Selectivity in Infant Social Referencing

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In laboratory studies of social referencing, infants as young as 12 months have been reported to prefer looking at the experimenter over the caregiver for clarifying information. From an expertise perspective, such behavior could be interpreted as if the infant seeks information from others and can discriminate between persons who have or do not have relevant information to provide in the laboratory. If this is the case, higher order cognitive capacities might be involved in infant selectivity in looking in social referencing situations. However, it has also been proposed that associative learning processes might account for infant preferences in such studies. To examine whether an expertise perspective or if more basic learning processes best explain infant selectivity in looking, 40 12-month-old infants were assigned to 1 of 2 comparable conditions. The experimenter versus the caregiver presented an ambiguous toy and delivered positive information about the toy. The infants preferred to look at the experimenter and they regulated their behavior more in accordance with information coming from the experimenter. Thus, an associative learning account cannot explain infant preferences in looking. The results are discussed in terms of an expertise perspective.

Social referencing, or looking at others for information in novel or ambiguous situations, has been examined in infants from the end of the first year of life (e.g., Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992; Hornik, Risenhoover, & Gunnar, 1987; Walden & Ogan, 1988). In laboratory studies, 12-month-old infants have been shown to more often prefer to look at the experimenter rather than at their caregiver, and regulate their behavior in accordance with information given by the experimenter, suggesting that infants prefer some informants over others. Recently, various mechanisms explaining infant selectivity in looking in social referencing studies have been proposed (e.g., Stenberg, 2003; Walden & Kim, 2005).
In a test of two such mechanisms, Stenberg and Hagekull (2007) found neither evidence for an attachment account of infant looking behavior nor conclusive support for an explanation in terms of expertise (i.e., seeking information from an expert). To further examine the information-seeking function of infant looking behavior, two mechanisms, one stemming from the expertise perspective and the other from an associative learning perspective, are contrasted in this study.

INTERPRETATIONS OF INFANT PREFERENCES IN LOOKING

In social referencing studies, the infant is typically exposed to an ambiguous object eliciting looking behavior toward an adult. During exposition, the caregiver or the experimenter conveys information about the object. Whether the infant regulates her or his behavior toward the object in accordance with the information provided is examined in a subsequent situation.

The Expertise Account

It has been suggested that infants should be more likely to reference an individual who appears to possess specific knowledge about a particular situation over persons that do not seem to possess such knowledge (see “The Selectivity Postulate” in Feinman, 1992). For example, in an unfamiliar environment (the laboratory) a person (the experimenter) who behaves in such a way that he or she seems to be familiar with the surroundings will be the selected referee. Thus, selectivity in infant referencing can vary as a function of the surrounding (e.g., Feinman et al., 1992; Stenberg, 2003). Accordingly, in situations when the caregiver seems to lack expertise, the infant is likely to choose another adult as a source of information. Such a description of the social referencing phenomenon puts certain demands on infant social cognitive understanding: The infant must have the capacity to interpret signals of specific competence in the behavior of others. Whether infants possess such a capacity at the end of the first year has been discussed (e.g., Flavell & Miller, 1998).

The Associative Learning Account

A lean interpretation of infant looking comes from the perspective of associative learning processes (Slaughter & McConnell, 2003). In such a process, an object or person becomes, through pairing, associated with another object or person (Perner, 1991). The behavior of watching the ambiguous object in social referencing experiments and at the same time looking at the person who presents the object creates a pairing between these two behaviors. In many studies comparing degree of looking
to experimenter versus caregiver, the object has been presented exclusively by the experimenter, as in the study by Stenberg and Hagekull (2007). Accordingly, the behavior of looking at the experimenter is assumed to become associated with the behavior of looking at the target object, resulting in infants looking more at the experimenter than at other individuals during object presentation.

EMPIRICAL STUDIES

Young children use other persons as sources of information about the world, and recent studies show that children prefer some informants over others (e.g., Harris, 2007). Sabbagh and Baldwin (2001) reported that 4-year-old children learned new words better when the speaker was knowledgeable rather than when the speaker was ignorant concerning the words’ referents. At the same age children show selective trust in particular persons depending on whether the person previously has been a reliable informant or not (Koenig & Harris, 2005). At 2 years children begin to show mistrust in others by not accepting false affirmatives (Pea, 1982). Three-year-old children prefer to seek information from a person who seems knowledgeable rather than from a person who seems ignorant (Koenig & Harris, 2005). In sum, several studies show that young children are selective in their choice of informant.

