposed here with the onion metaphor is a multilayer view on consciousness in development, each layer offering a particular zone of awareness through which we constantly navigate depending on the mind state of our being in the world: dozing and dreaming, implicitly or explicitly aware, co-aware, conscious, or co-conscious.

It is an alternative view compared to the depiction of the growth of one kind of awareness (rational conscious awareness) that, in development, would transform itself via equilibration and other reflective abstraction “bootstrapping” mechanisms Piaget proposes as well as other cognitive development researchers in his footsteps (see in particular Carey, 2011, in relation to conceptual development). The model is additive in the sense that a new layer of awareness simply adds on to what already exists. In other words, it adds a new range of subjective experience, and more importantly a new range of self-experience. Central to the model is the fact that a new layer adds new degrees of navigability across ranges of subjective experience and self-experiences, in other words multiple possible “phenomenal tunnels”.

The navigability intuition underlying the model is based on the fact that we, as conscious grown-ups, are masters at “code switching” and “multiple norm juggling”. We develop to become great navigators of standards and norms, adopting them from moments to moments as we go along in our chores and duties. Consciousness is about wearing multiple hats while carrying the same head: unity in flexibility. We sleep, we dream, we wake up, are parent, lover, worker, chief, believer, voter, party member, friend, foe, life partner, constantly calibrating our role and place as part of each of these multiple, highly contrasted roles. This is part of conscious stream as we go about life. In the end, consciousness is the flow of our moment to moment attention to things. In this respect the spot light metaphor is apt. As many neuroscientists describe it, consciousness is the content of our selective attention: “Consciousness in the (mental theater) metaphor resembles a bright spot on the stage of immediate memory, directed there by a spotlight of attention, under executive guidance. The rest of the theater is dark and unconscious.” (Baars, 2003, p. 3; for similar views see also DeHaene & Naccache, 2001; DeHaene, 2014; Edelman & Tononi, 2000; Kanwisher, 2001). It is also the content of our attention as it moves and often builds up in the context of plans and more organized goals and intentions.

The model tries to capture the fact that human consciousness consists of poly-awareness, moment to moment patterns of interrelated levels of awareness that are co-present and co-active with various weights changing all the time: non-conscious (always there if alive), unconscious (if recoverable), aware (feeling state), co-aware (feeling with others), conscious (objectified thoughts and feelings), co-conscious (objectified in reference to others) and ethical (meta-awareness in reference to collective values and beliefs, i.e. communal norms).

The proposed onion metaphor of consciousness in development is an attempt at capturing this poly-phonic phenomenal nature of human awareness, above and beyond simply capturing the emergence and character of the rational mind (i.e., cognitive development in its typical treatment). Here consciousness refers to patterns of coherence that have varying depth of meta-processing, from very shallow to deep.

Contrary to Piaget's assumptions, representational knowledge can be a given from birth, some evolutionary built-in competencies exist that do not need to be constructed per se. Jump started and activated, yes, but not constructed or actively organized like the co-activation of sight and touch, basic physical knowledge and discrimination like faces or the own body as a differentiated entity among other entities in the world. So the question is, what develops?

Layers of pictorial awareness in development

As already mentioned, the intuition behind the proposed developmental model was first formed in the context of studies regarding young children's progressive grasp and construal of pictorial representation (Callaghan, Rochat, & Corbit, 2012; DeLoache, Pierroutsakos, & Uttal, 2003; Rochat & Callaghan, 2005; see also Poss & Rochat, 2003 for cross primate species comparison). We thus start illustrating the model at a coarse grain level, to set the stage, in the footsteps of Judy De Loache and collaborators, as well as Tara Callaghan's pioneer works on symbolic development, with for example observations of 2 year-olds trying to physically grasp objects depicted on photographs or try put on themselves tiny shoes of a doll they are playing with (DeLoache, Uttal, & Rosengren, 2004). These observations are striking demonstrations indexing, in the context of pictorial and spatial understanding, various levels of awareness that appear to unfold chronologically in early development (see in particular DeLoache et al., 2003; Rochat & Callaghan, 2005).

When viewing pictures, as adults, we manifest a range of different understandings, from confounding them with their referent (zero awareness), to awareness of the intention of the artist behind the picture (intention awareness). In the zero awareness case, a painting can be hyper realistic and becomes in the mind of the viewer confounded with its referent. It is not unlike hitting accidentally the solid 2D surface of a glass door that eluded us or experiencing mirrors that give the illusory sense of a 3D spatial expand. In the mind of the perceiver, the picture's 2D materiality disappears. Beyond zero awareness, levels of pictorial awareness are multiple and can be experienced alternatively. Informed by numerous facts on the development of pictorial understanding and production, we distinguish 6 levels of pictorial awareness unfolding chronologically between birth and 5 years (Rochat & Callaghan, 2005). Following our model, these levels would exhaust the full range of *basic* pictorial awareness. Research shows that this range appears to develop from birth and is achieved by 5 years, achieving the full basic range of possible pictorial awareness. This basic range continues to be expressed through the life span, each layer potentially refined with experience and exposure.

In other words, these unfolding levels of pictorial awareness (how we experience, understand and reason about pictures) would correspond to the full range of pictorial processing through which individuals constantly oscillate when encountering graphic symbols: from not actually experiencing the picture (zero awareness), to simply differentiating 2D depiction from the depicted 3D reality; the understanding of the referential nature of pictures and eventually the meta-awareness of the picture maker (see summary Table 1, reproduced from Rochat & Callaghan, 2005).

By 5 years children have developed a multi-layer pictorial awareness system through which from then on, they will constantly navigate, oscillating from literal to more symbolic and intentional experience of pictorial representations, depending on behavioral states, contexts, training, as well as cultural circumstances (Callaghan, 2000a, 2000b; Callaghan et al., 2012).

Table 1

Graphic symbol development: successive levels of pictorial awareness (from Rochat & Callaghan, 2005).

Level	Age	
0	/	No differentiation between pictorial symbol and its referent
1	Birth	Basic differentiation between 2D depicting artifacts and depicted 3D reality
2	6 months	Relating similarities between pictures and their referents
3	3 years	Referential understanding of pictures
4	4 years	Symbolic flexibility and constancy of pictures
5	5 years	Meta-awareness of the picture maker

In relation to pictorial understanding, and following our model, what develop are new possible levels of pictorial awareness that in development are not cancelling each other out, not fundamentally restructuring preceding levels as new one emerges. A child capable by 5 years of referring a picture to the mind state of its creator (Callaghan & Rochat, 2003) does not lose the ability a moment later to experience the same picture in a radically different manner, for example as simply standing for the landscape or object it depicts or by taking it as referent itself focusing on the materiality of the medium be it the grain of a photography or the pigments of a painting.

What is gained in development is the added possible range of pictorial awareness, a range that persists through the life span, each level actualized depending on circumstances and individuals' current frame of mind. Accordingly, prior to 5 years, children do not have yet the full range of possible pictorial awareness. It is cumulatively in the making.

Based on this account, and as a working hypothesis, we can tentatively propose different kinds of general awareness or mind states, as they appear to unfold chronologically in development. After describing them and for the rest of the article, I provide more detailed empirical support for such developmental account with more recent facts on mirror self-experience and the development of intersubjectivity, i.e. the way infants and children develop the sharing of experience with others.

Unfolding range of mind states¹

Elsewhere, we proposed that there are at least 6 mental states that can be distinguished from a phenomenal stand point, spanning from non-conscious to co-conscious mind states. These ontologically different mental or mind states would emerge chronologically in development. They correspond respectively to (1) Non-conscious states of the mind, (2) unconscious, (3) aware, (4) co-aware, (5) conscious, and last but not least (6) co-consciousness. These mind states are succinctly described below in the putative order of their ontogenetic emergence (see Rochat, 2009).

