

## BRIEF REPORT

# ***FOLLOWING THE DIRECTION OF GAZE AND LANGUAGE DEVELOPMENT IN 6-MONTH-OLDS***

**Michael Morales**

**Peter Mundy**

**Jennifer Rojas**

*University of Miami*

This study examined the age of onset of the capacity to align with direction of gaze, and the relations between individual differences in this capacity and language acquisition. Infants demonstrated the capacity to match mother's direction of gaze, and individual differences in this capacity were related to vocabulary development.

---

gaze following   language development   joint attention

---

The capacity to apprehend and follow the gaze of others is regarded as a critical component of joint attention skills. These types of skills, in turn, are regarded as a fundamental aspect of early social communication development (Butterworth & Grover, 1990; Moore & Corkum, 1994; Mundy & Gomes, 1997; Scaife & Bruner, 1975; Tomasello, 1995). In part, this is because gaze following may contribute to social and cognitive interactive processes that facilitate language development.

Recently, studies have provided some support for a linkage between gaze following skill and language development in 14 to 17-month-olds (Mundy & Gomes, 1996; Mundy, Kasari, Sigman, & Ruskin, 1995) and even 12-month-olds (Willoughby & Mundy, 1997). However, it is still not clear at what age meaningful differences in development of the capacity to follow direction of gaze are first observable.

Scaife and Bruner (1975), for example, provided evidence suggesting two-month-old

---

• **Peter Munday**, Department of Psychology, Psychology Annex, University of Miami, P.O. Box 249229, Coral Gables, FL 33124-0721; e-mail: pmundy@umiami.ir.miami.edu.

---

infants shifted their direction of gaze to match that of the experimenter. Similarly, Butterworth and colleagues (Butterworth & Cochran, 1980; Butterworth & Jarrett, 1991) found that six-month-old infants adjusted their line of gaze to match changes in their mother's focus of attention. However, Corkum and Moore (1998) and Morissette, Ricard, and Gouin-Decarie (1995) found that it was not until between 10-12 months of age that infants reliably demonstrated the capacity to follow direction of gaze. Corkum and Moore (1998) suggested that one reason for the discrepancy in age may be that studies finding ages of onset prior to 10 months reported only the frequency or percentage of matches with an adult model's direction of gaze, and ignored the number of trials that an infant mismatched a model's direction of gaze.

The present study was designed to examine the age at which infants reliably demonstrated the ability to follow direction of gaze, and to explore the degree to which individual differences in this capacity in the first 12 months of life may be related to subsequent language acquisition.

The prototypical joint attention paradigm (Scaife & Bruner, 1975) was used to assess infant's capacity to follow gaze. However, two modifications were made. First, mothers were used in place of an experimenter because it seemed reasonable to assume that infants were accustomed to engaging in joint attention with their mothers, and as such, would be more likely to respond to her cues than to those of a stranger.

Second, mothers were instructed to say their child's name three times following each head turn. This seemed to be a much more natural situation for the infant, and one that would likely elicit more infant responding than the procedure generally used. In the prototypical joint attention paradigm, the experimenter or mother stops suddenly in the middle of her interaction with the infant, and turns her head in silence in a prespecified direction.

Beyond these procedural modifications, a second unique aspect of this study was the

examination of the degree to which individual differences in joint attention behavior at six months of age were related to early language development. Although a number of studies have found significant associations between joint attention and early language (e.g. Tomasello & Farrar, 1986; Willoughby & Mundy, 1997), no study has observed relations between joint attention behavior prior to 12 months of age and the acquisition of language.

Based on the extant literature, and our procedural modifications, we expected that infants as young as 6 months of age would demonstrate the capacity to follow changes in adult's direction of gaze. Also, based on current research linking joint attention to early language development, and the notion that the capacity to follow direction of gaze may serve as an early index of joint attention, we predicted that individual differences in this capacity at 6 months of age would be associated with the acquisition of language.

Participants were 21 infants (and their parents) participating in a longitudinal study of social-communication development. Infants' capacity to follow direction of gaze was assessed at six months of age. The infants came from two-parent middle to upper middle SES families (Hollingshead, 1978). Maternal education ranged from two years of college to postgraduate level, with the median educational level being four years of college. Eight of the infants were Caucasian (non-Hispanic), three were Hispanic, one was African-American, and nine were of multi-ethnic background, Hispanic and Anglo.

