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## **The social correlates of co-ordinated attention to adult and objects in mother-infant interaction\***

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### ABSTRACT

Co-ordinated attention to objects and adults is positively associated with later language development in children with and without disabilities. This relationship may occur because of social correlates of co-ordinated attention, which may in turn facilitate language development. This study investigated two potential social correlates of co-ordinated attention. Both of them have been suggested to have a role in facilitating later language development.

The purpose of this study was to test two hypotheses. First, we expected a positive relationship between infants' use of co-ordinated attention and mothers' attributions of communication to their infants' behaviour. Second, we expected mothers to respond to a cluster of behaviours they identified as communicative more often when the cluster contained at least one instance of co-ordinated attention than when the cluster showed no co-ordinated attention. Mothers and coders analysed the free play interactions of 16 mother-infant pairs. First, mothers indicated their infants' communicative behaviours. Then, coders identified: (a) instances of co-ordinated attention to an object and person, (b) types of infant behaviours observed in mother-identified infant communication, and (c) responses to infant behaviours that mothers identified as communicative. The results supported both hypotheses. Implications of the results are discussed.

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Harding (1983) suggests that parental attributions of communicative value to an infant's behaviours motivate parental responding to such infant behaviours. Harding's model further states that it is the attribution of communication, not the occurrence of behaviours that fit an *a priori* definition of communication, which motivates maternal responding (Harding 1983). Goldberg (1977) posited that mothers tend to attribute communicative value to, and thus respond to, clear communicative behaviour more than to unclear communicative behaviour. In this paper, 'clear communicative behaviour' is a set of infant behaviours from which the mother can confidently infer her infant's intentions, thoughts or feelings. When mothers respond more to clear communicative behaviours than to unclear communicative behaviours, they provide children with information concerning which behaviours are most successful in communicating their messages (Golinkoff 1986). When infants find that clear communicative behaviours result in communicative success more than unclear communicative behaviours, they may begin to use such clear communicative behaviour more often (Harding 1983). These clear communicative behaviours may, in turn, elicit from adults the type of linguistic input that helps children learn to use spoken words to communicate their messages. For example, Yoder, Warren, Kim & Gazdag (in press) found that parents and teachers of children with disabilities say what they think children are communicating after clear communicative behaviour more often than after less clear communicative behaviour. In another study with developmentally delayed children, parents' selective responding to the children's most developmentally mature communicative behaviour facilitated the children's language development (Wilcox, Shannon & Bacon 1992). Therefore, infants' use of clear communicative behaviour may stimulate mothers to use linguistic input that may facilitate the infants' language development.

Infant behaviours that show co-ordinated attention to the adult listener and to the object the infant is communicating about may be one type of clear communicative behaviour. Co-ordinated attention is the simultaneous or sequential showing of attention to an object and a person. Examples of co-ordinated attention are: (a) shifting one's gaze from an object to a person and back to the object, and (b) showing or giving an object to a person. Co-ordinated attention is a clear communicative behaviour because it makes the content of the infant's message visible in a way that clearly includes the recipient of the message (Sugarman 1984).

Empirically, children who use co-ordinated attention more often to communicate also learn to talk earlier in their development (Bates, Benigni, Bretherton, Camaioni & Volterra 1979, Mundy & Kasari

1989, Mundy, Sigman & Kasari 1990, Smith & von Tetzchner 1986). For infants who are normally developing, co-ordinated attention in the prelinguistic period predicts later language level (Bates *et al.* 1979). This predictive relationship between co-ordinated attention in the prelinguistic period and language level 12 to 13 months later has been replicated for infants who exhibit mental retardation (Mundy & Kasari 1989, Smith & von Tetzchner 1986) and autism (Mundy *et al.* 1990).

One reason why this relationship may occur is that co-ordinated attention may have social correlates that in turn influence later language development. In this paper, we will address two possible social correlates of co-ordinated attention: maternal attributions of communication and maternal responses to infant behaviour.

Mothers of infants who frequently exhibit co-ordinated attention may frequently attribute communicative value to their infants' behaviour. One reason for this pattern may be that infants who frequently exhibit co-ordinated attention may be seen as frequent communicators by their mothers. Once the infants are seen as frequent communicators, mothers may increase the number of attributions of communication to many of their infants' behaviours, including those without co-ordinated attention. Another possibility is that co-ordinated attention is a particularly salient communicative behaviour that is more likely to elicit maternal communicative attributions than are many other infant behaviours. Either of these mechanisms would result in a positive relationship between co-ordinated attention and maternal attributions of communication. The difference between these two theoretical models is that the former suggests that mothers attribute communication to co-ordinated attention behaviour more than to other types of infant behaviour; the latter does not.