- (1) *Non-conscious* states correspond to the state of being alive, yet absolutely oblivious of being, like a comatose person in a vegetative state. It is a state of the mind by negation, like a cosmic black hole of anti matter, a thing of nothingness. It is as difficult for us to construe non-consciousness while conscious, as it is to construe death while alive, nothingness while being in the world. However, non-consciousness does exist as a reality that is necessary, if not by direct inference from experience, at least by logical deduction.
- (2) *Unconscious* states correspond to another kind of oblivious state of the mind with no traces of explicit awareness as in the preceding state of "comatose" nonconsciousness. Yet, it is clearly distinct from it, because contrary to a non-conscious, comatose state, in being unconscious one can eventually become aware and conscious of it. For example, through a psychoanalytical cure or mere self-reflection and mental inference, one can bring to explicit awareness subliminal phenomena like subconscious desires or influences that are shown to pull and push us in our feelings and decisions.
- (3) *Awareness* is an implicit state in which one is neither conscious, non-conscious, nor unconscious. It is a state in which one is aware of being alive in a sentient body in the world. It corresponds to what phenomenologists like Husserl or Merleau-Ponty capture as the sense of being present in the world: "le sentiment de sa présence au monde" (the feeling of one's own presence in the world). To be aware is ontologically distinct from being conscious. It is different because awareness is by definition implicit as it does not have to be conceptual. It is pre-conceptual or implicit. To be aware of something is different from conceiving, thinking, objectifying, or being explicit about this thing, like I am doing now writing about it. One is aware of something typically prior to being able to communicate about it to others via language or any kind of intentional gestures. In awareness, no intention is involved. Note that any explicit account of the awareness of being alive is very difficult since it is an experience

¹ Based on Rochat (2009, Chapter 4); see for more details.

that, in essence, is implicit and preconceptual. As adepts of phenomenology insist, it precedes and is the foundation as well as the necessary condition of any explicit experience of the self in the world.

- (4) *Co-awareness* is an extension of the awareness state presented prior. As for awareness, it is not an objectified, intentional state of mind, nor is it non-conscious or unconscious. It is experientially accessible. Yet, it is ontologically distinct because it is a mind state that is in essence social. It is an awareness projected outward toward the presence of other individuals. It pertains to the sense of being aware of one's presence in the world with others, not alone in a solipsist way. Co-awareness is the awareness that our presence in the world is communal rather than individual, a presence that is simultaneously shared with the presence of others: that one's presence in the world is not alone but rather together with the presence of others. As elusive as it might sound, it is crucial to emphasize co-awareness as a specific state of mind, distinct from either awareness per se or any other conscious states. It is for example the implicit awareness that there are other tenants in my apartment building, even if I don't hear them or don't know explicitly who they are. They represent an implicit presence that explicitly determines my behavior (e.g., not making too much noise with my stereo, shushing my friends if they sound too loud during a late party).
- (5) *Consciousness* is the state of mind where one knows that he knows, and that what he knows knowing is not just transparent, but rather opaque in the sense of being objectify-able. It can become explicit in terms of propositions, predicates or any other kinds of mental representations, be it simulation, pretense, or memories. These representations are for oneself but also eventually for others, when formatted in words, in texts or any other public formats. Consciousness is a mental state in that it is the result of a process that depends primarily on the individual's self-reflection and thinking, as exemplified in Descartes' famous cogito: "I think therefore I am". It acknowledges the fact that there is a state of mind where we can think primarily for ourselves, making discoveries on our own and for ourselves in the privacy of our embodied self, and not primarily for others. Consciousness does entail a self-reflective loop and an introspective process dealing with mental objects or objects that are re-presented. The nature and format of these mental objects is the main topic of today's abundant cognitive science research. Some claim that these mental objects are mainly symbolic and propositional in nature. Other researchers claim that they are mainly embodied simulations. Whatever these mental objects might be, they are considered mainly as mental objects generated by the solitary conscious individual, not enough as mental objects co-constructed and elaborated in interaction with other individuals.
- (6) *Co-consciousness* corresponds to the mind state in which, not only we know of knowing, but more importantly, we know of sharing knowledge with others. Here the knowledge of knowing is not just individual as in the case of consciousness, but is collective. In contradistinction to the Cartesian, solipsistic conception of consciousness, the knowledge of knowing co-exists in multiple minds and in a way transcends the individual who becomes only one part of a whole. The knowledge that the individual knows is not of the conscious kind described prior. Why? – Simply because it will survive individuals. This knowledge will eventually be retained in the mind of other surviving persons as well as in institutions (marriage, justice, schools) that the passing individuals helped shaping during their lifetime whether by abiding to it, by transgressing it, or rebelling against it. Rather than embodied in the individual, this meta-knowledge is embodied in the group, including the family, the society and the culture where the individual evolves. Furthermore, the mental objects or re-presentations of coconsciousness are not within the individual, but rather outside. In particular, they are between the individual and others, not in one of them taken separately. They exist in the social transaction. The mental objects of co-consciousness are at the interface between an individual and other individuals with whom he or she is sharing the experience of being in the world.

As a more concrete illustration of the unfolding range of mind states in development, we consider next how children develop awareness of their own reflection in mirrors. The goal is to show that this development matches the emerging range of mind states just described.

Developing levels of *mirror self-awareness*²

What do children see when they see themselves in a mirror? Do they see that it is them or do they perceive someone else facing them? When do mirrors and their reflection begin to be considered for what they are, namely a solid polished surface that reflects back? What will children do when discovering an unexpected mark on their own mirror reflection (mirror mark test)? We outline 6 possibilities, ranging from self-obliviousness to self-consciousness, corresponding to particular levels of *mirror self-awareness* unfolding chronologically between birth and approximately 5 years. Following the proposed model, each level would enlarge the child's possible range of self-awareness (Rochat, 2003, 2009).

Level 0: confusion

This is the degree zero of mirror self-experience, level at which the individual is oblivious of any mirror reflection, thus oblivious of the mirror itself. The specular image is confounded with the reality of the environment it reflects. It is perceived as a mere extension of the world, not a reflection of it. Animals challenging their own mirror reflection as a stranger would express such level, like birds sometimes accidentally crashing into windows or polished surfaces like mirrors. They mistakenly perceive mirrors as an extension of the environment, not as differentiated objects. Pet owners know that placing a mirror in a canary cage is a substitute for companionship and triggers in the bird melodious courtship song. It is also the level expressed by dogs, cats, or monkeys facing mirrors and posturing endless aggressive displays to their own specular image as if they were confronting a creature other than themselves.

Level 1: differentiation

This is the first sign that the individual is not oblivious of mirrors as a tool for reflection. At this level, there is a sense that what is perceived in the mirror is different from what is perceived in the surrounding environment. More specifically, when perceiving their own specular image, the individual picks up the fact that there is something unique about the experience, namely that there is a perfect contingency between seen and felt movements. Beyond the confusion of the preceding level, this level entails some basic perceptual differentiation, differentiation between the experience of own bodily movements as reflected in the mirror and the direct experience of other moving entities in the world. This is a first level of self-world differentiation: a differentiated self is expressed.

Level 2: situation

Beyond the differentiation of the uniqueness of self-produced movements seen on the surface of the mirror, the individual now is capable of systematically exploring the intermodal link between seen movements on the mirror surface and what is perceived of the own body proprioceptively. In other words, individuals now go beyond the awareness of matched surface characteristics of seen and felt movements. They also explore how the experience of their own body relates to the specular image, an image that is out there, projecting back at them what they feel from within. As compared to the preceding level, this can be viewed as first signs of a contemplative stance toward the specular image, a sort of *proto-narcissistic* stage guided by self-exploration on a projected surface. At this level, there is no confusion. The individual is aware that what is seen on the mirror is unique to the self. In addition, the individual is also aware that what is seen is “out there”, on a surface that is spatially situated in relation to the body: a situated self is expressed.

² Based on Rochat (2003); see also Rochat and Zahavi (2011) for more details.

Level 3: identification

At this level, the individual manifests recognition, the fact that what is in the mirror is “Me”, not another individual staring and shadowing the self. There is more than differentiation and situation of self in relation to the specular image. This level is expressed when children refer explicitly to the self while exploring their own specular image. In the case of the “Post-It” sticker surreptitiously placed on the child’s forehead prior to mirror exposure, the child discovers it in the mirror and reaches for it for touch or removal. This behavior is considered by developmental psychologists as the index of an emerging conceptual self (e.g., Lewis & Brooks-Gunn, 1979), but also as a major cognitive landmark by evolutionary psychologists (e.g., Gallup, 1982; Parker, Mitchell, & Boccia, 1994). At this level, the individual is capable of referring the specular image to the own body, the latter being the referent of what is seen in the mirror. There is an identity relation between the self as experienced from within and what is displayed on the polished surface of the mirror: an identified self is expressed.

Level 4: permanence

The self is identified beyond the here and now of mirror experience. It can be identified in pictures and movies taken in the past, where the self might be significantly younger, at a different location and dressed in different clothes. In other words, the identification of the self is not tied to the temporal simultaneity and spatial coincidence of the body and its reflection, whether in live videos or specular images. The individual manifests a sense of self that persists beyond the immediacy of mirror experience. A permanent self is expressed: an entity that is represented as invariant over time and appearance changes.

