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Childrens Early Understanding of Mind

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Early Understanding of Referential Intent and Attentional Focus: Evidence from Language and Emotion

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INTRODUCTION

Communication among adults is grounded in a theory of mind. As Grice (1957) and others (e.g. Clark & Marshall, 1981; Rommetveit, 1979) have made clear, we cannot make sense of communicative interactions without presupposing that the interlocutors possess mutual knowledge of relevant beliefs and intentions. In the case of children, recent research indicates that a rudimentary theory of mind is well in place by the early preschool years, as are a rich array of communicative skills (Moses & Chandler, 1992; Perner, 1991; Wellman, 1990). The present volume is centrally concerned with the origins of a theory of mind. One way in which we might profitably search for these origins is to examine the path of communicative development as a potential window on early understanding of the mental realm. Communicative development is a particularly rich arena for examining theory of mind development. Mature communicative skills depend on, and thus index, theory of mind abilities. Further, as communicative competence increases, children gain access to increasingly powerful sources of information about the mind. In this way communicative development not only reflects advances in mentalistic understanding, but also makes possible further enrichments in children's theories of mind.

In what follows we explore a variety of links between children's early communicative advances and their emerging theory of mind. We begin by describing the major communicative milestones of the infancy period. Next,

we sample the views of several authors with respect to what these early communicative achievements might indicate about infants' theory of mind and, in so doing, we find marked disagreement: For some, infants' communicative competence is taken as a clear indicator of an initial theory of mind, whereas for others more frugal, reductive interpretations of this competence seem preferable. We then describe our own programme of research, which is in part designed to help clarify the nature of the theory of mind abilities underlying early communicative skills. Two lines of research, one on language learning and the other on understanding of emotional signals, suggest that by 18 months of age, and possibly earlier, infants' communicative abilities are mediated by important insights into the nature of mental life, wherein other people are seen as psychological beings capable of thoughts, feelings, and intentions concerning what is taking place in the surrounding environment. In particular, by the middle of the second year, infants understand that other people's attentional cues (e.g. line-of-regard, gestures, and so on) reflect their *mental* focus and referential *intentions*. We end by considering more generally some of the interactive links between theory of mind and communicative development.

MILESTONES OF EARLY COMMUNICATIVE DEVELOPMENT

From the moment of birth infants are drawn into the circle of human interaction and are active participants in the social flow. Reflexive cries fortuitously summon adults when infants are distressed, and preferences for looking at detailed, dynamic, high-contrast visual stimuli lead infants to gaze intensely and persistently at others' faces (Banks & Salapatek, 1983; Haith, 1980; C. Nelson & Horowitz, 1987), a propensity adults find endearing and which promotes further interaction. Between two and three months of age infants begin to respond systematically to others' smiles with smiles of their own, a response that also serves to maintain and enhance the quality of interaction for both participants. They can discriminate facial expressions (e.g. happy from sad; C. Nelson, 1987), and by about four to seven months they have begun to abstract the invariance of facial expression across physically different instantiations, noting, for instance, the similarity of happy expressions even when they appear on different individuals' faces (Caron, Caron, & Myers, 1982; Ludemann & C. Nelson, 1988).

Around this age, infants also show an emerging interest in other sorts of communicative signals. For example, young infants will sometimes follow their mother's line-of-regard if they happen to notice that she is looking elsewhere (Scaife & Bruner, 1975; see also Butterworth, this volume), and they will also follow her pointing gestures to nearby objects (e.g. Murphy & Messer, 1977). Shortly after this—sometime between 8 and 12 months—

infants begin to comprehend a few individual words; for instance, they will look toward the correct object when a label such as "bottle" or "dog" is uttered by an adult (e.g. Oviatt, 1985). At about this same age "social referencing" is first observed: Infants make use of an adult's emotional signals—facial expression and/or vocal intonation—to guide their behaviour with respect to newly encountered events (e.g. Campos, 1983; Feinman, 1982; Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992; Sorce, Emde, Campos, & Klinnert, 1985).

Early in the second year infants begin to produce increasingly refined and conventionalised signals of their own. Points and showing gestures are now evident (Leung & Rheingold, 1981; Murphy, 1978), and by 14 months infants have been observed to check their partner's gaze direction after pointing, as if to determine whether their point has successfully effected the appropriate change in the other's attentional focus (Bretherton et al., 1981). At this time infants are often producing a few recognisable words as well as conventionalised gestures, such as holding their arms up high to indicate a wish to be picked up (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bretherton, et al., 1981; Harding & Golinkoff, 1979). This is also a period of increased interest in engaging with others in co-operative enterprises. For example, Bakeman and Adamson (1984) found a marked increase between 15 and 18 months in the amount of time infants spend with others in joint focus concerning an object or external event.

As infants approach their second birthday, their communicative signals show a marked degree of sophistication. In the gestural realm they now show an ability to accommodate to the needs of their partner—for example, they will orient an object so as to take into account the other's line-of-sight (Lempers, Flavell, & Flavell, 1977). In addition, when an adult fails to respond appropriately to a gesture they will reproduce the gesture, and if this is not successful they will substitute other gestures as if to clarify their communicative intention (Bates, 1979; Golinkoff, 1986). In the language domain, learning begins to accelerate, although great strides have already been made. Infants between 18 and 24 months typically understand hundreds of words (Baldwin, 1991; Benedict, 1979), comprehend many multi-word sentences (Chapman, 1981; Hirsh-Pasek & Golinkoff, 1991), tend to be producing about a hundred words (Baldwin, 1991), and have begun to construct multi-word combinations of their own (K. Nelson, 1973).