Another correlate of co-ordinated attention may be maternal responses. Mothers may respond more often to a communicative behaviour that contains co-ordinated attention than to other types of communicative infant behaviour. This may occur because acts with co-ordinated attention may be easier to interpret than a communicative behaviour that does not contain co-ordinated attention. The infants' act of directing behaviour to mother and including attention to an object or activity may convey to the parent that the infant expects her to do something or say something about the object or activity of interest. Prelinguistic communication behaviours that show attention to an object, but not to the mother (or any other person), may not convey to the mother that the infant expects her to do something. Also, prelinguistic communication behaviour that shows attention to the mother, but not to any object or activity, may not convey information about what the infant wants the adult to do.

While these social correlates of co-ordinated attention may seem obvious, there is currently no empirical evidence of a relationship between infant co-ordinated attention and maternal attributions of communication to their infants' behaviour. Additionally, no studies have investigated whether mothers of infants who are developing typically are more likely to respond to communicative acts with co-ordinated attention than to other types of communicative behaviour.

We tested two hypotheses in this study. First, we expected a positive relationship between the number of times infants used co-ordinated attention and the number of attributions of communication mothers made to their infants' behaviour. Second, we expected mothers to respond to infant behaviours they considered communicative more often if the infant behaviour contained at least one instance of co-ordinated attention than if it did not.

## METHODS

### *Subjects*

Sixteen mother-infant pairs were recruited through parent information packets at local paediatric clinics in a small university town. Parent report indicated no evidence of hearing or visual impairments. The mean Bayley (1969) Mental Development Index score was 118.19 (SD = 10.09). Half the infants were male. Fourteen (87.5%) of the infants were white; one was black and one was Asian. Nine (56.25%) infants were first-born; five (31.25%) were second-born and the remaining two were third- and fourth-born. The infants were approximately 10 months (mean = 10.4 months, SD = 0.52, range = 9.3–11.33). Bakeman & Adamson (1984) found that infants typically begin to display co-ordinated attention between 9 and 12 months.

The mean age of participating mothers was 29.98 years (SD = 3.91). All mothers had some college training. Seven mothers were low-middle socio-economic level; the remaining mothers were middle socio-economic level based on maternal report of family income.

### *Procedures*

*Mother-infant interaction session* The setting for the 20-minute mother-infant interaction session was the carpeted area of a play room. Camera placement allowed recording of behaviours of both mother and infant. One camera was sufficient for detecting the hypothesized relations. Off-screen behaviours were not coded. Figure 1 indicates the toys and lay out of the play room.

