

# Maternal sensitivity and infant triadic communication

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**Background and method:** The aim of this study was to examine whether a mother's sensitivity towards her one-year-old infant is related to the infant's propensity to engage in 'triadic' relations – that is, to orientate to an adult's engagement with objects and events in the world, for example in sharing experiences with an adult. In order to determine that any effects were specific to infants' behaviour in the interpersonal domain, we also tested their performance on tests of understanding means–ends relations and object permanence. **Results:** The results were that high maternal sensitivity and low intrusiveness correlated with high levels of infant triadic interpersonal engagement with a stranger *vis-à-vis* performance on the non-social tasks. There was also suggestive evidence that maternal sensitivity might be related to infants' propensity to share experiences with the mother. Exploratory analyses revealed that these findings held up when the effects of maternal socio-economic status and ethnic group were taken into account; and there was some indication that the effects of maternal intrusiveness on infant profiles of performance were more marked for mothers who did not have a partner. **Conclusion:** There is a specific relation between maternal sensitivity and one-year-old infants' propensity to engage with someone else in relation to the world. **Keywords:** Attention, communication, infancy, joint attention, mothers, non-verbal communication, secondary intersubjectivity, triadic relations.

Towards the end of the first year of life, infants manifest new patterns of communication with other people. Trevarthen (e.g., Trevarthen & Hubley, 1978) was one of the first to describe this transition, which he characterised as a development from primary to secondary intersubjectivity. It involves a shift from the infant's one-to-one engagement *either* with objects and events in the environment, *or* with another person, to a 'triadic' pattern of communication in which the infant relates to another person in relation to an object or event (Adamson, 1995; Bakeman & Adamson, 1984). A number of authors consider such communication to have great developmental significance, not only as a stepping-stone to more elaborate forms of social interchange, but also as critical for the emergence of symbolic functioning and language (e.g., Baldwin, 1995; Bruner, 1983; Hobson, 1993; Tomasello, 1999).

Towards the end of the 1970s, there were several attempts to catalogue the forms of interpersonal behaviour and communicative transaction that characterise this newfound ability for triadic relations (e.g., Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bretherton, McNew, & Beeghly-Smith, 1981; Trevarthen & Hubley, 1978). The list includes the infant's capacity to follow the eye-gaze or point of another person, to request help and respond to simple verbal requests by others, to indicate or show objects to others (often looking to the other person's eyes, to check whether he or she is attending), to initiate as well as accept invitations to play games such as peek-a-boo, to shake the head to express refusal, to imitate conventional gestures

(e.g., hugging) and actions with objects, to utter greetings ('Hi!') and name-like words, and to pretend to carry out adult activities such as using the telephone.

Carpenter, Nagell, and Tomasello (1998) examined the degree to which several of these kinds of behaviour emerged concurrently or in an ordered sequence in the development of individual infants. In observations of 24 infants at each month between 9 and 15 months of age, these investigators measured joint attentional engagement, gaze and point following, imitation, imperative and declarative gestures, and the comprehension and production of language. They reported that infants progressed from sharing to following to directing others' attention and behaviour. At 12 months of age, for example, when all infants had been showing joint engagement for at least three months, 23 of the 24 infants showed proximal declarative gestures (showing/giving), 17 followed a point, 11 followed gaze, and 9 showed imperative gestures (Carpenter et al., 1998, figures 3 and 6, pp. 53 and 59, respectively). At this same age, 14 out of the 24 infants passed a test of object permanence (figure 8, p. 62).

There is very little evidence from the study of typically developing infants to suggest which developmental mechanisms are responsible for the emergence of triadic interpersonal relations at the end of the first year, or which factors may affect this development. Striano and Rochat (1999) videotaped 7-month-old and 10-month-old infants in a dyadic situation in which free play between the infant and a female stranger was followed by a 'still-face' period

and then another phase of natural play, and in relation to which the authors assessed the infants' initiations to re-engage the experimenter, and b) triadic settings of play in which infants were assessed for joint engagement (looking from an object to the experimenter and back to the object), their ability to localise a target by following another person's gaze and/or point, and looking to the experimenter when the latter covered the infant's hands holding a toy ('blocking') or when teased. The principal finding was that across the groups, infants' scores out of three for each *kind* of re-engagement behaviour – smiling, re-engagement activity and re-engagement vocalisation – were significantly correlated with total scores in triadic interaction. The authors also stated that the number of social initiatives during the first normal dyadic interaction was not correlated with the number of triadic behaviours, and from this they concluded that the results could not be explained by infants' relative sociability. Therefore this preliminary study of individual differences provides suggestive evidence of a link between an infant's active engagement with a stranger in a one-to-one exchange, and triadic forms of interaction with an unfamiliar person.

