Socially guided attention influences infants’ communicative behavior

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\section{Abstract}
For effective prelinguistic communication, infants must be able to direct their attention, vocalizations, and nonverbal gestures in social interactions. The purpose of our study was to examine how different styles of caregiver responses influenced infant attentional and communicative behavior in social interactions, based on prior studies that have shown influences of responsiveness on attention, language and cognitive outcomes. Infants were exposed to redirective and sensitive behavior systematically using an ABA design to examine real-time changes in infants’ behavior as a function of caregiver responses. During the two baseline “A” periods, caregivers were instructed to play as they would at home. During the social response “B” period, caregivers were instructed to respond sensitively to infants’ behavior on one visit and redirectively on the other visit. Results demonstrated that when caregivers behaved redirectively, infants shifted their attention more frequently and decreased the duration of their visual attention. Caregiver responses also resulted in changes in vocal and gesture production. Infants decreased their production of caregiver-directed vocalizations, gestures, and gesture-vocal combinations during the redirective condition. Results suggest that caregiver sensitive responding to infants’ attentional focus may be one influence on infants’ attentional and prelinguistic communicative behavior.

\section{Introduction}
Much research has examined the relation between caregiver responsiveness and outcomes in cognitive, attention, social, communicative, and emotional development (Bornstein & Tamis-LeMonda, 1997; De Wolff & van Ijzendoorn, 1997; Stams, Juffer, & van Ijzendoorn, 2002). Caregivers’ responses can be classified as sensitive or redirective, with sensitive responses defined as prompt, contingent and appropriate responding (Ainsworth, 1973; Bornstein & Tamis-LeMonda, 1989; “follow-in” Tomasello & Farrar, 1986), whereas redirective responses are unrelated to a child’s behavior or attentional focus (Ainsworth, Blehar, Waters, & Wall, 1978; Baumwell, Tamis-LeMonda, & Bornstein, 1997; “directive” Baldwin, Markman, Bill, Desjardins, & Irwin, 1996). Sensitive responsiveness predicts more positive development, whereas redirectiveness is negatively associated, or not related, to outcomes (Baumwell et al., 1997; De Wolff & van Ijzendoorn, 1997; Egeland, Pianta, & O’Brien, 1993; Goldsmith & Alansky, 1987; Landry, Smith, Miller-Loncar, & Swank, 1997; Stams et al., 2002;
Tamis-LeMonda, Bornstein, & Baumwell, 2001). For example, maternal responses that are sensitive to children’s attentional focus can influence language comprehension, production, and social communicative behavior (Baumwell et al., 1997; Paavola, Kunnari, Moilanen, & Lehtihalms, 2005; Tamis-LeMonda et al., 2001).

Although many studies have demonstrated the long-term developmental consequences of sensitivity, what is lacking is a link between differential caregiver response styles and real-time changes in infant behavior; most studies focus on caregiver behavioral characteristics and outcome variables weeks to months later. Long-term changes must be grounded to immediate changes in behavior to understand the mechanisms of developmental change. Intervention studies suggest that changes in moment-to-moment interactions have effects on developmental trajectories over time. For example, manipulations to increase maternal responsiveness have resulted in an increase in infants’ focused and sophisticated toy exploration over the period of the intervention (Riksen-Walraven, 1978; van den Boom, 1997; see also Belsky, Goode, & Most, 1980; Parrinello & Ruff, 1988). The few studies that have examined short-term effects of caregiver sensitivity provide suggestive evidence that style of responsiveness influences infant attention in the moment, which may have cascading effects over time. Short-term experimental manipulations of experimenter behavior revealed that children showed shorter durations of attentional engagement and more attentional shifts when interacting with an experimenter exhibiting redirecive behavior (Miller, Ables, King, & West, 2009). Taken together, the intervention and short-term studies suggest that the effects of caregiver responsiveness on object exploration are likely related to effects on infants’ attentional engagement.

