

Intersubjective Communication and Emotion in Early Ontogeny

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CHAPTER 2

Infant intersubjectivity: broadening the dialogue to include imitation, identity and intention

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What is the problem of intersubjectivity and why does it intrigue us so? The problem stems from the fact that persons are more than physical objects. When we describe a person's height, weight, eyes, etc., we do not exhaust our description of that person. We have left off their psychological makeup. If a self-mobile, human-looking body were devoid of psychological characteristics it would not be a person at all, but a robot or, to use a philosopher's favourite, a zombie. A fundamental issue is how we come to know others as persons like ourselves.

Each one of us has the phenomenological experience that he or she is not alone in the world, in particular that we are not the unique bearer of psychological properties. We know that we think, feel, have intentions; we also find ourselves believing that others have similar psychological states, despite the fact that we do not experience others' states in the same way that we experience ours. Reflection on this gulf between ourselves and others intrigues us and can raise questions about our understanding of other persons. A computer with voice synthesis could be made to cry out, but we would not think it felt pain. A robot might be programmed to wrinkle its elastic 'face' when an internal chip detected sobbing, but we would not ascribe empathy to it. Why, then, do we ascribe psychological states to other humans?

Philosophers seek to justify the inference that the moving sacks of skin that we see are animated by psychological states just like our own. They contemplate whether this way of thinking might be a fiction and criteria for knowing whether it is or is not. Developmental psychologists ask different questions. They inquire how such a view takes hold among humans. Is it present at birth? Does it develop through social interaction? Does the nature of intersubjectivity change with age?

The philosophical questions about intersubjectivity remain unsettled, but every day people continue to talk, act and write in the (often vain) hope of changing the minds and hearts of others. Regarding the developmentalist's questions, there have been wide swings of the interpretive pendulum. At the apogee in one direction is Piaget (1936/1977, 1954) who famously argued that the infant is born a 'solipsist'. Piaget's infant was not an intersubjective infant, still less was his newborn. At the apogee in the other direction is Trevarthen (1979a, 1983; Trevarthen and Hubley, 1978; also Bråten, 1988a), who argued for an innate intersubjectivity wired into the human brain at birth.

Recent debates about early intersubjectivity often cite literature on three phenomena: the mutual timing and turn-taking aspects of adult-infant interactions (Bråten, 1988a; Brazelton *et al.*, 1974; Brazelton and Tronick, 1980; Stern, 1985; Trevarthen, 1979a), joint attention (e.g., Bruner, 1975, 1983; Butterworth and Cochran, 1980; Butterworth and Jarret, 1991; Moore and Dunham, 1995) and social referencing (e.g., Campos and Stenberg, 1981; Sorce *et al.*, 1985). These are thought to be important clues to non-verbal intersubjectivity, because they indicate a certain attitude, a 'taking into account' of the other by the infant.

The logical prerequisite for inferring intersubjectivity, however, is that the infant take into account the *psychological* aspects of the other, not solely the physics of the other. If a baby climbs on the shoulders of another simply as a footstool, this involves an other but not intersubjectivity, because it is not the other's mind that was taken into account. Thus not all interactions between social agents necessarily entail intersubjectivity.

A conservative reading of the oft-cited phenomena can shake one's confidence in them as direct measures of intersubjectivity (Baldwin and Moses, 1994; Hobson, 1994a; Meltzoff and Gopnik, 1993; Tomasello, 1995b; Tomasello *et al.*, 1993; Whiten, 1994). Some faith-shaking questions are the following. Does sensitivity to timing actually entail that the infant attributes psychological properties to the other? What if joint attention is accomplished solely through perceptual geometry, the extension of a line in space from the adult's pupil? How do we know that in the classic social referencing set-up, the adult's reaction to the novel toy (their fright face) does not itself frighten the infant without necessitating any understanding of the adult mental state? Moreover, both joint attention and social referencing have onsets late in infancy, and therefore do not uniquely support a nativist thesis; nor do they fall out of a Piagetian analysis. Far from being the foundation for intersubjectivity, they have developmental roots that need to be explained.¹

What was once settled ground in Piaget's time, and was resettled by Trevarthen and colleagues, is now again open for reconceptualization. In this window of opportunity, we need to re-examine what we mean by intersubjectivity and the kind of evidence developmental psychologists can bring to bear on its origins and development.