If such a link exists, then questions arise about the sources of infant individual differences. Broadly speaking, one might begin by distinguishing between the effects of infant constitutional factors on the one hand, and environmental and especially social influences on the development of dyadic and triadic forms of interpersonal relatedness on the other – and of course, interactions among these factors. In addition, one might consider factors that promote or hinder the emergence of infant–adult–world relations towards the end of infancy, and perhaps as a partly separate matter (our focus in this paper), factors that increase or lessen an infant's propensity to engage in such relations with others, once they have the ability to do so. The picture is complicated by the likelihood that an infant's competence and/or propensity to engage in joint attention, to share experiences, to make requests of others, and so on, probably implicate a range of cognitive, motor and social-motivational abilities, which individually and in their integration may be affected by a combination of factors (Adamson & Russell, 1999; Mundy & Willoughby, 1996). It follows that, where possible, research approaches in this domain should attempt to determine the specificity of any individual differences in infant triadic relatedness, for example in relation to infants' regulation of attention and aspects of cognitive ability.

There are two lines of evidence that have proved especially helpful in highlighting the importance of constitutional/'biological' factors and social-environmental factors in the development of infant dyadic relations. The former of these, involving the study of children with autism, has elucidated potentially dissociable cognitive/social developmental pathways

in infancy as well as providing suggestive evidence of continuities between impairments in dyadic and triadic social functioning. An early body of research by Wetherby and Prutting (1984), Loveland and Landry (1986), and Sigman, Mundy, Sherman, and Ungerer (1986) has been complemented by more recent studies involving parental reports (e.g., Wimpory, Hobson, Williams, & Nash, 2000) and direct observations of very young children with autism (e.g., Baron-Cohen et al., 1996; Sigman, Kasari, Kwon, & Yirmiya, 1992). When compared with non-autistic infants or young children of similar mental ages, those with autism are unusual in failing to make eye contact to share experiences with others, they tend not to monitor the gaze of others, and they rarely point or follow the pointing of others. In autism, such limitations in triadic relations are associated with abnormalities in one-to-one interpersonal engagement; and equally important, there are associated abnormalities in some – but only some – cognitive abilities (e.g., Hobson, 2002). These findings have contributed practically as well as theoretically to the present study of typically developing infants, in that tests of the relatively spared, apparently non-social-dependent forms of cognitive ability were selected as control conditions for assessments of more socially imbued relational-cognitive abilities.

The second line of evidence provides a complementary perspective, focusing as it does on the impact of maternal sensitivity on infant triadic relations. Once again, the most telling evidence has emerged from the field of developmental psychopathology, in this case from the study of at-risk groups of mothers and their infants. For example, Flanagan, Coppa, Riggs, and Alario (1994) studied 13 teenage mother–infant pairs when the infants were 9–12 months old, and reported that mothers who scored poorly on a measure of maternal sensitivity and contingent responsiveness tended to have infants whose communicative acts were directed to regulating a stranger's behaviour rather than promoting social interaction and joint attention. Goldsmith and Rogoff (1997) reported that in a simulated toy-sales demonstration, mother–toddler dyads with a dysphoric mother spent a smaller proportion of time engaged in coordinated joint attention than did dyads with non-dysphoric mothers, principally because of differences in the time that such interactions were maintained. Raver and Leadbeater (1995) explored individual differences among mother–infant pairs in a high-risk sample of adolescent mothers and their infants, and reported qualitatively different styles of negotiating bouts of joint attention. For example, when the infants were 12 months of age, mothers who were judged to be highly sensitive in free-play interactions engaged in a greater proportion of reciprocal bidding sequences (when the mother persisted after her infant accepted a bid) and spent

more time in joint attention with their infants than did less sensitive mothers.

Although these studies are exceptional in tracing the effects of maternal sensitivity or engagement on infant joint attention and other aspects of triadic relations (and see Wachs & Chan, 1986, for a study of individual differences in the absence of maternal risk factors), there is a much larger literature concerning the broader effects of maternal psychopathology and relatedness on infant development. The most extensive body of work (reviewed in Murray & Cooper, 1997) concerns the effects of maternal depression, concerning which there are now several reports of marked disturbances in mother–infant interactions when the mothers come from disadvantaged circumstances. Depressed mothers have tended to be rated as hostile and intrusive, withdrawn, or showing negative affect, and infant distress and avoidance have been common (e.g., Cohn, Campbell, Matias, & Hopkins, 1990; Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Cohn & Tronick, 1989; Field, Healy, Goldstein, & Guthertz, 1990; Field et al., 1988; Field et al., 1985; Murray, 1992). In a study of low-risk mothers with depression and their two-month-old infants, Murray, Fiori-Cowley, Hooper, and Cooper (1996) reported that although such severe disturbances were not present, depressed mothers contrasted with well mothers in being less sensitively attuned to their infants and more negating of the infants' experience, even when the presence of adversity was taken into account. Follow-up studies indicated that maternal depression in the months after childbirth led to poor performance on tests of 18-month-olds' abilities to search for hidden objects and also resulted in boys (only) doing less well on a test of more general functioning. Even among four-year-olds, the male children of mothers depressed after childbirth have been reported to perform less well than children of non-depressed mothers on the McCarthy Scales of Children's Abilities (Sharp et al., 1995).