Previous studies have demonstrated the relationship between infant attention, such as joint engagement, and infant communicative behavior, such as gestures, word production and comprehension (Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998). The purpose of this study is to examine how caregiver responsiveness affects attention and communicative behavior in real time interactions, as attention toward social partners is a key component of prelinguistic communication (Bates, Camaioni, & Volterra, 1975; Carpenter, Mastergeorge, & Coggins, 1983; Craig, Douglas, & Campbell, 2004; Rochat & Striano, 1999; Seibert, Hogan, & Mundy, 1982; Tamis-LeMonda et al., 2001). Therefore, we aimed to explore real-time effects of caregiver responsiveness that may contribute to long-term communicative outcomes, such as gestures. We manipulated caregiver behavior to systematically expose infants to both sensitive and directive responses in a short time frame because we wanted to examine how infants would respond to different patterns of social responsiveness of a familiar individual. If infants did respond to different kinds of social responsiveness by a caregiver, it would suggest that infants’ behavior is influenced by the immediate interaction rather than being influenced globally by the relationship. We predict that when caregivers are redirecive, infants will not only have shorter attention spans as predicted by the Miller et al. (2009) study, but they will also have fewer directed behaviors, such as gestures and vocalizations, as suggested by Carpenter et al. (1998).

When caregivers are sensitive, infants will either increase their directed behaviors or maintain similar levels given that previous studies of middle-class caregivers have found they typically respond highly sensitively (e.g. Miller et al., 2009; Dewey and Gros-Louis, submitted for publication).

2. Methods

2.1. Participants

Participants were selected from a database composed of published birth records from Monroe County, IN and maintained by the Department of Psychological and Brain Sciences at Indiana University. A total of twenty-two 13–16-month-old infants (10 females, mean age: 15.4 months; range: 13 months 10 days – 16 months 10 days) participated in the study with one caregiver (20 mothers, 2 fathers). Demographic data was available for all of the caregiver–infant pairs based on voluntary demographic questionnaires given prior to the study. Nineteen caregivers self-reported as white (non-Hispanic), one Hispanic, one Korean, and one Japanese. All of the caregivers had at least a high-school diploma, with 21 caregivers holding a bachelor’s degree or higher. Twenty-one of the caregivers reported speaking English as the primary language at home and one spoke English and Japanese. Caregivers reported no known hearing problems for their infant and all infants were born full term. An additional five infants were not included for the following reasons: (1) two caregivers did not follow instructions during the study; (2) one participant did not schedule a second visit; (3) one caregiver did not speak English during the study; (4) equipment malfunction. Participants were given a book or toy as compensation for their participation after the first visit and a gift card after the second visit.

2.2. Apparatus

Caregivers and infants were video recorded playing with a standard set of toys in a 3.9 m × 4.6 m playroom. A large toy box was placed in the corner of the playroom that contained a variety of toys including pop-up toys, soft books, toy blocks, a dump truck, and soft puzzles. The large playroom and toy box allowed infants and caregivers to move around without constraint to engage in interactions with one another. The same toys were available during all infants’ visits. To obtain high quality audio recordings, infants wore a pair of overalls with a small wireless microphone and transmitter (Telex Communications FMR-150). Caregivers also wore a small wireless microphone and transmitter. Caregivers and infants were recorded with four wall-mounted camcorders (Sony HDR-HC7) via a digital video mixer (Videonics MX-1 NTSC). The video feed was sent to
2.3. Procedure

To examine the effects of sensitivity on infant and communicative behavior, caregiver responses were manipulated. Caregivers and their infants came into the lab for two 30-min play sessions. The two visits were conducted within one week. Each session consisted of an ABA design with three 10-min periods: baseline 1, social response, and baseline 2. Before each session, caregivers received directions for the entire procedure. During baseline 1, caregivers were instructed to play with their infants as they normally would at home. Baseline 1 served to establish typical caregiver and infant behavioral interactions during unstructured play. During the social response period, caregivers were instructed to either interact with their infant by following in to what their infant was attending to (sensitive) or to redirect their infant’s attention about every 30 s (redirective). Examples were given to each caregiver on how to appropriately respond either in a sensitive or a redirective manner. For example, if a child was playing with a toy ball, a sensitive response may include a verbalization such as “That’s a red ball,” or picking up the ball to demonstrate the object properties such as bouncing the ball. Alternatively, a redirective response to the child playing with the ball might include a verbalization such as “Look at this toy frog,” or a nonvocal behavior such as introducing the toy frog in the child’s visual field. The sensitive and redirective social response periods were counterbalanced across sessions. Because caregivers interact at different rates with their infant, caregivers were allowed to respond on their own schedule. During baseline 2, caregivers were instructed to play with their infant as they normally would at home. Caregivers were verbally told when to switch to the social response period and baseline 2.