In this chapter we will argue that newborns are not isolated from others at birth, but on the other hand do not yet understand the internal feelings and mental states of others in the way a 2-year-old does (Gopnik and Meltzoff, 1997). A developmental view is needed. The promise of a developmental view is obvious, but it requires evidence and a cogent argument to be taken seriously. One goal of this essay is to provide the needed detail about the development of intersubjectivity in the preverbal period. We will propose that the imitation of human actions is the first bridge between the infant and others, and that imitation serves the dual functions of differentiating the broad class of 'others' into individuals and providing an early means of communication with them. It is through mutually imitative games, we argue, that infants progress from conceptions of others as entities with whom one can share actions to persons with whom one can share goals and intentions.

Overview of a developmental account

The bedrock on which intersubjective development is built is recognition of the 'like-me-ness' of others. This provides a basis for connection between the infant and other. Imitation is perhaps the first observable act demonstrating this connection. In newborn facial imitation, there is an apparent gulf to be bridged. The self can be felt, but cannot be seen. The other's face can be seen, but cannot be felt. Yet self and other somehow connect. The other can be understood as like me, at least in the sense that we can do the same acts.

True intersubjectivity requires not only connection but also differentiation. It involves more than a feeling of communion with an undifferentiated class of 'other'. It also entails relations with particular others who are valued as individuals. This in turn raises the question of how to determine their identity. A complete theory of early intersubjectivity must account for infants' ability to distinguish individuals from one another and reidentify a person as the same one again. We show that young infants deploy imitation as one means of sorting out the identity of individual people. Young infants are sometimes unsure about whether someone is the self-same person who has changed appearance or a new person who looks like the old one. They use imitation to help make these determinations. They do so by treating

the distinctive games people play as shared memories or at least shared experiences by which the other can be reidentified. They treat distinctive games as if they are invisible marks that can be rendered visible through interaction. This further illustrates the intersubjective significance of early imitative behaviour, for it is one of the earliest means by which infants solicit and recreate the distinctive acts of particular others.

The imitation game is a bidirectional experience through which infants explore relations between self and other. The parent can propose and the infant answer, or the infant propose and the adult answer. Parents spend hours playing reciprocal imitation games with their children, banging when they bang, shaking when they shake. We suggest that these games provide an engine for development. Such episodes provide infants with evidence that self and other are commensurate bearers of genuinely psychological properties like goals and intentions. This delimits the class of entities to which the infant ascribes psychological properties. Infants should construe people (but not things) as intentional beings, because people can be imitated, are like them, and engage in reciprocal games.

A fuller understanding of others as 'subjects' is that they can intend something different from what they actually achieve. In the adult ontology, 'subjects' are entities for which there is a differentiation between intention and behaviour. We found that 18-month-olds can recognize the intention of another even when the adult accidentally fails to fulfil this end. At least by this age they make a differentiation between the surface behaviour of people (what they actually do or say) and another deeper level involving goals and intentions. This differentiation in turn underlies linguistic communication (Grice, 1957) and arguably sows the seeds for ascribing more complex mental states to others (e.g. beliefs), which have been studied under the label of 'theory of mind' research (Astington and Gopnik, 1991; Flavell, 1988; Gopnik, 1993; Harris, 1989; Perner, 1991; Wellman, 1990).

Intention reading in infancy

In investigating the origins of intersubjectivity one is immediately confronted with the question of how to 'ask' infants whether they read below surface behaviour into the minds and hearts of others. This seems a difficult question to pose without language, because all we can do is show the infant behaviour and measure their behavioural (or physiological) responses. How can we test whether infants treat another as *someone* who has a psychology and not *something* that is completely described by physics?

