

OUTLINING THE WINDOWS OF ACHIEVEMENT OF INTERSUBJECTIVE MILESTONES IN TYPICALLY DEVELOPING TODDLERS

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Babies are born with an innate drive or intrinsic motive formation with which to communicate and share meanings with others and that some authors have called *intersubjectivity* (S. Bråten & C. Trevarthen, 2007; C. Trevarthen, 1974, 2001). Around the ninth month of life, this motivation changes and passes from a person-to-person dyadic (primary intersubjectivity) to a person–person–object relationship (secondary intersubjectivity). S. Bråten and C. Trevarthen (2007) also proposed a third form or layer of intersubjectivity known as *tertiary intersubjectivity*. One hundred fifteen free-play sessions of 27 mother–child dyads (13 girls and 14 boys ages 9–37 months) were filmed and categorized using the Level of Intersubjective Attunement Scale (LISA-T; M. Pérez Burriel & M. Sadurní Brugué, 2014; M. Sadurní Brugué & M. Pérez Burriel, 2012). Results from these nine hierarchical levels are presented, following a developmental sequence or population trajectory around an interindividual variability. In this article, we propose viewing these age-related levels as windows of achievement of intersubjective milestones. The statistical analysis suggested a redesign of the LISA-T levels of intersubjectivity; thus, results from this redesign and the debate on the implications of these transitions in infant mental health development are presented.

Intersubjectivity is an innate, primary system of motivation, essential for species survival, and has a status like sex or attachment (Stern, 2004, p. 97). The intersubjective system of motivation guides knowledge and learning through attraction to attuning in to and engaging with others (e.g., Bråten, 1998, 2007, 2008; Stern, 2004, 2010; Trevarthen, 1974, 1982b, 1995, 2001; Trevarthen & Aitken, 2001). As Seligman and Harrison (2012) explained, findings from developmental neuroscience have described how brain architecture and physiology are organized to orient the infant to the interpersonal world from the very beginning of life (e.g., Coan, 2008; Perry, 2009; Porges, 2009). This includes current

research on mirror neurons, which registers observed motor activity, leading the observer to feel as if he or she were making the motion while knowing that it is being made by another (“embodied simulation”). This microprocess of intersubjectivity provides an inner sense of another person's experience as something similar to one's own, but occurring to someone else (Ferrari & Gallese, 2007; Rizzolatti & Sinigaglia, 2006). In addition, this biological device allows the infant to gradually enter into a matrix of the shared meanings of the culture in which he or she is immersed (Cowley, 2007; Cowley, Moodley, & Fiori-Cowley, 2004; Perinat & Sadurní, 1999; Perinat, 2007; Sadurní, 1993).

Following systems model research and theoretical frameworks, development can be envisioned as a series of patterns evolving and dissolving over time and, at any point in time, possessing particular degrees of stability (Thelen & Smith, 1994). Development is characterized by emerging complexity and self-organization. New, more complex behavior emerges from what was present previously, and new structures show emergent properties not specified in the constituent parts (Schoore, 1994; Sroufe, Egeland, Carlson, & Collins, 2005; Thelen & Smith, 2007).

Some studies have proven that rather than the development of each child following a haphazard or random pattern, it is to the contrary, and there is some “normative” in the development that is common to all children. This “typical route” is demonstrated, for example, in the gross motor development milestones [World Health Organization (WHO) Multicentre Growth Reference Study Group, 2006b]. In this sense, there is increasing evidence for age-related brain development or temporary and predictable periods of change in the child that go beyond the embryonic prenatal period (Plooij, 1998; van de Rijt-Plooij & Plooij, 1993; Sadurní & Rostan, 2002; Trevarthen & Aitken, 2003). Trevarthen and Aitken (2003) called these *Periods of Rapid Change*. For example, Brazelton (1992; Brazelton & Sparrow, 2006) developed his notion of “touchpoints” as predictable times that occur just before a surge or rapid growth in any line of development when, for a short time, the baby's behavior falls apart. van de Rijt-Plooij and Plooij (1992, 1993) showed that intrinsic changes must be occurring at times when infants become grumpy, difficult in temperament, demanding of parental attention, and vulnerable. These authors used the term *regression periods* to refer to the return to high-frequency mother–infant contact during these periods observed at 5, 8, 12, 17, 26, 36, 44, 53, 61 to 62, and 72 to 73 weeks. A European intercultural study of infantile regression periods (ISIRP Research Group) presented good evidence supporting these age-linked regression periods (Lindahl, Heimann, & Ullstadius, 2003; Sadurní & Rostan, 2002, 2003; Woolmore & Richer, 2003). Using microgenetic methodology, eight transition periods linked to regression periods in the first year of life have been found (Sadurní, Pérez Burriel, & Plooij, 2010).

Patterns of intersubjectivity development capacity also evolve during the first 3 years of life, suggesting regular routes of infant development. Bråten and Trevarthen (2007) proposed three layers of intersubjective attunement in human development. They argued that infants from the first months of life share and tune into the basic motivational states of the other in what they called *primary intersubjectivity* (PI). The child fixes his or her attention on the mother, especially her facial expressions, and participates in proto-conversations (Bateson, 1979), sharing a person–person game such as peek-a-boo. This PI leads naturally to a readiness to learn the rudiments of actions from the other and to understand the intentions of the other's mind.

From about 9 months, there is a profound transformation in infant motives, and *secondary intersubjectivity* (SI) begins. It appears as a deliberate acceptance by the infant, for the

first time, of a systematic combination of purpose and attention orientation of two kinds: to act on things and to communicate with the mother. Trevarthen and Hubley (1978) highlighted the relevance of the nonlinguistic forms of cooperative behavior “in which images and intentions are oriented to and specified for others by gesture and by the direction, rhythm and mood of purposeful movement” (p. 184). Actions by the infant to either attract others’ interest and emotional evaluation are coupled with purposeful object use in “declarative” as well as “instrumental” expressions (Bakeman & Adamson, 1984; Camaioni, 1997; Hobson, 2002; Tomasello, 1999; Trevarthen, 2001). Bruner's (1983) joint action routines emerge at that point. Gradually, infants become more able in understanding the intentions that guide the actions of other people and are better predisposed to adjust their actions and cooperate with the adult.

Bråten and Trevarthen (2007) also talked about a third grade in intersubjective capabilities and motivation achieved between 2 and 6 years, which they termed *tertiary intersubjectivity* (TI). This step or layer is characterized by a meta-understanding of others’ understanding that entails second-order mental understanding of thoughts and emotions in self and others related to the children's simulation or theory of mind.

