Joint attention at 10 months of age in infant-mother dyads: Contrasting free toy-play with semi-structured toy-play.

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Abstract

Fifty-two 10-month-olds and their mothers were observed in free toy-play and semi-structured toy-play for assessing joint attention capabilities. Mothers exhibited more bids for joint attention during semi-structured toy-play. Infants' response to maternal behaviors and their bids for initiating joint attention were higher during free toy-play.

Keywords: joint attention; infancy; assessment

In the second half of the first year of life, infants become capable of engaging in triadic interactions in which they share attention with another person regarding an object or event, an ability commonly referred to as joint attention (Bakeman & Adamson, 1984).

To date, joint attention behaviors have been assessed using one of two paradigms: (i) infant-tester paradigms (e.g., *Early Social Communication Scales*, *ESCS*; Mundy et al., 2003), which typically consist of a set of structured tasks administered in the laboratory by trained testers who adopt responsive, yet standardized, interactive behavior; or (ii) infant-mother interactions (e.g., Bakeman & Adamson, 1984; Gaffan, Martins, Healy, & Murray, 2010; Tomasello & Farrar, 1986), that can be set up without prior training, either in laboratory or naturalistic contexts. The choice of either paradigm is likely to impact on joint attention results. Thus, whereas infant-tester paradigms might maximize infants' inter-individual differences – for instance, in terms of response to and initiation of joint attention bids (Vaughan et al., 2003), and possibly at ages when such abilities are more established in infants' behavioral repertoire –, infant-mother paradigms might be more successful in capturing infants' joint attention capacities when interacting with their everyday social partner at very young ages, when those capabilities are emerging (Osório, Martins, Meins, Martins, & Soares, 2011). As mothers typically assume the role of primary caregiver, they may be more capable of providing optimal stimulation and arousal regulation by reading their infants' signals and personal preferences (Field, 1994). Infant-mother paradigms may thus offer researchers a unique opportunity to study the contributions of the relational context for the emergence of joint attention abilities in infants (Gaffan et al., 2010; Osório et al., 2011).

Beyond the potential impact of the social partner, the type of interaction taking place is also of great relevance when assessing joint attention. Some investigations used structured (e.g., Mundy et al., 2007) or semi-structured tasks (e.g., Gaffan et al., 2010), where the infant is placed in a situation specifically created for the purpose of studying his/her joint attention capabilities, and the social partner must follow specific guidelines while presenting a set of toys to the infant. Contrastingly,

other authors (e.g., Bakeman & Adamson, 1984; Osório et al., 2011; Tomasello & Farrar, 1986) studied infants' joint engagement states during free toy-play, under the assumption that much of infant's early social learning takes place in informal and unstructured situations (Baldwin, 1995). Whereas a more standardized pattern of interaction in (semi)-structured toy-play is likely to reduce the influence of the social partner, free toy-play might provide a much more representative picture of infants' daily joint attention capabilities.

The current investigation is anchored in a relational framework and was aimed at answering the methodological question: What differences arise in infants' and mothers' joint attention behaviors when assessed in two types of interactions? In order to achieve this goal, an intra-subject design was adopted with the same infant-mother dyads being filmed interacting during free toy-play and in a semi-structured toy-play task.

Several hypotheses are laid out. Firstly, we anticipate that mothers will display different patterns of attention-directing behaviors in the two distinct conditions, therefore adjusting their behavior to the situation and its demands. Whereas during free toy-play, mothers may allow the infant to take more initiatives, exhibiting fewer bids for joint attention, in the semi-structured condition, mothers may perform more attempts to elicit joint attention, assuming a more dominant role in the interaction. Secondly, although we expect more maternal bids in the semi-structured condition, we predict that infants will exhibit higher levels of responding and initiating joint attention in the free toy-play condition. We hypothesize that maternal behaviors during the semi-structured condition may inhibit infants' response and initiative to spontaneously make bids for joint engagement.

Fifty-two infants (31 boys, 59.6%) aged 9 to 11 months (M = 10.38, SD = .36), and their mothers, involved in a larger longitudinal study (Osório et al., 2011), were recruited from day childcare centers in a large city in the north of Portugal. All infants were White, had Portuguese as their first language, and came from two-parent middle- to middle-upper socioeconomic households.