This research reinforces the lesson that one needs to establish the specificity of any observed relation between mother–infant interactions and social-cognitive development, given that there may be wide-ranging effects. A similar message comes from non-clinical studies, where there is evidence to suggest that features of mother–child interactions have a bearing upon relatively general aspects of children's developing intellectual as well as social abilities (e.g., Crandell & Hobson, 1999; van Ijzendoorn, Dijkstra, & Bus, 1995). It remains an open question how far these findings are to be explained by individual differences among infants and young children in their abilities to sustain attention, to self-monitor, to apply language-related thinking, or in other aspects of psychological functioning. Such psychological characteristics may be developmental sequelae to early-arising individual differences in more specific domains – not least, in triadic relatedness – that have

broad but not domain-general implications for subsequent cognitive as well as social development.

This is a matter that is receiving close attention from developmental researchers. In particular, an infant's propensity to learn *through* others in contexts of joint attention has been subject to a body of empirical and theoretical work on the social context of early language learning (Baldwin, 1995; Bruner, 1983; Carpenter et al., 1998; Mundy & Gomes, 1998; Tomasello & Farrar, 1986), and the development of other symbolic capacities (Hobson, 2000, 2002; Tomasello, 1999). It has been claimed that an infant's tendencies to attend to things jointly with others, to engage in social referencing, and to imitate and identify with other people – and a caregiver's sensitivity in facilitating such triadic engagement, for example by 'following in' on the child's focus of attention – make an important contribution to subsequent cognitive as well as social development. If this is so, then it becomes even more important to determine the factors that may affect triadic relations at the end of the first year of life. With this aim in mind, we focused upon the implications for such relatedness of maternal sensitivity and intrusiveness towards the infant, but also explored the potential importance of maternal social class, ethnicity, and living with the child as a single parent.

In order to assess how mothers related to their infants, we gave the mothers a two-minute task of teaching their infants to play with a toy train. In order to test infant secondary intersubjectivity, we investigated infant engagement with a stranger in the following respects: following eye-gaze, following pointing, requesting, and reciprocal play with a ball. For each of these 'social' items, the critical issue was whether the infant related to the experimenter and some object or event simultaneously, and so each was a test of triadic interaction. The tests of non-social ability assessed means–ends understanding and object permanence. Although we expected that the infants of more sensitive mothers would show relatively more triadic engagement *vis-à-vis* performance on the non-social tasks than the infants of less sensitive mothers, we have applied two-tailed tests of significance in analysing the results. As a subsidiary procedure involving mothers rather than a stranger, we tested the infants' engagement with their mothers in contexts of sharing experience of an interesting event on the one hand, and reacting to a potentially anxiety-provoking event on the other.

## Method

### Participants

A total of 28 mothers and their infants took part in the testing procedures. Participants were recruited through screening at antenatal clinics, and through advertisements placed in local publications. They were unaware of the aims of the study, and were told only that the

project would be investigating mother–infant relationships and infant development at the end of the first year of life. In addition, a member of the study team was available to discuss what participation in the study would involve.

The characteristics of the 28 mothers were as follows. They had a mean age of 33 years 6 months (range 25 years 5 months to 42 years 5 months); in ethnic origin, 21 were Caucasian and seven were Afro-Caribbean; in socio-economic status, 22 were from social classes I and II, and six were from classes III–IV; and in educational attainment, 14 had graduated from university, another six had passed ‘A’ levels (higher school exams), seven had passed CSE or ‘O’ level exams (intermediate school exams), and one had no formal qualification. Eight of the mothers had had

difficulties in pregnancy and/or childbirth, but in only two cases was the baby placed in a special care baby unit.

At the time of testing, the infants had a mean age of 55 weeks (range 52–59 weeks). There were 14 males and 14 females. For 25 of the infants the mother was the primary caregiver, and in the remaining three cases, this role was shared with the father or a nanny.

### Procedure

We set up a series of events (the Secondary Intersubjectivity Schedule) that were designed to evaluate specific aspects of infant social and non-social relatedness and understanding. The items were presented in a fixed