The observational data on mother–infant interaction from our laboratory suggest that there are probably phases or steps that occur between these three main layers of intersubjectivity. Results for these empirical data have shown that by using a linear mixed-effects model, population trajectory and random individual differences of the levels of intersubjective attunement can be sketched (Pérez Burriel & Sadurní Brugué, 2014). Specifically, we found nine hierarchical, age-related developmental changes or developmental transitions between the beginning of SI and the emergence of TI (Sadurní Brugué & Pérez Burriel, 2007). One attempt to unfold and describe the steps from the final phases of PI to the beginning of TI has been presented (Pérez Burriel & Sadurní Brugué, 2014).

The present study examines the distribution of every level of intersubjective attunement by the age at which they appear (emergence) and disappear (transformation in a more complex configuration), and sketches the windows of achievement of these developmental transitions. The research into motor or cognitive skills has shown how, despite important individual variability, typical (and alternative) routes of “normal development” can be traced (Adolph, Robinson, Young, & Gill-Alvarez, 2008; Thelen & Smith, 2007). In this sense, we thought it was worth considering establishing the windows of achievement for intersubjective milestones as a standard, in the same way as the six large motor development milestones studied by the WHO Multicentre Growth Reference Study Group (2006b) were. A standard describes the growth of a “healthy” population and suggests an aspirational model. Furthermore, growth standards could indicate deviations from this “population pattern” and could be used as a screening tool for symptomatology associated with abnormal growth. These developmental patterns could be useful in mental health practice and research.

METHOD

Participants

Participants included 27 mothers and their children (14 boys, 13 girls), recruited from among relatives, friends, and neighbors by researchers from the Attachment and Human Development Laboratory of the University of Girona and by graduate and postgraduate

students from the faculty. participation in the study was voluntary. Exclusion criteria included maternal drug use or mental illness. Infant development disability and/or history of any mental illness in the mother was reported by mothers using a Family and Social Context Interview (Sadurní & Pérez Burriel, 2007).

Mothers' ages ranged from 27 to 43 years at study entry ($M = 33.23$, $SD = 3.88$), and fathers' ages ranged from 26 to 54 years ($M = 35.09$, $SD = 6.32$). In terms of education, parents' mean educational level was 13 years (range = 8–25). The families were classified as middle class, and none of them reported any diseases or disadvantaged social situations.

All infants were born at term and belonged to nonseparated, two-parent homes. Age of the children ranged from 9 to 29 months at the first session ($M = 16.63$, $SD = 7$) and between 9 and 37 months across all sessions ($M = 20$, $SD = 7$).

Material

Sadurní's (1993) Symbolic Toy Box was used to enhance mother–object–child triangulate interaction. This box contains 14 items among which there are two toy figures (e.g., Playmobil), a spoon, and different pieces that can be assembled in different ways, all of which are especially designed to allow flexible use (e.g., imaginative and decontextualized). A picture of the Symbolic Toy Box is available in Perinat and Sadurní (1999).

Procedure

At the time of initial recruitment into the study, participants were interviewed in their own homes, during which they were given information about the study and asked to fill in a consent form to participate.

Data collection of the mother–child free-play included five home visits at 2-month intervals ($M = 1.98$, $SD = 0.68$). This schedule was flexible and could be modified if the child was ill or because of unforeseen personal circumstances. We took care to avoid interfering with the children's daily routines (e.g., napping, snacking, bath time, etc.).

Each session was recorded for about 10 min ($M = 9: 43$, $SD = 2.1$). Agreement was made with the mother on choosing a suitable filming area, and the videos were recorded using a single camera on a tripod. The mother was then given the following instruction: "In this area play with your child with these toys as you would normally." If the family had more children or other relatives present, they were asked to leave the room during the filming.

The infant's age in days was calculated by subtracting the date of the session from the date of birth. To calculate their age in weeks, this figure was divided by 7, and the age in months was calculated by dividing it by 30.4375, following the conventions used by the WHO Growth Reference Study Group of the World Health Organization (2006a).

Measures

Infant and Mother Intersubjective Attunement Coding System

To assess the degree of intersubjective attunement, the Level of Mother–Toddler Intersubjective Attunement was used (LISA; Sadurní & Pérez Burriel, 2012). This is a system which evaluates the meaning that mother and infant are able to share regarding use of the objects (Symbolic Toy Box) in the course of the free-play session. This coding system differentiates between the (a) Level of Intersubjective Attunement Scale for Toddlers (LISA-T) and the (b) Level of Intersubjective Attunement Scale for Mothers (LISA-M). The results of the LISA-M categories will be presented elsewhere.

The videotape was coded after a full viewing to make a brief assessment. Sessions with no audible or no visible sections were removed from the study.

Maternal and infant behaviors were analyzed through episodes. Episodes are displays by the child or the mother that are expressed as incidents, events, or series of events usually organized around an object (Perinat & Sadurní, 1999). These episodes were coded with a 9-point rating scale and a default (null) (see LISA-T: Appendix). The LISA-T is conceived hierarchically; that is, higher levels of intersubjective attunement capabilities are built upon the lower levels, like a set of Russian nesting dolls.

The codes were mutually exclusive. Infant and maternal behavior were coded separately and at a different time by the same researcher.

To rate a session, episodes qualified with a higher rank had to be considered, but note that an isolated episode did not mean that the infant or toddler had reached that level because at least two or more episodes within the same session would have been required to ensure the stability of the new self-organized pattern of intersubjective attunement.

Ten percent of all sessions ($n = 12$ sessions) were randomly selected and were categorized yet again by five independent and trained raters who are clinical psychologists, child development specialists, and members of the Attachment and Human Development Laboratory.

We used the Online Kappa Calculator (Randolph, 2008) to calculate the Fleiss κ statistic (Fleiss, 1971). The free-marginal κ was 0.89 for the level of the session, which can be considered as good agreement between the raters.

Assessment of Levels of Intersubjective Attunement

The LISA-T attempts to be an observational tool of the growing toddler's capacities for understanding others' intentions or the meanings that trigger lead their actions and emotions. This growing capacity gives rise to the different levels of intersubjective interaction and communication. To evaluate different levels of the Intersubjective Attunement Scale, we use different categories grouped into levels (see Table 1). For the interested reader, a description of the LISA-T levels and categories can be found in Sadurní Brugué and Pérez Burriel (2007) and Pérez Burriel and Sadurní Brugué (2014).