Level 5: others in mind

The self is now recognized not only from a first person perspective, but also from a third person’s. Individuals are not only aware of what they are but *how* they are in the mind of others: How they present themselves to the public eye (Goffman, 1959). The public outlook on the self is simulated for further evaluation of how one is perceived and valued by others. The result of this evaluation, more often than not, is either a devaluation or a delusion, linked to so-called “self-conscious” emotions or attitudes such as pride or shame. A self-conscious self is expressed: an entity that is simulated and projected in the mind of others.

Once again, following our model, once level 5 is expressed, the child would now experience the full range of *possible* mirror self-experience, able now to navigate through them as a function of constantly fluctuating behavioral state and circumstances. The child begins to experience what we as adult might experience in relation to our own reflection in the mirror: from obliviousness in taking the own specular image as standing for somebody else, someone else facing me in 3D space, to the meta-awareness of how we might be evaluated by others in the display of our public image as reflected in the mirror.

What kind of empirical evidence supports the preceding view that there are major chronological steps in the early development of self-awareness? What qualifies for this progression leading children toward level 5 range of self-awareness becoming capable of experiencing the all too human range of emotions such as guilt, shame and embarrassment, the range of self-conscious emotions that are presumably unique to humans as already noted by Darwin. In his book on *The Expression of the Emotions in Man and Animals*, Darwin (1872/1965) is struck by the unique and selective human crimsoning of the face, a region of the body that is most conspicuous to others. He writes: “Blushing is the most peculiar and the most human of all expressions” (p. 309).

Observing blushing in his son from approximately 3 years of age, and not prior, Darwin highlights the mental states that seem to induce human blushing: “It is not the simple act of reflecting on our own appearance, but the thinking what others think of us, which excites a blush. In absolute solitude the most sensitive person would be quite indifferent about his appearance. We feel blame or disapprobation more acutely than approbation; and consequently depreciatory remarks or ridicule, whether of our appearance or conduct, causes us to blush much more readily than does praise” (p. 325). These observations capture something fundamental and distinctive about humans, a unique motivation behind their social cognition:

the exacerbated quest for approbation and affiliation with others, the unmatched fear of being rejected by others (see Rochat, 2009). But where does that all come from and how does this new “self-conscious” level of self-awareness emerge in development on top of all the others?

Unfolding levels of self-awareness³

Starting state

Recent empirical findings suggest that infants do not come to the world with the exclusive expression of self-obliviousness corresponding to *Level 0*, the degree zero of mirror self-experience as described above. It appears that immediately after birth, infants demonstrate already a sense of their own body as a differentiated entity: an entity among other entities in the environment (*Level 1*). This is evident, for example, when observing the rooting response of newborns and what triggers it. When touching the cheek of newborns, they tend to orient their head toward the touch stimulation. This response is highly predictable and part of the routine neurobehavioral assessment of neonates.

In a study (Rochat & Hespos, 1997), we compared such response in 24 hour-old infants following either a tactile stimulation originating from the index finger of the experimenter or from self-stimulation, infants spontaneously bringing one of their hands in contact with a cheek. Systematic comparison shows that neonates do root significantly more to external compared to self-stimulation. From birth, infants differentiate between self- vs. non-self touch, between stimulation originating from either the own body or an external source. Contrary to the assumption of many classic theories of child development, infants are not born in a state of fusion or confusion with environment (the “blossoming, buzzing, confusion” proposed by William James). They do show some rudiments of self-world differentiation. What might be the origins of such innate capacity? The answer is that from birth and possibly even prior, there are distinct perceptual experiences that are *uniquely specifying* the own body as opposed to the experience of other entities in the world.

When infants experience their own crying, their own touch, or experience the perfect contingency between seen and felt bodily movements (e.g., the arm crossing the field of view), they perceive something that no one but themselves can perceive. There is an authority of first person perspective for this unique category of perceptual experiences. The transport of their own hand to their face, very frequent at birth and even during the last trimester of pregnancy, is a unique tactile experience, unlike any other tactile experience as it entails a “double touch”: the hand touching the face and simultaneously the face touching the hand. The same stands for the auditory experience of the own crying, or the visual-proprioceptive experience accompanying self-produced movements. These basic perceptual (i.e., multimodal) experiences are indeed self-specifying, unlike any other perception experienced by the infant from birth and even prior to birth in the confine of the maternal womb.

Young infants appear to pick up the invariant information that specifies the own body as a differentiated entity, an entity that is experienced differently from other physical bodies or objects that are *out there* in the environment. Aside from our own research, there is an abundance of experimental studies with newborns and very young infants that suggest the existence of early self-world differentiation (see for example the collected chapters in Rochat, 1995).

Situated self-awareness from 2 months of age

By the end of the second month, infants show clear signs that in addition to self-world differentiation, they also have a sense of how their own bodies are *situated* in relation to other entities in the environment (*Level 2*).

If infants from birth show a propensity to imitate facial expressions such as tongue protrusion (Meltzoff & Moore, 1977), or basic emotions such as joy or sadness (Field et al., 1982), by the second month they demonstrate systematic matching that denotes a novel sense of how they relate to the model

³ As depicted in Rochat (2009) *Others in Mind*, for more details see chapter 5 “birth of self-consciousness”.

they imitate. In one study researchers showed, for example, that 6 week-olds tend to copy systematically the orientation of the tongue protrusion of an adult model pulling her tongue either to the right or to the left, as opposed to midline. This imitative response of the infants indicates that, not only do they reproduce the global tongue protrusion act, something they are capable of from birth, they also approximate the directionality of the modeled tongue movements (Meltzoff & Moore, 1992). This entails that in addition to differentiating their own actions from those of the model, they are also capable of mapping their own bodily space to the bodily space of the model. With this sophisticated imitative behavior, infants appear not only to differentiate themselves but also to situate themselves in relation to the perceived model. What is particularly striking in the observations reported is the fact that by the second month infants are actively approximating the tongue orientation of the model, engaged in active exploration until they map the target action. Based on microanalyses of the videotapes, infants typically start to pull their tongues at midline, slowly and with apparent effort bringing it to the side while staring at the model. This active exploration is an index of both differentiation and situation of the infant in relation to the adult model facing her.

In a related perception–action study (Rochat & Striano, 1999a), we find that by the second month, infants become actively involved in exploring and contemplating the auditory consequences of their own sucking actions. In this study, we recorded young infants' oral activity while introduced to a pacifier connected to a sound producing device. Each time the infants applied oral pressure on the pacifier above a low threshold, they heard a perfectly contingent succession of discrete sounds with a particular pitch variation. In one condition, the pitch variation was an analog of the oral pressure applied on the pacifier, with an ascending and descending pitch variation mapping the increase and decrease of oral pressure. In another condition, the pitch variation was a non analog of the oral pressure, varying randomly. We found that the infants' oral activity on the pacifier was markedly different in either the analog or non analog condition. When trying to replicate these findings with a group of newborns but did not find any evidence of such differential activity, these younger infants demonstrate no sign of discrimination between the two conditions.

By the second month, infants thus appear to be newly exploring the perceptual events they produce in the environment adopting what was described as a *contemplative stance* (Rochat, 2001). Presumably, this developing stance implies both differentiation (*Level 1*) and situation (*Level 2*) in relation to the object of contemplation.

In the social realm, and corresponding also to the emergent contemplative stance, infants, by the second month, begin to smile when playfully engaging in face-to-face interactions with another person. As discussed before, the infants are expressing a novel sense of shared experience with others. It is also at this time that infants begin to engage in proto-conversations with others via turn taking, imitation, affective mirroring, and mutual monitoring, all implying a sense of self that is differentiated and situated in relation to the conversing partner they are sharing experiences with.

Finally, probably the less ambiguous demonstration of *Level 2* self-awareness is when infants start systematically to reach for objects they see, deliberately bringing their hands in contact with objects. By 4 months, normally developing infants become “touch all” or “*touche à tout*” as the French say. They express systematic eye–hand coordination. However, they do so selectively.

We observed that from the time they are capable of reaching, infants are sensitive to the situation of their own bodies in relation to the object they reach, namely the distance that separates them from the object (Rochat, Goubet, & Senders, 1999). In addition, they calibrate their decision to reach in relation to their postural degrees of freedom, whether they are more or less able to move forward toward the object without losing balance and falling onto the ground. Infants are capable of eye–hand coordination long before they are capable of maintaining postural stability while sitting. Early reaching is therefore challenging the infant's overall body balance.

