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The Role of Maternal Attention-Directing Strategies in 9-Month-Old Infants Attaining Joint Engagement

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Abstract

Coordinated Joint Engagement (CJE) is a behavioral measure used in the infant-caregiver interaction paradigm to measure joint attention. To know how mothers scaffold infant attention to prompt joint engagement states, this study attempted to determine (a) which specific maternal Attention-Directing Strategies facilitate CJE in mother-infant interactions and (b) how Attention-Directing Strategies precede a range of infant engagement states. Free play in 33 low-SES dyads was analyzed sequentially, a method that reveals temporal relations between the behaviors involved in an interaction. Maintaining was the only strategy that preceded CJE, and Introducing and Redirecting preceded infant Engagement with Object, Onlooking, and Supported Joint Engagement. The results point to the scaffolding role of Maintaining and the mediating role of Introducing and Redirecting maternal strategies. To understand how low-SES infants attain CJE is important given the relation between joint attention and cognitive development. Implications of the results for interventions aimed at reducing socioeconomic inequities in early cognitive development are discussed.

Keywords

Joint attention; Mother-infant interaction; Scaffolding; Attention-Directing Strategies; Sequential Analysis

Joint attention refers to the set of skills infants use to coordinate their attention with that of another person in relation to a mutually interesting property, object, or event in the environment (Mundy & Sigman, 2006). Due to its predictive association with cognitive (Bornstein, 1985), language (Akhtar, Dunham, & Dunham, 1991; Baldwin & Moses, 2001; Delgado et al., 2002; D'Entremont, Wazbeck, Morgan, & MacAulay, 2007; Dunham & Dunham, 1995; Laakso, Poikkeus, Eklund, & Lyytinen, 1999; Mundy et al., 2007), and social competencies (Mundy & Sigman, 2006), joint attention during the first 2 years of the infant's life is attributed with applied significance. Coordinated Joint Engagement (CJE) is the behavioral measure used in the "infant-caregiver interaction paradigm" to measure joint attention (Mundy & Sigman, 2006, p. 301). An infant actively coordinating his/her attention with another person and an object signals that is participating in CJE (Bakeman & Adamson,

1984). Sensitivity in triadic interaction emerges in 6-month-olds (Striano & Stahl, 2005); CJE continues to blossom between 8 and 10 months (Striano & Bertin, 2005; Tomasello, 1999); CJE consolidates around 12 months (Adamson & McArthur, 1995); and infants show significant increases in the time devoted to CJE from 12 to 15 to 18 months (Bakeman & Adamson, 1984). These findings motivate a need to explore interpersonal factors that influence the development of joint attention (Mundy & Newell, 2007) as well as how “specific types of scaffolding behaviors in mothers may affect the development of joint attention” (Mundy & Sigman, 2006, p. 308).

During the second half of the first year, mothers drive social interaction bids with infants (Cohen & Tronick, 1987; Kochanska & Askan, 2004; Papoušek, 1995) and exert influences in promoting CJE. Raver (1996) found that 66% of bouts of collaborative joint attention at 24 months—when children’s joint attention skills have nearly reached their full development (Butterworth, 2006)—were preceded by sequences initiated by the mother. Additionally, Bakeman and Adamson (1984) found that CJE episodes were longer when 6- to 18-month-olds interacted with their mothers than with peers and, conversely, that unengaged states were shorter when infants played with their mothers versus peers. In this study, we explored the origins of CJE in mother-infant interactions and attempted to determine which specific maternal attention-directing behaviors facilitate CJE.

Attention-Directing Strategies (ADS) refer to how mothers regulate infant focus of attention (Landry, Chapieski, & Smith, 1986). They include three prominent active behaviors: (a) *Introducing*, when the mother orients the focus of attention of the infant when the infant is not already involved with an object; (b) *Maintaining*, when the mother follows and reinforces the infant’s focus of attention; and (c) *Redirecting*, when the mother changes the infant’s ongoing focus of attention to a different topic. The role of ADS has been studied longitudinally in relation to language development (Akhtar, et al., 1991; Laakso et al., 1999; Tomasello & Farrar, 1986), but less in relation to joint attention development (cf. Vaughan et al., 2003).