Studies Within the Social Referencing Domain

Laboratory studies of social referencing have reported 12-month-old infants to show selectivity in looking. Infant preferences in looking at the experimenter over the caregiver in laboratory settings (e.g., Moses, Baldwin, Rosicky, & Tidball, 2001; Stenberg, 2003; Striano & Rochat, 2000; Walden & Kim, 2005) could be taken as an indication that the infant perceives the experimenter as the most knowledgeable person present. Such findings suggest that infants, already at the end of the first year, might have developed an early, rudimentary understanding of other people’s intentions and mental states like knowledge. However, studies that systematically examine infant selectivity in looking are lacking. The conditions have not been identical; that is, the experimenter and the caregiver have played different roles in the manipulation part of the experiment (the conveyance of information; e.g., Stenberg & Hagekull, 1997), and other potential referees have typically not been equally available to reference (e.g., Barrett, Campos, & Emde, 1996; Moses et al., 2001).

In the few studies where both the experimenter and the caregiver have been available, 18- and 24-month-old infants (Walden & Kim, 2005) and 12-month-old infants (Stenberg, 2003) have looked more at the experimenter than at their mother during the exposure of an ambiguous object. If the intention behind infant looking in ambiguous situations is to seek information to disambiguate the situation, infant
behavior toward the object eliciting ambiguity should be regulated in accordance with information obtained. Because information was provided every time the infant looked at an adult in the Walden and Kim (2005) study, infant behavior regulation in accordance with information conveyed by the caregiver versus the experimenter became impossible to examine: The infants could have been exposed to information from both adults. Also in the Stenberg (2003) study, differences in behavior regulation were not assessable, as only the mother and not the experimenter provided information.

When both the experimenter and the mother provided information and both adults were available to turn to in the Stenberg and Hagekull (2007) study, the 12-month-old infants preferred to look at the experimenter when she delivered positive information about an ambiguous toy and the mother remained silent, as well as when the experimenter was silent and the mother provided positive information. In the subsequent free play situation, the infants regulated their behaviors in accordance with information gained from the experimenter to a greater extent than they regulated their responses in accordance with information coming from their mother. Although the findings from that study suggest that the infants were engaged in a social referencing process, another process might account for infant looking behavior. In both conditions the toy was presented by the experimenter. The infants might have associated the object with the experimenter, resulting in increased looking at her. Further, when one adult provided information about the toy, the other adult was also looking at the toy, although silent and with a neutral expression. Given the infants’ preferences for looking at the experimenter in both conditions during toy presentation, the infants might have regulated their behavior in accordance with a positive message from the experimenter in the experimenter condition, and a “neutral message” from the experimenter in the mother condition. In sum, to our knowledge, no study today has examined potential causes of infant selectivity in looking in social referencing situations.

This study was designed to complement the experiment of Stenberg and Hagekull (2007). Specifically, the study addressed the question of whether infant preferences in looking in laboratory-conducted social referencing setups should be interpreted as information seeking from a knowledgeable adult, and thus emanate from an understanding of expertise, or be due to associative learning processes. The experiment was conducted in a laboratory, a setting that was unfamiliar to both the caregiver and the infant. A design was used in which both the experimenter and the caregiver presented the ambiguous object and delivered information. Thus, the procedural features of the two conditions were comparable. Because 12-month-old infants are able to follow the gaze direction of another person (e.g., Moses et
al., 2001), only the adult who provided information about the stimulus attended to the same and the other adult directed her attention elsewhere. It has been underlined in the social referencing literature that different types of infants’ looks must be distinguished to understand the meanings of the looks (e.g., Vaish & Striano, 2004). In this study, infant puzzled looks (a look combined with a quizzical or puzzled facial expression), which have been considered to serve an information-gathering function (e.g., Feinman et al., 1992; Hagekull, Stenberg, & Bohlin, 1993), were the focus. The necessity of having highly controlled situations where all infants gain information on a consistent schedule, without requiring an active reference by the infant, has been highlighted (e.g., Carver & Vaccaro, 2007). Therefore, to ascertain that the infants in both conditions received the same amount of information from the caregiver and the experimenter, unsolicited information was provided. A free play situation, where infant behavior regulation was examined, followed the stimulus presentation phase.