For example, in a series of studies, we found that 4- to 6-month-old infants' decision to reach toward an object placed at various distances and locations in front of them was determined by their own sense of situation and postural ability. For objects presented at the same distance, the propensity of infants to reach for these objects varied according to their sitting ability. We also found in infants of comparable sitting ability, hence with comparable postural degrees of freedom, that their attempts to reach for an object varied whether we attached weights to their wrists. These weights brought back the center of mass of their body, therefore adding to their balance problem as they reach forward toward the

object. We found that in the weight condition, infants are less inclined to reach, despite the fact that they have no problem moving their arms around with the loaded bracelet. In short, these observations clearly indicate that infants have a sense of self not only as differentiated (*Level 1*) but also as situated in relation to what the environment affords for action (*Level 2*).

Birth of “Me” by the second year

Until the middle of the second year, when linguistic and symbolic competencies start to play a major role in the psychic life of children, self-awareness remains *implicit*. It is expressed in perception and action, not yet expressed via symbolic means such as words. Prior to approximately 14–18 months there is no clear evidence yet that the children perceive traces of themselves, as *standing for* themselves, only themselves, and no one else, such as the footprints they might leave in the mud or the image they see in the mirror.

Infants do however, months earlier, discriminate between their own images and the image of another infant. Preferential looking studies show that by 5–6 months infants tend to be significantly more captivated by a video recording of another, same age infant, compared to a video recording of themselves wearing an identical, same color outfit (Bahrick, Moss, & Fadil, 1996). It appears that by this age, and presumably via previous exposure to mirrors and other self-reflecting devices, infants pick up invariant features of their own faces. It does not mean, however, that they construe these features as standing for themselves. It is the product of perceptual learning of subtle invariant facial features they quickly become familiar with. When placed in a situation where they have the choice to explore either their familiar faces or the face of another child, they show a typical preference for novelty. Although certainly a necessary precursor and a sign of remarkable perceptual learning ability, this preference does not mean yet that infants do *recognize* themselves on the TV.

The same kind of interpretation applies to our findings that 4- and 7-month-olds show clear discrimination between seeing themselves live on a TV while moving around in their seat versus seeing a live experimenter on a TV engaged in the systematic imitation of what the infant is doing (Rochat & Striano, 2002). In our experiment, the experimenter shadowed the infant as mirrors do. We found that infants smiled, vocalized, and looked differentially at the imitating experimenter seen on TV compared to the self. In addition, infants tended to react differentially in either condition when the image was suddenly frozen in “still-face” episodes.

In all, young infants demonstrated once again their perceptual ability to distinguish between the familiar sight of themselves and the novelty of the experimenter appearing on the TV, the age variable, notwithstanding the inescapable lack of perfect contingency in the Experimenter’s shadowing of the infant’s own.

Despite all these remarkable abilities to discriminate perceptually between what pertains to the self and what pertains to others, up to the middle of the first year infants are oblivious that some rouge has surreptitiously been smeared on their faces or that a yellow “Post-It” might appear on their foreheads when looking at their own specular images. It is only by 18 months that infants start to reach for the mark on their own bodies, often in order to remove it (*Level 3*). Most developmental and comparative psychologists consider this behavior as the Litmus test of self-awareness. It is often viewed as the evidence of a conceptual or “represented” sense of self in any organism behaving like this in front of mirrors, whether human or non human primates, avian, mammals like elephants, or even cetaceans like dolphins.

But why might it be the case? It is mainly because by showing this behavior, individuals demonstrate the ability to refer to the specular image as referring to their own bodies. In other words, they refer the silhouette they see reflected in the mirror to precise regions of their own bodies they cannot see directly (e.g., their foreheads). This would be impossible without some kind of a representation of the own body that is mapped onto what is seen in the mirror. Therefore, this behavior indicates that the individual sees the mirror reflection as standing for this representation (*Level 3*). It is identified as referring to the body experienced and represented from within, not anybody else’s. Identity is used here in the literal, dictionary sense of “recognizing the condition of being oneself, not another” (Random House Unabridged dictionary).

In relation to the above formulation, mirror self-recognition expressed via the “successful” passing of the mark test is predictably linked to major progress in symbolic (referential) functioning of the child in other domains, in particular language development.

By 18 months, infants also start to emphasize differences between themselves and other people in their verbal production. They express semantic roles that can be taken either by themselves or by others (Bates, 1990). An explicit, hence reflective conception of the self is apparent at the early stage of language acquisition, at around the same age that infants begin to recognize themselves in mirrors. This chronological link in development provides indirect validation of the mirror test and the interpretation outlined above. Indeed, language acquisition requires a preexisting conceptual or represented sense of self as “Me” as opposed to simply “I”: “a theory of the self as distinct from other people, and a theory of the self from the point of view of one’s conversational partners” (Bates, 1990, p. 165).

The birth of Me extending over time

If infants identify themselves in mirrors starting at 18 months, they still demonstrate that the Me they identify in the specular image remains enigmatic and ambivalent. They appear to still oscillate between an awareness of the self and an awareness of seeing someone else facing them. Identifying oneself in the mirror is a major feat, not only for the referential mapping between the mirror reflection and the own body schema, but also because what the child sees in the mirror is the way he or she always sees others: in an “en face” posture often with eye contact. In relation to this basic experience of social encounters, what the child experiences in the mirror might be “Me”, but it is also what others typically look like. The child therefore has to suspend and override his overall visual experience of others, the specular image standing for “Me as an other” (Me but Not Me dilemma, Rochat, 2001); see also from a psychoanalytical perspective Jacques Lacan (1953; 1966) account of “the mirror stage” and his views on ego formation in development.

The mirror experience of the self carries this fundamental ambiguity and children struggle with it, as we will see, until at least their fourth birthday. Note that this ambiguity is pervasive all through the life span. As adults, we look at ourselves in mirrors, working on our presentation by simulating or representing the looking of others on our own bodies. What we are seeing is de facto our appearance as seen by others, hence the pretense of someone else.

In his seminal observations of his own children, Piaget reports anecdotes that pertain to the mirror dilemma. Jacqueline, aged 23 months, announces to her father as they are coming back from a walk, that she is going to see her father, her aunt, and herself in the mirror. Perfectly capable of identifying herself in the mirror as “Me” when prompted by her father asking “who is there?”, Piaget observes that Jacqueline provides also at time a *third person* account of what she sees in the specular image. Likewise, she tends to oscillate between claiming that it is “Me” or that it is “Jacqueline” when viewing photographs with herself on it (Piaget, 1962, pp. 224–225).

More recently, as part of a series of ingenious studies on the developmental origins of self-recognition, Povinelli reports the commentary of a 3 year-old viewing herself on a TV with a sticker on her forehead. She says: “it’s Jennifer ... it’s a sticker” and then adds: “but why is she wearing my shirt?” (Povinelli, 2001, p. 81).

In all, these observations illustrate once again the Me-But-Not-Me dilemma, children struggling with it months after they show signs of self-identification in mirrors. The recent research of Povinelli and colleagues demonstrates that children slowly bypass the Me-But-Not-Me dilemma when viewing live or pre-recorded videos of themselves. For example, 3 year-olds and younger do tend to reach for a large sticker they see on top of their own heads while viewing a live video of themselves. In contrast, they don’t do this when viewing the replay of the same video taken only 3 minutes prior. Furthermore, when asked who was on the TV, it is only by 4 years that the majority of children say “Me” rather than their proper names suggesting a first person stance rather than a third.

The careful empirical work of Povinelli and colleagues on delayed self-recognition shows that it is not prior to the age of 3 years that children begin to grasp the temporal dimension of the self. That the self pertains not only to what is experienced now but also to what was experienced then, what can be seen in a mirror now or in a movie tomorrow: the same enduring self (*Level 4*).

Others in mind: evaluative and the meta-cognitive self-knowledge

By the time young children begin to express and recognize themselves as enduring entities, they also begin to show major advances in their understanding of others. By 4–5 years, children begin to be capable of holding multiple representations and perspectives on objects and people. They can, for example, infer the particular age, relative sentience, temperament, and emotionality of a person by merely looking at the quality of a simple drawing. By this age, children infer the mind and affects of the artist behind a graphic symbol (Callaghan & Rochat, 2003). This ability is linked to the developing child's ability to construe false belief in others, as well as to grasp the representational status of graphic and other symbolic artifacts such as maps, photos, or scale models (DeLoache, 1991; see also Olson & Campbell, 1993; Perner, 1991).