Just prior to the mother-infant interaction session, mothers were

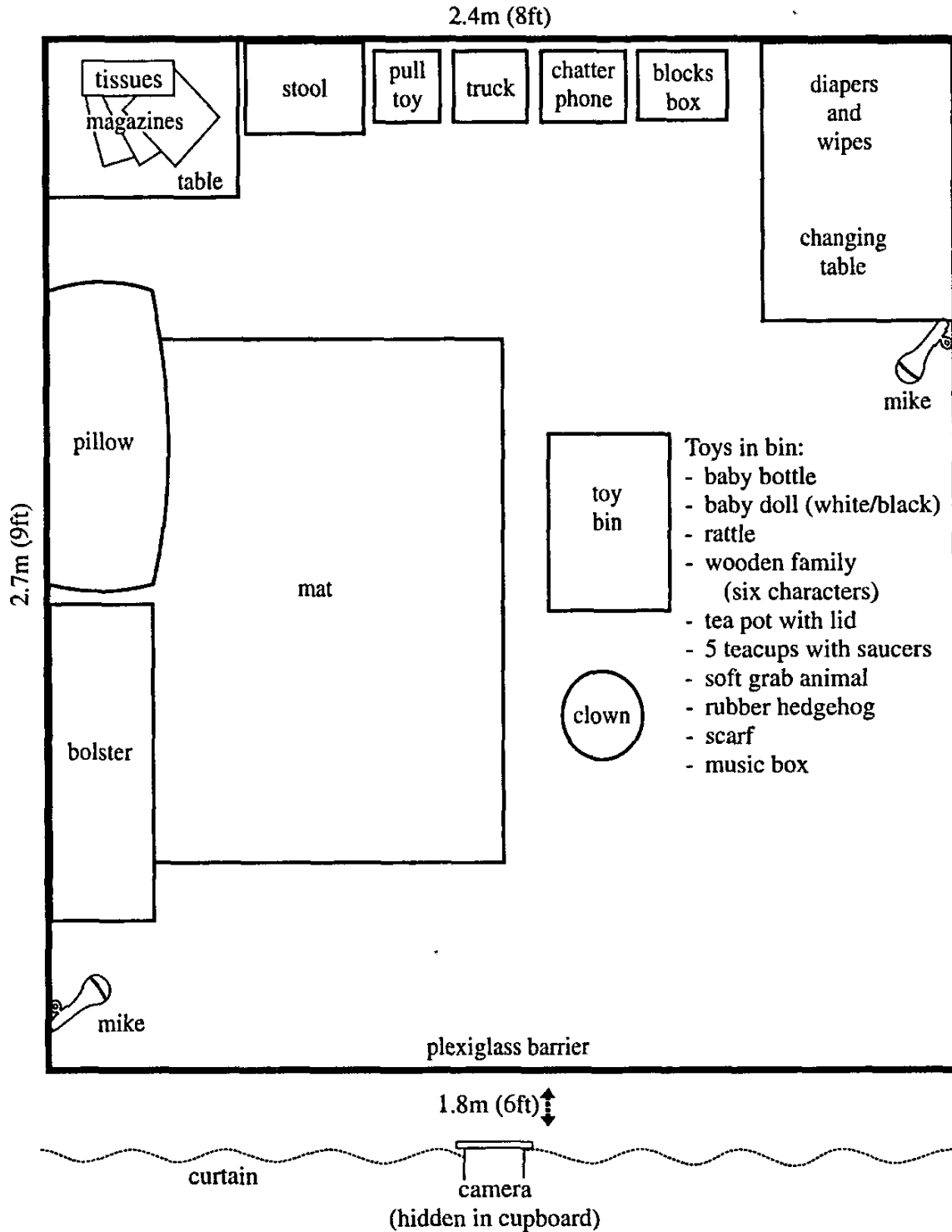


Fig. 1. Physical layout of the measurement setting for the mother-child interaction session

given the following instructions: 'We are interested in how babies play with toys and their mothers. Play with your baby as you would if you were at home.' Following a three-minute warm-up session, a staff member videotaped the mother-infant interaction session for later analysis. If an infant was crying, the staff delayed videotaping until crying had ceased.

*Mothers' identification of infant communication* To measure the rate of maternal attributions of communication, we asked each mother to view the first 10 minutes of her videotaped interaction session. Only the first 10 minutes were used, to reduce the demand on mothers' time and effort. A research assistant played with the infant in another room while the mother completed this procedure.

Immediately following the videotaping session, we instructed mothers to identify when they believed their infants communicated, by pushing a button on the data-collection device (OS3 by Observation Systems). The exact instructions given to the mothers were as follows: 'Since you know your baby better than we, we are particularly interested in when you think your baby is communicating. So I'd like you to watch the first 10 minutes of the session that you just completed and push the button each time your baby communicates.' Originally Newtonson (1976) developed this method to study attributions of causality. Adamson, Bakeman, Smith & Walters (1987), Yoder (1986) and Yoder & Feagans (1988) adapted this method to measure maternal attributions of communication. The number of times the mother pushed the button was the measure of the number of mother-identified infant communication acts.

After mothers identified instances and beginnings of their infant's communications, coders identified the endings of these mother-identified infant communications. Coders were trained by the first author to 80% reliability before beginning coding. Coders were blind to the hypotheses. The first author made periodic inter-observer agreement checks, and coders were retrained if reliability was below 80%.

*Determining the end of mother-identified infant communication* Coders, instead of mothers, were used to determine the end of the mother-identified infant communication. Pilot testing (Yoder 1985) and past research (Newtonson 1976) indicated mothers were not reliable in identifying the end of their infants' meaningful segments of behaviour as indicated by brief-interval test-retest procedures. In contrast, pilot testing (Yoder 1985) indicated that coders could agree with themselves and with each other in identifying the end of communication segments.

In the present report, coders used shifts in infant attention to code

the end of the infant communication. This method of defining the end of infant communicative behaviour resulted in acts of varying lengths. The length of a cluster was not related to any other variable reported in this study. In addition, a second method of ending the communicative event using a fixed five-second segmenting criterion provided nearly identical results to those using the thematic criterion reported here (Yodër 1985).