**Table 1** Secondary Intersubjectivity Schedule

Task	Aim	Criteria
1. Means–ends (35 seconds)	To assess the degree to which infant understands that one thing/action can be employed as a means to a separate goal.	One end of string close to infant, with a key tied to far end of the string, beyond reach. <b>Infant pulls the string to obtain the keys.</b>
2. Request for bubbles (45 seconds)	To assess whether the infant is able to make a deliberate request for more bubbles.	E blows bubbles, then pauses. <b>Infant makes a request for more bubbles.</b>
3. Gaze-following (10 seconds)	To assess whether the infant is able to follow the gaze of another person.	E engages infant, then looks to something at 90 degrees to one side, in the distance. <b>Infant looks in the direction of E’s gaze.</b>
4. Object permanence I (45 seconds)	To assess whether the infant is able to understand that an object continues to exist when out of sight.	Small toy placed under one of two cups (two trials). <b>Infant lifts the cup under which the toy was placed.</b>
5. Reciprocal play with a ball (40 seconds)	To assess whether the infant can engage in reciprocal play with E, with a ball.	E rolls a soft ball to the infant. <b>Infant rolls or gives the ball back to E.</b>
6. Object permanence and means-ends (50 seconds)	To assess whether the infant understands that an object continues to exist when out of sight <i>and</i> that one thing leads to another.	Toy placed out of reach of infant on the end of a towel, with other end of towel within infant’s reach. Toy covered with a cloth. <b>Infant pulls towel to self and lifts cloth to retrieve toy.</b>
7. Request for spinning top (40 seconds)	To assess whether the infant is able to make a deliberate request for a toy to be activated.	E activates a spinning toy for 10 seconds, then pauses. <b>Infant makes a request for the toy to be reactivated.</b>
8. Point-following (10 seconds)	To assess whether the infant is able to follow the experimenter’s point towards a distal focus.	E engages infant, then points to something at 90 degrees to one side, in the distance. <b>Infant follows E’s point.</b>
9. Object permanence II (25 seconds)	To assess whether the infant is able to understand that an object continues to exist when out of sight.	E places small toy into a box and rattles the box. Item surreptitiously removed. Box handed to infant. <b>Infant looks into the box, seeking the toy.</b>
10. With mother: Social referencing I (45 seconds)	To assess the infant’s awareness that an unexpected event can be shared with mother.	While mother and infant are playing a Chinese bell is chimed for two 8-second periods. <b>Infant looks from bell to mother with intention of sharing the experience.</b>
11. With mother: Social referencing II (45 seconds)	To assess the infant’s awareness that an unexpected event can be shared with mother.	While infant is playing alone a remote-controlled car is driven towards and then away from the infant. <b>Infant looks from car to mother with intention of sharing the experience.</b>

order, and the baby and experimenter were videotaped. The infant sat in a baby-chair across a table from the experimenter, with the infant's mother at the end of the table, to the infant's right-hand side. The position of the infant was such that he or she was able to reach forward and manipulate objects that were placed upon the table, but could not reach beyond the middle of the table when objects were placed out of reach. We employed a female experimenter for this series of tasks.

The items of the Secondary Intersubjectivity Schedule are summarised in Table 1, where the first nine items concerned infants' interactions with a stranger, and the last two arose from interactions with their mothers. The items with the stranger took approximately five minutes to administer.

In addition to these procedures, there was a two-minute period of mother-child interaction in which the mother was given a plastic toy train with two figures, and was asked to teach her infant how to play with this and put the figures into the train (after Trevarthen & Hubley, 1978). This 'teaching task' took place immediately after the final test of object permanence, and it was ended after two minutes by the sounding of the Chinese bell for Task 10.

### Scoring

The videotapes of the sessions were edited so that the episodes of infant engagement with the experimenter were separated from the period in which the mothers attempted to teach their infants to play with the train. The videotapes of these latter phases of mother-infant interaction were edited so that they terminated just before the Chinese bell was rung. Ratings of the videotaped triadic interactions were made by someone who was blind to the hypotheses of the study; inter-rater reliabilities were calculated on the basis of ratings of 60% of the videotapes by an independent judge who was also blind to maternal characteristics. One year later and without knowledge of previous data, the two raters assessed the style of maternal relatedness for all mothers in the teaching task; the blind ratings were used as the definitive judgements, and the ratings of the person who was not blind to maternal characteristics were used for assessing reliability.

(i) *Infant performance on the Secondary Intersubjectivity Schedule (SIS)*. For each task, the criteria for scoring were introduced with a brief paragraph that conveyed the essence of what was being rated. There followed detailed criteria for each item on a 5-point scale of ratings of infant behaviour, ranging from no behavioural evidence of the ability in question (score 0) to clear evidence of the ability (score 4). For example, for the task of requesting bubbles it was stated: 'The critical issue is whether the infant is able to make a *deliberate request* for more bubbles'. The criteria ranged from zero for showing no signs of trying to communicate anything, through a mid-point (score 2) where 'the infant does something which seems to be a deliberate expression of his/her wanting more bubbles *and* looks to an adult - but it is unclear whether the look or other action is *intended as a request*', to a maximum (score 4) where there is a clear request in which 'typically, this will involve

alternating gaze between the bubbles and the adult's face'. The criterion of looking to the adult's face was also included in the scoring of the other item for testing requesting (the spinning toy) and the two tests of social referencing the mother. For the latter items, high scores were given only when there were indications that the infant was sharing experiences of the object, or evaluating its significance through the mother's attitude towards it.

The inter-rater reliabilities in judgements were rated on the basis of two independent judges rating 60% of the sample. For the bubbles task and following pointing, the kappa coefficients of agreement were .67 and .72 (representing 'substantial' agreement according to the criteria of Landis & Koch, 1977); for all the remaining items, the kappa coefficients were above .8 ('almost perfect' agreement).

(ii) *Maternal relatedness to the infant*. Our aim was to assess the degree of maternal sensitivity and intrusiveness in the period of two minutes during which the mother was left with the task of teaching her infant how to play with the train and put in the toy figures. For the purposes of rating, we modified the criteria that Fiori-Cowley and Murray had devised for rating mothers in interaction with younger infants (Murray et al., 1996), so that they were applicable to the present setting. The scoring criteria appear in Appendix 1.