The development of representational abilities, in general, and theories of mind, in particular, corresponds also to evidence of meta-awareness in relation to the self (*Level 5*). For example, when children begin to explicitly understand that another person holds a false belief, they necessarily understand that they themselves hold the right belief. In the same way, when infants demonstrate some construal of object permanence, they also demonstrate their own permanence in relation to objects (Rochat, 2001). These terms are inseparable.

The expression of embarrassment in front of mirrors by the second year can be interpreted as the first signs of young children's awareness of their public appearances and how others perceive them. As proposed earlier, by this age children begin to experience the basic fear-generating realization of a gap between how they perceive themselves from within and what others perceive from the outside.

An alternative interpretation would be that young children shy away from their reflections in the mirror, not because they are "self-conscious", but rather because they wrongly construe the presence of another child staring at them with some kind of a persistent still face. But this is doubtful, considering that at an early age, infants discriminate between seeing themselves or seeing someone else in a video.

By showing embarrassment and other so-called secondary emotions, young children demonstrate a new propensity toward an evaluation of the self in relation to the social world. They begin to have others in mind, existing "through," in addition to "with" others.

Secondary emotions, such as the embarrassment children begin to express by 2–3 years of age parallel, linked to the emergence of symbolic and pretend plays. Such play entails, if not at the beginning, but at least by 3–4 years, some ability to simulate events and roles, and to take and elaborate on the perspective of others (Harris, 1991; Tomasello, Striano, & Rochat, 1999).

The process of imagining what others might perceive or judge about the self, whether this imagination is implicitly or explicitly expressed, is linked to the cognitive ability of running a simulation of others' minds as they encounter the self. There are fantasies and phantasms involved, the imaginary stuff that tends to feed the self-conscious mind and characterizes the meta-cognitive level of self-awareness (*Level 5*).

Unfolding levels of interpersonal awareness

By the second month, there is a behavioral revolution. Typical infants open up to the world in unmistakable ways. When not sleeping or crying, they spend markedly more time in a wakeful state, actively and spontaneously tracking and exploring objects, and in particular faces in the environment (Wolf, 1987). When attending to faces, they begin to spend significantly more time exploring internal features, namely eyes and mouth, compared to outside features such as forehead contours and hairline, which are preferentially attended to by one-month and younger infants (Haith, Bergman, & Moore, 1977). More significant is the fact that by 6 weeks, in a face-to-face situation, infants begin to manifest smiling. Such smiling expression is elicited by the social engagement of others as they typically try to create a shared positive emotional experience with the infant.

From this point on, infants enter the give and take of interpersonal conversation – a privileged context in which they can differentiate their own, first person perspective, from the third person perspective of the social partner they converse with. They develop a sense of shared experience or primary intersubjectivity. This primary sense of shared experience in face-to-face exchanges is a first form of triadic

exchanges that is turned toward the self of the infant, the infant being the prime topic of the communicative exchanges with the adult. From 2 months on and until approximately 9 months, the main topic of communication is the infant himself and not yet the objects that surround the infant and the adult (secondary inter-subjectivity, see Tomasello, 1995; Trevarthen, 1980).

Sociality and reciprocity in development

The sense of reciprocity is expressed very early in the life of the healthy child. By two months, infants start to engage in face-to-face proto-conversations, first manifesting signs of socially elicited smiles toward others (Rochat, 2001; Wolff, 1987). Such emotional co-regulation and affective attunement are more than the mirroring process underlying neonatal imitation and emotional contagion evident immediately after birth (Meltzoff & Moore, 1977; Sagi & Hoffman, 1976; Simner, 1971). From this point on, infants express a new sense of shared experience with others in the context of interactive, typically face-to-face plays, what Colwyn Trevarthen (1980) first coined as “primary inter-subjectivity”.

When infants start to engage in proto-conversation, they are quick to pick up cues regarding what to be expected next from the social partner. In general they are quick to expect that following an emotional bid on their part, be it via a smile, a gaze, or a frown, the other will respond in return. Interestingly, adult caretakers in their response are typically inclined to reproduce, even exaggerate the bid of the child. If the child smiles or frowns, we are inclined to smile or frown back at her with amplification and additional sound effects. There is some kind of irrepressible affective mirroring on the part of the adult (Gergely & Watson, 1999).

The complex mirror game underlying social cognition does manifest itself from approximately 2 months of age and from then on, infants develop expectations and representations as to what should happen next in this context. The still-face experimental paradigm that has been extensively used by infancy researchers for over 30 years provides good support for this assertion (see the original study by Tronick, Als, Adamson, Wise, & Brazelton, 1978). Infants are disturbed when the interactive partner suddenly freezes while staring at them (Rochat & Striano, 1999a). They manifest unmistakable negative affects, frowning, suppressing bouts of smiling, looking away and sometimes even starting to cry. In general, they become avoidant of the other person, presumably expecting them to behave in a different, more attuned way toward them.

This reliable phenomenon is not just due to the sudden stillness of the adult, as the infant's degree of negative responses varies depending on the kind of facial expression (i.e., happy, neutral, or fearful) adopted by the adult while suddenly still (Rochat, Striano, & Blatt, 2002). Also, it appears that beyond 7 months old, infants become increasingly active, rather than avoidant and unhappy, showing initiative in trying to re-engage the still-faced adult. Typically, they touch her, tap her, or clap hands to bring the still-faced adult back into the play, with an intense gaze toward her (Striano & Rochat, 1999).

Numerous studies based on this still-face paradigm and studies using the double video paradigm, in which the infants interact with their mothers seen on a TV (either live or in replay) (Murray & Trevarthen, 1985; Nadel, Carchon, Kervella, Marcelli, & Réserbat-Plantey, 1999; Rochat, Neisser, & Marian, 1998), all show that early on, infants develop social expectations as to what should happen next or what should happen while interacting with others. The difficult question is what do these expectations actually mean psychologically for the child. What does it mean for 2-month-olds to understand that if they smile toward an individual, this individual should “normally” smile back at them? What does it mean that he picks up the fact that amplified and synchronized mirroring from the adult is an invitation for more bouts of interaction?

One could interpret these expectations as basic, possibly sub-personal and automatic. Accordingly, face-to-face interactions are information-rich events for which infants are innately wired to pick up information, attuned and prepared from birth to attend to and eventually recognize familiar voices and faces (e.g., DeCasper & Fifer, 1980; Morton & Johnson, 1991). From birth, infants would be attuned to perceptual regularities and perceptual consequences of their own actions, wired to prefer faces, human voices, and contingent events as opposed to any other objects, any other noises, or any other random events. Accordingly, this would be enough for young infants to build social expectations and manifest apparent eagerness to be socially connected as shown by studies using the still-face experimental paradigm or the double video system. But there is more than what meets the eyes of an

Table 2

Levels of intersubjectivity unfolding in early development (reproduced from Rochat & Passos-Ferreira, 2008).

Type	Context	Behavioral index	Process	Age	
I	Mirroring	Face-to-face engagement	Imitation	Automatic simulation	Birth
II	Primary inter-subjectivity	Reciprocal dyadic exchanges	Proto-conversation, social expectations	Emotional co-regulation	2 m.
III	Secondary inter-subjectivity	Triadic exchanges about things	Joint attention; social referencing	Intentional communication and intentional co-experience	9 m.
IV	Tertiary inter-subjectivity	Triadic exchanges about the value of things	Self-recognition and embarrassment, use of possessives, claim of ownership, pro-social behaviors	Projection and identification of self onto others	20 m.
V	Ethical stance	Decision regarding the value of things, what is right vs. wrong	Claim of ownership, sharing, distributive justice, theories of mind	Value negotiation with others, narration, meta-representation of reputation	From 4 y.

“engineering look” at the phenomenon (Rochat, 2009). It is more than just mechanical and requires another richer look to capture its full psychological meaning.

This proposal is based on evidence of major developmental changes in the ways that children appear to connect with others and reciprocate. Infants rapidly go beyond mirroring and imitation to reciprocate with others in increasingly complex ways, adding the explicit social negotiation of *values* to the process. This development corresponds to the unfolding of primary and secondary (i.e., triadic exchanges of the infant with people in reference to objects in the environment by 7–9 months), and also a *tertiary* level of inter-subjectivity from at least 3 years of age. Table 2 summarizes the roadmap of various levels of intersubjectivity unfolding in typical development between birth and approximately 4 years of age.