Vaughan et al. (2003) found that scaffolding, which they defined as when mother “directs, shows, and demonstrates” was associated with both longer CJE episodes with 9-month-olds and infants’ increased ability to instigate bouts of joint attention with an examiner at 12 months. However, this blunt operationalization appears to conflate *Introducing*, *Maintaining*, and *Redirecting*. Although Vaughan et al. (2003) analyzed interactions through systematic observations, their results were correlational. Correlation indicates how two behaviors covary, but correlation does not speak to how behaviors unfold through time. By pursuing a contingency approach through sequential analysis (Bakeman & Gottman, 1997; Bakeman & Quera, 2011; Cook, 2003), the research reported here aimed primarily to fill a gap in our knowledge about how mothers’ Attention-Directing Strategies relate sequentially to CJE.

Infants show different *engagement states* (ES; the terminology used here follows the mutually exclusive and exhaustive nominal categories proposed by Bakeman & Adamson, 1984). An infant may be: (a) *Unengaged* with any specific object, person, or activity, although the infant may be scanning the environment as though looking for something to do; (b) *Onlooking* an object, person, or activity but not taking part in the activity; (c) *Engaged* with objects alone, attending to objects at hand through approaching, touching, handling, shaking, manipulating, or throwing independent of a person; or (d) *Engaged with just one person*, say, in face-to-face or person play. Additionally, an infant may be in one of two kinds of joint engagement states: (e) *Supported joint engagement*, during which the infant may share an object or activity with another person and which is mainly attained due to adult scaffolding; or (f) *Coordinated joint engagement*, during which the infant shares an

object or activity with another person and actively coordinates his/her gaze between the object and the other person.

Considering engagement states as a stream of behavior, Bakeman and Adamson (1984) examined how infants enter that stream. At 9 months, Supported Joint Engagement was sequentially preceded by Onlooking and Engagement with Objects; at 12 months, CJE was sequentially preceded by Engagement with Object. To know how mothers scaffold infant attention to achieve both joint engagement states, a secondary purpose of this study was to explore how ADS precede the six infant engagement states.

Guided by the extant literature, for this study we developed the following three hypotheses about contingency relations between maternal ADS and infant ES: first, Introducing precedes Onlooking and the range of infant ES with Object, Person and Supported Joint Engagement; second, Maintaining precedes infant CJE; and third, Redirecting precedes infant Onlooking. The first and third hypotheses are based on the prominent influence of mothers in interactions during infants' first year (Kochanska & Askan, 2004). However, we hypothesized that Redirecting precedes only Onlooking because it would take a longer time for the infant to engage with the object suggested by the mother as the infant would need first to cease engaging with the previous object, look at the new one, and finally engage with it. The second hypothesis derives from macroanalytic evidence. Maintaining, as measured in mother-infant interaction, has a predictive role in later language development (Laakso, et al., 1999; Tomasello & Farrar, 1986) and, in turn, joint attention skills have a predictive association with language development (e.g., Mundy et al., 2007). Therefore, we hypothesized that maintaining promotes the onset of CJE.

We studied these mother-infant contingent relations in a low-SES sample in an under-researched population in Santiago, Chile. Low SES is considered a risk factor in children's development due to its negative effect on the quality of mother-infant interaction (Dodge, Pettit, & Bates, 1994). Moreover, low SES relates to cognitive outcomes in children through maternal interaction (Magnuson & Duncan, 2002), but this relation has not been explored adequately before the start of schooling. According to the 2006 Encuesta de Caracterización Socioeconómica (CASEN, 2006), the Chilean National Survey of the socioeconomic status of the population, 1.3% of the Chilean population is younger than 1 year of age and nearly one-quarter (22.8%) live in poverty. Considering well-documented socioeconomic disparities in early cognitive development (Hoff, Laursen, & Tardif, 2002; Walker et al., 2007), a study of relations between early maternal ADS and infant ES promises also to be of relevance to the construction of early compensatory interventions in low-SES contexts.