To address this question, a new procedure was developed, which was dubbed the behavioural re-enactment paradigm. The procedure capitalizes on the fact that human infants are highly imitative. However, it uses this proclivity in a new way, by testing if infants can read below the literal surface behaviour to something like a psychological state.

The study involved showing infants an unsuccessful act. For example, the adult tried to perform a behaviour, but his hand slipped. Thus the goal-state was not achieved. Alternatively, the adult accidentally under- or overshoot his target. To an adult, it was easy to read the actor's intention though he was not able to fulfil it. The experimental question was whether infants also read through the surface behaviour to the underlying goal or intention of the actor. The measure of how they interpreted the event was what they chose to re-enact, in particular whether they chose to produce the intended act despite the fact that it was never present to the senses.

Using this paradigm, Meltzoff (1995) tested four groups of 18-month-old infants. The Demonstration(target) group saw the adult successfully fulfil his intentions and perform a series of target acts on five different objects. The Demonstration(intention) group saw accidental failures for five different events. With each object, the adult strove to reach the goal but did not successfully carry out his intention. The Control(baseline) group simply omitted any adult demonstrations. The Control(adult activity) group saw the adult perform control actions on the objects for the same length of time as in the two Demonstration groups, but the adult showed neither the target acts nor the intention to achieve them. The control acts were carefully designed so as to control for the possibility that spatial proximity of the adult's hands to the target, or proximity of two objects with each other, might 'suggest' the target behaviour (see Meltzoff, 1995 for details).

The results were very clear cut. Infants in the control groups did not tend to produce the target acts spontaneously or by chance. However, infants in the two Demonstration groups produced more than 75% of the target acts. They reproduced the targets after observing the adult do so, which is straightforward imitation. The important, new finding is that they also produced the targets in the intention condition. Indeed infants were just as good at duplicating the target after seeing the adult trying but failing as they were when the target was actually achieved.

We next inquired how infants would respond to a mechanical device that mimicked the same movements as the actor in the failed-attempt condition. One stimulus used was the effort to pull apart a

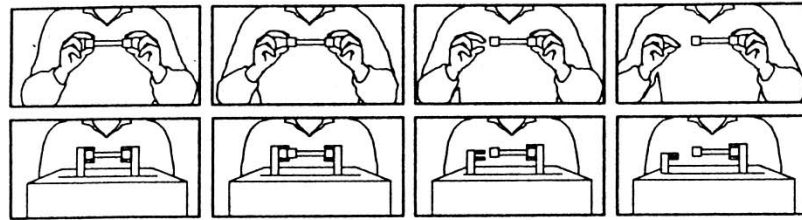


Fig. 2.1 Human demonstrator (top panel) and mechanical device performing the movements (bottom panel) (from Meltzoff, 1995)

dumbbell-shaped object, which failed because the adult's hand accidentally slipped off. An inanimate device was constructed that had poles for arms and mechanical pincers for hands. It did not look human but it could move very similarly to the human (Fig. 2.1). For the test, the pincers 'grasped' the dumbbell at the two ends just as the human hands did. One mechanical arm was then moved outwards, just as in the human case, and its pincer slipped off the end of the dumbbell just as the human hand did. The movement patterns of machine and man were closely matched from a purely spatiotemporal description of movements in space.

The results showed that infants did not attribute a goal or intention to the movements of the inanimate device. Although they looked at the device as long as at the human display, they simply did not see the sequence of actions as implying a goal. Infants were six times more likely to pull apart the dumbbell after seeing the human failed attempt than after the 'failed attempt' of the inanimate device.

This research helps to codify a distinction that was made earlier and is important for scientists gathering data on intersubjectivity. It is essential for our research to distinguish between construing the behaviours of others in purely physical versus psychological terms. To help keep this distinction clear we call the former *movements* or *motions* and the latter *human acts*. The behaviour of another person can be described using either physics or psychology. We can say 'Kate's hand contacted the cup, the cup fell over' or 'Kate was trying to pick up the cup.' Behaviourists try to stick to the former description precisely because they eschew appealing to invisible psychological states. Evidently, infants are not behaviourists. They construe the behaviour of others not simply as 'hold the dumbbell and then remove one hand quickly' but rather as an effort at pulling. Moreover, the new work shows that infants have a differentiation in the kinds of attributions they make to people versus things. In this sense infants have adopted an intersubjective stance; they construe people, but not

things, as 'subjects' with whom they might have an intersubjective relation.