Each transition represents a major extension in the range of interpersonal awareness that maps onto what was discussed in relation to pictorial understanding, mirror self-experience and the development of self-awareness. The extension from primary to secondary inter-subjectivity is well accounted for in the literature (Bruner, 1983; Tomasello, 1995; Trevarthen, 1980; Trevarthen & Hubley, 1978; see Table 2). At the tertiary level of inter-subjectivity, objects and situations in the environment are not just jointly attended to (secondary inter-subjectivity), they become also *jointly evaluated* via negotiation, until eventually some kind of a mutual agreement is reached, also a crucial progress in the development of sociality and morality (Rochat, 2011).

Products of emerging reciprocity

When infants begin to open up to their social environment by reciprocating via smiling and cooing toward others interacting with them, and because of the obligatory propensity of others to mimic or *reproduce* with marked exaggeration what infants express (i.e., “affective mirroring” according to Gergely & Watson, 1999), infants have the unique opportunity to *objectify* themselves in relation to others. Face-to-face exchanges, turn taking, and the proto-conversations dominated by affective mirroring allow for self-objectification and the objectification of first vs. third person perspective. All this forms a privileged context in which infants can learn to distinguish their own and others’ perspectives on the self, the basic prerequisite of intentional and referential communication. This context is the template for the intentionality expressed in relation to physical objects, intentionality that starts to be manifested by infants by the time they begin to smile in the context of reciprocal social exchanges (Rochat & Striano, 1999a).

Infants might learn also to objectify themselves in the exploration of their own dynamic traces in objects they acted upon: a mobile they kicked or a ball they pushed (Piaget, 1936/1952; Watson, 1995). The effect of self-generated actions on the object does indeed reflect the dynamic and the amount of energy produced by the infant who can pause and contemplate traces of himself in such effects. However, in this context, the differentiation between first and third person (object) perspective is possible only

on a trial and error basis. Interactions with physical objects do not carry the bi-directionality of attention, the mutuality and tutoring guidance that a reciprocating adult typically offers to the child. Reciprocal exchanges are intrinsically referential in relation to each of the protagonists (infant and adult). They specify on-line, in a unique way, the alternating perspectives of each protagonist because of the give and take, reciprocal, and co-constructed format of conversational exchanges.

The learning of a differentiation between first and third person perspective is facilitated by reciprocal exchanges. Infants can eventually generalize what they learn in interaction with others to their interaction with physical objects, rather than the reverse. It is reasonable to postulate the precedence of one format of exchange (social interaction) over the other (action on physical objects) to explain the emergence of intentionality in development, assuming of course that we do not postulate innate module for such stance.

Social partners (caretakers, etc.) work hard from the outset at revealing themselves intentional in communication, quickly perceived as such by the infants. The child will eventually also perceive others as intentional *outside* of face-to-face communicative contexts, when observing them interacting and acting on physical objects. The generalization of an understanding of others as intentional with both objects and other people aside from the self opens up new, crucial opportunities for observational and imitative learning. These are often identified as basic mechanisms of cultural transmission that are considered, by some, to be unique to our species (Tomasello, 1999; Tomasello, Kruger, & Ratner, 1993).

Unfolding levels of sharing awareness

In a recent book (Rochat, 2014), we applied the same level of awareness analysis to the development of sharing between birth and 5 years, linking such development to the same levels of mind state, pictorial understanding, mirror self-experience and self-awareness. We summarize this analysis in this last section, completing the illustration of proposed model of unfolding layers of awareness in development.⁴

From a psychological, hence subjective and intersubjective perspective, there are different kinds of sharing: (I) *Intersubjective*; (II) *Referential*; (III) *Intentional*; (IV) *Co-conscious*; and finally (V) *Negotiated and ethical*. From a starting state of biological mutualism between infant and caretaker, each of these levels adds a new layer and range of meaning to sharing awareness. This enlargement follows a path that parallels and echoes the development of self-awareness depicted above. Accordingly, this development leads children from an instinctive and innate core of biologically determined mutualism and resonance, through the exchange of gazes and smiles, the sharing of attention toward objects, to the actual offering and request for physical things, and ultimately to the negotiation of material and immaterial values in reciprocal exchanges (see Rochat, 2014 for further discussion).

(0) *Non-conscious biological mutualism (birth and up)*

As mentioned in the introduction, progress in infancy research of the past 40 years debunked many theoretical assumptions that were prescribed by pioneer developmental theories in the realm of philosophy, psychology and psychoanalysis. These assumptions revolved around the ill-informed intuition of a starting state characterized by an initial state of emotional, social, perceptual and cognitive incompetence in newborns.

In the midst of now established early, presumably innate behavioral competencies, infants also show remarkable attunement to particular features in the environment (see Rochat, 2001 for a review). From birth on, infants prefer and discriminate among animate as opposed to inanimate things; face vs. non-face entities; familiar as opposed to unfamiliar people based on even pre-natal experience of maternal voice (e.g., DeCasper & Fifer, 1980), and the taste of maternal amniotic fluid (e.g., Marlier, Schaal, & Soussignan, 1998).

⁴ For further details, see Rochat (2014), chapter 7.

One major psychological consequence of birth is the fact that from the moment the child leaves the maternal womb, she instantly has to engage in searching for the food that was provided ad libitum and with no volitional effort (passively) in utero. The fragile survival of the newborn depends on his ability to search and find food, but also to feed. For this, infants are innately endowed with complex action and orienting systems that enabled them to find and ingest food orally as well as regulate temperature in close contact with others from the very moment the umbilical cord is cut and the child comes into the world outside the womb (Reed, 1984; Rochat & Senders, 1991). These action systems evolved in co-design with other features and resources in the environment such as nipple, milk and caretakers. This evolved co-design includes strong psychological features. It entails the mutual motivation and resonance between infant and mother. As a simple case in point, there is a universal co-dependence of the child's feeding motives and the maternal need to empty gorging breasts, source of pain and potential infections. Healthy newborns are ready to suck and display complex action systems oriented toward feeding. Mothers, on the other hand, display *intuitive parenting* (Papoušek & Papoušek, 1995). They instinctively and viscerally coordinate care responses, gently tending to their newborns, accompanying, scaffolding, and facilitating infants in their behavioral propensities. This instinctive parental scaffolding includes, in addition to providing food and facilitating feeding, affective mirroring, postural re-orientation (e.g., positioning the infant in relation to the breast or bottle), systematic tactile (caresses and massages), auditory (clicking sounds, lullabies, and infant directed speech), vestibular (rocking and shaking), visual (face presentation), taste and olfactory stimulation (food and nipple rubbing in the perioral region of the child). Most mothers discover these skills and gestures spontaneously, pushed and pulled by their infants, anticipating and responding to their needs.

Newborns' innate behavioral organization and intuitive parenting are mutually dependent, co-designed features of evolution. At birth, mothers and infants do share mutually adapted instinctive behaviors orchestrating their transactions in feeding and caring. This primeval, biological kind of transaction is reflected at multiple levels, from the physiological (lactation and energy "fueling" via actual food transfer and digestion), the psychological (intuitive parenting, infant early learning and preference), to the cultural (artifacts like bottles, milk pumps, pacifiers, diet, sleeping arrangement).

(1) *Intersubjective sharing (2 months and up)*

Beyond biological mutualism and co-adaptation orchestrating mother–infant exchanges and transactions at birth, some major changes occur by approximately 6 weeks post partum, indexed by first signs of emotional co-regulation (i.e., first socially-oriented smiles). A new kind of mutual sharing emerges, distinct from the primeval complex biological co-regulation expressed at birth. Transactions between self and others become psychological and intersubjective. It is this first active sharing of affects in proto-conversation with others that amounts to the so-called *primary intersubjectivity* (Trevarthen, 1980). It is the original ground for sharing in the literal sense of reciprocal exchanges in terms of affects and emotions, in particular via cooing and smiling. Infancy researchers have documented and characterized this sharing in terms of rhythmical *turn taking* (Gergely & Watson, 1999), and *two way shared mutual gazes* (Stern, 1985; Stern, Hofer, Haft, & Dore, 1985). It goes beyond mere affective mirroring or emotional contagion as such exchanges take place for the first time within open-ended, *co-created* transactions made of successive emotional bids.