The following hypotheses from an expertise perspective were formulated. In the stimulus presentation phase, the infants were expected to prefer to look at the experimenter rather than their mother in both conditions regardless of who delivered the information. This hypothesis was based on the expertise account: In an unfamiliar environment, a person who seems familiar with the setting will be preferred as an information source. In the behavior regulation phase, the infants who had received information from the knowledgeable experimenter were expected to play more with the toy than infants who had received information from their mother.

The null hypotheses were stated from the perspective of associative learning processes. In the stimulus presentation phase, no differences in infant looking behavior between the experimenter and the mother conditions were expected. This hypothesis was based on the assumption that the infants would associate the toy with the person who presented the toy. In the behavior regulation phase, given that the infants in both conditions associated the toy with the person who presented the toy, no differences in infants’ playtime with the toy as a function of condition were expected.

**METHOD**

A total of 40 infants who were 12 months old ($M = 52.9$ weeks, $SD = 0.9$ weeks), 20 boys and 20 girls, participated with their caregivers (their mothers). Thirty-eight percent were firstborn. The rest had one to four siblings. Eligible families were those who, according to the official birth register, had an infant born at the Academic Hospital in Uppsala, Sweden. Further inclusion criteria were a Swedish surname (to avoid language problems), and the inclusion of the family in the official telephone directory of Uppsala municipality. Eighty-seven percent of the
mothers contacted agreed to participate. Reasons for declining participation were illness in the family and shortage of time. The mothers’ age ranged from 24 to 44 years ($M = 32.1$ years, $SD = 3.9$ years). Fifteen mothers had a university degree, 14 had started or completed other post-high-school training, and 11 had completed high school.

One infant–mother pair was excluded from the study because of infant fussiness. That pair was replaced.

Experimental Conditions

The infants were randomly assigned to one of two conditions, yielding 20 infants (10 girls, 10 boys) in each condition:

1. The experimenter delivers positive information. The female experimenter smiled while saying “What a funny thing!” three times during toy presentation. She looked alternately at the toy and the infant. The experimenter neither commanded the infant to approach nor to avoid the toy. Meanwhile the mother was holding a magazine in front of her as if she was reading. However, the mother’s face was fully visible to the infant.

2. The mother delivers positive information. The mother was instructed to smile while saying “What a funny thing!” three times during toy presentation and to look alternately at the toy and the infant. Further, she was instructed not to command the infant to approach or avoid the toy. The female experimenter was holding a magazine in front of her as if she was reading. The experimenter’s face was fully visible.

Procedure

**Setting and stimulus toy.** In one corner of a laboratory playroom (5 m × 3 m) we placed a video camera. An armchair and a doll were placed in the diagonal corner, and a small mattress was centered on the floor. A table (1.2 m × 0.6 m) was placed behind the mattress with an infant highchair at one end of the table. The experimenter and the mother were seated perpendicularly to the infant, facing each other. Their placements at the table (i.e., to the right or left of the infant) were balanced. The table was equipped with three marks, 20 cm apart, showing that the message should be conveyed when the toy reached the marks. The target toy was a mechanical dinosaur (20 cm high). It buzzed softly as it moved. Pilot testing with 32 infants who were 12 months old showed that it evoked puzzled looking behavior toward an adult but did not elicit strong approach or strong avoidance behaviors toward itself. Thus, the toy met the criteria for an ambiguous object (cf. Walden & Ogan, 1988).
**Stimulus presentation phase.** The experimenter, when participants arrived, asked the mother to sit in the armchair and invited the infant to play with the doll near the mother. The experimenter instructed the mother about the procedure, told her what behavior to display during toy presentation, and asked her to sign a consent form after reminding her of her right to interrupt participation at any time. After practicing the behavior, the mother was told to put her infant in the highchair and to sit down at the table. The mother was again reminded of what to do during the presentation of the toy. When the mother signaled that the infant was comfortable, the experimental trial began. In the experimenter condition, the experimenter took the dinosaur out of a bag hidden under the table and placed it at the short side of the table, opposite the infant. In the mother condition, the mother took the dinosaur out of the bag and then placed it at the table. The dinosaur moved slowly toward the infant for 45 sec. Each time the dinosaur passed a mark, the adult who handled the toy conveyed positive information. The toy was removed by the same adult when it was 20 cm from the infant. Thus, it was the same procedure in both conditions. The toy was presented once in each condition.