IMPLICATIONS FOR INFANTS' THEORY OF MIND

We thus see the gradual emergence of a rich array of communicative skills in the first two years of life. However, although there is considerable

agreement on when these various skills are acquired, it is much less clear what implications they have for how we should characterise infants' understanding of mental life. A broad spectrum of views can be found, many of them differing considerably over how richly the phenomena should be interpreted (Baron-Cohen, 1991; 1993; Baron-Cohen & Ring, this volume; Bretherton, 1991; Butterworth, 1991; this volume; Butterworth & Jarrett, 1991; Hobson, this volume; Leslie & Happé, 1989; Perner, 1991; Tomasello, Kruger, & Ratner, 1993; Wellman, 1993).

Toward one end of this spectrum are those who suggest that the communicative abilities of 9- to 12-month-old infants already presuppose some insight into the minds of others. Baron-Cohen (1991; 1993; Baron-Cohen & Ring, this volume), for example, argues that young infants' communicative behaviours rest on a primitive, but nonetheless genuinely mentalistic, understanding of other people's goals and focus of attention. Infants have what he calls an "attention-goal psychology" that will later blossom into a fully fledged "belief-desire psychology." In particular, Baron-Cohen believes that gaze monitoring, comprehension and production of proto-declarative points (points suggesting a desire to comment on, rather than obtain, an object of interest), and social referencing all indicate that infants comprehend another's focus of attention in terms of simple underlying mental states. That is, infants' ability to interpret focus of attention in these contexts suggests an understanding that the other is *interested* in some external object or event (in the case of gaze or point following) or has either a positive or negative evaluation of it (in the case of social referencing). Baron-Cohen bolsters his argument that these early-appearing competencies constitute the origins of a theory of mind by noting their absence in autistic children, a population for which there is mounting evidence of a range of other theory of mind impairments (Baron-Cohen, Tager-Flusberg, & Cohen, 1993). In a similar vein Wellman (1993), invoking much the same evidence, argues that one-year-olds possess a rudimentary understanding of the internal, subjective, and experiential nature of the psychological lives of others. In particular, he argues that infants of this early age already interpret others as intentional beings having subjective desires, perceptions, and emotions that are directed at things in the outside world.

At the other end of the spectrum are those who remain sceptical concerning whether a genuine theory of mind underlies infants' otherwise impressive communicative achievements. Butterworth (1991; Butterworth & Jarrett, 1991; see also Butterworth, this volume), for example, in discussing infants' ability to locate the target of an adult's gaze, argues that it is not necessary to attribute an abstract theory of mind on the basis of such abilities. Instead he proposes that infants may simply understand that changes in another's line of regard are good predictors of

where an object might be located. For somewhat different reasons, Perner (1991) draws similar conclusions in discussing infants' gaze monitoring, pointing, and social referencing. He suggests, for example, that when infants point to a desired object and then check their mother's gaze to see if she has following the point, they need not understand the mentalistic aspects of her focus of attention but rather they may have simply figured out that appropriate looking on her part leads her to act in the right kind of way (e.g. to bring a desired object to the infant). Moreover, Perner argues, even cases of proto-declarative pointing—in which infants are clearly not pointing in order to obtain an object—do not amount to compelling evidence that infants are making a mentalistic interpretation of their mother's attentional focus. In such cases, he suggests, they may not be trying to manipulate her attention in order to produce a shared psychological experience but instead they may simply enjoy mastery over her eyes. Finally, with respect to social referencing, Perner points out that the mother's emotional expression might influence infants' behaviour without their understanding the mental experience underlying that expression. Instead of comprehending the psychological meaning of her emotional display, young infants may only understand what Perner calls its "environmental meaning." That is, they might merely have noticed the environmental correlation between the emotional expression and whether or not an object or event is threatening: They might just be following the rule (Perner, 1991, p. 128) that "when you see something dubious and your mother is watching you and shows a fearful face, then avoid that object or area." In sum, Perner suggests that early communicative abilities do not clarify whether infants understand the mental states of their communicative partners. He argues that other sources of evidence are required to illuminate early developments in theory of mind.

This brief sampling of opinion clearly indicates that there is very little agreement on how to interpret infants' early communicative competence. The existing evidence does not effectively discriminate between rich and lean interpretations of the kind we have just sketched. In view of this we have carried out several studies designed in part to determine just how sophisticated infants' communicative abilities might be and, in particular, to help decide between these alternative readings of the evidence. The logic of the studies has been to place infants in settings that would lead them to interpret communicative acts either accurately or inaccurately depending on whether they possessed insight into the mental lives of others. This approach has been taken in two domains: One of us has explored these issues extensively in the domain of language learning (Baldwin, 1991; 1993a; 1993b; in press), and we are now jointly pursuing a parallel set of studies in the domain of early emotional understanding (e.g. Baldwin, Moses, & Tidball, in preparation).

LANGUAGE LEARNING

As mentioned earlier, infants begin to comprehend a few individual words as early as 10–12 months, and by 18 months their comprehension vocabularies typically include hundreds of words. It has been argued by some that word learning during infancy proceeds primarily via simple associative mechanisms (e.g. Whitehurst, Kedesdy, & White, 1982). That is, new words may be acquired because over time infants register associative links between those words and the things with which the words correlate in their own experience. This process could be facilitated by the fact that parents often provide words at a time when infants happen to be focused on the object, event, or property to which the adult is referring (e.g. Collis, 1977; Harris, Jones, & Grant, 1983).