Table 1. Nine Hierarchical Age-Related Developmental Changes or Developmental Transitions Between the Beginning of Secondary Intersubjective Attunement and the Emergence of the Tertiary Intersubjective Attunement (Sadurní & Pérez Burriel, 2012)

Developmental Transitions of Intersubjectivity

A. Primary Intersubjective Attunement
B. Transition to Secondary Intersubjective Attunement
C. Secondary Intersubjective Attunement–Manipulative
D. Secondary Intersubjective Attunement–Manipulative Functional
E. Secondary Intersubjective Attunement–Simple Pretend Play
F. Secondary Intersubjective Attunement–Jointed Pretend Play
G. Secondary Intersubjective Attunement–Recontextualized Pretend Play
H. Transition to Tertiary Intersubjective Attunement
I. Tertiary Intersubjective Attunement

We were able to synthesize these transitions as follows. The *transition to secondary intersubjective attunement* is the first of these steps. At this level, we were able to observe that the infants pay more active attention to their mothers, they glance at her more, they show a more active interest in her actions, and they even, by mirroring, repeat or reproduce some simple actions (Bråten, 2008).

At the *secondary intersubjective attunement–manipulative*, we noticeably reach a triangular subject–subject–object format (Trevarthen & Hubley, 1978). This level has two different modalities that probably belong to different developmental microstages. In the first modality, infants are attracted by the objects that are offered by their mothers, explore them manipulatively (inspecting, shaking, poking, banging, throwing, etc.), and show the joy of sharing through their facial expressions of emotion (e.g., by their looks of joy, surprise, or complicity). The second modality supposes an effort to understand and collaborate in the relational and combinatorial use of two or more objects (Fenson, Kagan, Kearsley, & Zelazo, 1976).

At this stage, the infant stares at the adult, searching for confirmations of his or her own actions in an aware and attentive manner. According to social referencing research, infants search for and use information from others to help define uncertain situations and to guide their subsequent behavior (e.g., Feinman, 1982; Stenberg, 2003). These latter facts are crucial for the infant's moral shaping of pride and shame in relation to their own actions and intentions; that is, in connection with their own feeling of being in sync with the standard cultural rules and systems of values (e.g., self-esteem) (Schorre, 1994).

A higher hierarchical level is found in the *secondary intersubjective attunement–manipulative functional*. At this level, children reenact the functional or cultural use that adults give to objects (e.g., a “small core of meaning” or routine such as dialing a toy phone before putting it near the ear (Perinat, 1995; Zelazo & Kearsley, 1980).

Another qualitative leap in toddler development is made when *simple pretend play* appears. The representational capacities that are emerging in the child's mind enables them to understand that interactions and actions with objects are able to be placed in a scene of “as-if” (Camaioni, Aureli, Bellagamba, & Fogel, 2003; Lillard et al., 2013). The onset of pretending is associated with the beginning of lexical development (McCune, 1995); it supposes the beginning of “enunciation.” To enunciate, following Bakhtin rationale, supposes a communicative interaction with an interlocutor, sharing a situated context (place, time, and theme); that is, some sort of dialogue (Holquist, 2002; Todorov,

1981). In this sense, pretend play is understood as an act of authorship—or more precisely, as an act of coauthorship (Perinat & Sadurní, 1999; Sadurní, 1993) and implies the possibility of imagination (Leslie, 1987; Vygotsky, 1978). Pretend play begins in a simple way when the child creates a novel context of interaction and knowingly and intentionally projects some mentally represented alternative onto the present situation in the spirit of play (Lillard, 1993), but we can also find some different levels of complexity in this domain that imply growing intersubjective capacities.

In the *SI attunement–jointed level*, toddlers engaging in pretend play are able to join two words or gesture-speech combinations (Capirci, Iverson, Pizzuto, & Volterra, 2008; Capirci & Volterra, 2008) and also to enchain two pretend-play actions.

Recontextualized pretend play intersubjective attunement is conceptualized as the entrance of symbolism. Children at this level are able to understand the decontextualization of the meaning of objects, as described in Leslie sense (see Leslie, 1987). We use the term *recontextualization* because we emphasize the fact that the child goes beyond the shared “normative” or “functional” context of the object (Sadurní, 1993; Sadurní Brugué & Pérez Burriel, 2007).

The *transitional level to the TI attunement* attempts to capture the transitional complexities between simple recontextualized pretend play and shared attentional capacities that a child undergoes in a narration, when the dyad could enchain different “pretend play schemas” and/or recontextualizations within them.

The last level we considered was coined by Bråten and Trevarthen (2007) as *TI Understanding*, when children are able to create (or co-create with their mothers) “small worlds” in miniature, in a process in which the game itself creates the characters, the setting, and the plot—the features of narrative thinking (Bruner, 1990, 1991). In these shared play scenarios, the emotions of the others, even of the fictional characters, are indissoluble parts of the intersubjective dialogue between mother and child.

Furthermore, the narrative capacities that emerge in the second year of life frame experience by segmenting its temporal flow into memorable events (Gratier & Trevarthen, 2008) and transform this experience beyond “here-and-now” to other possible worlds that can occur “somewhere sometime,” assisted by language (Donaldson, 1992).

Finally, we have to take into account Bowlby's (1969) theory of attachment, which explains the complementarity between the exploration and attachment motivational systems. The attachment system has evolved to bring the infant into close proximity with his or her caregiver, thereby protecting the infant from harm and predation. On the other hand, the exploration system has evolved to propel the infant into the world to learn about the environment, thereby enhancing the likelihood of its safe and effective functioning (Elliot & Reis, 2003). If children are anxious, sick, angry, or upset, they probably activate their system of attachment and display attachment behaviors (e.g., proximity-seeking, cries, tears, etc.) since at these moments, they need their parents (or attachment figures) to act as a secure base and regulate and calm them (Ainsworth & Bell, 1970; Ainsworth, Blehar, Waters, & Wall, 1978; Main, 1983). We coded these episodes as *Attachment needs*. Children also can show a lack of motivation to meet and interact with their mothers as well as demonstrate some disruptive behaviors. We coded this as *Lack of intersubjective attunement*.