In overview, the purposes of this study were to determine in an under-researched and under-served low-SES Chilean sample how maternal ADS immediately precede infant engagement states when infants are unengaged or engaged with objects and/or people in their environment. We addressed these issues via systematic observation and contingency analysis of a free-play situation involving 9-month-olds and their mothers.

Method

Participants

In total, 33 of 38 dyads recorded were analyzed (5 cases were not included because >20% of either mother or infant coded intervals were Off Task). Infants were 9 months old ($M = 277$ days, $SD = 17$, range = 247 to 301), and 55% ($n = 18$) were boys. Infant birth weight averaged $M = 3413$ g ($SD = 465$, range = 2600 to 4352). Mothers averaged $M = 28$ years of age ($SD = 6.7$, range = 18 to 39) and had completed $M = 12$ years of formal education ($SD = 2.5$, range = 7 to 18; $n = 30$); 17% did not complete high school. CASEN (2006) set the

“poverty threshold” at monthly income of \$47,100 Chilean pesos [US\$70.82] for each family member. The *M* individual monthly income of the sample was \$45,256 [US\$68.05] (*SD* = \$35,223).

Procedure

Participants were recruited in preschool institutions that reported about infants who met age and other criteria for normal development. Mothers all signed a general informed consent. After the mother agreed to participate, sleeping and feeding patterns and the infant’s health were checked to ensure appropriate scheduling of filming. Information about mothers’ education was obtained via telephone interview.

All measures were taken at the preschools, which fostered parents’ assistance and filmers’ security. Filmers were trained in rapport and recording. Ten min of mother–infant interaction in a semi-structured play session with a standard set of toys were video recorded, that is the most typical activity in this group and one that mothers and infants commonly perform in Western cultures (Fogel, Garvey, Hsu, & West-Stroming, 2006). Past research has shown that 10 min is adequate to reveal maternal mediational patterns with unique impacts on infant outcomes (Klein, 1988). The toys included a telephone, a picture book, a teddy bear, a cylinder, a baby’s rattle, and a plastic car (Bakeman & Adamson, 1984; Damast, Tamis-LeMonda, & Bornstein, 1996; Laakso et al., 1999). The main instruction to mothers was to “play as you do at home.” Mothers were also asked to refrain from initiating contact with the filmer. The dyad played on a blanket placed on the floor. The settings conformed to general requirements of good illumination and quiet.

Behavioral Coding

Coding was based on recorded sessions. Each interaction was divided into intervals of equal duration (Bakeman & Quera, 1995). To obviate disagreement about unitizing (differences in detecting onsets and offsets of behaviors) and to address the issue of more than one behavior occurring within or between two intervals, a time window of 3 sec was used based on previous studies about the best time window for capturing contingencies in mother–infant interaction (e.g., Bornstein, Cote, Haynes & Bakeman, in press; Van Egeren, Barratt, & Roach, 2001). Thus, each 10-min interaction was divided into 200 intervals. On average, 199 intervals were coded (minimum = 188) using Videograph (version 3.5.0.1) coding software (Rimmele, 2004).

To test hypotheses about the dynamics of the maternal ADS and infant ES, infant and mother activities were classified into mutually exclusive and exhaustive nominal categories in independent passes through the video records (Bakeman, & Gottman, 1997). Supplementary recoding determined when the infant and mother were engaged in the same state and with the same object (Mendive, Sangüesa, Rodríguez, & Guillén, 2008).

Infant ES were modified with minor context-specific alterations from Bakeman and Adamson (1984, p. 1281; see Adamson, Bakeman, Russell, & Deckner, 2000). This coding scheme segments the child’s activity into distinct and mutually exclusive periods. These periods characterize different ways the child might engage objects, people, or activities. The coder’s task is to determine the sustained focus of the child’s interest and then to code the child’s engagement state. Two codes (1 and 2 below) describe little or no active engagement with objects or people; two (3 and 4) describe engagement with a single non-symbolic focus; and two (5 and 6) describe different ways that the child and partner focus together on an object. In such joint engagement, the child is actively involved with an object with which the other person is also engaged. Thus, a key decision is whether or not the mother is engaged with the same object as the child. Usually, the mother’s engagement is evidenced

by active manipulation of the object. However, the mother may be engaged without touching the object when, for example, she remains actively focused on a shared object while the child is playing with the object.