Assessments were carried out in the families' house and mother-infant interactions lasted approximately 40 minutes, segmented in three different phases. In the first 20 minutes, mothers were asked to interact as naturally as possible so that the dyad would become accustomed with the researcher's presence. Then, mothers were asked to play with their babies as they would do at home using the infant's favorite toys, allowing for the assessment of joint attention during a 10-minute free toy-play condition. In the third phase, mothers were presented with a shape shorter bucket and instructed to teach their infants how to play with the new toy – 10-minute semi-structured toy-play. The total procedure was video-recorded for subsequent coding. The free toy-play condition and semi-structured toy-play condition were coded using a coding system focused on the infant's response to adult bids for joint attention and the occurrence of efforts to direct the adult's attention to a target (Martins, 2003; Osório et al., 2011).

The frequency of seven maternal bids for joint attention behaviors was coded: *engaging with contact* (playfully touching the infant's body using the toy); *animating* a toy (expressive performance with the toy to entertain the infant); *showing* a toy (for example, raising the toy to infant's eye level); *offering* a toy; *pointing* (to indicate something with index finger extended); *demonstrating* an action (to perform specific actions on a toy with the intention of teaching the infant); and *verbal directives* (verbally encouraging the infant to perform an action on a toy).

These behaviors were subsequently collapsed into three categories, in accordance with Osório et al. (2011). A Principal Component Analysis followed by a Varimax rotation revealed the existence of three components accounting for 64.7% of variance. Component 1 comprised engaging with contact and animating behaviors and was labelled *Mother entertains* (Cronbach's alpha = .51). Component 2 involved pointing and demonstrating and was called *Mother teaches* (Cronbach's alpha = .49). Component 3 incorporated showing, offering a toy and verbal directives and was named *Mother directs attention* (Cronbach's alpha = .29). Although low Cronbach's alphas warrant special care in the interpretation of the components, these values were possibly affected by the low

number of items included in each dimension. The decision to accept this component solution was guided also by theoretical principles. We computed a frequency score for each category as well as a total score that reflected the total number of mother's bids for joint attention.

Infant's response was coded when it occurred within 6 seconds (Mundy et al.,, 2003) of any of the maternal behaviors presented above and received two possible codings: *responds to joint attention* (follows the mother's action on the toy, and also alternates gaze between the toy and the mother); and *ignores* (coded when the infant does not look at the mother's action at any point, revealing no interest in the toy). Responding to joint attention was scored as the proportion of instances of involvement in joint attention, divided by the total number of maternal bids for joint attention.

Three types of infant behaviors were considered as attempts to initiate joint attention with the mother: *animating a toy* (moving the toy to get the mother's attention); *offering a toy* (holding a toy in front of the mother); and *pointing* (index finger extended toward a target), which could be of communicative nature or non-communicative nature. All behaviors required the infant to look at the mother's face at some point during the action, except for non-communicative pointing. The frequency of each type of infant's initiating joint attention behavior was combined into an overall score.

A randomly selected 20% of the interactions were coded by a second trained judge. Inter-rater reliability was calculated using Cohen's kappa, which was adequate across all measures of joint attention (mother engages with contact = .75; mother animates toy = .70; mother shows = .72; mother offers = .71; mother points = .71; mother demonstrates = .71; mother gives verbal directives = .71; infant responding to joint attention = .79; infant initiating joint attention = .73).

As the assumptions underlying the use of parametric tests were not met, parametric (*t* test for paired samples) and non-parametric tests (Wilcoxon Signed Ranks Test) were carried out. Both

procedures lead to the same conclusions, so the results of parametric tests will be reported (Fife-Schaw, 2006).

During free toy-play, all but one mother (98.1%) performed at least one entertaining and directing attention behaviors while 37 mothers (71.2%) showed at least one teaching behavior. Conversely, 39 infants (75.0%) exhibited at least one instance of responding to joint attention, and 37 infants (71.2%) displayed bids for initiating joint attention with the mother. In the semi-structured toy-play, all mothers (100%) performed at least one behavior from all categories – entertaining, directing attention, and teaching. Thirty-two infants (61.5%) responded to their mother's bids for joint attention and 26 infants (50.0%) showed initiating joint attention behaviors.