RESULTS

Descriptive Statistics

Level A or the PI stage ranged from Weeks 41 to 62 of life ($MA = 48.5$, $SDA = 25.6$). There was an increase in the capacity that the child showed for focusing on the mother's displays that we considered a *transition to SI*, and it seems to be between 42 and 67 weeks ($MB = 58.2$, $SDB = 8.97$). The emergence and development of SI on a manipulative level (*Level C*) appeared in Week 48 and lasted until Week 79 ($MC = 65.1$, $SDC = 8.90$). Games that involved some functional use of the objects (*Level D*) did not emerge until Week 64 and then disappeared at Week 99 ($MD = 78.9$, $SDD = 9.77$). Simple pretend games (*Level E*) appeared in Week 74 and lasted until Week 108 ($ME = 89.9$, $SDE = 12.6$). These pretend games were linked or jointed in our study (*Level F*) from Week 86, and this kind of simple articulation disappeared at Week 129 ($MF = 104$, $SDF = 13.2$). This developmental stage coincided with the following one, when children demonstrated their capabilities to recontextualize (decontextualize) meanings of toys (*Level G*), starting at 83 weeks and lasting until Week 129 ($MG = 109.8$, $SDG = 14.8$). A more complex game consisting of a recontextualization of more than one toy or object (*Level H*) appeared at Week 111 and ended at Week 141 ($MH = 127$, $SDH = 8.34$). The last stage studied (*Level I*), which was the appearance of the narrative games, appeared at Week 138 and lasted until the final week studied ($MI = 147$, $SDI = .367$). Note that both the beginning of the first level (PI) and the end of the last level (TI) were dependent on the age range of the children studied; in other words, the first level most likely emerges a few weeks before and the final level ends some weeks later than is shown in our study. These results are presented in Figure 1.

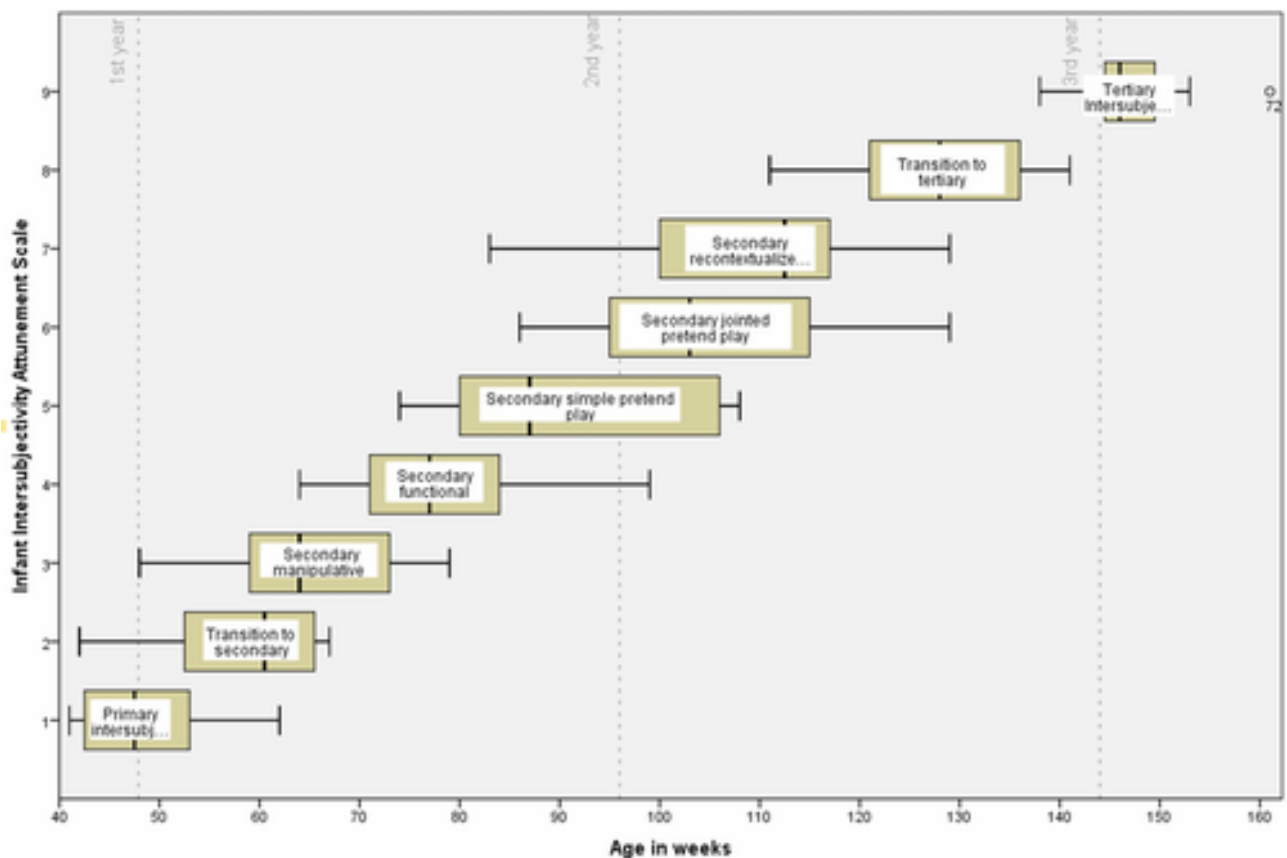


Figure 1

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Box plot of the initial LISA-T intersubjective attunement categories by infant age (in weeks). The median is shown by the vertical line within the box; the left side of the boxes represents the 25th percentile of scores, and the right side of the boxes represents the 75th percentile. The minimum and maximum scores are represented at the ends of the horizontal lines extending above and below the box.

Grouping the LISA-T Categories

An initial analysis of variance (ANOVA) was used to test whether the scores of the LISA-T are grouped around their mean values. ANOVA for repeated measures was discarded because the sample does not fulfill the requirements to be a balanced sampling with equally spaced intervals. This breach of the criterion, related to the randomness of the measures, warrants interpreting the results with caution.

The result of the LISA-T levels distributed by age showed that there is a statistically significant difference between the nine age groups, $F(8, 106) = 121$, $MSE = 101$, $p < .001$. Post hoc comparisons using the Tukey HSD procedure showed that the differences between the different levels of the LISA-T are significant in 32 of the 36 possible combinations of the nine levels, $p < .05$. We found no significant differences between the following levels, which, as one would expect, are correlative: Levels A and B, $p = .390$; Levels B and C, $p = .794$; Levels D and E, $p = .115$, and Levels F and G, $p = .971$.