Because the judgements of sensitivity and intrusiveness were more subtle than in the case of ratings of the Secondary Intersubjectivity Schedule, we evaluated inter-rater reliabilities by asking two independent judges who were blind to the SIS results to rate the full sample of participants on the teaching task. For ratings of sensitivity the kappa coefficient was .51, and for intrusiveness there was a kappa of .75 (moderate and substantial agreement, respectively, according to Landis & Koch, 1977).

(iii) *Missing values*. For a variety of reasons, one infant missed out on a single item (out of the total of 9 items) of the SIS in relating to a stranger, and two further infants missed a single item in relating to their mothers. The particular item varied in each case. In these instances, we employed the median score for that item as judged by the other infants.

## Results

### (a) Levels of performance

(i) *Maternal relatedness*. There were two ratings of maternal relatedness towards the infants on the teaching task, and for each the range of scores was between 0 and 4. The mean score for maternal sensitivity was 2.25 out of 4 (SD 1.27) and that for intrusiveness was 2.07 (SD 1.4). Both visual inspection of the distribution of scores and the value of the kurtosis statistic indicated that the results did not deviate significantly from a normal distribution. In view of the need to conduct regression analyses to determine the possible effects of factors such as social class and ethnicity, we

applied Pearson's parametric statistic in conducting correlational analyses.

It should be noted that although the ratings of maternal sensitivity and intrusiveness were different in kind, there was also substantial overlap in the phenomena to which the ratings applied. In the event, and unsurprisingly, the correlation between mothers' scores on these two measures was highly negative (Pearson's correlation  $-0.71$ ). Despite this, we believe it is worthwhile to analyse the two sets of scores independently, providing it is borne in mind that they represent measures of two partly complementary concepts.

(ii) *Infant performance on the SIS.* With regard to measures of infant triadic social engagement with the stranger, these were defined in advance as those that tested an infant's ability to follow eye gaze, to follow pointing, to request (two tests), and to join in reciprocal play with a ball. Although the criteria for scoring the ball task do not make explicit reference to the infant's engagement with the experimenter, the judgements about the infant intentionally offering or rolling the ball was evaluated with regard to whether the interchange was 'personal'. In the event, of 15 infants who scored either 3 or 4 out of 4 in this task, all but two infants looked to the experimenter's face in a way that was co-ordinated with their actions of offering or rolling the ball. The non-social items were the key-and-string means-ends test, the 'find the bunny' and 'blue box' tests of object permanence, and the test involving the hidden toy that implicated both these kinds of understanding.

The range of possible scores on the social items was between 0 and 20, and on the non-social items it was between 0 and 16. The range of infant scores on the social items was 2 to 19 out of 20 (mean 10.3, SD 3.9), and on the non-social items was 2 to 16 out of 16 (mean 11.1, SD 3.5). In order to achieve comparability, these scores were converted into percentage scores, yielding the following results: on social scores, mean 52%, SD 19.7%, range 10–95%; and on non-social scores, mean 69%, SD 21.9%, range 13–100%.

Another way to characterise the levels of infant performance is to consider the numbers of infants who show clear instances of 'success' on each item. This also allows comparison with the results from 12-month-olds reported by Carpenter et al. (1998), which we cite here in order to examine the consistency of the two sets of findings. For these purposes, 'success' was defined *a priori* as a score of 3 or 4 out of a maximum 4. Taking the numbers of infants who achieved 'success' on critical social items in turn: following a point, 20 out of 28 infants (compared with Carpenter et al., 1998: 17 out of 24); following gaze, 9 out of 28 infants (compared with 11 out of 24); showing requesting gestures, 15 out of 28 on one of two tasks, and 5 on both

(compared with 9 out of 24); and sharing experiences with mother for *either* the Chinese bell *or* the approaching toy car, 20 out of 24 (compared with 23 out of 24 infants demonstrating showing or giving in rather different settings used by Carpenter et al., 1998). On each of the three non-social tasks (i.e., those requiring understanding of means-ends relations and object permanence), the numbers of infants in the present study achieving 'success' were between 15 and 17 out of 28, compared with the 14 out of 24 infants who succeeded in the test of object permanence in Carpenter et al. (1998). In each respect, therefore, the very close correspondence between the present results and those reported by Carpenter et al. (1998) suggests that the present procedures, although derived independently, yielded findings that were in accord with those from the earlier study.

### (b) Profiles of performance

The principal aim of this study was to examine whether maternal sensitivity and intrusiveness make a difference to the *profile* of abilities and propensities of infants. We assessed whether maternal relatedness was associated with an infant's triadic social relations *vis-à-vis* that same infant's performance on non-social tasks that also required attentiveness, cognitive ability, and behavioural/executive organisation. Thus our primary focus was on whether maternal relatedness affected individual infants' scores on the social *vis-à-vis* non-social items, a reflection of their abilities/propensities in one domain relative to the other. The infants' mean 'social minus non-social' difference score, calculated by subtracting each infant's non-social from the social score (in percentages), was  $-17.6\%$  (SD 29.5%), with a range of  $-78\%$  to  $+43\%$ .