The imitation game

We propose that imitative games lead to growth of intersubjectivity. Parent-infant games are often reciprocally imitative in nature. First, the infant begins banging a tabletop. The parent seizes the opportunity for making a communicative connection and bangs in return. Next the child repeats the same. . . then the parent. . . and so on in a kind of non-verbal exchange game. Many theorists have focused on the temporal patterning, the turn-taking aspect, of the interaction, and much has been made of this (e.g., Bråten, 1988a, 1992; Brazelton *et al.*, 1974; Bruner, 1975, 1983; Stern, 1985; Trevarthen, 1979a).

We see additional value in such interactions in the congruence between self and other in the bodily activities performed and the intentions underlying them. Physical objects may come under temporal control, but only people, indeed only people who are paying attention to you and acting intentionally, can imitate your behaviour in a generative fashion. We will make much of this.

If congruence is important, one needs to demonstrate that infants are sensitive to it. It is not addressed by the (quite fascinating) perturbation studies in which a mother stops responding to her infant, and the infant's affect is monitored (Muir and Hains, 1993; Murray and Trevarthen, 1985; Tronick *et al.*, 1978). Such an arrangement disrupts the timing of the interaction, and infants may find this change disturbing without any recognition of the fundamental similarity between oneself and another human being.

The issue in question is difficult to examine in natural interaction. However, we can arrange a structured interaction that focuses on the problem. In our laboratory interactions, 14-month-old infants sat across a table from two adults who sat side by side (Meltzoff, 1990). One adult imitated everything the infant did and the other did not imitate. Let I = infant; I' = imitating adult; NI = non-imitating adult. We wanted NI not only to be active, but to do 'baby-like' things with the toys so that no preference for I' could be based solely on a differentiation of adult versus infantile actions. A yoked-control procedure was used in which the adult interactants viewed TV monitors that were behind the infants. One monitor displayed the actions of the current infant, live; the other the immediately preceding infant. Each adult copied one of the infants, so each acted like perfect babies. Could the infants distinguish which adult was acting just like the self (gaze, affect, etc. were controlled)?

The results showed that they could. They looked longer at I'; smiled more at I'; and directed testing behaviour at I'. By 'testing' we mean that infants often modulated their acts by performing sudden and unexpected movements to check if I' was following what they did. The Marx brothers are famous for substituting see-through glass with a confederate on the other side for a mirror. The actor in such a situation self-consciously varies his acts to see if the other is still in congruence. Infants acted in this same way.

These results suggest that being imitated is attention-getting and pleasing at this age. Given a choice between an adult who was or was not imitating them, infants looked longer and smiled more at the imitating adult. This is a laboratory demonstration that reciprocal imitation focuses the infant's attention and is emotionally stirring.

How did the babies detect the imitative relationship? Two kinds of information are available: temporal contingency and structural congruence. It is relevant to theories of intersubjectivity to distinguish between these two bases. The former only requires that infants are sensitive to contingency information, but the latter implies that they are processing the relationship between self and other at least at the level of human acts.

A new study was designed in which the temporal aspects were equated by having both experimenters act at the same time. Both experimenters sat with neutral expressions until the infant performed a target act from a predetermined list. If and only if the infant exhibited one of these target actions, both experimenters began to act in unison. I' performed the infant's act; NI performed a different behaviour from the list. What differentiated the two interactions is not timing, but the structure of their actions *vis-à-vis* the subject.

The results showed that the infants looked, smiled and directed more testing at the adult who acted just like them. Evidently infants do not just recognize that another moves *when* they move (temporal synchrony), but recognize that another moves in the same *manner* as they do (structural congruence). We can infer that infants recognize a similarity between themselves and other people, something exceeding shared timing and based on a more fundamental commonality. Only people can act 'like me' across a wide range of behaviours and interactions.