2.4. Data coding and analysis

Caregiver and infant behavior were coded using ELAN software (http://www.lat-mpi.eu/tools/elan/; Lausberg & Sloetjes, 2009).

2.5. Infant behaviors

2.5.1. Visual attention

The coding of visual attention followed Miller et al. (2009). For each infant, the frequency and duration of each shift in visual attention was coded. Both the visual gaze and body orientation of infants were used as a proxy for visual attention. The focus of the infant’s attention was coded as looking at the caregiver (look caregiver), looking at the room without a clear focus (look other), looking at a toy the caregiver was playing with (look engaged toy), or looking at a toy the caregiver was not playing with (look disengaged toy).

2.5.2. Vocal behavior

Each vocalization was categorized as either an object-directed, caregiver-directed, or undirected vocalization (Goldstein, Schwade, Briesch, & Syal, 2010; Gros-Louis, West, & King, 2010). Object-directed vocalizations were scored when an infant vocalized while looking at the object that he/she was holding or that was within reach (Goldstein et al., 2010). Caregiver-directed vocalizations were scored when an infant vocalized while looking at the caregiver. Undirected vocalizations were scored when an infant vocalized while looking around the room or without a clear focus.

2.5.3. Gestures

The frequency of deictic and conventional gestures was measured for each infant. Deictic gestures were placed in one of three categories, following Iverson and Goldin-Meadow (2005): (1) index point—an extension of the pointer finger typically extended to an object or social partner; (2) palm point—an extension of more than one finger toward an object or social partner; and (3) show-extended or raising an object to at least to the midpoint of the torso of the social partner. Conventional gestures were also recorded in which the meaning is traditionally accepted or known (Iverson & Goldin-Meadow, 2005).

2.6. Caregiver behaviors

2.6.1. Caregiver responses to infant attention

The frequency of sensitive and redirective behaviors of caregivers was coded during all three periods (Miller et al., 2009). Caregiver physical manipulations of objects, caregiver vocalizations, and combinations of the two behaviors were classified as either sensitive or redirective depending on the infant’s focus of attention at the time the behavior occurred. A physical manipulation was coded when the caregiver touched an object; additional manipulations were coded when the caregiver had their hands off the objects for 0.5 s or more and subsequently touched the object again. Every utterance of the caregiver was coded as either sensitive or redirective. Sensitive vocalizations were coded when the caregiver commented on the state of the infant or the object the infant was attending to or playing with. Redirective vocalizations were coded when the caregiver commented on an object the infant was not visually attending to. For another vocalization to be coded, a ≥ 0.5
second break had to occur between speech streams. A combination of both behaviors was coded when the onset of both the vocalizing and physical manipulations occurred within 0.5 s of one another.

2.7. Data analysis

To analyze infant and caregiver behavior, a repeated measures ANOVA was used to compare across the three periods (baseline 1, social response, baseline 2) for each condition (sensitive, redirective). Two planned comparisons were used after each significant ANOVA, based on prior ABA experimental studies of infant vocal behavior and hypothesized changes due to manipulation of caregiver behavior during the social response period (e.g., Goldstein & Schwade, 2008). The first comparison examined increases or decreases from baseline 1 to social response period. The second comparison examined whether the increase or decrease was maintained during baseline 2. A significant result from the social response to baseline 2 would indicate an increase or decrease of behavior from the social response period. A nonsignificant result from the social response to baseline 2 would indicate the maintenance of the behavior. Due to a priori predictions that would exist between baseline 1 and the social response period and the social response period and baseline 2, we did not correct for multiple comparisons (Howell, 2002).

