

Human twelve-month-olds point cooperatively to share interest with and helpfully provide information for a communicative partner

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This paper investigates infant pointing at 12 months. Three recent experimental studies from our lab are reported and contrasted with existing accounts on infant communicative and social-cognitive abilities. The new results show that infant pointing at 12 months already is a communicative act which involves the intentional transmission of information to share interest with, or provide information for other persons. It is argued that infant pointing is an inherently social and cooperative act which is used to share psychological relations between interlocutors and environment, repairs misunderstandings in proto-conversational turn-taking, and helps others by providing information. Infant pointing builds on an understanding of others as persons with attentional states and attitudes. Findings do not support lean accounts on early infant pointing which posit that it is initially non-communicative, does not serve the function of indicating, or is purely self-centered. It is suggested to investigate the emergence of reference and the motivation to jointly engage with others also before pointing has emerged.

Keywords: pointing, infant communication, reference, attitude, helping, cooperation, inform

Pointing in human primates

Pointing is foundational to human communication and has the primary function of indicating an object or location in space (e.g., Kita, 2003; Brinck, 2004). However, pointing would not be foundational to human communication if its indicative function was not understood as being *for someone*. Pointing is not

an individualistic goal-directed action upon the physical environment, like, for example, reaching for or manipulating an object. Instead, human pointing is a cooperative activity between individuals, a communicative act, which involves a sender's communicative intention to both transmit information and have a person receive the information on the basis of the sender's communicative intention (Sperber & Wilson, 1995). Bratman (1992) has convincingly argued that human cooperation involves helping the other continue his part in a joint activity. Pointing as cooperative act can also be helpful. For example, in the course of joint cooperative activities we frequently point fast and effortlessly to provide information for a person, to help her overcome misunderstandings about a referent, or to help her find items she might be looking for.

Without the given context of a point it would be impossible to derive a meaning beyond its indication. For a point to communicate meaning it has to be embedded in a context which is construed by the interlocutors' relations towards each other and the environment. Therefore, interlocutors must be able to understand the relations between each other and the environment, i.e. to share each other's attention (Tomasello, 1999), or to mutually manifest knowledge (Sperber & Wilson, 1995). Pointing thus provides a means for a 'meeting of minds' in the external environment. Social-cognitively, human communicative pointing in a shared context requires an understanding of the indication as being about a referent, and an understanding of the interlocutors' psychological relations towards each other and the referent.

Interestingly, non-human primates in captivity also produce the pointing gesture (Leavens & Hopkins, 1998) although it is claimed that they lack the social-cognitive abilities necessary for this (Povinelli, Bering, & Giambrone, 2003), have problems in understanding the communicative intent of pointing (Itakura, Agnetta, Hare, & Tomasello, 1999), and clearly do not engage in what might resemble human-like communication (Tomasello, *in press*). It might seem then that human 1-year-olds too point without a deeper social-cognitive understanding, because it has been claimed to emerge only later around 3 to 4 years (see Wellman, Cross, & Watson, 2001). But human 1-year-olds have no problems understanding the communicative intent of pointing (Behne, Carpenter, & Tomasello, *in press*; Camaioni, Perucchini, Bellagamba, & Colonnesi, 2004) and they become competent linguistic communicators fairly early, both of which already reveals some kind of mental understanding. And human pointing has been related to symbolic communication theoretically (Werner & Kaplan, 1963) and to language acquisition empirically (e.g., Goldin-Meadow & Butcher, 2003). Therefore, it is questionable whether pointing in human ontog-

eny really resembles ape pointing and initially does not reflect any mental understanding, or whether it already bears cognitive and motivational properties of uniquely human communicative pointing when it has just emerged.

In resolving this question, this paper reports three recent experimental studies from our lab (Liszkowski, Carpenter, Henning, Striano, & Tomasello, 2004; Liszkowski, Carpenter, & Tomasello, 2005; Liszkowski, Carpenter, Striano, & Tomasello, in press) which investigated in detail communicative motives and social-cognitive abilities of pointing in 12-month-old human infants. New findings show that infant pointing already is a communicative act, even before language has emerged. It is motivated by cooperatively sharing interest with or helpfully providing information for other persons and builds on infants' understanding of others as persons with attentional states and attitudes. These new findings are contrasted with existing accounts of infant pointing and underlying communicative and social-cognitive abilities which are reviewed below.