This first approach to organizing the data suggested that there was a correspondence between the hierarchical order of the different levels (i.e., following the predetermined progression) and ages of the children in our sample (e.g., none of the children had fallen or jumped more than 2 points on the scale). It also pointed to a possible revision or redefinition of the LISA-T levels to better adjust to the data collected.

Redesigning the LISA-T Categories

We redesigned the LISA-T based on our data and joined the following levels: Levels B and C; that is, *transition to SI attunement* was incorporated to *SI attunement–manipulative* in one single category.

We also joined Levels D and E, in one single *SI attunement–manipulative functional and simple pretend play*. Although we think that there are clear distinctions between the competences that are required for the child in one or the other type of play, we admit that in nonproblematic developmental trajectories, these types of play appear in almost the same window of time.

Finally, we joined Levels F and G in one single *SI attunement–jointed and recontextualized pretend play*. As in Levels D and E, the processes implicated in jointing episodes of play or recontextualizing objects are clearly different, but they appear in the same window of time.

We did not join Levels A and B because to study the window of achievement of the PI attunement properly, we would have had to obtain data from 3 months onward (or even beforehand). A summarized version of the LISA-T redesigned (LISA-Tr) is shown in the Appendix.

Results From the LISA-Tr

Our results from the LISA-Tr levels distributed by age showed that there is a statistically significant difference between the six age groups, $F(5, 109) = 177.41$, $MSE = 109.56$, $p < .001$. Post hoc comparisons using the Tukey HSD procedure showed that the differences between the different levels of LISA-Tr are significant in 14 of the 15 possible combinations of the six levels $p < .001$. In the comparison of Levels E and F, the p value is .01.

Results of the LISA-Tr are shown in Table 2 and Figure 2.

Table 2. Percentiles Median Values (50th Percentile) in Bold and Mean in Days and Months for Seven Intersubjective Attunement Milestones

Level A. Primary Intersubjective Attunement (primary intersubjectivity)		
Percentile	Weeks	Months
5th	41	9.5
25th	43	9.9
50th	48	11
75th	53	12.2
95th	62	14.3
<i>M (SD)</i>	48.50 (6.25)	11.22 (1.43)
Level B. Secondary Intersubjective Attunement–Manipulative (sharing manipulations with objects)		
Percentile	Weeks	Months
5th	48	11.2
25th	58	13.3
50th	64	14.7
75th	71	16.5
95th	78	17.9
<i>M (SD)</i>	63.07 (9.31)	14.60 (2.15)
Level C. Secondary Intersubjective Attunement–Manipulative Functional and Simple Pretend Play (sharing manipulative functional and simple pretend)		
Percentile	Weeks	Months
5th	67	15.4
25th	74	17.1
50th	80	18.6
75th	87	20.1
95th	107	24.6
<i>M (SD)</i>	82.45 (11.80)	19.06 (2.72)
Level D. Secondary Intersubjective Attunement–Jointed Pretend Play and Recontextualized Pretend Play (sharing jointed and recontextualized pretend play)		

Percentile	Weeks	Months
5th	85	19.5
25th	96	22.0
50th	108	24.8
75th	117	27.0
95th	129	29.8
<i>M (SD)</i>	107.30 (13.94)	24.77 (3.21)
Level E. Transition to Tertiary Intersubjective Attunement (sharing complex pretend play)		
Percentile	Weeks	Months
5th	111	25.6
25th	121	27.9
50th	128	29.6
75th	136	31.4
95th	141	32.5
<i>M (SD)</i>	127.93 (8.34)	29.51 (1.94)
Level F. Tertiary Intersubjective Attunement (sharing narratives)		
Percentile	Weeks	Months
5th	138	31.7
25th	144	33.1
50th	146	33.7
75th	153	35.4
95th	161	37.1
<i>M (SD)</i>	147.57 (7.37)	34.01 (1.71)