Further research revealed that even infants younger than 2 months of age are attentive to being imitated. However, we found an important difference between the younger and the older infants. Although younger infants increase the particular gesture being imitated, they do not switch to mismatching gestures to see if they will be copied. For example, if infant mouth opening is being copied, young infants'

attention is attracted and they increase the like behaviour; but they do not switch to tongue protrusion to test this relationship. Younger infants seem to interpret being copied within a causal framework, as though their act causes the adult's act. The older infants go beyond this interpretation and treat the interaction as a matching game that is being shared.

By saying that the older infant appreciates the matching game *per se*, we mean that the relationship is being abstractly considered – the notion is that 'you will do what I do' where the particular behaviours are infinitely substitutable. It is not the notion that mouth opening causes mouth opening (a mapping at the level of a particular behaviour), but the more abstract notion that the other is doing 'the same as' I do. By 14 months, infants undoubtedly know that adults are not under their total control, and part of the joy of this exchange is the realization that although the infant does not actually control the other (the neonate's illusion), nonetheless the other is choosing to do just what I do. Together these two factors may help to explain why older infants will joyfully engage in the imitation game for 20 minutes or more – much longer and with greater glee than watching themselves in a mirror.

Newborn imitation and intersubjectivity

We have argued that the infant is sensitive not only to the timing of interactions but to the structural congruence between his own acts and those of other people. A developmentalist is immediately drawn to the question of origins. If one is interested in origins, the study of 14-month-olds or even 2-month-olds will not do. The place to look is the newborn.

The response of newborns to human faces is doubly interesting. On the one hand, it involves their reaction to a conspecific, one half of the intersubjective duet. On the other hand, we know with complete assurance that they have never seen their own face. At first blush it would seem out of the question that newborns could know anything about the fundamental similarity between their own face and that of the faces they see.

First impressions can be wrong. Research indicates that newborns are especially sensitive to human faces (Boysson-Bardies *et al.*, 1993; Morton and Johnson, 1991). More importantly for intersubjectivity, infants are not just visually attracted to faces, they are motivated to perform actions that match those they see. This is shown by the studies of neonatal imitation which have been replicated in more than twenty studies from a dozen independent laboratories (e.g. Abravanel

and Sigafos, 1984; Field *et al.*, 1982; Fontaine, 1984; Heimann, 1989; Heimann and Schaller, 1985; Heimann *et al.*, 1989; Jacobson, 1979; Kaitz *et al.*, 1988; Kugiumutzakis, 1985b; Legerstee, 1991; Maratos, 1982; Meltzoff and Moore, 1977, 1983a, 1989, 1992, 1994; Reissland, 1988; Vinter, 1986). In Meltzoff and Moore (1983a, 1989) literal newborns were tested. The oldest infant was 72 hours old, and the youngest was 42 minutes old. One cannot trace a human's response to other humans much farther back than this. This is the initial state.

We suggest that early imitation has deep intersubjective and communicative significance. This argument is a delicate one and takes some patience to get through. It is not so much that newborns imitate, but *how* they do so that is critical. If imitation were automatic, rote and reflexive it would have less far-reaching consequences. In fact, early imitation is non-reflexive, volitional and intentional.

Non-reflexive nature of imitation

If imitation were a simple reflex, it might fall to chance if a delay and intervening activity were inserted between eliciting stimulus and the motor response. In one study, a pacifier was put in infants' mouths as they watched the display (Meltzoff and Moore, 1977). Infants engaged in competing motor activity (sucking on the pacifier) during the presentation. The adult then stopped gesturing, assumed a neutral face pose, and only then removed the pacifier. The results showed that infants were able to imitate. Meltzoff and Moore (1994) pushed the delay further. Infants saw gestures on one day and were sent home. When they returned the next day the same adult sat before them with a neutral face. The infants stared at the adult and produced the particular gesture they saw the day before. These studies suggested that imitation can be mediated by a representation of the now-absent acts.