It is important to recognise that with the present design, we cannot infer whether maternal sensitivity affects general aspects of infant behaviour and/or cognitive ability. The reason is that we do not have an estimate of an infant's potential according to which we might judge whether such potential is lessened or augmented in any particular case. The design has the more specific aim of comparing individual infants' profiles of performance on social and non-social tasks.

### (c) Secondary Intersubjectivity Scores for infant-stranger interactions

The correlations between maternal sensitivity and intrusiveness on the one hand, and individual infants' 'social minus non-social' difference scores on the other, were each significant at the level of  $p < .05$  (the correlation being positive for maternal sensitivity and negative for maternal intrusiveness). The results appear in Table 2, together with the correlations between maternal sensitivity and

**Table 2** Correlations between ratings of maternal sensitivity/intrusiveness and measures of infant performance

	Infants' difference scores	Breakdown of infants' difference scores <sup>a</sup>	
	Social minus non-social scores	Scores on 'social' tasks	Scores on 'non-social' tasks
Maternal sensitivity	+.38*	+.38	-.17
Maternal intrusiveness	-.40*	-.26	+.31

\* $p < .05$ , two tailed. <sup>a</sup> Exploratory analyses ( $p$ -values not computed).

intrusiveness and scores on the social and non-social tasks considered separately.

It has been argued (e.g., Mundy & Gomes, 1998) that it may be appropriate to distinguish among those aspects of triadic interaction in which an infant initiates joint attention, initiates behaviour regulation (i.e., makes requests), and responds to the joint attention bids of others. In the present setting, infant initiation of joint attention was tested in the context of interactions with the mother (to be reported later in the paper); and when scores on the two tests that most clearly represented infant requesting (the bubbles and spinning toy items) were separated from those that represented infant responses to adult bids for joint attention (the gaze-following and point-following items), and correlations with maternal sensitivity and intrusiveness were computed, the patterns of correlation for each set of scores were broadly in keeping with those given in Table 2. Although the present study was not designed to address possible distinctions in these respects, therefore, it was not the case that the correlations reported were restricted to specific aspects of triadic relations.

#### (d) Regression analyses

In order to examine whether the relations between maternal sensitivity and intrusiveness and infant behaviour were affected by the factors of social class, ethnicity, single parenthood (in the sense of the mother not cohabiting with a partner), or infant sex, we conducted separate linear regression analyses in each respect. The modest sample size precluded a hierarchical regression analysis, but multiple analyses obviously increase the chance of arriving at false positive results. We conducted the analyses not because we expected the demographic factors to affect the observed correlations – we did not – but rather, to exclude the possibility that these factors might account for the initial findings.

In the event, maternal social class, ethnicity, cohabiting status, and infant sex did not lead to a significant lowering of the correlations between maternal sensitivity and intrusiveness on the one hand, and infant 'social minus non-social' scores on the other, with one exception (out of the 8 analyses conducted): the correlation between maternal intrusiveness and the 'social minus non-social' scores was lowered from  $-.4$  to  $-.36$  ( $F$  change  $p < .05$ ) when cohabiting status was taken into account. As a

further check on the results, we conducted correlational analyses on the majority subgroups for social class (i.e., computing the correlations for the 22 mothers in social class I–II) and for ethnicity (i.e., for the 21 Caucasian mothers). Within the high social class subgroup, the negative correlation between maternal intrusiveness and infant 'social minus non-social' scores remained significant, and the positive correlation between maternal sensitivity and infant 'social minus non-social' scores ( $+.39$ ) just failed to reach significance; and within the Caucasian subgroup, the pattern of significant correlations was unchanged.

It is important not to place too much weight on the one significant, albeit relatively modest, effect of the variable of cohabiting status in lowering the correlation between maternal intrusiveness and infant 'social minus non-social' scores, especially given the number of analyses conducted. However, it seemed worthwhile to explore this result further, in case it might lead to suggestive findings for future study. On inspection of the correlations within the two subgroups of 22 cohabiting mothers and 6 single-parent mothers, the most striking results were in the latter group of mothers. In particular, the correlations between maternal intrusiveness and infant scores on both the social and non-social tasks were very modest for the cohabiting mothers ( $-.06$  and  $+.18$  respectively, leading to a correlation of  $-.20$  for the 'social minus non-social' scores), but for the single mothers, maternal intrusiveness had a large negative correlation of  $-.82$  with infant social scores and a large positive correlation of  $+.82$  with infants' non-social scores, leading to a correlation of  $-.92$  with the 'social minus non-social' scores.