**Behavior regulation phase.** The free play situation followed immediately. The mother was asked to place her infant on the mattress on the floor. The toy was placed in front of the infant (by the experimenter in the experimenter condition, by the mother in the mother condition). The mother was instructed to sit in the armchair, paying no attention to her infant while reading a magazine. The experimenter withdrew behind the camera. During the next 3 min the infant was free to explore the toy. The toy was now silent and motionless.

**Manipulation Checks**

Two raters conducted the manipulation checks (for more information, see “Coding and Reliability” section later).

**The adults’ vocalizations.** The adults’ “information-giving vocalizations,” were checked (positive statements: playful, not demanding, statements; commands: encouraging the infant to approach or avoid the toy). Kappa reached 1.0. All vocalizations were scored as statements, and no commands were placed on the infant. When one adult delivered information, the other adult’s vocalizations were checked. No talk to the infant appeared.

**The adults’ facial expressions.** The adult who delivered positive information had to display the appropriate facial expression during more than 75% of the stimulus presentation phase. The number of 5-sec intervals during which the adults exhibited positive, neutral, and negative facial expressions were registered. Pearson correlation coefficients were .92, .89, and 1.0 for positive, neutral, and
negative expressions, respectively. In the mother condition, the mothers showed a positive face during a mean of 97%, and were neutral 3% of the time. In the experimenter condition, the experimenter showed a positive expression 100% of the time. The intensity of the positive expression (smiling) was rated on a 5-point scale ranging from 1 (expression not detectable) to 5 (greatest possible intensity). Kappa reached .81. No differences were found in intensity in positive facial expression between conditions, $t(19) = 1.23$, ns.

The facial expressions of the adult (neutral, positive, negative expressions; intensity in positive facial expression) who did not deliver information were checked. Mothers’ neutral expressions were presented during 95% and positive expressions were found during 5% of the time in the experimenter condition. The experimenter displayed neutral expressions during 100% of the period in the mother condition. No adult displayed negative facial expressions.

When one adult delivered information, the other adult’s looking behaviors (look at the infant, look at the toy) were checked. Interrater agreements were .79 and .82. Four mothers looked at their infants and three of these mothers plus two additional mothers looked at the toy when the experimenter delivered information. Because none of the infants was looking at the mother on these occasions, these infant–mother pairs were not excluded from the sample. The experimenter did not look at the infant or the toy in the mother condition. She looked at the magazine exclusively.

**Coding and Reliability**

Both the stimulus presentation and the behavior regulation phases were video-taped. A rater who was unaware of the research design and hypotheses of the study recorded infant, mother, and experimenter behaviors when the toy was presented. A second rater, blind for conditions, coded the infants’ behavior during the behavior regulation phase. The infants spent relatively long periods playing with the toy. Thus, instead of frequencies of behaviors, the number of 5-sec intervals during which the infants played with the toy was recorded. Cohen’s kappa (e.g., Bakeman & Gottman, 1992) was used for categorical variables, and Pearson product-moment correlations were calculated for frequencies.

A third rater with no knowledge of research aims and conditions made an independent coding of 20 infant–mother dyads to check reliability. No significant mean differences between the observers were found. Pearson correlations as reliability coefficients for each measure are shown in parentheses in the following section.

**Measures of Infant Behavior**

*Stimulus presentation phase.* After an initial look at the toy, frequency of looks directed toward the experimenter’s and the mother’s faces were recorded.
Puzzled looks (looks characterized by a puzzled or quizzical, attentive, or concerned expression, with a furrowed brow or wide eyes; cf. Feinman et al., 1992; Hornik & Gunnar, 1988) toward experimenter \( (r = .92) \) and toward mother \( (r = .90) \), positive looks (looks accompanied by a smile or positive vocalizations) toward experimenter \( (r = .95) \) and toward mother \( (r = .93) \), and negative looks (looks accompanied by a wary brow [i.e., eyebrows drawn closer together], cry face, or negative vocalizations) toward experimenter and toward mother were coded. Because only 3 infants displayed negative looks, this measure was dropped from further analyses.