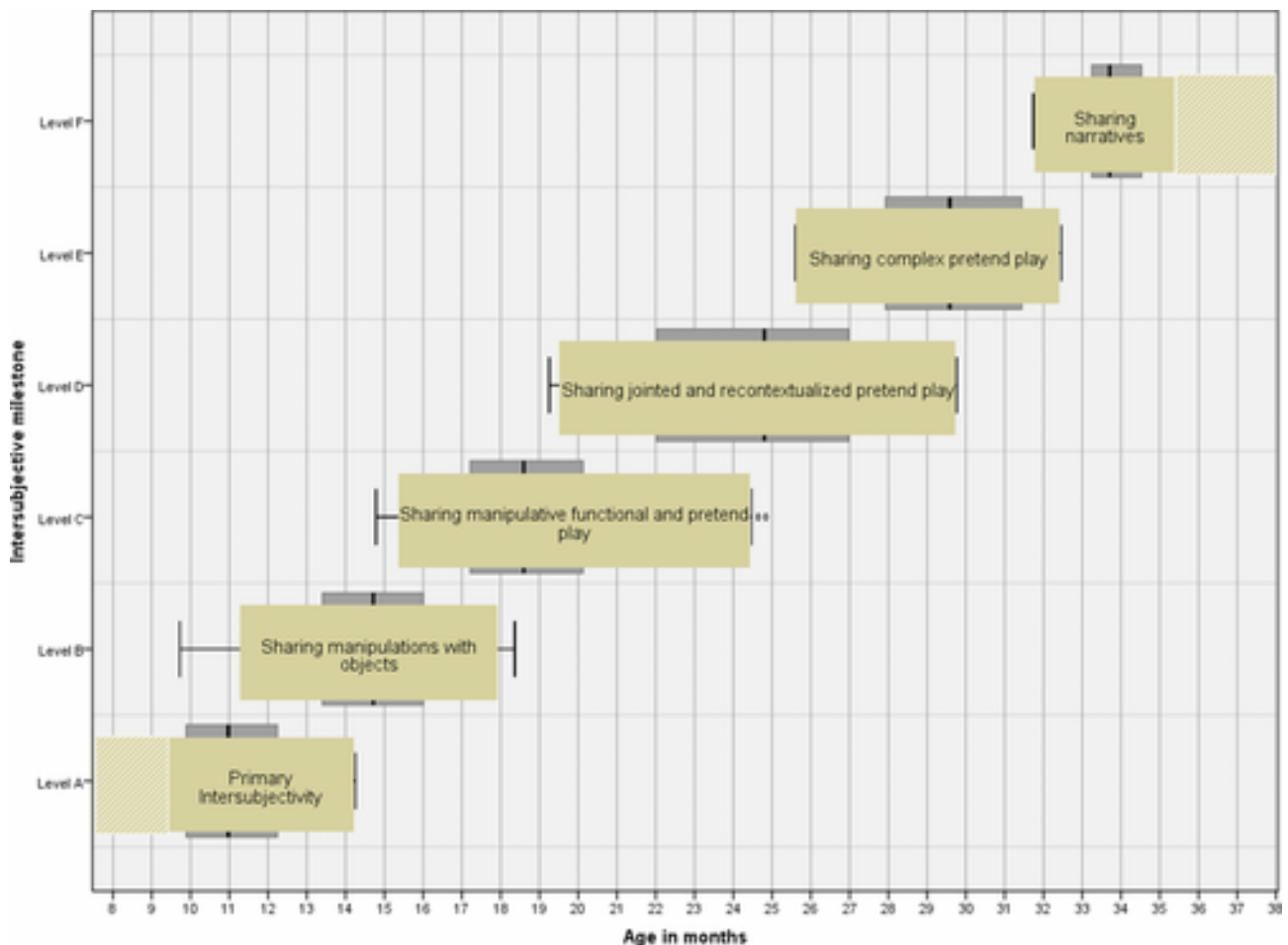


Figure 2
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Windows of achievement of intersubjective development milestones shown as lengthened boxes that represent the 5th and 95th percentiles, put on top of usual box plot boxes that show the 50% interquartile ranges and the median of each level.

DISCUSSION

Implications for Infant Mental Health

The first point we want to discuss is connected to the age-related changes in child development. We agree with Plooij (2003) when he stated that the well-defined age-related brain and body leaps or rapid changes in human embryo and fetal development do not stop at birth, and therefore age-related brain development is expected to occur from infancy to senescence. Furthermore, if we focus on exploratory behavior and play, there has been extensive scientific literature recognizing the different age-related levels in early childhood (e.g., Göncü & Gakin, 2007; Smith, 2010). The well-known studies of Piaget (e.g., 1970) have argued that these differences shed light on the cognitive development of children.

All cognitive-focused development that follows the Piagetian tradition suggests a developmental progression of representational capacities in the child's mind, assuming that they pass through some phases mainly interacting alone with the objects. Other paradigmatic points of view have been focused on understanding this process in an adult-child intermental matrix (e.g., Beebe, Knoblauch, Rustin, & Sorter, 2005; Bråten, 1998, 2007). Toddler exploration of objects and the different levels of meaning and symbolic use

would occur alongside the growing ability of children to become in tune with the adults and capture their internationalities and unfold their “acts of meaning” (Bruner, 1990). This intersubjective matrix could be considered as an underlying ability for the cultural and symbolic use of objects (Cowley et al., 2004; Hobson, 2002; Perinat & Sadurní, 1999; Stern, 2004; Tomasello, 1999). As a consequence, this intersubjective matrix is itself a developmental process that evolves throughout the early years of children's lives.

We hold with Trevarthen that these age-related changes are subsidiary to the infant intrinsic intersubjective motive formation or, in other words, some kind of intersubjective “experience-expectant” brain development (Greenough, Black, & Wallace, 1987; Schore, 1994; Siegel, 2001). In this sense, Trevarthen (1982a) stated that

. . . all major revolutions and steps up in human intelligence observed during the life of a person will be found to be associated with changes with intrinsic communicative psychology. I'm suggesting that each cognitive revolution is, in fact, subordinated to a revolution in the mechanism by which intelligence is established between the young person and older people upon whom a child's growth of knowledge is dependent. . . . (p. 32)

As we saw in the introduction, Trevarthen has been one of the pioneers exploring this new territory with a fresh paradigmatic lens, and during his fruitful career has described how this process evolves from a framework of adult–child rhythmic, musical, and emotionally laden communicative and intersubjective matrix (which does not yet explicitly refer to the objects or their cultural-meaning use) to a “person–person–object awareness” that creates the grounding of signs of culture (Trevarthen, 2001). This developmental leap takes place at the end of the first year of life, when the sensorimotor explorations of the objects join this previous intersubjective matrix to create a new intersubjective layer in which sharing meaningful actions on objects may emerge (SI). As a child makes gains in being able to comprehend others' minds, these meanings are organized into chains of events that take the form of small narratives co-constructed between the adult and the child (TI).

The three layers of intersubjective attunement are the new way of perceiving the infant's world; that is, from the autistic computational machine which deals with representations of reality (schemes, signs, symbols, etc.) to a biological system innately prepared to attune intersubjectively and share experiences with other subjects (feelings, jokes, songs, objects, narrations, etc.). Our previous study (Pérez Burriel & Sadurní Brugué, 2014) provided the first attempt to show some possible developmental steps between these main intersubjective attunement layers. In this article, we explored whether these hierarchical levels can be considered as age-related developmental changes.

The statistical analysis of our data has led us to redesign our levels. With the LISA-Tr, all levels of intersubjective attunement grouped by age are statistically different. Therefore, we propose these six levels as age-related developmental levels. This conclusion should be taken as a provisional one and with the utmost caution because of the scarcity of data.

On the other hand, our study opens up the possibility of sketching a window of achievement or standard age for each level of intersubjective attunement. According to the WHO Multicentre Growth Reference Study (2006b), a standard “defines how children should grow, and thus deviations from the pattern it sets should be taken as evidence of abnormal growth.” Our data sketched the following windows of intersubjective attunement in the mother–infant free-play setting:

- *Level A: Primary intersubjective attunement.* Between ages 11 and 14 months, all infants play with their mothers mainly at this level. The “person–person–object awareness” or “cooperative understanding,” if it does appear, is rare.
- *Level B: Secondary intersubjective attunement–manipulative.* Between 14.7 and 17.9 months, all toddlers have jumped to the “secondary intersubjectivity,” and this huge transformation in their motives drives them to share their manipulations and explorations of the objects.
- *Level C: Secondary intersubjective attunement–manipulative functional and simple pretend play.* Between 18.6 and 24.6 months, toddlers have passed to the third level, in which the cultural use of the objects is shared and simple pretend play appears.
- *Level D: Secondary intersubjective attunement –jointed and recontextualized two pretend play.* Between 24.8 and 29.8 months, toddlers have begun to attune intersubjectively, sharing absent objects and situations or chaining two simple pretend scripts.
- *Level E: Secondary intersubjective attunement multiple pretend play.* Between 29.6 and 32.5 months, these simple pretend scripts and recontextualizations have multiplied and become more complex, but the toddlers cannot be engaged in any narration.
- *Level F: Tertiary intersubjective attunement.* The last level begins at 33.7 months, when toddlers are motivated to attune to and engage in creative and imaginary stories or narrations full of scripts performed by different characters in different settings.