Review of infant pointing

Bates, Camaioni and Volterra (1975) first described infant pointing in a longitudinal investigation of infant communication. Following Austin's (1962) speech act theory, they proposed a developmental sequence in infant communication from perlocutionary to illocutionary to locutionary acts. Pointing was claimed to correspond to the illocutionary stage, revealing the intent to signal to a recipient. However, Bates et al. (1975) also reported pointing which they classified as non-communicative, based on the absence of gaze alternation to a recipient. They interpreted non-communicative pointing as a precursor to communicative pointing.

Since then, pointing has been suggested to become intentionally communicative only later in development, after its initial emergence, at around 15 months (Desrochers, Morissette, & Ricard, 1995), possibly through caregivers' communicative responses. As a criterion for intentional communication, research has usually relied on gaze alternation to the recipient. Methodologically, however, it might be misleading to use looks as the only main criterion to assess communicative intent. For example, infants might alternate gaze simply to check on the other person, without communicative intent. And absence of gaze alternation would not necessarily mean an absence of communicative intent — because infants might simply assume that adults understand the behavior

as communicative, or rely on auditory instead of visual information. Other criteria for intentional communication are whether it is done for somebody and whether persistence and flexibility in signal-use occur when the recipient does not react accordingly (see also Tomasello & Call, 1997). The three new studies from our lab will show that 12-month-olds' pointing already is intended to be communicative.

But infants also point for themselves. Delgado, Gómez, and Sarria (1999) observed that infants point even when they are alone in a room, without audience. However, Delgado and colleagues (2002, 2004) also showed that preschoolers at 3 and 5 years still point for themselves. Therefore, it is unlikely that such pointing for self is a precursor to communicative pointing — because it does not disappear when children already point communicatively. Instead, such pointing might serve a function similar to that of private speech (Vygotsky, 1978)¹. This interpretation is supported by DeLoache, Cassidy, and Brown (1985) who found that infants sometimes use pointing as a mnemonic strategy. Further, Bruner (1983) described an infant pointing for self without perceivable referent as “locating in his ‘present’ space an object recalled from memory” (p. 76). Pointing for self, then, seems to coexist with rather than develop into communicative pointing in infancy. It might even be hypothesized that pointing for self develops only after the communicative function of pointing already is established.

Communicative pointing in infancy has been claimed to involve rather self-centered motives, like using the adult as a tool to obtain an object (‘proto-imperative’), or the object as a tool to obtain adult attention (‘proto-declarative’), with an understanding of causality corresponding to the Piagetian level 5 of sensori-motor development (Bates et al., 1975). Subsequently, these two types of communicative pointing have received different interpretations in terms of their communicative and cognitive complexity (see Brinck, 2004).

Imperative pointing has typically been interpreted on a leaner, more behavioristic account, and declarative pointing on a richer, more mentalistic account (Camaioni, 1993). For example, Vygotsky (1978) claimed pointing to be a ritualized behavior through adults' repeated interventions to failed attempts of reaching, and Wundt (cited in Werner & Kaplan, 1963) described it as an “abbreviated grasp”. But Franco and Butterworth (1996) found reaching and pointing to serve different functions in development, and Masataka (2003) showed reaching and pointing to be developmentally not associated. Nevertheless, presumably because imperative pointing is more about spurring others into action, it has been interpreted as a self-centered instrumental act,

at most revealing some causal understanding of others' agency ('agent of action', Brinck, 2004; Camaioni, 1993; Gómez, Sarria, & Tamarit, 1993). The case that apes in captivity and children with autism can point imperatively despite the lack of a necessary understanding of others' mental agency (Tomasello, in press; Baron-Cohen, 1989) has lent support to this interpretation. However, adults point imperatively with an understanding of others' mental agency and, without other evidence, it is at least possible that typically developing infants point in this way as well; we simply do not know.

Declarative pointing, in contrast, has been taken to reflect sensitivity to others' mental agency. It is less about spurring someone into action than changing a person's attentional state (e.g., Baron-Cohen, 1991; Bretherton, McNew, & Beeghly-Smith, 1981; Tomasello, 1995). It has been claimed to be motivated by sharing attention, a motivation manifest also in other Joint Attention behaviors such as gaze following, social referencing, giving, showing and imitating (Tomasello, 1999), all of which emerge as a cluster around infants' first birthday and are related to the onset of language (Carpenter, Nagell, & Tomasello, 1998). In addition, apes (however they are raised) and children with autism do not point declaratively, presumably because they lack the necessary cognitive ability or are unmotivated to do so.