The frequency and duration of infant visual attention shifts, frequency of infant gestures, and frequency of infant vocalizations were compared across the three periods within each condition (sensitive and redirective). Infant vocalizations that occurred within gestures, known as gesture-vocal combinations were also compared within each condition. The frequency and proportion of caregiver sensitivity was compared both within and across conditions to ensure caregivers followed the instructions we gave to them and to ensure the instructions did not influence caregiver behavior during either baseline period. To assess reliability, 20% of the participants were re-coded by two additional assistants. Mean inter-rater percentage agreement across all infant and maternal behaviors was 90% (range: 84–98%; Miller & Lossia, in press).

3. Results

See Table 1 for descriptive statistics on caregiver behavior, infant attention and infant communicative behavior. All post hoc tests are described below while the specific details regarding the p-value are displayed in Table 1.

3.1. Caregiver behavior

To ensure that caregivers followed instructions, we compared caregivers’ responses across the baseline 1, social response, and baseline 2 periods. As expected, we found significant differences in sensitive and redirective behaviors during the social response periods compared to both baselines indicating that caregivers did alter their responses as instructed (sensitive: $F(2,42) = 12.161, p < .001$; redirective: $F(2,42) = 27.548, p < .001$). In the sensitive social response period, caregivers responded with a higher proportion of sensitive behavior during the social response period than baseline 1, and decreased the level of responding from the social response period to baseline 2. In the redirective social response period, caregivers responded with less sensitive behavior from baseline 1 to the social response period, but then increased the level of sensitive responses from the social response period to baseline 2. Importantly, our instructions did not influence how caregivers behaved during the baselines of the two conditions. There were no differences in the proportion of sensitive caregiver responses across the baselines for the two conditions $F(1,21) = 1.971, p = NS$. There were also no differences in the overall frequency of caregiver responses across the baselines for the two conditions, $F(1,21) = 0.708, p = NS$.

3.2. Infant behavior

3.2.1. Frequency of infant attention shifts

Overall, there were large differences in the frequency of infant attentional shifts during the sensitive, $F(2,42) = 5.056, p < .015$ and redirective conditions, $F(2,42) = 7.884, p < .001$. In the sensitive condition, infants shifted their attention less frequently from baseline 1 to the social response period and maintained similar levels from the social response period to baseline 2. In the redirective condition, infants decreased the frequency of attentional shifts from the social response period to baseline 2.

There was a significant change in how infants shifted their attention to toys with which the parent was engaged with in both the sensitive and redirective conditions (sensitive: $F(2,42) = 3.325, p < .05$; redirective: $F(2,42) = 22.314, p < .001$). In the sensitive condition, infants significantly decreased their attentional shifts from baseline 1 to social response and maintained similar levels from social response to the second baseline. In the redirective condition, infants significantly increased their attentional shifts from baseline 1 to the social response period, but decreased their attentional shifts from the social response period to baseline 2.

There was also a significant change in how infants shifted their attention to toys the parent was not engaged with in both the sensitive and redirective conditions (sensitive: $F(2,42) = 5.570, p < .010$; redirective: $F(2,42) = 5.029, p < .025$). In the redirective condition, there was a significant decrease in the frequency of attentional shifts to toys the caregivers were not interacting with from the social response period to the second baseline.

Finally, there was a significant change in the frequency of infant attentional shifts to other objects in the playroom, such as the carpet, walls, or cameras in the redirective condition but not the sensitive condition (redirective: $F(2,42) = 6.603, p < .005$; sensitive: $F(2,42) = 0.976, p = NS$). There was a trend in increasing the frequency of looking at other objects from baseline 1 to the social response period ($p = .08$) and from the social response period to baseline 2 ($p = .07$). There were no significant differences in the frequency of attentional shifts to the caregiver during either condition, both $F(2,42) < 1.785, p = NS$.