To the extent that such associative processes drive word learning, they would represent a surface-level analysis on the infants' part of others' communicative behaviour. Infants would simply note the presence of temporal contiguity between adult utterances and objects or events in the world, and recall the associations formed thereby; that is, they would not be undertaking any deeper analysis of *why* the adult happens to utter a word when a particular event occurs or a particular object is presented. If this is indeed a fair characterisation of how early word learning proceeds, then we would expect infants to make certain characteristic errors. In particular, they would tend to link a word with a given object or event any time those two things co-occurred in their experience, even when this co-occurrence was purely coincidental. For example, if an adult happened to utter an object label when infants were focused on something other than the correct thing—an instance of what we will call 'discrepant labelling'—infants would mistakenly link that label with whatever they themselves happened to be focused upon.

On the other hand, it may be that infants seldom fall prey to such mapping errors because they engage in a more sophisticated analysis of adults' utterances that helps to buffer them from the potential pitfalls of discrepant labelling. Infants may appreciate that people (1) utter words because they *intend* to refer to things or to talk about things, and (2) emit *attentional* cues as to the target of their reference—cues such as line-of-regard and gestures (e.g. showing, pointing, manipulating). If so, infants could then actively consult cues that speakers supply concerning the intended referents of their utterances. In a case of discrepant labelling, an active strategy to consult others' cues to reference would enable infants to avoid mapping errors, given that in speech to children speakers typically supply a rich and redundant set of cues regarding their intended reference (e.g. Kaye, 1977; Messer, 1978).

Making Sense of Discrepant Labelling

Observing how infants respond when discrepant labelling occurs is thus an ideal way to investigate whether they spontaneously initiate a deeper, mentalistic analysis of the speaker's reference. This is precisely what was done in two recent studies (Baldwin, 1991; 1993a). In this research, infants were shown two novel objects and heard a novel label applied four times to one of these objects under two different training circumstances: follow-in labelling (an adult looked at and labelled the toy of infants' focus) versus discrepant labelling (an adult looked at and labelled a different toy from the one upon which infants were focused). Later, infants were again shown the same two novel objects and were asked comprehension questions regarding the novel label (e.g. "Where is the *toma*?").

In the Baldwin (1993a) study, infants of 3 different ages participated: 14–15 months, 16–17 months, and 18–19 months. One finding was that infants across the 14–19 months span showed signs of noticing the discrepancy in focus that occurred between themselves and the experimenter in the discrepant labelling condition: In response to hearing the novel label during discrepant focus, infants were more likely to look at the experimenter's face and/or to look away from their own toy toward the other toy when discrepant labelling occurred relative to when the label was produced in a follow-in context. Apparently, then, even infants as young as 14 months actively monitor and follow another's attentional cues when language is provided.

However, such looking patterns alone do not clarify whether infants actually used the information they collected regarding the speaker's focus to guide their interpretation of the novel label. Of greatest interest is how infants interpreted the novel label in the two conditions as gauged by their response to the subsequent comprehension questions. First, it is important to consider how they performed on comprehension questions after follow-in labelling, because this provides a baseline estimate of their ability to establish a new word-object mapping in the experimental situation. In the two older age groups, infants selected the correct toy at high levels in response to comprehension questions after the follow-in condition training (68% [$SD = 18$] and 77% [$SD = 21$], on average, for the 16–17-month-olds and 18–19-month-olds, respectively), indicating that they had correctly linked the novel label with the appropriate referent. Infants in the youngest age group, however, were unsystematic in their responses (52% correct [$SD = 31$]). They appeared to be unable to establish stable word-object mappings in the experimental situation, perhaps because four exposures to the novel label was insufficient at this age.

Turning next to infants' comprehension performance following discrepant labelling, the question of interest is whether they would be led by a

superficial analysis to make a mapping error, and hence to select the toy they themselves had focused on at the time of labelling, or whether they would select correctly the object that the speaker focused on at that time. Here again, age differences emerged. The 18-19-month-olds selected the correct referent at greater than chance levels (74% [$SD = 3$] on average), indicating that they had analysed the speaker's cues to determine the target of her utterance. However, infants in the 2 younger age groups (14-15-month-olds and 16-17-month olds) were unsystematic in their responses to the comprehension questions (59% correct [$SD = 23$] and 49% correct [$SD = 37$], respectively. In one sense, neither of these younger groups could be said to have made mapping errors. However, with the youngest group no mappings of *any* kind were established: Recall that infants in this age group even responded unsystematically to comprehension questions after follow-in labelling. Thus, little can be inferred about their ability to avoid errors from such random performance. In contrast, the 16-17-month-olds systematically selected the correct toy after follow-in labelling, and showed chance level responding only after discrepant labelling. This suggests that during discrepant labelling they had noticed the discrepancy between their own and the speaker's focus, and realised that the speaker was not referring to the toy of their own focus. Hence they avoided a mapping error they otherwise would have made had they relied purely on temporal contiguity. Yet, though they avoided errors, they seemed unable to identify the correct target of the speaker's utterance, a problem posing no difficulty for infants only slightly older.

An important control was included in this study to ensure that the results indeed tapped infants' use of others' attentional cues to guide their interpretation of new words: An additional group of infants in the study received the same training circumstances that were described earlier (follow-in vs. discrepant labelling), but instead of later being asked comprehension questions concerning the novel toys, they were asked preference-control questions (e.g. "Where is your favourite one?" or "Point to the one you like."). Since the novel label did not appear in the preference-control questions, infants were essentially free to select whichever toy they preferred (whether or not they understood the specific content of these questions). Thus the preference-control questions clarify whether the training circumstances led infants simply to prefer a particular toy. A preference on infants' part for the toy of their own focus after follow-in labelling but for the experimenter's toy after discrepant labelling would raise the possibility that the comprehension findings might reduce to simple preferential responding and hence be uninformative about word-learning. As it turned out, however, infants of all ages showed random responding to preference-control questions. This is in marked contrast to the systematic performance of the older age groups in response to comprehension

questions, indicating that the comprehension findings truly reflected their use of attentional cues to interpret the novel labels.