Contrary to rich accounts of early declarative pointing, some researchers have expressed skepticism that declarative pointing, when it has just emerged, involves an understanding of others' mental agency (Carpendale & Lewis, 2004; Gómez et al., 1993; Moore & Corkum, 1994). For example, Gómez et al. (1993) have suggested that infants simply understand a recipient's behavioral relation to a referent when they point. More recently, Moore and D'Entremont (2001) have claimed that 12-month-olds do not point to direct others' attention. In an experiment, they found that 12-month-olds pointed equally often at an event, irrespective of whether an adult already was looking at it. They concluded that infants initially point only to obtain attention to the self.

Camaioni, in her work on infant pointing (1975–2004) took an intermediate position putting forward both lean and rich accounts. Like Brinck (2004), she separated imperative from declarative pointing, and suggested a developmental *décalage* between these two types. On her account, imperative pointing emerged before declarative pointing which she interpreted as a social-cognitive transition from an understanding of other persons as 'agents of action' to 'agents of contemplation' (Camaioni, 1993). Whereas she suggested that early declarative pointing revealed an understanding of others' intentionality, she claimed that early imperative pointing did not require such an understanding.

In her latest work (Camaioni et al., 2004) she empirically addressed this hypothesis, showing that imperative pointing was more frequent than declarative pointing among infants who had just begun pointing, and that declarative, but not imperative pointing was developmentally associated with passing Meltzoff's (1995) task of imitating failed attempts.

There are thus rich and lean accounts of infants' early pointing. Minimally, there is agreement that later in development, around the end of infants' second year, declarative pointing is about directing others' attention (Moore & D'Entremont, 2001) and about informational exchange (Franco & Gagliano, 2001). However, infants begin pointing a year earlier, around 12 months (Leung & Rheingold, 1981). It is thus not clear what infants do when they have just begun pointing. Existing accounts of 12-month-olds' pointing have not systematically been tested and consequently we lack necessary evidence on why young infants point. In overcoming this gap, this paper reports three of our recent studies which addressed the motives and social-cognitive abilities underlying infant pointing at 12 months.

Twelve-month-olds point to share attention and interest

In a recent study, Liszkowski et al. (2004) tested why 12-month-olds point in a classical declarative context (see Figure 1). Infants were presented with 10 interesting events, like hand puppets appearing behind a large screen at a distance or lights flashing, and a female experimenter (E) reacted consistently in specific ways to each infant's pointing. We were interested whether infants would be more satisfied with one over another reaction and whether they would modify their behavior as a function of E's reaction to their pointing. For example, we measured how often infants would point in the different social contexts, whether they would 'repair' their message and repeat pointing to the same referent more if E did not react in the expected way, and whether their looking behavior to E would differ across situations. Specifically, we tested four hypotheses on what infants might want when they point declaratively. In a *Joint Attention* condition, E responded to an infant's points by alternating gaze between the event and the infant and emoted positively about it on the hypothesis that infants want to share attention and interest. In the *Face* condition, E never looked at the event and instead attended to the infant's face and emoted positively to it, on Moore and D'Entremont's (2001) hypothesis that infants do not want to direct attention but just want to obtain attention to the self. In the

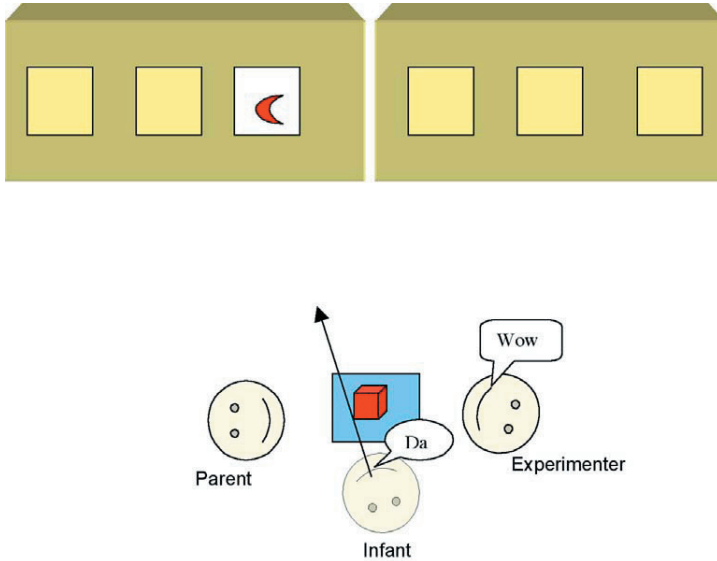


Figure 1. Study 1. Schematic drawing of the set-up. Back: screen with window-openings and protruded stimulus; front: infant in high-chair with an attached table and small, attached toy.