1. *Unengaged*: The infant shows no apparent engagement with a specific object or person. The infant may be unoccupied, may be scanning the environment as though looking for something with which to be engaged, or may be flitting between foci without committing to any.
2. *Onlooking*: The infant is watching another person, observing his or her activity. The infant may be looking primarily at the person or object(s) the person is manipulating or at both the person and object. The sense of this code is that the infant is not involved with the other person's activity but is merely an audience, and at the moment is making no active commitment to being an actor in the event being observed.
3. *Object*: The infant is engaged in object play, exploring or playing with object(s) by him or herself.
4. *Person*: The infant is engaged with another person only.
5. *Supported joint*: The other person's involvement influences the infant's activity with the object, but the infant does not acknowledge this involvement. It must appear that the partner's involvement with the object in some way influences the infant's experience of the object.
6. *Coordinated joint*: Elements of Person engagement and Supported Joint engagement occur in an alternating and/or integrated fashion. The key is coordination of attention to objects and people, and the infant indicates his or her attention by glancing toward the other person.
7. *Off task*: Due to the movement of the infant or the cameras, there is not an adequate view of the child's activities and no "best guess" is possible.

Maternal ADS consisted of:

1. *Introducing*: The mother suggested an object or engagement state to the infant while the infant was unengaged.
2. *Maintaining*: The mother followed and reinforced the infant's engagement with an object.
3. *Redirecting*: The mother suggested a different object or engagement state to the infant.
4. *Independent Action*: The mother's and infant's engagement states or objects were different.
5. *Not responding*: The mother showed neither verbal nor behavioral reactions while the infant was Onlooking, Engaged with Object, or either in Supported or Coordinated JE.
6. *Off task*: An adequate view of the mother's activities was unavailable, and no "best guess" was possible.

Different coders were responsible for coding infants and mothers. Coders were blind to the study's hypotheses and objectives. Data coding began only when high coding agreement (Cohen's kappa; $k > .70$) was achieved. Two coders independently coded 27% of randomly selected video records for both infants and mothers to calculate reliability. Regular reliability checks were conducted

unannounced. Mean kappa values were good (Fleiss, 1981, in Bakeman & Gottman, 1997, p. 66) for infant (.76) and mother (.73) codes.

Analytic Plan

Data transformation from Videograph to a SDIS format compatible with GSEQ software was performed with the TranSDIS software (Aparicio, 2008). Results were obtained using the Generalized Sequential Querier program (GSEQ version 4.2.0), and calculated by pooling over dyads (Bakeman & Quera, 1995). We adopted the pooling over dyads approach to increase reliability of estimated sequential statistics, as few transitions between ADS and target behavior CJE were obtained (Table 2) at the level of the individual dyad.

Sequential analysis describes how, in the flow of exchanges in an interaction, some behaviors are temporally related. Typically, a sequential research question asks which behavior (the *given*) is more likely to have come before another behavior (the *target*) of interest (Bakeman & Gottman, 1997; Bakeman, Deckner, & Quera, 2006; Bakeman & Quera, 2011). For this research, infant ES onsets were the targets, and different maternal ADS constituted the givens (Bakeman & Gottman, 1997). That is, the focus was on what preceded the onset of an infant ES and not intervals when the ES was simply continuing. In effect, this approach compresses the data and reduces the total number of tallies in the tables examined.

Lag-sequential analysis was used to test the hypotheses (Bakeman & Gottman, 1997). Conditional probabilities were calculated, meaning the likelihood with which a particular target (one of the six ESs) occurred at lag 1, relative to the specified given behavior (one of the five ADS) at lag 0. In addition, adjusted residuals, which reflect the significance of specific transitions, were calculated. Because adjusted residuals assume normal distributions, an assumption that may not always be fully met (Bakeman, Adamson, & Strisik, 1995; Bakeman & Gottman, 1997), a conservative adjusted residual value 2.58 was used to interpret the transition as significant.