It had originally been supposed, without much empirical evidence, that neonatal imitation existed but then 'dropped out' of the infant's repertoire in the first 2–3 months of life. This was seized on as supportive of the reflexive account. Such 'drop out' was disproved when both Kugiumutzakis (1985b) and Field *et al.* (1986) found evidence for imitation in the so-called drop out period. Meltzoff and Moore (1992) also conducted a relevant test and likewise did not find drop out. Indeed, we were able to show how the 'drop out' misconception got started. We showed that the same infants who did not imitate under one test paradigm nonetheless responded with imitation when tested in a different way. It turned out that the capacity for imitation never disappeared; instead infants' interest at 2–3 months shifted to other types of social games and greeting (smiling, cooing).

Imitation could be robustly elicited if the social situation was arranged to focus on imitation rather than the more common games of this age period. Although imitative drop out is still found in textbook and chapter summaries, it can be explained by performance or motivation factors that can easily be reversed.

Volitional nature of early imitation

The volitional nature of imitation is shown by the fact that infants may choose to perform a different gesture than the one they are being shown. In particular, they may imitate a gesture that they have in memory rather than the one that is in the perceptual field. Infants demonstrate this in two ways: (a) they imitate the gesture shown the day before when the same person returns and shows a neutral face (Meltzoff and Moore, 1994); (b) when confronted with two adults in succession, they may imitate person-1's gesture when viewing person-2's (Meltzoff and Moore, 1992). This pattern suggests the nonautomatic nature of imitation. It is not solely driven by the information presented to the senses but appears to be under voluntary control. As shown by the findings discussed in the following section (pp. 58–60), infants deploy imitation according to their interpretation of the social interaction rather than having it triggered by the physical stimulus.

Intentional nature of early imitation

Early imitation is an intentional activity. In one experiment, 6-week-old infants were shown a novel oral movement, a large tongue protrusion to the side. For most babies the initial response was not an exact copy of the adult. Instead they made mistakes. A microanalysis of the response profile documented that infants corrected these initial attempts over successive efforts (Meltzoff and Moore, 1994). This pattern over time suggests that young infants can imitate novel motor patterns by monitoring and modifying their own acts to bring them into congruence with others'. The infant's goal seems to be to match the adult's act. Other research showed that infants commit rule-governed errors in their efforts to match the adult (Meltzoff and Moore, 1997), which further supports the notion that early imitation is goal-directed, intentional activity.

Intersubjective significance

The new empirical evidence supports the inference that early imitation is non-reflexive, volitional and intentional. We have developed a

detailed model of the psychological mechanism mediating such early imitation (Meltzoff and Moore, 1997). In the model, the perception and production of human acts can be represented within a common supramodal framework. The model depicts infant imitation as a cross-modal matching-to-target process. The goal or behavioural target is specified visually. Infants' self-produced movements provide proprioceptive information that is compared to the visually specified target.

Our notion of a supramodal framework has implications for foundations of intersubjectivity, because it means that infants have a code for interpreting that the other is 'like me' right from the earliest phases of infancy. Self and other can be related because their bodily actions can be compared in commensurate terms: 'I can act like the other does and the other can act like me.' An early instance of intersubjectivity may be the 'state of being' experienced while intentionally imitating. This would encompass feelings about: the self (one's proprioceptive awareness and affective tone within the context of striving to match), the other (the other's acts felt/understood from the inside, having been carried out oneself), and the relationship (the infant is not alone, but is like the person who is seen, thus conferring a sense of identity or belonging).

Identity of individuals as a prerequisite for intersubjective relations

Intersubjectivity is not an oceanic feeling of connectedness between oneself and the universe of others. Our adult intuition is that 'subjective' experience is, at bottom, personal experience. Adult intersubjectivity arises from one's relation to specific others, each of whom is valued in their individuality.

A theory of the development of intersubjectivity must be concerned with how and when infants develop a notion of individual others. This raises an identity problem: How does an infant distinguish one person from another and reidentify a person as the 'same one' again, as someone with whom I have this relationship?