Infants at birth open their eyes and orient their gazes toward faces, preferring face to non face objects. Even though they are documented to imitate facial gestures and emotional expression (like tongue protrusion or sad faces) (Field et al., 1982; Meltzoff & Moore, 1977), the gazes of newborns remain often sluggish and hard to capture, as if it is passing through you. Staring straight at a newborn with open eyes often gives the impression that the child is looking through you rather than at you. By 6–8 weeks, however, the gaze becomes unmistakably *shared and mutual*, inaugurating a proto-conversational space of genuinely open-ended social exchanges made of turn taking and a novel sensitivity. In fact, whereas eye-to-eye contacts are often threatening signs and tend to be avoided in other primate species, it is a major attractor in humans and becomes a critical index of engagement in proto-conversational and early inter-subjective exchanges. It is a variable picked up by the child as a measure of the relative degree to which others are socially engaged and attentive, affectively attuned and effectively "with" them. It gives rise to prototypical narrative envelopes co-constructed in interaction with others, made

for example of tension build-ups and sudden releases of tension, like in peek-a-boo games that are universally compelling to infants starting the second month (Rochat, 2001; Stern, 1985). Such exchanges are primarily scaffold by strong affective marking and compulsive affective amplification on the part of the caretaker producing high pitch inflections of voice and exaggerated facial expressions (“motherese”), tapping into the child’s attention capacities and perceptual preferences (Gergely & Watson, 1999; Rochat, 1999, 2001; Stern et al., 1985). The adult’s systematic tendency toward affective scaffolding and amplification, a running emotional commentary that is attuned to the child’s expressed emotions, combined with the novel attentional capacities of the child by the second month (Wolff, 1987), makes such proto-conversation more than mere complementary actions between adult and child. Play and sharing games give children privileged access to their own limits and possibilities as agents in their environment. It is in such affective, face-to-face playful exchanges of gazes and smiles that infants first gauge their social situation: the impact they have on others, the quality of social attention they are able to generate and receive from others. It is from this point on that we can talk of sharing as a process that rests on reciprocation and putative co-creation of affects in interactions with others. Importantly, this is a process in which for the first time self and other are engaged *together* in an open-ended, emotional bid building process of co-creation. This emergence defines a novel horizon for development that leads the child toward symbolic functioning, explicit self-consciousness as opposed to implicit self-awareness, linguistic competence, and ultimately the development of an ethical stance toward others (i.e., strong reciprocity in sharing, see Robbins & Rochat, 2011). It also gives ground for infants to become early on socially selective, manifesting already from approximately 3 months relative preference and affiliation with particular others based on in-group/out-group differentiation. For example, recent research shows that young infants prefer strangers who speak with no foreign accent (Kinzler, Dupoux, & Spelke, 2007); respond to them in a familiar temporal manner (Bigelow & Rochat, 2006); or act in pro-social as opposed to anti-social ways (Hamlin, Wynn, & Bloom, 2007).

(II) Referential sharing (7–9 months and up)

If by 2 months infants begin to co-construct inter-subjectivity, hence to share experience in face-to-face, open-ended proto-conversation with others, things change again by 7–9 months when infants break away from mere face-to-face reciprocal exchanges to engage in referential sharing with others *about* things in the world outside of the dyadic exchange. This transition is behaviorally indexed with the emergence of social referencing and triadic joint attention whereby a triangular reciprocal exchange emerges between child and others in reference to objects or events in the environment (Striano & Rochat, 2000; Tomasello, 1995). By triangulation of attention, objects become jointly captured and shared. Objects start feeding into the exchange. This is the sign of a “secondary” inter-subjectivity (Trevarthen, 1980) adding to the first exchanges of 2–6 month-olds.

This new triangulation emerging by 7–9 months is also, and maybe more importantly, about social affiliation and togetherness. Like the optical parallax that gives depth cues to viewers, first signs of joint attention give children a new measure of their social affiliation, a novel social depth. By starting to point to objects in the presence of others, by presenting or offering grasped objects to social partners, infants prey for others’ mental focus by creating and advertising for a shared attention. Psychologically, it also corresponds to the first *appropriation* of an object as topic of social exchange, in the same way that in the course of a conversation someone might spontaneously appropriate an object (pen, stick of wood, any small object) to help in the telling of a story. The object, used as a conversational prop in early bouts of joint attention, becomes the infants’ new “fishing hook” to capture, gauge and eventually possess others’ attention against which they can gauge further their relative agentive role, control, and impact in relation to others: their situation and place in the social environment.

It is reasonable to state that in joint attention we find the roots of the child’s first socially shared mental projection of control over an object (i.e., possession in the literal sense). In starting to bring other people’s attention onto things in the environment, the infant opens up the possibility of claiming ownership of both the initiation of a conversation about something and the thing itself (Rochat, 2014). Pointing, offering, or presenting objects to others are all new social gestures becoming prominent in the healthy child from 7 to 9 months.

An object that is presented or offered can now be retrieved or taken away by others, given back or ignored by them. It gives rise to all sorts of new, complex and objectified social transactions. It is in these new objectified social transactions that the child consolidates the concept and idea of what eventually will become in a few months developmental time and with the emergence of language the explicit claim of ownership: the assertion of “that’s mine!” and “not yours!”.

From this point on, and at this pre-linguistic stage of development, objectified and socially shared centrifugal and centripetal forces are the new playing field created by children (Rochat & Striano, 1999b; Tomasello, Carpenter, Call, Behne, & Moll, 2005). It is a crucial step in the development of possession in general and the development of sharing in particular. Feeding their basic affiliation need, children learn from then on that with objects, others’ attention and recognition can be earned, thus shared.

(III) *Intentional sharing (12 months and up)*

By 11–12 months, the child adds a novel layer of meaning to referential sharing. This layer corresponds to a novel understanding of the *manners* in which sharing and exchange games are played. From 11 to 12 months, children do not simply emulate the actions of others (e.g., producing an effect on an object) but also start to imitate the specific way the action and its effects are produced (Carpenter, Tomasello, & Striano, 2005; Meltzoff & Moore, 1999). Likewise, by 11 months but not yet by 9 months, infants will tend to spend significantly more time attending to someone who is imitating them, compared to someone who is behaving contingently but not reproducing exactly what they do (Agnetta & Rochat, 2004). They begin to modulate their ways of sharing and reciprocating, becoming more selective of the person they share with, trying to imitate or to coordinate actions in attempts of co-operation.

From 12 months of age, infants also begin to show significantly greater modulation and flexibility by engaging spontaneously in role reversal imitation (Ratner & Bruner, 1978). For example, imagine a situation where an adult engages the infant to play a collaborative game where the adult holds a basket and the infant throws toys into it. If the adult suddenly stops holding the basket and now wants to throw, 12 month-olds seeing this are able to switch role to continue the joint game: the infant will spontaneously stop throwing, grab and hold the basket to let the adult throw the toys (Carpenter et al., 2005).

From 11 to 12 months and beyond, adding to referential sharing, infants begin to consider and factor in their decisions to share what others intend to do or want to do. This takes them deeper, beneath the surface monitoring of joint attention. They become sensitive to the forms and ways of sharing that they begin to perceive and understand as signs of intentions. By 14 months, the infant becomes explicit in discriminating the shared experience of an object as special. They identify objects experienced by “we” as opposed to “I” alone (Moll, Richter, Carpenter, & Tomasello, 2008; Tomasello et al., 2005).

Multiple studies of imitative games also show that by 14 months infants differentiate intentional from unintentional or accidental actions. If the game is to imitate an action performed on an object, such as the pulling of a sleeve covering a dowel (Meltzoff, 1995), turning on a lamp by pressing on it (Gergely, Bekkering, & Kiraly, 2002), or deciding what object an adult wants (Tomasello & Haberl, 2003), the child tends to detect intentions and reproduce selectively only those actions that they perceive as intentional, overlooking actions that are either failed attempts, accidental, or irrational. Children now start to read and factor what others have on their minds in terms of plans and wants, adding to all the other forms of sharing expressed prior to the second year a 4th layer of awareness in sharing: the intentional layer. The intentional layer prepares and opens up the child toward a new range of social cognitive development that parallels the emergence of self-concept and the explicit sense of inalienable ownership that the child starts to manifest by the end of the second year, with assertion like “that’s mine!” and *de facto* saying, “Not yours!”.

(IV) *Co-conscious sharing (21 months and up)*

The expletive “Mine!” that children start to utter by the end of the second year (approximately 21 months) (Bates, 1990; Tomasello, 1998) is symptomatic of a major transition happening at this stage. The explicit assertion of ownership parallels the emergence of self-recognition and self-objectification in the mirror (Rochat & Zahavi, 2011), but also novel expressions of self-conscious emotions like blushing,

shame, jealousy, envy, embarrassment, or pride that shapes much of toddlers' social and affective lives. It is from this point on that they start to care about their own reputation, developing a renewed ability to conceal their mental states, manipulate what they expose of themselves to others, and more to our point: become increasingly agile strategic manipulators in sharing. Based on their ability to detect intentions in others (intentional sharing), they now begin to add a layer from which a new negotiation channel in sharing develops. Sharing becomes *co-conscious* in the sense that it entails a new monitoring and assessment by the child of others' mental states. The child is newly capable of probing and seeing what works and what doesn't in sharing with others, starting a new era of bartering and endless negotiation of permissions that parents of 2 and 3 year-olds know too well. They properly start to be capable of having others in mind in the sharing process.