Finally, odds ratios (ORs) were calculated for their descriptive value (Bakeman et al., 2006; Bakeman & Quera, 2011). For example, to determine whether infant CJE is preceded significantly frequently by maternal Maintaining, we first built a 2×2 contingency table that tallied the frequencies (pooled over dyads) between maternal Maintaining versus the other maternal ADS collapsed at lag 0 (rows), and infant CJE versus other ES at lag 1 (columns), and then computed an odds ratio and 99% confidence intervals for the 2×2 table (Cooper & Hedges, 1994). As expected, the statistical significance for corresponding ORs and adjusted residuals was essentially the same.

Results

Descriptive Statistics

Total intervals for analyses were 6574, 5% and 6% of which were coded as off task for engagement states and maternal attention-directing strategies, respectively. These intervals were omitted in further analyses, leaving 6276 intervals for infants and 6180 for mothers.

First, simple probability (number of intervals in one code divided by the total number of intervals) of infant ES onset and maternal ADS are presented (Table 1). The three most probable infant ES were Supported Joint Engagement, Engaged with Object, and Onlooking, indicating that infants were engaged mainly with the same object as their mothers. Engaged with Person and CJE appeared with lowest frequency during interactions. Among mother variables, Maintaining, Redirecting, and Introducing were the three most probable ADS. Independent Action and Not Responding were the least probable maternal strategies.

Sequential Analyses: Mother ADS at Lag 0 and the onset of Infant ES at Lag 1

Maternal introducing at lag 0 and the onset of infant ES at lag 1—With respect to hypothesis 1, maternal introducing preceded both infant engagement with object and onlooking, with conditional probabilities of .36 and .23 respectively, but neither engagement with person nor supported joint engagement. The odds that Introducing precedes the onset of infant Engaged with Object and Onlooking were 1.93 (lower 99% CI=1.43) and 1.49 (lower 99% CI=1.06) times higher, respectively, than when preceded by other maternal ADS. Adjusted residuals greater than 2.58 indicate positive and significant relations for the Introducing – Engaged with Object and Onlooking transitions, respectively (Table 2). Overall, in support of hypothesis 1, the more the mother introduced focus on an object for infant attention, the more likely within 3 sec the infant engaged with that object, or to a lesser extent, simply onlooked the object.

Maternal maintaining at lag 0 and the onset of infant ES at lag 1—Two transitions resulted in significant effects. Maternal maintaining preceded infant CJE and Unengaged with conditional probabilities of .14 and .19 respectively. With respect to hypothesis 2, the odds that maintaining preceded CJE were 1.7 (lower 99% CI=1.24) times higher than when CJE was preceded by all other maternal ADS, indicating a positive and significant relation. Maternal maintaining and the onset of infant unengaged transition was less strong than maintaining preceding CJE. The odds that maintaining preceded unengaged were 1.39 (lower 99% CI=1.06) times higher than when unengaged was preceded by all other maternal ADS, indicating a significant transition. Overall, in support of hypothesis 2, if the mother maintained the infant's focus of attention, her infant was more likely to have entered a state of CJE within 3 sec and, to a lesser extent, to have become Unengaged.

Maternal redirecting at lag 0 and the onset of infant ES at lag 1—Redirecting preceded infant Onlooking and Supported Joint Engagement with conditional probabilities of .27 and .33 respectively. The odds that Redirecting preceded the onset of Onlooking, and Supported Joint Engagement were 2.12 (lower 99% CI=1.61) and 1.28 (lower 99% CI=1) times higher, respectively, than when preceded by other maternal ADS, indicating positive and significant relations for Redirecting–Onlooking and Redirecting–Supported Joint Engagement onset transitions, respectively. Overall, in support of hypothesis 3, if maternal Redirecting captured the infant's focus of attention, within the next 3 sec the infant was likely to start Onlooking or a state of Supported Joint Engagement.