To examine infant initial affective state, infant affective expressions (facial expressions and vocalizations) were examined during the stimulus presentation phase. The total number of 5-sec intervals during which the infant showed predominantly positive affect (smiling, positive vocalizations; \( r = .83 \)), negative affect (worried expressions, whimpering, crying; \( r = .81 \)), and a neutral expression (no signs of affect; \( r = .83 \)) were calculated.

**Behavior regulation phase.** Frequencies of looks toward mother \( (r = .80) \) and looks toward experimenter \( (r = .84) \) were recorded.

The following infant behaviors directed toward the toy were recorded: looking at toy (the number of times the infant looked at the toy without touching it; \( r = .84 \)), touching toy (the number of times the infant touched the toy without grabbing or holding it; \( r = .95 \)), and play with toy (the total number of 5-sec intervals during which the infant played with the toy; i.e., grabbed, held, or manipulated it; \( r = .85 \)).

**RESULTS**

In Tables 1 to 3, means, standard deviations, \( t \) values, and effect sizes (Cohen’s \( d \)) are reported. A \( d \) of .2 reflects a small, a \( d \) of .5 reflects a medium, and a \( d \) of .8 or higher reflects a large effect size (Cohen, 1988). All \( t \) tests are two-tailed.

**Stimulus Presentation Phase**

**Affect.** The infants displayed neutral facial expressions in most of the nine 5-sec intervals during the stimulus presentation phase. The three one-way analyses of variance (ANOVAs) showed no differences with regard to infant positive, neutral, and negative expressions between conditions (all \( F_s < 1.28 \), all \( p_s > .27 \)). Thus, neutral expressions dominated in both conditions (for means and standard deviations, see Table 1).

**Looking behavior.** Puzzled looks were the most frequent type of looks during stimulus presentation. A two-way ANOVA with repeated measures on looks
TABLE 1
Mean Number of 5-Second Intervals by Condition for Infant Affect Variables During the Stimulus Presentation Phase

<table>
<thead>
<tr>
<th>Affect Variable</th>
<th>Experimenter Condition</th>
<th>Mother Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Positive affect</td>
<td>2.90</td>
<td>2.71</td>
</tr>
<tr>
<td>Neutral expressions</td>
<td>5.85</td>
<td>2.56</td>
</tr>
<tr>
<td>Negative affect</td>
<td>0.25</td>
<td>0.72</td>
</tr>
</tbody>
</table>

TABLE 2
Mean Frequencies and Standard Deviations by Condition for Infant Looks During the Stimulus Presentation Phase

<table>
<thead>
<tr>
<th>Condition</th>
<th>Looks at Experimenter</th>
<th>Looks at Mother</th>
<th>df</th>
<th>t</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Positive looks in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimenter condition</td>
<td>0.70</td>
<td>1.26</td>
<td>0.45</td>
<td>0.89</td>
<td>NA</td>
</tr>
<tr>
<td>Mother condition</td>
<td>0.15</td>
<td>0.67</td>
<td>0.30</td>
<td>0.57</td>
<td>NA</td>
</tr>
<tr>
<td>Puzzled looks in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimenter condition</td>
<td>4.10</td>
<td>1.62</td>
<td>0.90</td>
<td>0.85</td>
<td>38</td>
</tr>
<tr>
<td>Mother condition</td>
<td>3.30</td>
<td>1.56</td>
<td>2.00</td>
<td>1.65</td>
<td>38</td>
</tr>
</tbody>
</table>

Note. NA = not applicable.  
*p < .05. **p < .0001.