In sum, then, when infants aged 16 months and up were faced with discrepant labelling they showed no sign of falling into mapping errors, indicating that they spontaneously initiated an analysis of the speaker's intended reference. Infants of 18-19 months provided especially clear-cut evidence that they had performed such an analysis successfully. Even though they had been looking at a different object when a novel label was uttered, they successfully linked that label with the appropriate referent, a referent which could only have been located through consulting the speaker's attentional cues.

One question raised by these findings is precisely what kind of analysis enabled infants to avoid mapping errors during discrepant labelling. As described earlier, a mentalistic analysis is one possibility: Understanding that people have *intentions* to refer, infants consult behavioural clues to that intent (e.g. line-of-regard, voice direction, body posture, etc.) and use these clues to help them in interpreting the new word. An intermediate possibility should also be considered, however. Perhaps infants simply orient to the speaker when sounds are uttered, and follow his or her line-of-regard or gestures without knowing why. These clues could merely serve to enhance the salience of the correct referent. In other words, infants may simply link the label to whichever object happens to be most salient, with line-of-regard and gestures being merely one way to enhance object salience. However, findings from two more recent studies (Baldwin, 1993b) rule out this intermediate possibility.

Distinguishing Referential from Non-referential Actions

The underlying logic of these studies was as follows. In a first study, infants heard a new label that was accompanied by *referential* action toward a novel toy. Then in a second study a different group of infants heard the novel label, but its presentation was this time accompanied by a salient *nonreferential* action. At issue, then, was whether infants would link the new label with the relevant object in the context of referential action, but inhibit such a link in the context of nonreferential action, despite the fact that both types of action enhanced the salience of the object involved.

In the first of these studies, in order to demonstrate that infants actually used the speaker's referential action to guide a new word-object mapping, it was necessary to rule out the possibility that mechanisms of association, such as temporal contiguity, were the source of infants' mappings. Although in the study described earlier infants did not rely on temporal contiguity to guide mappings, the robustness of this ability remained in question because

temporal contiguity was only weakly instantiated. The present study was therefore designed to make temporal contiguity compete more strongly with the attentional cues available in referential action. Sixteen infants of 19–20 months participated in either of 2 conditions. In the conflict condition infants played with two novel objects that were then hidden in opaque containers (they did not know which object was in which container). The experimenter then raised the lid of one container, peered in, and produced a novel label (e.g. "It's a *modi*. There's a *modi* in here."). Next, she turned to the other container, extracted the toy that had not been labelled, and handed it to infants. At least ten seconds later, she extracted the toy that had been labelled from its container and offered it to infants. Thus, that had been labelled from the label infants viewed an incorrect object (the first toy), and only after an interval of ten or more seconds did they see the correct object (the second toy). After infants had finished playing with the two toys, their comprehension of the new label was tested: They were shown the two toys and asked questions such as "Where is the *modi*?" The issue of interest was whether infants would make use of the speaker's referential cues (e.g. her action of raising the lid and peering into the container during labelling) to guide any mapping that they established, in which case they should select the second toy. The other possibility was that temporal contiguity would determine the mapping, in which case infants should select the first toy. As it turned out, infants selected the second toy—the toy specified by referential cues—at greater than chance levels (67% [$SD = 11.5$]) when answering the comprehension questions.

To rule out the possibility that these accurate selections were due to a simple preference for the second toy over the first toy, another condition was included—the coincide condition. Infants in this condition received the identical training as infants in the conflict condition, except that they were immediately shown the toy the experimenter had labelled, and only ten seconds later were they shown the other toy. Hence, in the coincide condition, the first toy was now the appropriate toy to select in response to comprehension questions, and infants did indeed show an above-chance tendency to select the first toy (70% [$SD = 14.9$]). Clearly, then, a simple bias in favour of the second toy could not have been the basis for infants' selection patterns in the conflict condition. Finally, an additional control for preferential-responding, like that used in the earlier study (i.e. a further group of 16 infants received the same training but were asked preference questions instead of comprehension questions), clarified that these findings reflect word-learning rather than simple toy preferences on infants' part.

Taken together, then, these findings indicate that infants relied on the speaker's referential action, despite conflicting information from temporal contiguity, to direct the new word-object mappings they established. Perhaps, however, as described earlier, infants used the referential action