Even though not hypothesized, adjusted residual greater than 2.58 of maternal Not responding at lag 0 appeared significantly associated with Unengaged at lag 1. The odds that Not responding precedes the onset of infant Unengaged were 1.95 (lower 99% CI = 1.12) times higher than when preceded by other maternal ADS. Overall, the more the mother did not respond to an action of her infant, the more likely that within 3 sec the infant would be Unengaged.

Discussion

This study explored, in a low-socioeconomic status under-researched Chilean sample, how maternal attention-directing strategies immediately precede infant engagement states when infants are unengaged or engaged with objects and/or people in their environment. Results supported three hypotheses, giving more evidence to the perspective that mothers usually drive dyadic interactions with infants (Cohen & Tronick, 1987; Koachanska & Askan, 2004; Papoušek, 1995) and suggested that the same patterns occur in triadic interaction of mother, infants, and toys during the second half of the first year.

By adding the role of mother attention-directing strategies this study contributes to completing a “story” previously developed by Bakeman and Adamson (1984) about how infants enter joint engagement states. Generally, our results suggest that 9-month-olds tend to follow maternal attention-directing strategies. We found that, when the mother introduces a focus of attention her infant subsequently looked at it or engaged with the object. If the mother maintained that focus of attention, her infant entered a coordinated joint engagement state. When the mother directed a different focus of attention her infant changed her or his focus by onlooking or engaging in a shared activity with it and the mother (Supported Joint Engagement).

We found support for the hypothesis that introducing a focus of attention precedes both infant engagement with object and onlooking, but neither engagement with person nor supported joint engagement. The lack of an association with engaged with person could be attributable to its low base rate; if so, the role of introducing preceding engaged with person needs further exploration. A post-hoc review of our videos revealed that infants typically mouthed an object introduced by the mother, which was coded as engaged with object. The prominence of mouthing at this age might help to explain why we did not find supported joint engagement after mother introduced a focus of attention.

We found strong support for the second hypothesis that the more the infant’s focus of attention is maintained, the more likely the infant subsequently entered coordinated joint engagement. Moreover, as we explored all transitions between mother attention-directing strategies and infant engagement states, we know that the onset of coordinated joint engagement was preceded by maternal maintaining exclusively. Surprisingly, the second most frequent infant engagement state after maintaining was unengaged. We conducted additional analyses to understand this relation. We explored whether the more likely the mother was to vocalize while maintaining infant focus of attention, the more unlikely the infant was subsequently to be unengaged. Results did not support this possible interpretation. A post-hoc review of videos revealed that the transition between maintaining and infant unengaged appeared after a repeated sequence of infant engaged with some object or participation in supported joint engagement and mother maintaining that focus of attention. This transition could be construed as meaning that the mother was mostly sensitive to the infant’s focus of attention and tended to maintain the infant’s focus of attention until the infant declined his/her attention.

The third hypothesis in this study, that the more the mother redirects her infant’s focus of attention, the more her infant will turn to onlooking, was supported by the data. In addition and contrary to the hypothesis, after maternal redirecting, infants began to participate in a game or activity with the mother and object in a supported joint engagement episode. It was hypothesized that, after redirecting, the infant needed more time to enter supported joint engagement, considering that first he or she would need to stop engaging with the object of focus, look at the other object suggested by the mother, and finally engage with that object. However, the immediate relation between redirecting and supported joint engagement reinforces the influential role of mother in the infant’s attention and activity with 9-month-olds. Cross-cultural variation of maternal influences on infant attention needs further study due to limited evidence that Chilean parents favor control over children’s actions (Leyva, Reese, & Wiser, 2012).