The inter-condition analysis (free toy-play versus semi-structured toy-play) showed that overall, mothers exhibited significantly more bids during semi-structured toy-play than during free toy-play, t (51) = -7.70, $p < .001$. Significant differences were also observed in all categories across conditions. Mothers performed more entertaining behaviors during free toy-play, t (51) = 4.88, $p < .001$, but in the semi-structured toy-play condition, they presented significantly more teaching behaviors, t (51) = -14.94, $p < .001$, and attention directing behaviors, t (51) = -7.43, $p < .001$ (cf. Table 1).

With respect to the response to maternal bids for joint attention, infants responded significantly more during free toy-play than in the semi-structured condition, t (51) = 5.48, $p < .001$. Considering the response to the three maternal categories, significant differences were only found for responding to attention directing behaviors, t (51) = 4.35, $p < .001$. Responding to entertaining behaviors showed marginally significant differences, t (51) = 1.77, $p = .083$. In both cases, infants responded more to joint attention behaviors during free toy-play (cf. Table 1).

Finally, infants displayed significantly more initiating joint attention behaviors in the free toy-play condition than in the semi-structured condition, t (51) = 3.37, $p = .001$ (cf. Table 1).

--- Insert Table 1 around here ---

As hypothesized, distinct contexts of interaction elicited different patterns of joint attention behaviors in both mothers and their infants. Our results revealed a significantly higher total number of maternal bids for joint attention in the semi-structured toy-play condition, comparatively to free toy-play, supporting our first hypothesis. Interestingly, infants displayed more responding and initiating joint attention during free toy-play, which confirms our second hypothesis.

These findings sustain Gaffan and colleagues' (2010) suggestion that in the context of semi-structured play mothers tend to set the agenda and to dominate the interaction, giving their infants fewer opportunities to make bids and respond to maternal efforts to direct their attention. Conversely, as there was no script in free-play, mothers and infants simply enjoyed that playful moment, with mothers respecting their infants' timing to respond to their bid for joint attention and letting them take the initiative. In turn, during this interaction, infants displayed more joint attention behaviors in the form of increased responding and initiating joint attention.

Several studies have already opted for free toy-play to analyze the contributions of caregiver scaffolding (Vaughan et al., 2003), attachment security (Meins, Fernyhough, Arnott, Vittorini, & Turner, 2011) and negative emotionality (Osório et al., 2011) to the development of joint attention capabilities in infancy. Studying infant and mother behaviors occurring in free-play may, therefore, allow for a broader perspective, addressing relevant relational variables to the study of joint attention.

It would be interesting to compare joint attention in free-toy play with more structured paradigms, such as the ESCS (Mundy et al., 2003). Were our results to be replicated, and, depending on the goals of researchers, both procedures - free toy-play and structured or semi-structured paradigms - may be adopted, providing reliable and important data on emerging joint attention capabilities in infants.

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Table 1

Mother and infant measures of joint attention in free toy-play and semi-structured toy-play conditions

	Free toy-play		Semi-structured toy-play		
	Min-Max	*M* (*SD*)	Min-Max	*M* (*SD*)	*t* (51)
Mother					
Bids for joint attention	0-179	81.73 (40.29)	62-246	126.67 (39.42)	-7.70***
Mother entertains	0-172	47.98 (32.74)	4-70	26.92 (16.76)	4.88***
Mother teaches	0-38	6.40 (8.29)	16-80	45.27 (16.67)	-14.94***
Mother directs attention	0-74	27.35 (16.97)	12-155	54.48 (30.67)	-7.43***
Infant					
Responding to joint attention	0-.21	.05 (.05)	0-.07	.01 (.02)	5.48***
Responding to entertaining behaviors	0-.18	.05 (.05)	0-.19	.03 (.05)	1.77^{+}
Responding to teaching behaviors	0-.50	.03 (.09)	0-.08	.01 (.02)	1.55
Responding to attention-directing behaviors	0-.24	.04 (.06)	0-.06	.01 (.02)	4.35***
Initiating joint attention	0-14	2.65 (2.97)	0-8	1.06 (1.70)	3.37***

*** $p < .001$; $^{+}$ $p < .10$