These age-related developmental levels or leaps should be replicated in larger samples as well as in comparative samples to search for possible cultural variations in the expressions of the same intrinsic motive formation or for deviations in abnormal developmental disorders or pathologies (autism spectrum disorder, attention deficit hyperactivity disorder, down syndrome, expressive language disorder, etc.).

In addition, we could compare these normative windows with the results from an “at risk population” or in nonoptimal developmental conditions (e.g., distressed, neglected, or abused children). Moreover, Main's (1983) pioneering study found that the security of attachment at 12 months of age was related to exploratory behavior, social behavior, cognitive development, and language at 21 months. Insecure toddlers who have had their attachment needs disturbed, explained Main, explore less and share less pleasure and happy moments than do secure ones. So, we could hypothesize that insecurity (or disorganization) of attachment could delay the age-related expression of intersubjective attunement capabilities. Further, there is much evidence indicating that more sophisticated partner collaboration in play raises the level of symbolic sophistication expression in a child's play, making it richer and more diverse, and sustaining it (e.g., Bornstein, Maurice Haynes, Legler, O'Reilly, & Painter, 1997). Conversely, maternal depression has been found to reduce the level of toddler symbolization (Jameson, Gelfand, Kulcsar, & Teti, 1997). This line of argument leads us to the role that the “other part of the dyad” plays (in our case, the mother) and how we could intervene to preserve the infant's development of his or her intersubjective self. We have a parallel scale for the mother (LISA-M) that will be presented and discussed in greater depth elsewhere.

A second focus of discussion is devoted to the regression periods, or age-related periods, when there is an intensification of mother–baby contact on the periphery of a developmental change. This phenomenon was first studied in several species of monkeys by Horwich (1974) and then expanded by van de Rijt-Plooij and Plooij to human babies

(Plooij, [2010](#); van de Rijt-Plooij & Plooij, [1993](#), [1992](#), [1993](#)). The main features of these periods in human babies are the need for maternal contact, intense crying, and infant irritability. Ten of these periods were established in the first 20 months of life (Heimann, [2003](#); Plooij, [1998](#); Sadurní & Rostan, [2002](#); Woolmore & Richer, [2003](#)). The regression periods suppose that there are weeks when an infant temporarily loses his or her hypothesized intrinsic stability due to reorganizations (Heimann, [2010](#)). This phenomena, however, incorporates a relational or transactional component because the parent is going back and forth relative of “temporary decrease/disappearance of the growing independence of the baby . . .” (van de Rijt-Plooij & Plooij, [1992](#)) from the caretaker(s) (mostly, their mother).

Sadurní et al. ([2010](#)) used these established 10 regression periods as hallmarks to investigate whether they were related to rapid changes or leaps in child development. Their study corroborates the hypothesis that was already held by Brazelton and colleagues (Brazelton & Greenspan, [2000](#); Brazelton & Sparrow, [2006](#)): “Development proceeds through a series of periods, or touchpoints, disorganization followed by reorganization that incorporate new functional capacities and skills” (Sparrow, [2010](#), p. 18). Taking into account in this study that six age-related intersubjective attunement transitional changes are sketched (from 9–36 months of life), it is reasonable to think that some disorganization of the system might emerge before or after these six major reorganizations of this intrinsic motive formation; that is, to investigate whether, before each change in the form of the intersubjective communication, children lose their homeostatic safety and activate their attachment system and the caretakers’ bonding behaviors that allow them to face new challenges and intersubjective feelings, meanings, and narrations supported by their parents. In this sense, it is worth considering Trevarthen's ([2005](#)) words, when he postulated that

(. . .) the intensely shared pleasure of pride in knowledge and skill that others applaud as well the feeling of shame in failure that threatens loss of relationship and hopeless isolation, are as important to the mental health of every human being as the emotions that seek comfort and care for the body. (p. 77)

This quote brings us to the third and final discussion issue that deals with the relationship between the emotional and biopsychosocial attachment devices and the exploratory and play drives that bring us to the symbolization and shared meaning of the human cultures (or intersubjectivity). Since the innate intersubjectivity theory was postulated by Trevarthen in the 1970s (Trevarthen, [1974](#), [1977](#)), the last 4 decades have stressed the importance of emotions supported in affectionate engagements between adults and infants (e.g., Hobson, [2002](#); Lester & Sparrow, [2010](#); Stern, [1977](#)). Furthermore, there is a growing consensus suggesting that the capacity for sympathy and intersubjective attunement is required for the development of good mental health (Stern, [1998](#), [2004](#), [2008](#); Trevarthen, [2001](#); Tronick et al., [1998](#)).

Development of the intersubjective meaning-making and understanding attunement capacities of the growing child's mind might not be separated from the emotional context in which the mother–infant intersubjective matrix flows. Bowlby ([1953](#), [1969](#), [1973](#), [1980](#)) explained the profound importance of shared emotions and attachment bonds in the infant–parent relationship. Although Freud acknowledged the crucial need of a mother's love for the emotional mental health of the child (Freud, [1926](#)), throughout the history of psychoanalysis, it has been only in recent decades that voices highlighting an infant's affectionate dependency as a way of developing an innate capacity of shared pleasure and meanings with other human beings have appeared (e.g., Seligman & Harrison, [2012](#)).

Feldman's (2007; Feldman & Greenbaum, 1997) research could help us to go beyond this, as her studies have revealed that mother–infant synchrony measured at 3 and 9 months in face-to-face play predicts the symbolic intersubjective capacities at age 2 years, above and beyond global assessments of the relationship in terms of sensitivity or responsiveness. Furthermore, Feldman's (2015) research on biobehavioral synchrony recently has demonstrated connections both between synchrony in attachment contexts and between synchrony and context-independent sociocognitive brain networks and social skills unrelated to attachment, such as formal social abilities, symbolization, social reasoning, and empathy (p. 377).