Role of Maternal Attention-Directing Strategies at a Microanalytic Level: Scaffolding and Mediating

The temporal association found between maintaining and coordinated joint engagement episodes could be construed to mean that, when the mother maintains the infant’s focus of attention, she is somehow holding as well as releasing the infant’s attentional efforts and, at

the same time offering auxiliary attentional resources for the infant to alternate his or her gaze between mother and object. On this account, maintaining might play a scaffolding role in the attainment of coordinated joint engagement. Likewise, maintaining can be regarded as a function operating in the infant's zone of proximal development (Vygotski, 1991) because infants at around 9 months of age just start coordinating one focus of attention simultaneously with another person (Adamson & McArthur, 1995).

Taken together the sequential relations found between mother introducing and redirecting, and infant engagement states could be construed to mean that a directive behavioral style of mother at a microanalytic level is part of the positive mediator role that adults play with their young children. When mother mediates, she modifies the stimuli that surround the infant "changing their intensity, frequency, order, and context; by arousing the child's curiosity, vigilance, and perceptual acuity" (Tzuriel, 1999, p. 110). In the context of interacting with toys by introducing or redirecting, mothers bring objects to life by showing object affordances or functional relations that infants can establish with objects (Fogel et al., 2006). Thus, the mediator role of redirecting allows the infant to approach objects in a symbolic way (to pretend to call his or her mother on the telephone) instead of an instrumental way (to mouth a telephone). Alternatively, the mediator role of introducing a focus of attention allows the infant to discover how a little train moves on its wheels instead of scanning the environment without any focus.

Role of Maternal Attention-Directing Strategies at a Macroanalytic Level

At a macroanalytic level, the directive style of mothers interacting with their infants has been associated negatively with both language development (Laakso et al., 1999; Tomasello & Farrar, 1986) and focal attention at 18 months (Bono & Stifter, 2003) in middle-SES samples. However, in low-SES contexts, directive attention-directing strategies could positively affect infant outcomes because they operate as communicating something, considering the lower level of stimulation, richness, and quantity of language and play materials that normally surround low-SES, compared with high-SES infants (Bornstein, 2002; Hart & Risley, 1995).

The hypothesis of a positive role for a directive maternal style in low-SES circumstances accords with the Vaughan's et al. (2003) hypothesis that "more engaged and directive caregiving style might be efficacious [during the first year but not during the second] with regard to joint attention development" (p. 613). They arrived at that hypothesis from the observation that maternal scaffolding is significantly associated with both longer episodes of joint engagement at 9 months and infants' increased ability to instigate bouts of joint attention with an examiner at 12 months. Even though our study did not intentionally test that hypothesis, our results can be regarded as supporting the suitability of the directive interactive style hypothesis but on a microanalytic scale and in a low-SES context. We plan further analyses to explore predictive longitudinal associations between ORs of all significant attention-directing strategies and infant engagement state transitions and with vocabulary development at 12 and 18 months to weigh the relative roles of different maternal behaviors in our sample.

Mundy and Sigman (2006) proposed that more research about specific types of scaffolding that affect joint attention development is called for. Results from this study suggest that, depending the infant's focus of attention, maternal maintaining, introducing and redirecting could operate as scaffolding and mediating functions that foster the development of joint attention skills in infants if the following conditions are met: (a) the free-play activity analyzed is a representative way of interaction in mother and infant dyads, as it was reported by the sample of this study; (b) the time analyzed is sufficient to reveal maternal patterns of directing infant attention, as Klein (1998) has found; (c) the maternal behaviors we analyzed

are stable during infancy, as has been found in previous studies during the first 2 years (Gottfried, 1984; Holden & Miller, 1999, as cited in Bornstein, 2002; Landry, Smith, Swank, Assel, Vellet, 2001); (d) the infant's tendency to establish CJE episodes with mothers at 9 months relate to subsequent independent development of joint attention skills, as preliminary evidence has been found (Vaughan et al., 2003); and (e) repeated experiences of coordinated joint engagement have a self-organization function with respect to joint attention development, as Mundy and Sigman (2006) suggested: "the more [infants] engage in joint attention, the more practiced they become in the types of social attention management that is necessary for facile participation in social interaction (...) then the more consistent or frequent use of joint attention skills may lead to more and clearer social learning opportunities for infants" (p. 300). From the socio-cultural perspective (Vygotski, 1991), psychological skills first operate in "interpsychological space" and then in "intrapsychological space" when they become internalized. Therefore, supported joint engagement and CJE for infants, aided by maternal attention-directing strategies, might occupy interpsychological space of joint attention skills that, through repeated experiences with CJE, infants gradually internalize.