3.2.2. Duration of infant visual attention

While there were no changes in the duration of visual attention during the sensitive condition, all $F(2,42) = < 3.870, p = NS$, there were significant changes in the duration of visual attention during the redirective condition. There was a significant change in the duration of infant attention to toys the caregiver was not playing with, $F(2,42) = 7.308, p < .005$, and toys the caregiver was playing with, $F(2,42) = 6.519, p < .005$. Infants decreased the duration of their visual attention to toys the parents were playing with from baseline 1 to the social response period, but increased the duration from the social response period to baseline 2. Infants increased the duration of visual attention to toys the caregiver was not playing with from social response to baseline 2.
Table 1
Infant and caregiver behavior.

<table>
<thead>
<tr>
<th></th>
<th>Sensitive condition</th>
<th>Redirective condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>Range</td>
</tr>
<tr>
<td>Infants communicative behavior (frequency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestures</td>
<td>16.94 (1.66)</td>
<td>15.54 (1.83)</td>
</tr>
<tr>
<td></td>
<td>9.34–17.50</td>
<td>8.30–18.50</td>
</tr>
<tr>
<td>Caregiver-directed vocalizations</td>
<td>8.13 (1.97)</td>
<td>9.40 (2.41)</td>
</tr>
<tr>
<td></td>
<td>7–34</td>
<td>7.40–15.80</td>
</tr>
<tr>
<td>Undirected vocalizations</td>
<td>32.09 (5.25)</td>
<td>35.41 (5.13)</td>
</tr>
<tr>
<td></td>
<td>3.50–46.50</td>
<td>3.58–43.05</td>
</tr>
<tr>
<td>Object-directed vocalizations</td>
<td>60.91 (6.87)</td>
<td>49.14 (6.36)</td>
</tr>
<tr>
<td></td>
<td>11–160</td>
<td>6–75</td>
</tr>
<tr>
<td>Gesture-vocal combinations</td>
<td>11.05 (1.91)</td>
<td>8.42 (1.05)</td>
</tr>
<tr>
<td></td>
<td>0.93–37.00</td>
<td>0–17.91</td>
</tr>
</tbody>
</table>

Infant attention behavior (frequency of attention shifts)

<table>
<thead>
<tr>
<th></th>
<th>Baseline 1</th>
<th>Social-response</th>
<th>Baseline 2</th>
<th>Social-response</th>
<th>Baseline 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>Range</td>
<td>Range</td>
<td>Range</td>
<td>Range</td>
</tr>
<tr>
<td>Total</td>
<td>127.05 (8.21)</td>
<td>112.18 (7.15)</td>
<td>103.50 (7.44)</td>
<td>123.95 (8.04)</td>
<td>131.69 (6.91)</td>
</tr>
<tr>
<td>Look engaged toy</td>
<td>51.88–190.43</td>
<td>59.41–162.46</td>
<td>53.03–178.43</td>
<td>54.79–190.98</td>
<td>80.87–195.13</td>
</tr>
<tr>
<td>Look disengaged toy</td>
<td>1.92–49.76</td>
<td>2.84–44.09</td>
<td>5.84–42.16</td>
<td>10.57–55.96</td>
<td>5.90–74.52</td>
</tr>
<tr>
<td>Look caregiver</td>
<td>46.36 (3.53)</td>
<td>41.49 (3.66)</td>
<td>34.35 (3.32)</td>
<td>44.79 (4.10)</td>
<td>43.66 (3.62)</td>
</tr>
</tbody>
</table>

Infant attention behavior (average duration of attention shifts, seconds)

<table>
<thead>
<tr>
<th></th>
<th>Baseline 1</th>
<th>Social-response</th>
<th>Baseline 2</th>
<th>Social-response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>Range</td>
<td>Range</td>
<td>Range</td>
</tr>
<tr>
<td>Look engaged toy</td>
<td>7.33 (1.03)</td>
<td>7.33 (1.16)</td>
<td>7.31 (1.00)</td>
<td>8.75 (0.88)</td>
</tr>
<tr>
<td>Look caregiver</td>
<td>6.05 (0.69)</td>
<td>7.71 (0.80)</td>
<td>7.03 (0.92)</td>
<td>5.35 (0.51)</td>
</tr>
<tr>
<td>Look other</td>
<td>1.64–17.74</td>
<td>3.39–16.06</td>
<td>2.67–18.59</td>
<td>3.02–11.74</td>
</tr>
<tr>
<td>Caregiver sensitive behavior</td>
<td>.50 (.03)</td>
<td>.86 (.02)</td>
<td>.79 (.03)</td>
<td>.77 (.03)</td>
</tr>
<tr>
<td></td>
<td>.52–.89</td>
<td>.60–.98</td>
<td>.39–.96</td>
<td>.45–.97</td>
</tr>
</tbody>
</table>