With co-conscious sharing, children express new levels of deception and duplicity toward others. It is at this time that children typically begin to cultivate the pleasures of disguising and pretend games, adjusting their look and public appearance in the mirror working on their self-presentation. They also begin to display growing pleasures in hide and seek games. They enjoy the concealment of themselves and the control of others in search of them. They also begin to understand pretense in others, able to generate as well as discriminate "as if" from "real" actions (Rakoczy, Tomasello, & Striano, 2004). That is, they begin and delight in *sharing pretense with others* (Harris & Kavanaugh, 1993; Piaget, 1962), which really means that the sharing with others reaches a new level of meaning. As a distinctive mark of childhood, they spontaneously invent pretend games, with or without the support of toys specifically designed by adults to replicate real things in miniature and to promote pretense in children. They might grab a banana pretending that it is a phone or get into the game of pretending sticking a foot in a box as if it was a shoe. They also can communicate with others about such "as if" actions. All is now pretext for pretending and suspending reality, sharing works of the imagination with others. A new level of participation is expressed in which the sharing is real but what is shared, its content, can be imagined with others.

(V) *Ethical sharing (36 months and up)*

There comes a point when, in some circumstances, children begin to act "principally", according to some ethical principles they internalized and seemingly hold for themselves. They might start to question authority and refuse to abide when they feel and think it is ethically wrong or less right. Children slowly become autonomous moral agents as opposed to strict conformists who might obey and abide to the greatest, more powerful majority in order to feed a basic social affiliation need.

From this point on, children start to show signs that they care about their moral identity. They begin to show clear signs that they try to maintain self-unity and coherence, avoiding moral dissonance for self in relation to others. They project moral rectitude in their self-presentation toward others. In the period between 3 and 5 years of age, children start opening up an area of life span development: the moral and ethical dimension of sharing possession with others. They become sensitive to inequities in the distribution of sparse resources, trying to reach some "just" decisions in relation to others, but also to themselves. They open the perennial issue of what is fair: the conundrum of *fairness*.

Research on distributive justice by young children reveals this universal transition toward ethical sharing. For example, we asked children from all over the world to split between themselves and an adult experimenter small collection of treats (e.g., candies, stickers, or valuable coins) that were either even (e.g., $N = 6$) or odd ($N = 7$). In addition, in some conditions, the odd number included one item that was "special", all children agreeing beforehand that this item was much better than all the other in the collection (e.g., bigger and/or brighter).

We tested hundreds of children from various socio-economic and cultural backgrounds of 3 and 5 years of age (Rochat et al., 2009). What we found is a robust, universal developmental trend toward an increase of spontaneous equity in sharing. All over the world, 3 year-olds tend to be significantly more inclined to self-maximize, giving much more to the self than to the adult experimenter. In the odd collection with a special item, not only do they give more to themselves, the vast majority of children also self-attribute the special item. Interestingly, this early "selfishness" is not innocent, nor is it nonchalant. Rather, it is deeply rooted and strategic. In one condition, when the child is told that

she will split and that the adult will then choose which one of the two created piles she wants (biblical or “perfect” sharing condition), 3 year-olds become suddenly much more equitable in their splitting.

By 5 years, children overall become significantly more equitable, often with remarkable instances in which the child actually *refuses* to go on splitting if the collection of treats cannot be distributed equally. Some children try to break in two the seventh item of the collection or insist on getting another one to reach equity. Five year-olds do so even if they are not recipients of the distribution, when asked to split between two dolls (third party sharing). Corroborating such findings we established that by 5 years children demonstrate a novel inclination to engage in costly punishment toward unfair others (Robbins & Rochat, 2011). They are willing to sacrifice their own resources to deprive defecting, unfair sharing partners. They show signs of being newly capable of actively implementing an ethical stance based on a growing inequity aversion and a tendency toward *egalitarianism* (Fehr, Bernhard, & Rockenbach, 2008).

By 5 years, in relation to sharing, children begin to find and define their ethical standpoint. The way we transfer ownership and share is indeed the great revelator of who we are as persons. In the development of their ways of sharing, children increasingly become capable of being more sensitive to what people think of them. Sharing is the primary context in which children establish their own reputation, their own moral perspective and moral identity in the evaluative eyes of others. Beyond 6 years of age, and in particular as children become immerse in the school environment, they increasingly refer and abide to trade rules and the pragmatics of what become ritualized exchanges sanctioned by *institutions* (group norms, collective ways of being, school or playground culture). They also become progressively more sensitive and aware of the cultural context: the institutional or consensual collective order that transcends and ultimately governs personal wants and inclinations (Rochat, 2014).

In summary, developmental observations force us to recognize the various layers of meanings that cover the concept of sharing. If sharing entails reciprocation, children in their development reveal that reciprocity in social exchanges can have multiple meanings corresponding to different layers of social awareness.

Summary and conclusion

The intuition guiding the present model is that consciousness construe as content of fleeting attention is essentially dynamic, constantly fluctuating and in essence multi-layered. From one moment to the next, we navigate through various kinds of wakeful awareness states, when not sleeping one third of our life or non-conscious as is the case of the brain mechanisms supporting our own conscious existence. We tried to distinguish at least 4 basic wakeful mind states through which we constantly oscillate and that we tentatively described as emerging in a cumulative way and chronological order between birth and 5 years. Aside from non-conscious and unconscious mind states, we distinguished wakeful states of respectively (a) awareness, (b) co-awareness, (c) consciousness, and finally (d) co-consciousness. Following our model, each would correspond to various levels of subjectivity and inter-subjectivity emerging chronologically in early ontogeny. Based on empirical facts regarding the development of pictorial awareness, mirror self-experience, self-consciousness, interpersonal awareness and sharing in development, we tried to show that these levels of wakeful experience emerge chronologically in the course of the first 5 years.

The main idea put forth here is that these levels would constitute the basic range of awareness through which we typically navigate in our life span. Ultimately, by 5 years, children add co-consciousness to the range of their wakeful experiences, able to meta-cognize with others in mind. It is from this point on that they begin to express what arguably is the cornerstone of what it means to be human: the care for reputation, the struggle for recognition, and a principled moral sense (Rochat, 2009, 2011). However, and this is at the crux of the model, the achieved level of co-conscious awareness does not eliminate the possibility of experiencing all ontogenetically anterior mind states. One can oscillate from being aware, co-aware, conscious to being co-conscious depending on context and circumstances.

From 5 years and beyond, the main avenue of development will be to orchestrate and often reconcile the various layers of awareness the child is now capable of experiencing alternatively. There

are many hurdles to this effort that is constant through the life span, as we try to combine rational and irrational, often blatantly contradictory thoughts and feelings. Face maintenance in relation to others and the struggle for internal validity in relation to the self is a perennial and universal psychological conundrum providing a novel horizon for much development beyond the multiple layers of awareness children have constituted by 5 years. From then on, a major line of life span development is the reconciliation of these various levels of awareness in the permanent struggle to maintain self-unity and moral identity.

As Charles Taylor notes in his book on the *Sources of the Self*: “What we are constantly losing from sight is that being a self is inseparable from existing in a space of moral issues, to do with identity and how one ought to be. It is being able to find one’s standpoint in this space, being able to occupy a perspective in it” (Taylor, 1989, p. 112). Albert Camus in *The First Man* (Camus, 1994), his last unfinished autobiographical novel published over 50 years after his premature death, tells a story where the young boy lies to his poor peasant grandmother about dropping accidentally small change in the stinky toilet hole of the rustic home they inhabit. With little hesitation, the grandmother pulled up one sleeve and went digging in the shithole in search of the few coins. Camus writes how he as a child suddenly learned the value and meaning of hard won money but adds: “... to this day Jacques (Camus pseudonym) wonders why he could not give these 2 francs back to his grandmother, nor how -in spite of it all- he managed to have pleasure the next day watching the soccer game using the stolen money to have a good seat” (pp. 87–88; author’s loose translation from French).

Camus’ anecdote and wonder illustrate how the struggle to reconcile multiple layers of awareness emerging in a cumulative fashion early in life remains a major line of development through the life span.

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