#### (e) A further approach

A further approach to examining the results was to categorise individual infants according to their ability to achieve unmistakable instances of 'success' on each class of item in the Secondary Inter-subjectivity Schedule. On inspection of the scores, it appeared that the most informative categories were as follows: (i) at least three scores of 3 or 4 on the four non-social items ( $n = 17$  out of 28), and (ii) at least three scores of 3 or 4 on the five social items ( $n = 12$  out of 28). We then compared the mothers of those 9 infants categorised as unsuccessful on the social items but successful on the non-social tasks,

with the remaining 19 infants who did not show this profile of low scores *specifically* in the social domain. Compared with mothers of the latter group, the mothers of the infants showing relatively lower success in the social domain had significantly lower scores for sensitivity (mean score 1.6 out of 4, SD 1.1, compared with mean 2.6, SD 1.2;  $t = 2.1$ ,  $df = 26$ ,  $p < .05$ , two-tailed) and near-significantly higher scores for intrusiveness (mean score 2.8 out of 5, SD 1.4, compared with mean 1.7, SD 1.3).

#### (f) Infant triadic relations with the mother

It should be noted that, since there were only two conditions completed with the mother, namely the Chinese bell and remote-controlled car, each scored between 0 and 4 (mean total score 3.7 out of 8, SD 2.4), the data for these correlations were limited. Unsurprisingly, correlations between maternal variables and infant performance on these items were not significant according to two-tailed tests, but were in the same direction as those already recorded: the Pearson correlation with maternal sensitivity was  $+0.33$  and the correlation with maternal intrusiveness was  $-0.15$ . There were 6 infants who looked to their mothers on both the items (i.e., scored 3 or 4 on each item), and 8 infants who did so on neither item; exploratory inspection of the data revealed that the mothers of the former group were given mean scores of 2.8 (SD 1.5) for sensitivity and 1.8 (SD 1.3) for intrusiveness, whereas the mothers of the less socially engaged infants were given mean scores of 1.8 (SD 1.2) for sensitivity and 2.3 (SD 1.5) for intrusiveness.

## Discussion

The present study has yielded evidence that around the end of the first year of life, infants' propensity to engage in triadic, person-person-world relations with an adult is related to the sensitivity with which their mothers relate to the infants themselves, at least in certain circumstances. Here we assessed mothers' styles of relating by asking them to teach their infants how to use a toy train. We tested infants' propensity for triadic interaction with a stranger by presenting items that prompted infant requests for actions (blowing bubbles and spinning a top), gaze- or point-following, and joint and reciprocal action (play with a ball). We also conducted tests of infants' propensity to share experiences with their mothers in settings of joint attention (a Chinese bell ringing) and social referencing (an approaching remote-controlled car). In order to assess the specificity of any findings in the social domain – and to exclude the possibility that non-specific factors such as infant inattentiveness or non-social cognitive ability were determining the pattern of results – we tested infants' abilities to accomplish non-social

tasks involving understanding of object permanence and means-ends relations.

In the event, there was evidence that with respect to both of our partly overlapping measures of maternal sensitivity on the one hand, and maternal intrusiveness on the other, there were meaningful correlations with specific profiles of infant performance on the social and non-social tasks with the stranger. These profiles were represented by infant 'social minus non-social' difference scores, which were calculated by deducting each infant's score on the non-social items from the score of that same infant on the social items of the Secondary Intersubjectivity Schedule. The 'social minus non-social' scores were positively associated with maternal sensitivity, and negatively associated with maternal intrusiveness. The pattern of results indicated that high maternal sensitivity and/or low intrusiveness tended to correlate with relatively more triadic social engagement by infants, a finding that was specific in relation to the modest (and sometimes negative) correlations with infant scores on the non-social tests of object permanence and means-ends understanding.

Subsequent exploratory analyses revealed that these significant correlations were unaffected by maternal social class and ethnicity, but there was suggestive evidence that the correlations were more marked in the small subgroup of mothers ( $n = 6$ ) who were living alone with their infants. Although the evidence was very tentative, given the small numbers of mother-infant pairs involved, there was a suggestion that in this latter group, high intrusiveness was correlated not only with low triadic social engagement by the infant, but also with relatively high scores on the non-social tasks. If this finding were to be replicated, it might suggest that under some circumstances, infants may turn away from insensitive/intrusive engagement and focus upon (and selectively develop) their interactions with the world of things.

In considering these results, it is important to remember that there was a high negative correlation between maternal characteristics of sensitivity and intrusiveness. At the outset we recognised that these qualities are by no means totally independent, although it is possible to be insensitive by withdrawing from rather than intruding upon one's infant. We employed the two separate ratings for the reason that raters were invited to adopt a different orientation when making the two kinds of rating, and because we were interested in the specifically intrusive kind of relating. On the other hand, it should be recognised that each of the two measures had a degree of redundancy with respect to the other, and so they amounted to two somewhat different 'takes' on closely related qualities of maternal relatedness.

It is noteworthy that the performance of the infants of mothers on the Secondary Intersubjectivity Schedule was similar to that of the infants tested by

Carpenter et al. (1998). For example, 17 out of the 28 infants showed unmistakable success on the non-social tests of our study, compared with 14 out of 24 of the 12-month-olds tested by Carpenter et al. (1998) who showed understanding of the object concept; and 15 out of 28 of our infants made unmistakable requests on at least one of two opportunities, compared with 9 out of 24 infants in the Carpenter et al. study. These comparisons suggest consistency in the profiles of performance on different and independently derived (but related) methods of testing infant triadic relations.