only because it enhanced the salience of one object relative to the other, not because they understood that the speaker's action reflected her referential intent. To test this possibility, in a second study 16 infants of 19–20 months heard new labels in either a coincide or conflict condition in which the speaker provided a *nonreferential* action toward one container at the time of labelling. The training procedure in these two conditions was virtually identical to that in the first study, except that the experimenter manipulated the lid of one container *while looking in infants' direction* and saying "I'll show you a *modi*. Want to see a *modi*? A *modi*." This action, although not referential, was designed to make one container more salient than the other at the time of labelling. If infants establish new mappings simply on the basis of salience, then their pattern of responses to comprehension questions in this study should parallel that obtained in the first study—they should select the second toy in the conflict condition and the first toy in the coincide condition. However, this was not what occurred. Instead, infants responded unsystematically, suggesting that they recognised that the experimenter had not specified a clear referent for her utterance. As a manipulation check, infants' looking times for each of the containers were measured during the training phase to ascertain whether the nonreferential actions in the second study increased the salience of the container to the same degree as the referential actions in the first study had done. In both studies infants looked significantly longer at the container toward which the experimenter's action was directed than at the other container, and no significant differences emerged between the looking times across the two studies. Hence, although a non-referential action did in fact increase the salience of one container during labelling, this did not lead infants to link the new label with the object residing in that container. It is likely, then, that the mappings infants established in the first study were the result of an understanding of referential cues rather than mere salience effects. It is also noteworthy that in the second study infants failed to link the new labels with any object in a stable way, despite the fact that both salience and temporal contiguity were available to drive such mappings. These findings suggest that for infants as young as 19 months, as for adults, neither enhanced salience nor temporal contiguity is sufficient to justify a new word-object link. Infants seem to require clear-cut signs of referential intent before establishing a new word-object mapping. This is not to say that salience and temporal contiguity have no impact on word-learning; it is just that unambiguous signs of referential intent seem to be the crucial trigger for infants to initiate a new mapping.

Although these studies demonstrate that infants can distinguish referential from non-referential acts by at least 19 months, the precise basis on which they make this distinction is not yet clear. They could have used any combination of several sources of evidence concerning the

speaker's referential intent. For example, in addition to differences on the action plane (i.e. line-of-regard plus contact with the container vs. contact alone), lexical and syntactic differences between the two studies in the carrier phrases within which labels were embedded may themselves have altered the likelihood that infants would infer referential intent. Whether infants of the age considered here possess the requisite lexical and syntactic knowledge to detect such subtle differences is currently unknown. In any case, what is important for present purposes is that infants are capable of distinguishing referential from nonreferential acts in at least some cases where multiple and redundant cues support this distinction.

All in all, the various studies described here provide the best evidence yet available that older infants are actually performing a mentalistic analysis of others' communicative behaviour. In the everyday world, surface effects like temporal contiguity and salience are often a consequence of infants' responsiveness to others' referential actions, but our findings clarify that these superficial contingencies are not the basis on which infants establish new mappings. That is, because infants follow others' attentional cues, they may often see the correct object first after hearing a new label, or find the correct object especially salient during labelling, yet they seem to regard such consequences as inessential to word mappings. Rather, they apparently draw inferences about others' intentions—specifically, their referential intentions—from close behavioural observation. It is these inferences that evidently serve as the impetus for establishing new word-object links.

INTERPRETING EMOTIONAL SIGNALS

Another context in which a mentalistic analysis of others' behaviour would serve infants well is the social-emotional domain. Emotions, like words, have an intentional, referential quality. They tend to be *about* things: One usually feels sad, ecstatic, disgusted, or fearful about something, be it an object, event, action, or outcome. Accurately interpreting others' emotional displays thus depends critically on both understanding this "aboutness" relation and being able to identify the relevant thing in any given instance. Attentional cues such as line-of-regard and ostensive gestures (e.g. showing, pointing, manipulating) can supply useful information regarding the target of others' emotional signals, just as they do in the language domain with respect to the target of others' utterances. An appreciation of the relevance of such attentional cues for guiding the interpretation of emotional displays would help infants to avoid certain kinds of misattributions. The problem here is analogous to that posed by discrepant labelling in the word-learning domain: In some cases infants may be focused on something other than the thing toward which another individual's affect is directed. If infants lack an ability to seek and utilise attentional cues to determine the target of the

other's affect, temporal contiguity between the emotional expression and the object or event they are focusing on would lead them to link that affect with the wrong thing. If, however, infants appreciate the relevance that attentional cues have for interpreting others' emotional signals, such errors can be avoided. Again, then, under circumstances of discrepant focus, a superficial analysis of others' emotional signals would lead infants to a quite different pattern of mappings than would a mentalistic analysis.

As mentioned earlier, evidence concerning early social referencing is often taken as suggesting that even young infants are capable of a mentalistic analysis of others' affective displays. The social referencing phenomenon is this: When confronted with an unfamiliar object or person, infants of only 10–12 months have been seen to (1) glance toward a parent, and (2) subsequently behave toward the new object or person in accord with the affect that the parent displays (e.g. Feinman, 1982; Sorce et al., 1985). Based on such observations, many researchers have concluded that infants of this age spontaneously seek emotional information from the parent to help in resolving their uncertainty regarding the new object confronting them (e.g. Bretherton, 1992; Campos, 1983). Although several aspects of this interpretation have recently come under scrutiny (e.g. Baldwin & Moses, 1994; Feinman et al., 1992; Gunnar & Stone, 1984; Harris, 1989; Hornik, Risenhoover, & Gunnar, 1987; Mumme, 1993), of particular interest in the present context is whether infants' social referencing is informed by an appreciation of the significance of the other's attentional focus. Put another way, do infants recognise that the parent's affective display concerns a specific external thing, and can they actively consult attentional cues to locate the relevant thing even when a discrepancy of focus occurs?

An answer to at least the first part of this question is already available through work by Hornik et al. (1987) and Walden and Ogan (1988). In the Hornik et al. study, for example, infants were shown a novel toy toward which the parent displayed positive, negative, or neutral affect. Infants then had the opportunity to play with the toy in a room littered with other toys. Hornik et al. found that infants' behaviour toward the target toy was influenced by the quality of parental affect, whereas their behaviour toward the other toys was unaffected. This selective effect of parental emotional signals on infants' toy play persisted over time, even though parents displayed only neutral affect at the time of later assessment. It appears, then, that parental affect guides infants' behaviour in a specific rather than a global fashion, and that this effect is maintained for some time.