These results could be interpreted as if synchrony paradoxically mediates both the dyadic attachment system and the dyadic intersubjective attunement system that develop in parallel, but antithetical, ways. This paradox could be explained by a theoretical view that integrates these findings. Along these lines, Trevarthen (2005) proposed the “circle of attachments” that moves us to engage with objects, with one's own body, and with other people that in pairs are related to the three motive functions of attachment and care (relating the other person and one's own body wellness or distress), creative and practical consciousness (relating one's own body perceptions and the physical properties of the objects), and companionship and collaboration (relating interest in the objects with the pleasure of the companionship with other persons). Within this theoretical framework, it makes sense that synchrony could affect both antithetical functions, as well as attachment and care, and companionship and collaboration. In any case, we think that this line of research is worth focusing on because of the implications for mental health and therapeutic intervention.

Appendix

Summarized Version of the Level of Intersubjective Attunement Scale–Toddlers Redesign (LISA-T):

Level	Description of Behaviors and Episodes
<p>A. Primary Intersubjective Attunement and Social Positive Engagement</p>	<ul style="list-style-type: none"> • This level will be categorized when these types of behaviors or <i>joint action routines</i> (Bruner, 1983) mostly appear and are not yet covered by higher scoring categories. <ul style="list-style-type: none"> • A.1. Child fixes his or her attention on the mother, especially her facial expressions, and could actively participate in <i>proto-conversations</i>. • A.2. Mother and child share a person–person game such as peek-a-boo or ride-a-cock-horse, in which usually mother makes subtle variations on a predictable theme. If some objects appear, they are for the purpose of the game (e.g., cuddles, cuddling, tickle games, peek-a-boo, ride-a-cock-horse). • In both, child displays facial expressions of joy, astonishment, and smiles.

B. Secondary
Intersubjective
Attunement–
Manipulative

- A child is categorized in this level when he or she is clearly able to share actions on objects (or events) with the mother. The infant is no longer restricted to a focus on an object or on a person but instead may be sensitive to a person's relation to an object (or an event). Child shows two or more of the following episodes in the session being coded, and a higher level does not match.

- B.1. Child shares with the mother, the infants are attracted by the objects offered by their mothers, explore them manipulatively (inspecting, shaking, poking, banging, throwing, etc.), and show the joy of sharing through their facial and body emotional expressions (e.g., by their looks of joy, surprise, or complicity). This manipulative play should be necessarily accompanied by glances at the mother or other forms of communication to ensure triangulation (e.g., grab, twist, and pull toys, alternating these behaviors with glances at the mother).
- B.2. Child shares with the mother and makes an effort to understand the relational and combinatorial mother's use of two or more objects (e.g., when she puts a stick into a cup and makes rhythmic sounds with the movement of the stick crashing with the sides

C. Secondary Intersubjective Attunement– Manipulative Functional and Simple Pretend Play

- At this level, the child's actions on the objects appear to become progressively more complex. Child begins to apply functional schemes on objects, maybe imitating what the mother does. Hence, objects gradually become signs of conventional meaning and understanding of the intentions and mediated use of the objects of the mother. That's the beginning of the pretend play, which implies that the infant understands and is capable of interacting in an “as if” scenario. This supposes the beginning of *enunciating*. Following Bakhtin, reference is built on a dialogical, embodied, and polyphonic basis and not only on their direct perceptive relation to extralinguistic entities (Cresswell & Teucher, 2011; Todorov, 1981). It is applied to children who show two or more of the following behaviors during the session being coded, and when a higher level does not match.

- C.1. Child shares object–object combinations with the mother; the actions suppose certain understanding of the cultural use of the objects. This manipulative functional play should be necessarily accompanied by glances at the mother or other forms of communication to ensure triangulation (e.g., stirring a cup with a spoon toy (which supposes certain knowledge of the function of these cultural artifacts).

- C.2. Child shares

D. Secondary Intersubjective Attunement Jointed and Recontextualized Two Pretend Play

- In this level, the child began to combine words and also exhibits the ability to join simple pretense games or when he or she is able to share pretend games with object substitutions, or is able to *recontextualize* the meanings of the objects with the adult. It is applied to children who show two or more of the following behaviors during the session being coded, and when a higher level does not match.

- D.1. Child shares his or her attention with the mother by joining two pretense games (e.g., drinking from an empty cup and afterward pretending to feed the figures from the same cup).

- D.2. Child shares pretend play with the mother, and one of the objects is used as if it were another of a different category (e.g., pretend that a telephone is a car or use a block of wood as a spoon).

E. Secondary
Intersubjective
Attunement Multiple
Pretend Play

- In this level, the child exhibits that he or she masters not only adjoining simple pretend games but also sharing object substitutions, in a few months beginning what will be a narrative context. It is applied to children who show two or more of the following behaviors during the session being coded, and when a higher level does not match.

- E.1. As in D.1., but adjoining three or more pretend games (e.g., pretending to feed him- or herself from an empty cup using a block of wood as a spoon, and afterward pretending to feed the figures from the same block, then putting the figures to bed to sleep).

- E.2. As in D.2., but with two or more object substitutions (e.g. pretending a cup is a telephone and talking into it, and afterward pretending that the same cup is a pan and using it for cooking).

F. Tertiary
Intersubjective
Attunement

- A child is categorized in this level when able to create (or co-create with the mother) a “small world” in miniature, and share the characters, the setting, and the plot; the features of narrative thinking (Bruner, **1990**). Also noticeable is the growing capacity to understand others’ minds and emotions. Unlike the rest, this episode usually takes up the whole session. Therefore, one single episode is enough to code this level.
 - G.1. Child shares with the mother a little narration, in which characters, settings, and situations appear and disappear following some sort of plot (e.g., child is pretending to feed the doll figures and then put them into a car to go to school, and then the children figures go to the car and the parent figures go to the factory, etc.).

Lack of Intersubjective Attunement or Attachment Needs

- This level will be categorized when there is a lack of intersubjective attunement or negative engagement in almost all of the session. This level will be categorized when the following types of behaviors appear throughout most of the session. We contemplate three types of null level behaviors:
 - Null.1. Child is not able to hold his or her attention persistently (>3 s) on mother's actions nor on objects (e.g., the infant looks inattentive and does not pay attention to what the mother is doing.
 - Null.2. Child focuses his or her attention on one or more objects only and seems to have no interest in mutual engagement with the mother. Infants can do sensorimotor simple schemes (Piagetian secondary circular reactions) (Piaget, 1936), but without looking for the mother's confirmation or approval (e.g., the infant observes and manipulates objects on the carpet, but without turning his or her gaze or body toward and/or on the mother.
 - Null.3. Child is not able to hold his or her attention persistently (>3 s) on objects or the mother's actions, and exhibits some disruptive behavior such as throwing objects away, pushing away, dropping, batting away, hitting.

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