3.2.3. Vocal usage
Although there were no significant differences in the directedness of vocalizations during the sensitive condition, all Fs(2,42) < 1.979, p > .NS, infants significantly decreased the number of caregiver directed vocalizations, F(2,42) = 5.103, p < .05, and increased the number of undirected vocalizations, F(2,42) = 3.522, p < .030, across the redirecitive condition. Specifically, infants increased the number of undirected vocalizations from the social response period to baseline 2. Infants also showed a trend for decreasing the number of caregiver directed vocalizations from baseline 1 to the social response period (p = .103), and significantly increased the number of caregiver directed vocalizations from the social response period to baseline 2.

3.2.4. Gestures
There was a significant difference in the amount of gestures infants produced across the redirecitive condition, F(2,42) = 6.586, p < .005. Infants decreased the frequency of gestures from baseline 1 to social response and maintained similar levels from social response to baseline 2. There was no significant difference in the amount of gestures produced across the sensitive condition F(2,42) = .754, p > .NS.

3.2.5. Gesture-vocal combinations
There were changes across the redirecitive condition in the frequency of gesture-vocal combinations, F(2,42) = 6.458, p < .005. Specifically, infants produced less during the social response period compared to the two baselines. There were no differences across periods in the amount of gesture-vocal combinations during the sensitive condition, F(2,42) = 2.638, p > .NS.

4. Discussion
This study examined how patterns of redirecitive and sensitive responsiveness influenced attentional and communicative behaviors. Results demonstrated that levels of caregiver sensitivity to infants’ attentional focus led to differences in attentional and communicative behavior. We found that infants, on average, had shorter durations of visual attention and more visual gaze shifts when the caregiver was redirecitive. In addition, infants decreased the number of caregiver-directed
vocalizations, gestures and gesture-vocal combinations. These results demonstrate that infants’ behavior was influenced by changes in their social environment, specifically related to caregiver response style.

Infants shifted their attention less frequently during the sensitive social response period, which was maintained when caregivers returned to unstructured play (second baseline). By contrast, infants in the directive condition shifted their attention more frequently, probably as a result of the caregiver introducing more toys to the infant’s immediate environment; however, there was a trend for infants to shift their attention more frequently outside of the dyadic interaction to items in the room such as the walls or cameras. These findings suggest a more global effect of caregivers’ directive behavior on infants’ attentional behavior rather than specifically in response to caregivers introducing toys. In addition, although infants did not increase their frequency of shifts to toys the caregiver was not playing with, infants did increase the length of time they spent attending to toys the caregiver was not playing with during the directive condition. The results suggest that when caregivers are directive, infants showed less focused attention within the ongoing social interchange, but more focus outside of the dyad in their engagement with their physical environment. Furthermore, this effect lasted beyond the social response period when caregivers returned to typical interaction and responsiveness (see also Miller et al., 2009). An open question in need of further study is to determine why infants show a decline in focused attention, particularly given the fact that the effect was not simply due to mothers presenting new toys. One possibility is that infants’ motivation to engage decreases. Once mothers introduce new objects repeatedly, infants may disengage or “take on” the style of the dyadic interaction via coupling (Jaegher, Paolo, & Gallagher, 2010).