What has remained unclear, however, is whether infants appreciate the relevance of the parent's attentional focus to the interpretation of their affective displays. The Hornik et al. research was not directed at answering this question, and in their study infants were almost certainly already focused upon the target object when the parent provided affective

information. Hence infants could simply apply parental affect to the particular object with which they were presently engaged without any need to check the parent's attentional focus. The critical issue, however, concerns infants' responses when there is a discrepancy of focus at the time of emotional signalling.

We are currently exploring this issue (Baldwin et al., in preparation). In a recently completed study, 32 infants (half 12–13 months, the other half 18–19 months) were shown 4 pairs of toys in succession, each pair in a different experimental condition. The toys included in the study were selected to be ambiguous to infants of 12–18 months, in the sense that they would be uncertain as to whether they should handle the toys or not. For example, one pair of toys included a fur-coated black plastic spider and a foam crescent-moon face displaying a dastardly expression. Toys within a pair were chosen so as to be easily distinguishable yet roughly balanced in salience. A standard procedure was followed across all four conditions: One toy in a given pair was pushed forward within infants' reach, and as they focused on that toy and initiated a reach, the experimenter supplied some affective information—positive in valence in two of the conditions (saying, for example, "Oh! Nice!" with exaggerated intonation), and of negative valence in the other two conditions (e.g. "Iuu! Yeech!"). After producing the affect, the experimenter placed the toys side-by-side, equidistant from infants and within their reach. Infants were then allowed to play with the toys for up to two minutes. In one of the two conditions in which the experimenter produced positive affect, she looked toward the toy of infants' focus at the time of displaying affect (the *joint positive* condition), whereas in the other positive affect condition she looked toward the other toy—the toy with which infants were *not* currently engaged (the *discrepant positive* condition). The two negative affect conditions differed in precisely the same way—in one case, negative affect was supplied during joint focus (the *joint negative* condition); in the other case during discrepant focus (the *discrepant negative* condition).

This design enabled several questions to be addressed. A first question was whether infants would show any signs of having noticed discrepancies between their own and the experimenter's focus. If so, they might be more likely to glance toward the experimenter's face and/or the other toy in the discrepant focus conditions than in the joint focus conditions. Of even greater interest is how infants would respond to the toys following the experimenter's display of affect. If they fail to recognise the significance of the experimenter's attentional focus, then it is likely that they would link her affect with the toy on which they were focused at the time the affect was produced (the child's toy), regardless of whether the experimenter was focused on that toy when producing the affect (joint focus) or not (discrepant focus). Hence in both positive affect conditions they would respond positively toward that toy (contacting it quickly, manipulating it

freely and at length, and showing positive affect toward it), whereas in both negative affect conditions they would respond negatively to that toy (being reluctant to contact it, treating it gingerly, manipulating it for a shorter period, and displaying negative affect toward it). In other words, infants would show an ability to distinguish between and be differentially guided by positive versus negative affect, yet no ability to appreciate the significance of joint versus discrepant focus. A different pattern would be expected if infants note and understand the importance of the experimenter's attentional focus: Their response to the experimenter's emotional display should be directed toward the toy of the experimenter's focus, rather than toward the toy of their own focus.

From videotapes, coders blind to condition judged whether, in response to the experimenter's emotional display, infants checked the experimenter's face and/or looked away from the toy of their own focus toward the other toy. These observations revealed that infants of both age groups were more likely to check the experimenter's face in response to a display of negative affect relative to positive affect, but no significant difference occurred for such checking during discrepant focus relative to joint focus. However, at both ages affect that occurred during discrepant focus elicited more looks away from infants' own toy toward the other toy than did affect displayed in a context of joint focus. These looking data suggest that negative affect led infants to be especially vigilant (see Mumme, 1993, for a related finding), and that infants across the 12- to 19-months span noticed when a discrepancy in focus occurred.

To ascertain whether infants were not only alert to such discrepancies, but also appreciated their significance for interpreting the experimenter's emotional signalling, a different set of blind coders was asked to judge the affective quality of infants' response to each of the toys in a pair on a five-point scale (ranging from extremely negative to extremely positive) both before (baseline estimate) and after the experimenter's affective display. We found that infants in both age groups were influenced by the quality of the affective display: They reacted more positively when the experimenter had displayed pleasure than when she had displayed disgust. Moreover, we found evidence that infants' reactions were appropriately influenced by the experimenter's attentional cues. That is, they reacted more positively to the toy of the experimenter's focus when the experimenter had signalled pleasure than when she had signalled disgust, and they did so not only in the joint focus condition but also in the critical discrepant focus condition, where the experimenter's focus conflicted with their own. These effects held up over and above infants' baseline affective response to the toys involved, hence clarifying that the results were not simply due to perseverance of infants' initial reactions to the toys, but indeed reflected the influence of the experimenter's emotional display.

In addition, however, some inappropriate generalisation occurred. That is, not only were infants influenced by the affect with respect to the toy of the experimenter's focus, they also tended to generalise their responses to the toy she had ignored (i.e. the other toy in the joint focus conditions and their own toy in the discrepant focus conditions). On the face of it, this generalisation effect might seem to call into question whether infants' emotional reactions were influenced at all by the experimenter's attentional cues. Perhaps the experimenter's affect simply had a global impact on infants, inducing either positive or negative mood and leading them to respond to both toys in accord with this mood. It is important to note, however, that infants' appropriate reactions to the toy of the experimenter's focus could not simply be the result of global responding or generalisation, because the effects held up for that toy even when infants' reactions to the other toy were partialled out. In other words, infants showed specificity in their reactions to the toys over and above generalisation. Their reactions to the toy of the experimenter's focus were more strongly influenced by the affect than were their reactions to the other toy.