Event condition, E only attended to the events, on the hypothesis that infants just want to direct attention and nothing else, and in the *Ignore* condition E attended neither to the infant nor to the event, on the hypothesis that infants might point non-communicatively, for themselves.

Table 1 summarizes the main statistically significant differences between conditions. The overall finding was that infants point to share attention and interest. First, infants were more satisfied in the joint attention condition and pointed on significantly more trials in that condition compared to the other three. Second, infants were not satisfied in the *Face* condition, when E only emoted positively to them. In that condition, although E emoted as positively

Table 1. Study 1. Summary of Main Results. ‘+’ Indicate Statistically Higher Numbers than ‘-’. Means in Parentheses.

	prop. of trials with point	# of points per trial	# of looks to E per trial
Joint Attention	+ (0.7)	- (1.07)	- (0.28)
Face	- (0.5)	+ (1.23)	- (0.33)
Event	- (0.5)	+ (1.23)	+ (0.77)
Ignore	- (0.4)	+ (1.19)	- (0.44)

to the infant as in the *Joint Attention* condition, infants repeated their pointing to the same referent significantly more often than when she shared attention to it. In the *Face* condition, infants thus attempted to redirect E's attention to the event. Third, infants were not satisfied in the *Event* condition either. When E only attended to the event and did not comment back, infants also repeated their pointing more within a trial than in the *Joint Attention* condition. In addition, they looked more to E than in any other condition, presumably because they expected E to comment back.

Results show, first, that infants point intentionally communicatively and tailor their communicative behavior to different social responses. Second, in a declarative context, infants point to share their attention and interest with a communicative partner. Sharing attention and interest involves both (i) directing the other person's attention *and* (ii) receiving a comment about the mutually attended to event; neither alone is sufficient.

We have recently followed up these results in a new experiment (Liszkowski et al., 2005) and investigated the two components, directing attention and receiving a comment, in more detail. Again we used a declarative context (see Figure 2) to elicit pointing, and a male experimenter (E) sitting in front of the infant with the back turned to the stimuli responded in one of four specific ways. Specifically, we were interested which of E's reactions might satisfy the infant's motive to share attention and interest. Therefore we systematically

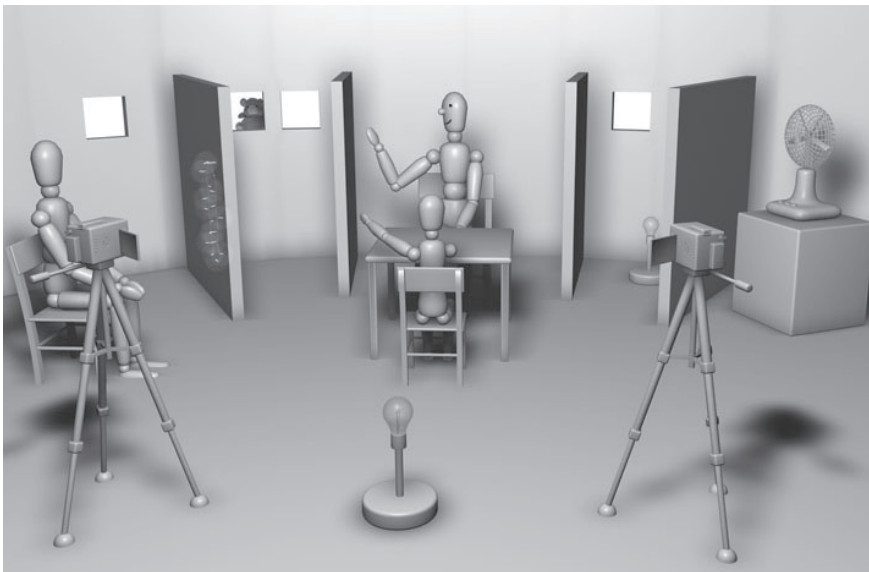


Figure 2. Study 2. Schematic drawing of the set-up with barriers.