There is, of course, a question that might be raised concerning the direction of causation between maternal sensitivity/intrusiveness and the infants' propensity to engage in triadic relations with the stranger (and probably, the mother). A correlation does not establish a direction of causation, and from the results reported here it is not possible to know whether a mother's intrusive and/or insensitive style of relating to her infant leads to the infant's lowered propensity to engage in triadic relations, or whether such maternal relatedness is elicited by constitutional infant characteristics, or whether some other mediating variable is involved. If constitutional factors were involved, then these were not of a kind to affect social and non-social development in a general way. In particular, infants' abilities to attend to, comprehend, and organise their responses to the tests of means-ends and object permanence understanding were at least in part dissociable from their abilities/propensities in the tests of triadic relations. Longitudinal studies are needed to shed further light on these issues.

Finally, it is relevant to consider the possible implications of the results. Infant triadic relatedness appears to be an important way-station between person-to-person social engagement in the early months of life, and symbolic and linguistic functioning that emerges in the course of an infant's second year. As Carpenter et al. (1998) have described, Bruner's (e.g., 1983) seminal work in this domain tended to stress the significance of caregivers' techniques of enhancing or scaffolding an infant's joint activity and joint attention in relatively predictable formats of co-ordinated action and communication; but of equal importance are a range of cognitive, motivational and self-regulatory factors 'in the infant' that may influence the child's propensity and ability to engage with someone else in triadic settings (Mundy & Willoughby, 1996; and Raver & Leadbeater, 1995, for a systemic view). This is suggested by the exceptional case of autism, where limitations in one-to-one interpersonal engagement are associated with delays in and sometimes relative absence of joint attention and social referencing, and subsequent delays and often deviance in symbolic and linguistic functioning (e.g., Mundy, Sigman, & Kasari, 1990; Wimpory et al., 2000). In the case of typical development, where attachment status

(which is itself related to parental sensitivity) bears a relation to developing language and other symbolic skills, we need to consider the possibility that the implications of parental input for infant development are mediated *both* by continuities in the effects of sensitive adjustment to infant state – for example, individual differences in parents' sensitivity towards their infants may sometimes extend to later settings of language-learning – *and* by effects on infant availability and motivation for those forms of interpersonal engagement that promote learning.

The present study contributes to this area of study, by suggesting that one mechanism by which parental sensitivity/intrusiveness may have an impact on subsequent development is through effects on an infant's propensity to turn towards the adult and make or respond to bids for engagement in relation to objects and events in the world. In other words, an infant who has experienced sensitive and non-intrusive care may be more likely to turn to another person, whether a stranger or parent, to request things or establish joint attention, whereas one who has not may tend to restrict attention to the non-social world.

The implications for subsequent social and cognitive development might be considerable. As Raver and Leadbeater (1995, p. 251) observe, 'Infants' skill in negotiating bouts of joint visual attention may well be among the building blocks of...early social partnerships.' With regard to other aspects of communicative and linguistic development, the study by Carpenter et al. (1998) yielded evidence that there was a strong correlation between the amount of time mother-infant dyads spent in joint-attentional engagement at the end of the first year of life, and infants' gestural communication and word comprehension. Although much remains to discover about the sources and implications of individual differences in infant joint attention, it appears that here is a fulcrum for early development – one fashioned by social-emotional as well as cognitive forces.

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## Appendix 1: Ratings for maternal teaching task (adapted from Murray et al., 1996)

### Sensitive–insensitive

A very sensitive mother is, firstly, aware of even very subtle infant signals and of his/her willing-

ness for interaction or reluctance to interact; secondly, she empathises and identifies with her infant and understands (correctly) what response he/she is looking for or is needing at that particular moment; finally, she acts and responds in an appropriate way. For example, she does not cut gaze when her infant is obviously wanting to keep eye contact and he/she is in the middle of communication; she does not criticise her infant's interest in the environment; she does not block her infant's expressions of sadness and distress, nor are her responses to his/her negative states 'too extreme' since when this happens the mother fails to help the infant's recovery; she never laughs at her infant; and she never acts intrusively to block her infant's communication.

Overall, sensitivity has to do with *awareness* of the infant's state, together with appropriate *adjustment* to this. It mostly involves a 'warm' and accepting attitude, even though the mother may require things of her infant. In a sense, the sensitive mother is (potentially) 'linked in with' her infant, and aligned with his/her feelings and orientation.

**Ratings:** 4 = 'Very sensitive'; 0 = 'Least sensitive'.

### Intrusive–non-intrusive behaviour

This characterises the extent to which the mother's actions (interventions) cut across, take over or disrupt the infant's activities. A mother is also rated as intrusive when her demands for interaction, or for the infant's attention when he/she is self-absorbed or looking actively away, are very insistent.

Overall, the focus here is on whether the infant is allowed his/her own 'mental space'.

**Ratings:** 4 = 'Very intrusive'; 0 = 'Non intrusive'.