These findings are noteworthy on several counts. This is the first evidence to date that infants of 12 months and older not only notice that another's attention is discrepant from their own, but also use another's emotional signals *in reference to* the object of that individual's focus. By this age, then, infants are capable of avoiding errors in the interpretation of others' emotions that would otherwise occur under circumstances of discrepant focus. The strength of their ability to do this, however, remains in question because in our study they also tended to generalise their emotional reactions to the other toy. To the extent that they do this in naturalistic circumstances, they would in fact make some errors in interpreting the target of other's emotions.

In fairness to our infants we should point out that a number of factors in the study may have created uncertainty in infants' minds as to whether just one rather than both toys was the target of the experimenter's affect. It is possible that the cues to both affect and attentional focus may not have been strong enough or clear enough in this study for infants to avoid overgeneralising. In addition, certain pragmatic aspects of the task may have actively misled infants to generalise to both toys. For example, although the experimenter displayed affect toward just one of the toys, she then subsequently gave infants both toys. This impartial approach on the experimenter's part may have led infants to be uncertain about the degree of specificity that should be assigned to her affect. For example, infants may have felt (with some justification) that, in the negative affect conditions, if she had been genuinely disgusted with the toy in question she would not have given it to them at all. Similarly, in the positive affect conditions, they may have felt that if she was only pleased with one of the toys she would not

have given the other toy to them as well. We are currently designing a study that will circumvent these pragmatic problems. In this new study, the experimenter will not give the toys to infants but rather she and the infant will enter a setting in which the toys are already present. Moreover, stronger, more clear-cut cues to affect and attention focus will be provided. The experimenter will signal her affect not only via speech and facial expression but through action as well (in the positive affect conditions she will reach for and contact a toy whereas, in the negative affect conditions, she will reach for and then retract her hand from a toy). Finally, cues to her attentional focus will be strengthened by having her position be such that her back is toward one toy while she directs affect toward the other toy. If infants genuinely understand the relation between attentional focus and the intentionality of emotion then, under these enhanced conditions, even our 12-month-olds should again rely on attentional cues in reacting to the toys and, further, they should now be much less likely to generalise their reactions to the other toy.

CONCLUSIONS

Our findings indicate that when an adult utters a label or displays an emotion infants take pains to discover the intended referent of that label or emotion, and are aided in this process of discovery by skilful use of the adult's attentional cues. In the domain of language the relevant abilities were clearly present by 18 months of age and in the domain of emotion suggestive evidence emerged that they may be available as early as 12 months of age. In both domains infants were solving a complex problem of social co-ordination in a strikingly non-egocentric fashion. Not only did they need to notice a discrepancy between their own attentional focus and that of the adult, but they also needed to set aside the object of their own current focus, locate the target of the adult's attentional cues, and then infer that the adult's label or emotion related to this target.

These findings bring us back to the controversy raised at the beginning of this chapter concerning the appropriate interpretation of infants' early communicative abilities. The findings are more consistent with the rich interpretation of these abilities (Baron-Cohen, 1993; Wellman, 1993) than with the lean interpretation (Butterworth, 1991; Perner, 1991). The data are especially strong for the older infants in our studies. We would argue that by 18 months of age infants may grasp something about the mental states that cause people to direct their attention to one object rather than another, as evidenced in our studies by their steady reliance on attentional information as the preferred guide to interpreting others' utterances and emotional displays. Infants of this age do indeed operate with something like Baron-Cohen's "attention-goal psychology." They understand that when another

person is labelling or reacting emotionally to an object, that person is not simply physically oriented to the object but rather is attending to it in the sense of being psychologically engaged with it, where that engagement might take the form of being interested in or thinking about the object, or being happy or disgusted with it. In addition, infants understand that coming to the correct interpretation of the goals underlying another's communicative act, be it linguistic or emotional, involves determining that individual's referential intent.

Our interpretation of infants' abilities at this age receives further support when we consider the developmental timetable of other theory of mind abilities. That is, a slough of abilities related to theory of mind begin to emerge or is strongly consolidated in the middle of the second year. For example, around this age important developments take place in areas as diverse as pretence (Leslie, 1988), self-recognition (Lewis & Brooks-Gunn, 1979), imitation (Asendorpf & Baudonniere, 1993; Meltzoff & Gopnik, 1993), empathy (Zahn-Waxler & Radke-Yarrow, 1982), and internal state language (Bretherton, 1991), suggesting that infants may have already achieved some general conceptual insight into the minds of others.

At younger ages these other abilities have yet to emerge in a sophisticated form and our own data are also less compelling. Our conclusions for younger infants are thus only tentative at this point. In the linguistic realm infants in our youngest age group (14-15-month-olds) were unable to establish word-object mappings in either the follow-in or discrepant labelling situations. Because these infants failed to establish mappings even under conditions of joint focus, we simply do not know whether they appreciate the significance of attentional focus for interpreting language. It is possible, however, that they do have an understanding of attentional focus but that their failure arose because of the processing demands imposed by what, for very young infants, may have been a complex and confusing situation. Our findings in the emotional realm provide some support for this hypothesis. In the emotional domain somewhat younger infants (12-13 months of age) were able to rely on attentional cues in reacting appropriately to the target of another person's affect. Hence there is at least preliminary evidence that, by the beginning of the second year, infants have a dawning appreciation of the mentalistic significance of attentional information as an index of the other's psychological engagement and referential intentions. Before strong conclusions can be drawn, however, we will need to carry out a study, such as that described earlier, designed to replicate and extend our finding that 12-month-olds show specificity in their use of attentional cues to interpret another's affect.