TABLE 3
Mean Frequencies, Mean Number of 5-Second Intervals, Standard Deviations, and Group Differences by Condition for Infant Behavioral Variables During the Behavior Regulation Phase

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Experimenter Condition</th>
<th>Mother Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Look at toy	extsuperscript{a}</td>
<td>6.35</td>
<td>3.80</td>
</tr>
<tr>
<td>Touch toy	extsuperscript{a}</td>
<td>2.65</td>
<td>2.80</td>
</tr>
<tr>
<td>Play with toy	extsuperscript{b}</td>
<td>13.90</td>
<td>9.76</td>
</tr>
</tbody>
</table>

Note. NA = not applicable.  
	extsuperscript{a}Mean frequencies. 	extsuperscript{b}Mean number of 5-sec intervals.  
*p = .01. +p < .10.
(puzzled vs. positive) and between-group comparisons for condition (experimenter vs. mother) showed no main effect of condition, $F(1, 38) = 0.73, p = .40$. The results reflected a significant main effect of looks, $F(1, 38) = 142.02, p < .0001, d = 1.86$, but the interaction effect (Condition $\times$ Looks) was not significant, $F(1, 38) = 1.17, p = .29$. Thus, it was concluded that puzzled looks dominated infant looking behavior in both conditions (Table 2).

Further, the infants displayed more puzzled looks toward the experimenter than toward mother during stimulus presentation. The two-way ANOVA with repeated measures on puzzled looks (toward experimenter vs. toward mother) and between-group comparisons for condition (experimenter vs. mother) showed no main effect of condition, $F(1, 38) = 0.03, p = .86$. However, there was a significant main effect of looks, $F(1, 38) = 36.96, p < .0001$. The interaction between looks and condition was also significant, $F(1, 38) = 6.69, p = .01$. Planned $t$ tests showed that the infants looked more toward the experimenter than toward the mother in both the experimenter condition and the mother condition (for means and standard deviations, see Table 2).

**Behavior Regulation Phase**

**Looking behavior.** To examine differences in infants’ looking behavior toward the adults during free play, the data on looks at experimenter and at mother were examined. The $t$ test showed no difference in looking at the experimenter ($M = 5.10, SD = 2.32$) versus the mother ($M = 5.24, SD = 3.08$), $t(38) = 0.76, p = .45$. Thus, no preference in infant looking behavior was found during this phase.

**Behavior toward toy.** Infant behavior regulation was examined. Comparisons between the experimenter and the mother conditions were performed with $t$ tests for independent groups. No differences were found in the number of times the infants touched the toy. However, the infants tended to look more at the toy (without touching it) after having received guidance from the mother than from the experimenter. Further, a significant difference in playing with the toy was found. Infants in the experimenter condition played with the toy for a longer period of time than infants in the mother condition (for means and standard deviations, see Table 3).

The infants in the mother condition looked more toward the experimenter than toward the mother during toy presentation. Thus, these infants might not have acquired the information delivered by the mother, which might explain the differences in behavior toward the toy. To examine whether looking at the experimenter during toy presentation in the mother condition was related to infant subsequent behavior regulation, correlations between puzzled looks toward experimenter and the three variables—looking at toy, touching toy, and play with toy—were carried out. However, none of the correlations was significant (all $rs < .12$, all $ps > .63$).
DISCUSSION

Building on previous studies, this experiment aimed to further our understanding about infant looking behavior in the face of ambiguity. More exactly, we wanted to examine if infant preferences in looking in social referencing setups could be signs of a growing understanding that some persons are knowledgeable and some are not in a certain environment, or if less sophisticated processes like associative learning (see Stenberg & Hagekull, 2007) might explain infant selectivity in looking. In one condition, the experimenter conveyed a positive message about an ambiguous toy, and in the other condition the mother conveyed the same message. Precautions had been taken to make the two conditions as similar as possible. Further, to examine infant behavior regulation in accordance with the information provided, a subsequent behavior regulating phase was included.

Infant Looking Behavior

In both conditions, the infants preferred to look at the experimenter over the mother when the ambiguous toy was presented. Even when the mother delivered information and the experimenter was busy reading a magazine, the infants looked more to the experimenter than at their mother. These results are in line with those reported by Stenberg and Hagekull (2007). However, in their study the experimenter presented the toy in all conditions, whether she delivered information or not, leading Stenberg and Hagekull to suggest that associative learning processes could account for the results. If associative learning processes had been at work in this study, the infants should have looked mostly at their mother, and not at the experimenter, in the mother condition. Thus, these results seem to rule out an interpretation of infant preferences in looking in terms of associative learning.