Limitations

One limitation of this study is the lack of validation for maternal engagement states that we adapted. A study that looks at significant transitions found between mother attention-directing strategies and infant engagement states, together with later outcomes in the same children, may be a way to ascertain the predictive validity of attention-directing strategies. Second, even though sequential analysis offers a more accurate picture of the dynamic flow of the interaction than does correlational analysis (Bakeman & Gottman, 1997), it is still not possible to conclude that maintaining causes infants to attain a CJE state (Bakeman & Gottman, 1997).

Implications for Low-SES Groups

This study about mother-infant interaction in Chilean dyads of low SES also indicates that these mothers tend to maintain their infants' focus of attention for about 50% of a play bout on average. This study extends the scope of maternal adaptations previously described to infant vocalizations in face-to-face interaction in middle-SES samples (Papoušek, 1995) to infant visual focus of attention in interaction with toys. In addition, the high proportion of maintaining revealed the presence of positive interactive strategies within a low-SES group.

The positive temporal association between maintaining and CJE found in this study also has some practical implications. Even though more evidence is necessary before recommending maintaining as a strategy to foster infant joint attention skills, this study opens a new possible object of intervention to reduce early cognitive inequities ascribable to socioeconomic reasons (Walker et al., 2007) by improving the quality of early interactions, a variable that seems to make a difference in school readiness within low-SES groups (Magnuson & Duncan, 2002). In addition, maintaining could prove to be an easier way to improve early interactions between caregivers and infants compared, for example, with joint-book reading, which also demands literacy skills that tend to be low in low-SES adults (Bravo & Contreras, 2002). Instead, interventions to improve maintaining would be mainly based on adults "learning" to follow infant gaze and to acknowledge that this simple behavior might contribute to the infant's learning opportunities and language development (Baldwin & Moses, 2001; Dunham & Dunham, 1995; Tomasello, 2001).

Conclusions

This study responds to the need for knowledge about "the phenomenology of ... processes that ... contribute to individual differences in joint attention utilization among children"

(Mundy & Sigman, 2006, p. 300) and exposes specific social interaction processes in typical mother and infant activity. We found a significant role of maternal maintaining for infant coordinated joint engagement, and a potential mediating role of introducing and redirecting for infant attention development.

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Highlights

- Free play activity of 33 low-SES dyads 9-month-old were analyzed sequentially
- To determine how maternal behaviors precede infant engagement states
- Maintaining preceded coordinated joint engagement.
- Scaffolding and mediating roles of maintaining, introducing and redirecting are discussed.

Table 1

Descriptive Statistics for Infant and Mother Variables

Behavior	Duration	Simple Probability
Infant Engagement State		
Unengaged	744	.12
Onlooking	897	.14
Engaged with object	1548	.25
Engaged with person	38	.01
Supported joint engagement	2514	.40
Coordinated joint engagement	535	.09
Total	6276	1.00
Mother Attention Directing Strategy		
Maintaining	3413	.55
Redirecting	1375	.22
Introducing	595	.10
Independent action	434	.07
Not responding	363	.06
Total	6180	1.00

Note. Duration indicates the number of intervals coded for the behavior.

Table 2

Conditional Probabilities for Maternal ADS at lag 0 and the onset of Infant ES at lag 1

Mother ADS	Infant engagement state				
	Unengaged	Onlooking	Object	Person	Supported
Maintaining	.19 ⁺	.11	.26	.01	.29
Redirecting	.19	.27 ⁺	.12	.01	.33 ⁺
Introducing	.00	.23 ⁺	.36 ⁺	.01	.33
Independent action	.18	.22	.27	.01	.22
Not responding	.27 ⁺	.14	.39	.01	.06

Note.

⁺ indicates a conditional probability whose adjusted residual was greater than 2.58.