In thinking about this issue it is important to be clear about two meanings of 'identity' or 'sameness'. One meaning of 'the same' concerns the notion of an object being the self-same individual over different encounters in space and time. No two objects are 'the same' in this sense. A different meaning concerns appearances, in the sense that the features of this object are 'the same' or 'identical to' the features of that object. Many objects may be 'the same' in this sense. We refer to the first as 'unique identity' and the second as 'featural identity'.²

Unique identity is crucial to the adult notion of intersubjectivity. For

example, one loves a person despite a change in hair style or wardrobe; one loves a specific person, not her twin, etc. The intersubjective relation goes between oneself and a particular other, where the unique identity of the other is essential.

One immediately becomes interested in whether infants are sensitive to the unique identity of persons. This matters because infants' intersubjective world would be very different from ours if they loved humanity but did not love individuals, or if an intersubjective relationship was not maintained whenever the surface features of the other were altered. To the degree that infants' notion of 'subject', or even their notion of individual, differs from our own, then the type of intersubjectivity this supports must be correspondingly different.

We conducted several studies in an effort to explore whether young infants paid any heed to unique identity at all, or whether their world of people was limited solely to a featural analysis.³ In one study we showed 6-week-olds a gesture on one day and brought them back after a 24-hour delay when they were shown the same person sitting with a neutral face (Meltzoff and Moore, 1994). The results showed that infants remembered and imitated the particular gesture the adult did the day before. This suggested to us that infants were probing whether this person was 'the same one as' was seen the day before, despite the fact that the person's surface behaviour was clearly different. It is as if the infants were asking, 'Didn't we play this?' 'Aren't you the one who does this?'

The previous study concerned infants' use of gestures to reidentify people. We also explored their ability to differentiate individuals from each other. We presented 6-week-old infants with people who came and went in front of them, as would happen in real world interaction (Meltzoff and Moore, 1992). The mother appeared and showed one gesture (say, mouth opening); then she exited and was replaced by a stranger who showed a different gesture (say, tongue protrusion). When infants visually tracked these exchanges they could switch their actions to play two different gestural games, mouth opening with one person and tongue protrusion with the other. This finding, taken together with the previous one, suggests that young infants are showing a sensitivity to the individuality of the other. Thus, we think early interactive behaviour is directed toward *human individuals* and meets one minimal criterion for being treated as an intersubjective relation.

We also observed an interesting error infants made in the two-person experiment. We found that if the mother and stranger changed places without the infant visually tracking the exchange, they paused

to inspect the new person, and then performed a burst of the actions shown by the previous person. This behaviour, as odd as it seems, is quite revealing. Recall that in the same test situation, when infants visually tracked the exchange, they smoothly switched gestures. It appears that if infants see the exit of one person and entrance of the second, they appropriately construe it as two individuals. However, in the absence of clear evidence that there are two people, in the absence of spatiotemporal evidence of twoness, very young infants were confused: Is it the same person who looks different, or a new person in the old place?

These questions are consistent with studies investigating the criteria infants use for maintaining the identity of a physical object. They show that very young infants predominantly rely on spatiotemporal information, such as places and trajectories, rather than featural appearances to determine unique identity (Bower, 1982; Moore *et al.*, 1978; Moore and Meltzoff, 1978; Meltzoff and Moore, 1995, 1998; Xu and Carey, 1996).

Our research goes beyond this previous work, because we made people, not inanimate things, disappear and reappear before the infant. Infants deployed imitative reactions to sort out their questions about the identity of people. This suggests that infants use *functional criteria* to complement other criteria for identity, at least for people. It is not only how a person looks, but the distinctive games he or she plays that helps to verify their unique identity. Distinctive games are functional properities that can be elicited through interaction. Infants deploy imitative behaviours as a tool for probing the identity of the other, as if the earlier interaction is a marker particular to that person.