There are other interpretations of infant looking behavior in this particular situation. Young infants might engage in social interplay with familiar as well as unfamiliar persons, for example, when an adult looks smilingly at the infant and the infant responds by looking back at the adult while smiling. The infants in this study might have come to like the experimenter and looked at her to initiate an interaction. If the infants were seeking a positive interaction, one might expect them to show positive affect expressions. However, the infants showed few positive reactions when the toy was presented, and affect sharing looks were rarely seen. Most of the time, when the infants looked at the experimenter, they looked at her with a puzzled facial expression. Thus, an explanation in terms of social engagement does not seem appropriate.

New persons and new objects attract young children’s attention (Tomasello & Haberl, 2003). A friendly, although unfamiliar, adult might awaken curiosity in infants of this age. Thus, looking at the experimenter does not necessarily mean that the infants seek information from her. Infant preferences in looking at the experimenter convey a preference to engage in interactions with them.
menter might stem from an urge to get information about the experimenter herself: a “novelty effect” (see also Walden & Kim, 2005). If so, the infants might be expected to continue looking at her during the behavior regulation phase. However, no difference in looking at the two adults during that phase was found. To further examine this possibility, a study in which the degree of novelty in the experimenter varies should clarify if infant preference in looking in common social referencing setups is due to a novelty effect or not.

In discussing the motivation behind infant looking behavior in social referencing studies, Baldwin and Moses (1996) questioned whether infants actively look to others to seek information. As an alternative they proposed an account in terms of attachment. Infant looking in ambiguous situations might be seen as requests for comfort, and the authors pointed out that interpreting infant looking behavior from an attachment viewpoint puts less demand on infant sociocognitive skills essential for social information gathering. However, behaviors driven by the attachment system are directed foremost to the caregiver. Thus, from an attachment perspective, the infants should prefer to look at the caregiver given that the caregiver and an unfamiliar adult are equally available to look at (Baldwin & Moses, 1996). The attachment and the social referencing perspectives were contrasted by Stenberg and Hagekull (2007) and no evidence was found for an attachment account of infant looking behavior. This study showed that the infants preferred to look at the experimenter even when the mother and the experimenter acted similarly, which strengthens the previous interpretation made by Stenberg and Hagekull: Infant looking in this particular situation was not an expression of attachment behavior. Instead, the results reported here strongly suggest that the infants were seeking information.

Infant Behavior Regulation

In the subsequent free play phase, the infants tended to look more at the toy after receiving guidance from their mothers than from the experimenter. This could be interpreted as if the maternal message elicited more interest in the toy. However, the infants in the mother condition played less with the toy. Thus, the increased looking at the toy in the mother condition could instead be interpreted as a sign of hesitation: The infants restricted their exploration to “just” look at the toy. No difference in touching the toy was found between the groups, but they played more with the toy after receiving information from the experimenter. Thus, the infants seemed more influenced by the experimenter’s message than by the mother’s message as shown in the more intensive type of contact with the toy. However, the quality of the exposure of the message might explain this result. The maternal message might have been indistinct and vague due to the artificial situation. The experimenter, on the other hand, who was comfortable with the laboratory situation and more trained in the procedure, might have been more skilled in sending the mes-
sage. To check this possibility, an examination of message delivery was carried out. The manipulation checks (see “Method” section) did not show any differences between the mother’s and the experimenter’s conveyance of information. Thus, the quality of the exposure of the message does not seem to account for the differences in playtime.

The information was delivered verbally in combination with proper facial expressions. Thus, the infants did not have to look at the message provider: They could receive the message through the auditory channel alone. However, a message received through two channels could be assumed to have more impact on the receiver than a message received through one channel. Infants who looked at the experimenter when their mother provided information became less exposed to positive information than infants in the experimenter condition who looked at the person who provided the positive information. Thus, the lower degree of behavior regulation among the infants in the mother condition could be an effect of not having acquired the message. To examine whether looking at the experimenter during toy presentation was related to infant behavior regulation in the mother condition, a second set of analyses were carried out. However, no relations were found between amount of looking at the experimenter and degree of behavior regulation in the mother condition, suggesting that looking to the experimenter during toy presentation in the mother condition was irrelevant to infant behavior during free play.