In response to our account of infants' behaviour in these various studies, it might be argued that a reductive interpretation is still possible. That is, perhaps a way could be found to redescribe the abilities displayed by these

infants that would not require conceding them any real insight into the minds of others. However, we find it hard to imagine what a compelling reductive account would look like. It is true that when phenomena like gaze following are taken alone, low-level interpretations have some plausibility: Infants might simply note an environmental correlation between direction of gaze and interesting sights that lie in that direction (Butterworth, 1991). It is more difficult, however, to come up with a *simple* associative account that would explain the range of skills infants displayed in the studies we have presented. For example, Perner's reductive interpretation of social referencing as simple rule-following cannot account for the performance of our infants. He suggests that infants might simply relate an adult's fearful expression to whatever they find dubious in the immediate environment and hence avoid that thing. In our study, however, more than one dubious object was present and yet infants successfully consulted the adult's attentional focus to disambiguate the target of her affect. Clearly, such discriminating use of attentional cues to clarify referential intent goes well beyond blind application of a simple associative rule. In this regard we find infants' ability in the language domain equally telling. Recall that older infants were able to override salient, nonreferential actions and very strong associative cues like temporal contiguity in establishing new word mappings. Instead they consistently relied on attentional cues and referential action as their preferred guide to such mappings. It is surely unlikely that infants would isolate, and interpret non-mentalistically, just those cues—namely, the cues with genuine referential import—for which adults have a mentalistic interpretation.

In sum, our findings suggest that between 12 and 18 months of age a fledgling understanding of attention as something like a psychological spotlight that can be intentionally directed at external objects and events has begun to emerge. A remaining question concerns *how* infants might traverse the conceptual distance from this early understanding regarding attentional focus and referential intent to the more explicit conception of others as thinking beings that is seen in children just a few years older. This richer understanding of thinking includes, for example, an appreciation of the distinction between mental entities like thoughts and the external referents of those thoughts (Estes, Wellman, & Woolley, 1989), and of the distinction between the process of thinking and related processes like perceiving, talking and acting upon (Flavell, Green, & Flavell, in press). Another important aspect is the knowledge that people can think about or focus attention upon things that are not physically present. In the studies we have described the conception of attention that infants revealed was always of attention to some currently available object. How infants extend this conception to include the possibility that attention may be focused on things not present in the immediate surround is unknown. However, we would speculate that one

of the most influential factors in this regard might be the development of language itself. With the help of the referential abilities demonstrated in this research, infants have typically acquired a respectable comprehension vocabulary by the middle of their second year. Having fixed the reference of a sizeable number of terms, they are in a position to make some interesting observations about others' use of language. Language is a uniquely powerful medium for communicating about things that are spatially or temporally distant, and we utilise it heavily for this purpose. Infants will thus have many opportunities to note that people sometimes utter words when no potential referent is in view; for example, people talk about the family dog when the dog is outside or in another room. Without an understanding that attention and thinking can take place in the absence of tangible referents, such utterances would surely be difficult to fathom. In order to make sense of such anomalies, infants would be pushed toward inferring that what a person is thinking about, and the language which sometimes accompanies such thoughts, often goes well beyond the bounds of the immediate perceptual neighbourhood. In this way infants' budding linguistic knowledge might provide an especially strong impetus to construct a more powerful theory of mind (see Robinson, this volume, for an analogous suggestion with respect to later developments). At this point little is known about when infants begin to comprehend another person's references to absent objects but, given the findings from our language studies, such an understanding might be expected to develop from the middle of the second year. In this regard, there is at least some data from children's productions that is consistent with this hypothesis (Sachs, 1983). A final speculation with respect to the relation between language and theory of mind concerns species differences in mental state attribution. The fact that language seems to be a specialised skill that is largely unique to the human species may be at least some part of the explanation for why we eventually construct altogether richer theories of mental life than do even our closest phylogenetic relatives, the great apes.

The referential skills displayed by infants in our studies may also lay the groundwork for an awareness of the knowledge-ignorance distinction that develops more fully in the preschool period (e.g. Pillow, 1989; Pratt & Bryant, 1990). That is, infants with such skills will have plenty of opportunities to realise that, in situations like those they faced in our studies, they are ignorant while others are knowledgeable (i.e. others may know the name for a novel object and they may also know whether it is dangerous or safe). If infants are able to take advantage of these opportunities, we should expect to see them beginning actively to seek out and consult other people as potential sources of information about the world. Unfortunately, we currently know very little about just how sophisticated infants' social information-gathering abilities really are

(Baldwin & Moses, 1994). The fact that infants in our studies consulted attentional cues when the adult produced an utterance or emotional display does not clarify whether they actively *sought* such linguistic or emotional information. In other words, infants might be skilled at interpreting messages that are provided and yet not be capable of conceptualising the *possibility* of linguistic or emotional information before it is supplied.

Finally, the research we have presented here illustrates not only that communicative development opens a window on infants' developing theories of mind but that infants' growing awareness of mental life has profound implications for early learning. To the extent that infants fail to recognise the significance of others' attentional focus and how it reflects referential intent, knowledge acquisition will be greatly compromised in the flux of daily interaction. Errors of interpretation will occur and these will slow the path of acquisition. The skill that infants in the second year display in this arena thus helps to explain the phenomenal pace at which knowledge is acquired at this age. Because infants themselves play an important role in locating the target of others' linguistic and emotional messages, they not only avoid many potential pitfalls, but their opportunities for learning are also greatly expanded.

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