Therefore, mother-identified infant communication began at the time of occurrence of each maternal button press and ended immediately following a shift in the infant's focus of attention. We refer to the clusters of behaviours that mothers identified as communicative as 'communicative behaviour clusters'.

*Types of behaviour coders observed in mother-identified infant communication* Trained coders again viewed the videotapes to categorize the contents of the communicative behaviour clusters for the types of infant behaviour contained in the clusters. Coders were blind to the hypotheses of this study. The communicative behaviour clusters were categorized into two classes: those containing co-ordinated attention and those without co-ordinated attention.

The operational definition of co-ordinated attention was the simultaneous or sequential showing of attention to the mother and an object or event. Attention to an object or mother could be shown through gaze direction or touch. Coders did not classify as co-ordinated attention instances in which the mother said or did something to elicit the infant's attention to the mother or toy. This latter class of behaviour was not coded because it could occur without the child actively co-ordinating attention to the adult and object. For example, when a child is playing with an object and she looks at the adult in response to the adult saying her name. Immediately, the child returns to her previous activity. The simplest explanation for this example is that the adult interrupted the child's play, which the child wished to continue.

*Responses to infant behaviours mothers called communicative* Coders used a two-step process to code whether mothers responded to infant communicative behaviour clusters. First, using the mothers' information about the location of communication behaviour clusters, coders located the infant communicative behaviour cluster on the videotape. Second, coders observed whether the mother responded to any of the infant behaviours in the behaviour cluster.

A mother's behaviour was considered a 'response' when: (a) it followed an infant communicative behaviour cluster, and (b) it imitated, complied with, or explicitly acknowledged the infant behaviour. Scores



derived for the analyses were: (a) number of mother responses / number of infant communicative behaviour clusters with co-ordinated attention, and (b) number of mother responses/number of infant communicative behaviour clusters without co-ordinated attention.

*Rate of co-ordinated attention to an object and a person in mother-infant interaction session* Coders recorded the number of instances of co-ordinated attention that occurred during 20 minutes of the mother-infant interaction session. The operational definition of co-ordinated attention is given above in the section on coding the types of behaviour coders observed in mother-identified infant communication.

*Reliability* The first author computed inter-observer reliability for the variables derived from the trained coders' observations of the videotapes. An independent observer coded a random sample of 25% of the subjects' data to estimate inter-observer reliability. We used intraclass correlation coefficients as the reliability coefficients because it allowed us to estimate summary level reliability while correcting for chance agreement in highly variable data (Berk 1979, Mitchell 1979).

Inter-observer reliability estimates were as follows: (a) rate of co-ordinated attention, 0.98, (b) proportion of mother-identified infant communication with co-ordinated attention, 0.87, (c) proportion of mother-identified infant communication without co-ordinated attention, 0.90, (d) proportion of mother-identified infant communication with co-ordinated attention to which mothers respond, 0.80, and (g) proportion of mother-identified communicative behaviour without co-ordinated attention to which mothers respond, 0.65. Mitchell (1979) considers intra-class correlation coefficients above 0.60 to be adequate for most purposes. Although some readers would disagree with the 0.60 standard, low reliability reduces the probability of finding differences or relationships that really are in the population (Pedhazur 1982).

Test-retest reliability was calculated for mothers' attributions of communication to measure the stability in the frequency with which they thought their infants communicated. Test-retest agreement across 2 weeks on the same session for the number of mother-identified communicative behaviours in a random subsample of 19% of the mothers averaged 81% (67%–93%). Test-retest agreement is more appropriate for the measure of maternal attributions of communication than is inter-observer agreement because Harding's (1983) theory suggests that mothers' perception of what is communicative in their babies' behaviour is important, even if their perception differs from our definition of communication.

TABLE 1. *Means and standard deviations for the variables in the study*

Variables	Mean	SD
Rate of mother-identified infant communication	2.3	1.4
Rate of co-ordinated attention	1.1	0.55
Proportion of infant communicative behaviour clusters with attention to toy and mother	0.40	0.22
Proportion of infant communicative behaviour clusters with other behaviours	0.60	0.23
Proportion of infant communicative behaviour clusters with co-ordinated attention to which mothers responded	0.95	0.06
Proportion of infant communicative behaviour clusters without co-ordinated attention to which mothers responded	0.70	0.31

## RESULTS

### *Descriptive statistics*

Table 1 provides descriptive statistics for variables involved in testing the hypotheses. Mothers identified an average of 23 instances of communicative behaviour in the 10-minute interaction session. Coders identified a mean of 40% of these maternal attributions of communication as containing co-ordinated attention. Mothers responded to 95% of these. On the average, infants used co-ordinated attention about 1.1 times per minute.