If the infants perceived the experimenter as the adult present who had the most relevant information to provide about the toy, then the infants could be expected to rely more on information coming from her than on information coming from the mother. Accordingly, the infants should make more use of the information coming from the experimenter, that is, play more with the toy. Such findings were obtained by Stenberg and Hagekull (2007): The infants were more interested in playing with the toy after receiving positive information from the experimenter than from the mother. Thus, given the infants’ preferences in looking at the experimenter during toy presentation and infant behavior regulation in accordance with information gained from the experimenter, the results from this study seem to fit within an explanation in terms of an expertise perspective.

If so, what was it about the experimenter that made her appear as an expert? To begin with, the experimenter was familiar with the surroundings: She showed the mother and infant how to get to the lab (which stairs to take, which elevator to choose), she opened the doors (she had the keys), and so on. Regarding the mother, the reversed scenario was at hand: She did not know where the lab was located, did not open the doors, and so on. The mother had to follow the experimenter. Such behaviors might have signaled that the mother was not familiar with the situation. Further, on arrival at the laboratory room, the experimenter described the procedure, told the mother what to do, where to sit, what would happen next, and so on. Thus, the experimenter was the adult who took all the initiatives. Based on such observable cues indicating competence, the infants might have preferred to turn to
the experimenter for information because they found her to be the most knowledgeable person about the situation.

Such reasoning not only presupposes that infants seek information from others in the face of ambiguity, but also that they can determine whether another person possesses knowledge or not about a certain situation from that person’s behavior. Young children are assumed to use different cues by which to appraise if a person is trustworthy or not. For example, children are more likely to use information coming from a person who seems confident of her or his claims than a person who does not (cf. Harris, 2007), and 2-year-old children have been found to be sensitive to others’ knowledge state in a certain situation (O’Neill, 1996). Researchers have been skeptical concerning whether infants, already at the end of the first year, have an understanding of internal mental states in others, such as the possession of specific knowledge (e.g., Moses et al., 2001). However, there are findings pointing in that direction. The 12-month-old infants in the Tomasello and Haberl (2003) study could determine which object an adult was attending to based on knowledge of which of the objects was new to the adult. Such behavior, that is, to identify what is new for others, suggests that infants might have an understanding of different knowledge states in others. In the same vein, it seems reasonable to conclude that infant preferences in looking in this study could stem from a rudimentary understanding of others as bearers of differential pieces of knowledge.

CONCLUSIONS AND FUTURE RESEARCH

Building on previous research, this study shows that associative learning processes do not account for infant preferences in looking in typical social referencing setups, and lends further support to the interpretation made by Stenberg and Hagekull (2007) that attachment processes are not involved in infant looking behavior in social referencing experiments. The infants preferred to look at the experimenter over their mother regardless of whether the experimenter presented the toy or not. In the subsequent free play situation, the infants used the information conveyed by the experimenter to a higher degree in guiding their behavior with respect to the target stimulus. Together, these results strongly suggest that the infants were indeed looking for information from the person whom they perceived could best define the situation, the experimenter, giving support for an expertise perspective of infant looking behavior in social referencing situations.

There are certain social and cognitive skills necessary for engaging in social referencing that develop during the first year of life (cf. Klinnert, Campos, Sorce, Emde, & Svejda, 1983). The infant must have the capacity to evaluate the likely consequences of an ambiguous event on himself or herself. When the infant’s own intrinsic capabilities of coping with the situation fall short and a need for information arises, she or he must be capable of discriminating among the unique patterns
of facial and vocal cues in the emotional expressions of other people. The infant must be able to use the obtained information appropriately in guiding his or her responses with respect to the event or object eliciting uncertainty (cf. Feinman et al., 1992). The findings reported here suggest that 12-month-old infants also might have the capacity to detect and correctly interpret signals of superior competence in the behavior of others, adding to the notion that infants, already at the end of the first year, might have a growing understanding of different knowledge states in other people (e.g., Tomasello & Haberl, 2003). Thus, these results add to research concerning young children’s use of other people as sources of information (e.g., Harris, 2007). Future studies are needed to further examine when and how this ability develops.

To further examine the expertise perspective, a study carried out in an environment that is familiar to the mother but not to the experimenter would be an important contribution to the area. Such a study could clarify if infants prefer to turn to an individual who appears to possess specific knowledge within a particular setting. Moreover, a study in which two experimenters are available to reference, but only one of them appears to possess information about the current situation, could shed further light concerning infant preferences in looking in ambiguous or novel situations.

REFERENCES