That infants use imitation in this way suggests that they remember individual others and their own interactions with them. Instead of being limited to generalized reactions, such as smiling, cooing and greeting of 'humans in general', the specialness of particular relationships is born. Others become individuals whose relations with the infant are differentiated from each other. Because adult-like intersubjectivity depends on having individualized others with whom to relate, the deployment of imitation as a non-verbal criterion of identity gives it special relevance to the origins of intersubjectivity and communication.

Origins and development of infant intersubjectivity

We are now in a position to examine the innate structure infants bring to their first encounters and how this starting state is transformed through interpersonal interaction.

Human acts are the currency of early intersubjectivity

Let's start at the beginning, with newborns. What we are calling the *human act* may be the most elementary parsing of the world into things that bear on self-other relations and those that do not. Human acts are especially relevant to infants because they look like the infant feels himself to be, and because they are things infants can intend. When a human act is shown to a newborn baby, it may provide a primordial 'aha' experience. 'Something interpretable! That (seen) event is like this (felt) event.' It is not simply the features of the adults – the eyes, the lips, the hair – that are special for infants but the way the body moves and its relation to the self. The fact that infants can recreate the act allows them to give it special meaning.

On this view, the initial cut infants impose on the world is not any one of the usual suspects found in textbooks. It is not animate versus inanimate (because armadillos are only of passing interest), not self-mobile versus moved-by-a-seen force (because swinging clock pendulums are not viewed as special), nor even people (as adults know them) versus things. The most elementary distinction may be something closer to human acts versus other events.

Infants' tendency to see behaviour in terms of human acts that can be imitated has interesting implications: (a) the world of physical bodies is then divisible into those that perform human acts (people) and those that do not (things); (b) having made the division in the external world, new meanings are possible. Because human acts are seen in others and performed by the self, the infant can represent the other as 'like me': I can act like the other and reciprocally the other can act like me. Thus the newborn is not a social isolate and is provided with a bridge connecting self and other right from the beginning of infancy.

From shared acts to shared minds

Although we are postulating powerful innate tools for exploring self-other correspondences, experience with reciprocal imitation games provides a host of information for enriching this understanding. Such interaction carries at least the following information: (a) the adult's behaviour matches the infant's; (b) it is not a random congruence, (c) the specific behaviours do not matter, because the invariant of the game is to match, (d) from the infant's viewpoint, the infant's own novel behaviours were intended acts, (e) either the infant can propose and the adult respond or vice versa, and (f) either can withhold the reciprocal act. This provides grounds for an important realization by

the infant: 'I intend to produce these acts, the adult performs these same acts, they are not chance events, therefore the adult intends his acts.' In other words, the similarity transcends the surface behaviour. This is a matching of intended acts.

There are dual implications from considering these interactions at the level of mutually intended acts, instead of only shared behaviours. Going in one direction, the infant now knows more about the other. The adult is an intending other. Going in the other direction, since the other is also like me, the infant could reconceptualize the intentional aspects of self. We have already shown that very young infants have intentions; but having intentions is different from being aware that one has intentions. The conception of self as one-who-intends and is like an intending-other would mark a considerable advance in intersubjectivity.

Infants begin life with a rich innate structure, which changes as their understanding of persons – themselves and others – is transformed through interpersonal exchanges. By the end of infancy they appreciate that they are psychological beings among other psychological beings, different from others, yet neither alone nor unique in the world.

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Notes

- 1 A word about what this chapter is not. It is not our goal to reject previous discoveries about non-verbal intersubjectivity (mutual timing, joint attention and social referencing). Instead we hope to show how new work and theorizing complement these discoveries to provide a more comprehensive and developmental view.
- 2 With reference to the adult mind, philosophers refer to the former as 'numerical' or 'particular' identity (Strawson, 1959). We believe infants are engaged by this aspect of identity, but that the criteria they use to determine numerical identity are different from the adults'.
- 3 Previous work had shown that very young infants at least process the visual features of people. They can visually discriminate between a familiar facial pattern versus a novel one (e.g. Bushnell *et al.*, 1989; Field, Cohen, Garcia and Greenberg, 1984; Walton *et al.*, 1992). This does not inform us about their grasp of the unique identity of persons (Meltzoff and Moore, 1992, 1995).