Infants and mothers were videotaped using two cameras in a 12 minute face-to-face interaction. One camera was stationed behind the mother facing the infant, and the second camera was stationed behind the infant facing the mother. At two points during the interaction, parents were instructed to present three consecutive trials to their infants in which they turned and fixated a target that was 90 degrees to the right or left of the infant, or 180 degrees behind the infant. During each parent head-turn trial, parents said the child's name

emphatically three times, but they maintained their head orientation and gaze on the referent target throughout the trial.

Two independent coders, who were blind to the language data collected in this study, rated videotapes for the direction of the first infant gaze or head turn in the horizontal plane to occur during each trial. A gaze or head turn was scored as a correct response if it was in the same direction of the parent's head turn. A gaze or head turn was scored as an incorrect response if it was in the opposite direction of the parent's head turn. The rating procedure yielded six infant response scores: The total number of trials that an infant's first response was correct (*range* = 0-6); the total number of trials that an infant's first response was incorrect (*range* = 0-6); the total number of left and right trials that an infant's first response was correct (*range* = 0-4); the total number of left and right trials that an infant's first response was incorrect (*range* = 0-4); the total number of behind trials that an infant's first response was correct (*range* = 0-2); and the total number of behind trials that an infant's first response was incorrect (*range* = 0-2). A sample of 10 subjects was randomly selected for reliability coding. Paired samples correlations calculated for first correct and first incorrect infant response were  $r(10) = .94$ ,  $p < .001$ , and  $r(10) = .71$ ,  $p < .07$ , respectively.

Infant response scores were used to compute a difference score for each infant to test whether or not infants reliably demonstrated the ability to match direction of gaze at 6 months (see Corkum and Moore, 1998). The difference score was calculated by subtracting the number of incorrect first responses from the number of correct first responses. In order for joint attention to be demonstrated, we required that infants show a difference score significantly greater than 0.

Additionally, a positive ratio score was calculated for each infant. The positive ratio score was computed by dividing the total number of trials that a correct response was displayed by the sum of the total number trials that a correct response was displayed and the total number

of trials that an incorrect response was displayed.

The MacArthur Communicative Development Inventory (MCDI; Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994) was used to provide parent report of their children's vocabulary development at 12, 18, 21, and 24 months of age. Toddlers' basic expressive and receptive vocabulary at 12 and 18 months, and their expressive vocabulary at 21 months, was assessed using the MacArthur Short Form Vocabulary Checklist: Level I. Basic expressive vocabulary at 24 months was assessed using the MacArthur Short Form Vocabulary Checklist: Level II.

To test if infants were reliably demonstrating the capacity to match direction of adult gaze, mean difference scores were calculated for left and right trials combined ( $M = 1.86$ ,  $SD = 1.53$ ), behind trials ( $M = -1.05$ ,  $SD = .74$ ), and total trials combined ( $M = .81$ ,  $SD = 1.94$ ). One-Sample *t* Tests (two-tailed) were conducted using mean difference scores. Results indicated that the mean difference score for left and right trials combined was significantly greater than 0 ( $t(20) = 5.58$ ,  $p < .0001$ ), while the mean difference score for behind trials was significantly less than 0 ( $t(20) = 6.49$ ,  $p < .0001$ ). Additionally, the mean difference score for all trials combined was marginally greater than 0 ( $t(20) = 1.91$ , *ns.*).

These findings suggest that a substantial number of 6-month-olds reliably demonstrated the capacity to match adult direction of gaze when parents fixated targets within the infants' visual field. However, infants were unable to follow adult direction of gaze when parents fixated targets outside (behind) the infants' visual field.

Pearson-Product Moment Correlations were conducted to examine the associations between individual differences in infant's ability to match direction of gaze and language acquisition. Language data were available for only 20 subjects. Findings indicated that individual differences in infant's ability to match direction of gaze, as indexed by positive ratio scores, was positively related to infant's receptive vocabu-

lary at 12 months,  $r(20) = .47$ ,  $p < .05$ , and to infant's expressive vocabulary at 18,  $r(20) = .46$ ,  $p < .05$ , 21,  $r(20) = .50$ ,  $p < .05$ , and 24 months,  $r(20) = .51$ ,  $p < .05$ . These data suggest that infants who showed a greater capacity to match direction of gaze at six months had larger receptive vocabularies at 12 months, and larger expressive vocabularies at 18, 21, and 24 months than those who either lacked or showed this capacity to a lesser extent.