### *Testing the hypotheses*

As predicted, the number of times the mothers said their infants communicated was positively related to the rate that their infants used co-ordinated attention between mother and toy (Pearson's  $r = 0.74$ ;  $p < 0.01$ ). Squaring this coefficient gives an estimate of the percentage of variance shared by maternal attributions and the rate of co-ordinated attention (Pedhazur 1982). The rate of co-ordinated attention accounts for over 50% of the variance in the rate with which the mothers said their infants communicated during a free play session.

The results also confirm the second hypothesis. Most of the mothers (12/14, N reduced due to 2 ties) responded more to infant communicative behaviour clusters containing co-ordinated attention than to those without coordinated attention (sign test  $p = 0.005$ ). It should be noted in Table 1 that the amount of the difference in responsivity to the two different types of communicative behaviour

clusters is 0.25. This difference is significant at the 0.05 level using a paired *t*-test ( $t(13) = 3.74$ ).

## DISCUSSION

The current study found a positive association between co-ordinated attention and mothers' attributions of communication and responses. Both findings add to our knowledge of how children and parents may influence each other. They also add to our knowledge of what variables account for variance in individual differences in the extent to which mothers attribute communicative value to infant behaviours. Previous work indicates that adults attribute communication more often when the child they are viewing is older than when the child is younger (Hyche, Bakeman & Adamson 1992). This could occur because developmentally older children have more co-ordinated attention than developmentally younger children (Bakeman & Adamson 1984).

The second major finding of the present study was that mothers respond to infant behaviours they consider communicative more often if the infant behaviour shows co-ordinated attention than if it does not. This finding supports Goldberg's (1977) model that mothers respond to clear communicative behaviours more than to unclear ones. This is consistent with the finding of Yoder *et al.* (in press) that mothers and teachers of children with disabilities use a particular type of response more often after intentional communication than after pre-intentional communication. In the Yoder *et al.* study (in press), intentional communication had co-ordinated attention; pre-intentional communication did not.

In the introduction, we pointed out the relationship between co-ordinated attention and later language level. The present findings add to the body of empirical support for the hypothesis that this relationship may, in part, be due to mothers' interpreting and responding to co-ordinated attention more often than to other infant behaviours. Goldberg (1977) and Harding (1983) suggest that such selective responsiveness facilitates language development. Several studies have shown that responsiveness is positively associated with many aspects of later child competence, including language development (Yoder 1990). Additionally, an intervention based on differential responsiveness to the child's most developmentally mature communicative behaviours resulted in language development in children with disabilities (Wilcox *et al.* 1992). Future work is needed to determine if such selective responsivity facilitates language development in typically developing children, but Harding's and Goldberg's theories suggest that it does.

However, any concurrent correlational study allows alternative explanations for the results obtained. For example, one may point out that co-ordinated attention (Bakeman & Adamson 1984) and attributions of communication (Hyche, Bakeman & Adamson 1992) increase with age. Therefore, general maturation is a possible unmeasured covariate that could explain this relationship. However, we do not think it is this simple. The infants in this report were all within 2 weeks of 10 months old and had MDIs within the normal range. Therefore, it is unlikely that they varied much in their general developmental and maturational levels. The relationship between mental age and the number of maternal attributions in the present study is non-significant. There are, of course, other possible unmeasured covariates which may explain the relationship between infant co-ordinated attention and maternal attributions of communication.

The need to control such unmeasured variables is the main reason for well controlled experiments to determine whether the relationship between co-ordinated attention and maternal attributions of communication is a causal one. For example, one would have to manipulate co-ordinated attention (i.e., elicit or teach infants to use more co-ordinated attention) to determine whether its presence influences the frequency with which mothers say their infants communicate. Alternatively, maternal responsiveness may affect infant co-ordinated attention. We could test this hypothesis by manipulating maternal responsiveness and observing whether infant co-ordinated attention changed over time.

In summary, the current study provided important support for the positive relationship between infant co-ordinated attention and maternal attributions of communication and responsiveness. The results are a step in the direction of determining whether the development of co-ordinated attention has social, and eventually developmental, consequences for infants. Future experimental research is needed to determine whether the relationships are causal and, if so who affects whom.

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