Changes in caregiver sensitivity not only changed infant attentional behavior, but also communicative behavior; however, these differences occurred only during the directive condition. Behavioral changes occurred with both gestures and vocalizations: infants decreased caregiver-directed vocalizations, gestures, and gesture-vocal combinations, while increasing undirected vocalizations. Similar to shifts in attention, therefore, infants showed less engagement with caregivers. Previous studies examining the relationship between social feedback and vocal change have found changes in vocal structure after contingent feedback to vocalizations (Goldstein, King, & West, 2003; Goldstein & Schwade, 2008). In addition, a prior longitudinal study found a relationship between maternal responsiveness and caregiver-directed vocalizations: sensitive responses to vocalizations in earlier months predicted an increase in caregiver-directed vocalizations over time (Gros-Louis et al., submitted for publication). Here, we examined older infants and used a procedure that examined sensitive responsiveness more globally to infant behavior (attentional focus) during play, not just in response to vocalizations. The current results, and those of Goldstein and colleagues (2003, 2008), suggest a connection between infant attention, vocal usage and vocal structure. There has been an increased awareness in understanding the connection of multiple behaviors such as attention, vocal structure and vocal usage (Gros-Louis et al., 2010). The combination of these behaviors often gives rise to pragmatic ability, the ability for an individual to effectively communicate (Bates, 1976; Golinkoff, 1986; Ninio & Bruner, 1978).

We propose that the changes that we observed in infant attention and communicative behaviors were related to variation in the caregiver responses that we manipulated. We confirmed that caregivers changed their behaviors as instructed; during the social response period in the sensitive condition, caregivers increased their proportion of sensitive responses, whereas during the social response period in the directive condition, caregivers increased their proportion of directive responses. After the social response period in both the sensitive and directive conditions, caregivers returned to normal baseline 1 levels of sensitive responsiveness. Importantly, the levels of sensitive and directive responsiveness were within normal range as in unstructured interactions.

Results suggest that potential origins of individual variability in communicative behavior may arise from interactions with caregivers and, specifically, responsiveness of caregivers. It is important to understand variability, particularly given that differences in gesture production have been linked to later language learning. Early gesture use at 14 months predicts vocabulary size at 42 months (Rowe, Ozcaliskan, & Goldin-Meadow, 2008). Gestures aid the infant in learning new words or concepts via the role they play in social interactions. Caregivers often respond more to gestural behaviors, such as pointing, that they interpret as more functional (Kishimoto, Shizawa, Yasuda, Hinobayashi, & Minami, 2007). Additionally, caregivers’ comments are guided by infants’ gestures in that caregivers often translate what they perceive to be the message and function of a gesture (Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007). Furthermore, lexical items that children initially indicate using pointing gestures are later produced in children’s verbal lexicon (Goldin-Meadow et al., 2007; Iverson & Goldin-Meadow, 2005). Understanding what underlies variability in infants’ communicative behavior might help inform interventions to increase particular behaviors that elicit caregiver responses known to facilitate language development (e.g., Yoder & Warren, 1998).

The current study extends the findings of prior studies that have shown effects of caregiver sensitivity on various aspects of infant development. Here, we demonstrate that variation in caregiver sensitivity corresponded to changes in both attentional and communicative behavior in moment-to-moment interactions. This provides important information about early communicative development, as many studies have documented the development of joint attention and communication development (e.g., Carpenter et al., 1998). At the end of the first year, infants develop joint attention abilities as they are also beginning to develop more complex communicative behaviors involving objects, such as referential pointing, showing, and vocalizing about objects (e.g., Bakeman & Adamson, 1984; Bates et al., 1975). When infants vocalize or gesture they must engage the social partner in addition to communicating about an object for effective communication. This involves not only joint attention and particular gestures or vocalizations, but bringing them together during dynamic interaction, relative to the social partners’ involvement in the interaction and responses to ones’ own behavior. Our findings suggest that
Caregiver sensitivity to infants’ attentional focus may provide the mechanism for the merging of attentional and communicative behavior. Future studies are needed to examine gestural and vocal behavior prior to the emergence of joint attention abilities to examine how sustained attention contributes to the development of directed vocalizations and gestures toward pragmatic usage of communicative behavior (Bates, Thal, Whitesell, Fenson, & Oakes, 1989).

References


Dewey, A., & Gros-Louis, J. The relation between infants’ social communicative ability and maternal responsiveness to prelinguistic vocalizations, submitted for publication.