Current research and theory have given rise to a debate regarding the onset of joint attention skills (e.g. Butterworth & Cochran, 1980; Corkum & Moore, 1998; Scaife & Bruner, 1975; Tomasello, 1995). The results of this study suggest that, by six months of age, a substantial number of infants may display joint attention skill development, as indexed by their ability to systematically match their mother's direction of gaze. It may be argued, however, that the capacity to match direction of gaze at this age does not reflect true joint attention development (Tomasello, 1995). This may be correct. For example, it was not clear to what degree vocal or postural cues influenced the capacity of infants in this study to align with the direction of their mother's gaze. Nevertheless, data from this study suggest that individual differences in the capacity to match direction of gaze as early as six months may be related to early language development, as much as 18 month later. Given theory that links joint attention to language development, this pattern of individual difference data is at least consistent with the hypothesis that the capacity to match direction of gaze at six months provides a valid index of some aspect of early joint attention skill development. Current theory, though, suggests that infants' cognitive capacity to understand intentional relations in interactions, which emerges in the second year, may be critical to the linkage of joint attention process with language (Tomasello, 1995). Alternatively, one hypothesis raised by the present data is that other more elementary processes in the first year of life, be they interactional or intrinsic to the child, may also play a role in linking joint attention and lan-

guage development. Further, study of this possibility may be of theoretical and applied value.

**Acknowledgments:** This study was supported by NIDCD grant #00484. We thank Rebecca Neal, Rebecca Eilers and Kim Oller for their assistance.

## REFERENCES

- Butterworth, G., & Cochran, E. (1980). Towards a mechanism of joint visual attention in human infancy. *International Journal of Behavioral Development*, 3, 253-272.
- Butterworth, G., & Grover, L. (1990). Joint visual attention, manual pointing, and preverbal communication in human infancy. In M. Jeannerod (Ed.), *Attention and Performance XIII* (pp. 605-624). Hillsdale, NJ: Erlbaum.
- Butterworth, G., & Jarrett, N. (1991). What minds have in common in space: Spatial mechanisms serving joint visual attention in infancy. *British Journal of Developmental Psychology*, 9, 55-72.
- Corkum, V.L., & Moore, C. (1988). The origins of joint attention. *Developmental Psychology*, 34, 28-38.
- Fenson, L., Dale, P.S., Reznick, J.S., Bates, E., Thal, D.J., & Pethick, S.J. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development*, 59(5, Serial No. 242) Chicago: University of Chicago Press.
- Hollingshead, A. B. (1978). *Two-factor index of social status*. New Haven, CT: Yale University Press.
- Moore, C., & Corkum, V.L. (1994). Social understanding at the end of the first year of life. *Developmental Review*, 14, 349-372.
- Morissette, P., Ricard, M., & Gouin-Decarie, T. (1995). Joint visual attention and pointing in infancy: A longitudinal study of comprehension. *British Journal of Developmental Psychology*, 13, 163-175.
- Mundy, P., & Gomes, A. (1996, April). *Responding to joint attention bids and language development*. Paper presented at the International Conference on Infant Studies, Providence, RI.
- Mundy, P., Kasari, C., Sigman, M., & Ruskin, E. (1995). Nonverbal communication and early language acquisition in children with Down syndrome and in normally developing children.

- Journal of Speech and Hearing Research*, 38, 157-167.
- Scaife, M., & Bruner, J.S. (1975). The capacity for joint visual attention in the infant. *Nature*, 253, 265-266.
- Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P.J. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 103-130). Hillsdale, NJ: Erlbaum.
- Tomasello, M., & Farrar, J. (1986). Joint attention and early language. *Child Development*, 57, 1454-1463.
- Willoughby, J., & Mundy, P. (1997, April). *Joint attention, other nonverbal communication skills, and language development in infants at risk due to prenatal cocaine exposure*. Paper presented at the meeting of Society for Research in Child Development, Washington, D.C.

**28 May 1997; Revised 28 August 1997 ■**