Table 2. Study 2. Summary of Main Results. ‘+’ Indicate Statistically Higher Numbers than ‘-’. Means in Parentheses.

	prop. of trials with point	prop. of trials with repetitions	# of looks to E per trial
Joint Attention	+ (0.9)	- (0.3)	- (0.7)
Misunderstanding	- (0.7)	+ (0.5)	+ (1.7)
Uninterested	- (0.6)	- (0.2)	+ (1.9)
No Sharing	- (0.6)	- (0.3)	+ (2.2)

Table 3. Study 2. Qualitative Differences of Point Repetitions between *Joint Attention* and *Misunderstanding*. ‘+’ Indicate Statistically Higher Numbers than ‘-’. Means in Parentheses.

	Point repetitions		
	Latency in sec. to 2nd point	# of looks to E between 1st and 2nd point	# of vocalizing during 2nd point
Joint Attention	- (4.9)	- (0.49)	- (0.57)
Misunderstanding	+ (6.6)	+ (1.27)	+ (0.82)

violated infants’ expectations of E’s attention and of his comment. E either did not share the infant’s attention, i.e. he did not refer to what the infant pointed at, or he did not share the infant’s interest, i.e. he commented uninterestedly about the referent. First, we wanted to know whether infants would be satisfied when E simply oriented behaviorally into the direction of the referent without actually attending to it (a barrier obstructed his line of sight). Second, we wanted to know whether the adult needed to comment positively, or whether a neutral comment would suffice. We thus controlled two components of E’s reaction to infants’ pointing: (i) the referent of E’s attention and (ii) E’s attitude toward the referent, as expressed in his comment. This resulted in four conditions. In the *Joint Attention* condition, E attended to the infant’s referent and emoted positively about it (but never named it), emphasizing his attention toward it by turning head and body towards it and slightly extending his arm, palm up into its direction. In the *Misunderstanding* condition, E reacted in the same way, except that a barrier obstructed his line of sight to the infant’s referent and E mistakenly referred to an insignificant piece of paper attached to the barrier. In the *Uninterested* condition, there was no barrier and E reacted as in *Joint Attention*, except that he commented neutrally about the referent, stating his disinterest in it. The *No Sharing* condition involved the same barriers as in the *Misunderstanding* condition and E commented neutrally as in the *Uninterested* condition to an alternative referent on the barrier.

Table 2 summarizes the main results. First, as in the previous study, infants were more satisfied in the *Joint Attention* condition, pointing on more trials in that condition than in the other three. Second, in the *Misunderstanding* condition, when E emoted as positively as in the *Joint Attention* condition and behaviorally oriented into the same direction but referred to the barrier instead of the referent, infants were not satisfied. In that condition (*Misunderstanding*) they persisted in their message and repeated pointing to the referent within trials more than when E attended to the referent (*Joint Attention*). In addition, these point repetitions were accompanied by significantly more gaze alternation to E and vocalizations, and less impulsive than in the *Joint Attention* condition (see Table 3). Third, in the *Uninterested* condition, when E attended to the referent just as in the *Joint Attention* condition but commented neutrally about it, infants did not repeat their pointing within trials. Although infants were overall less satisfied with a neutral comment response — they pointed on fewer trials than in the *Joint Attention* condition — they did not repeat pointing within trials in order to receive a different response.

Results show, first, that infants point to direct another person's attention to the event which they point at. This is in line with the results of the *Face* condition in the first study. Importantly, results show that infants were not satisfied when the recipient oriented only behaviorally and simply turned into the direction of the referent, even when he emoted positively. This means that infants do not point simply to direct a recipient's external bodily behavior, or simply to elicit a positive comment. Instead, infants point to direct the other person's attentional state to what they themselves attend to. Second, results show that in this context, infants prefer a positive over a neutral comment about a mutually attended to event. However, in contrast to the *Event* condition of the first experiment, in which infants repeated pointing when they did not receive any comment, in the *Uninterested* condition, when the comment was not the preferred one, infants did not repeat their pointing to receive a different reaction from E. This shows that infants do not point simply to request a positively emoted comment about an event mutually attended to, like they request, for example, when imperatively pointing to obtain a cookie. Instead, infants' pointing in such a context rather resembles an offer (see Bruner, 1983), to mutually engage about an event and share interest in it with an interested partner.

Taken together, findings of these two recent studies strongly support the interpretation that infants point in a context in which interesting things happen or appear to share their attention and interest with a communicative partner. Further, findings do not support alternative, leaner hypotheses of infant

pointing in such a context. First, contrary to Desrochers et al. (1995), our findings clearly show that 12-month-olds already point intentionally communicatively and not simply for themselves. Second, in contrast to Moore and D'Entremont's (2001) hypothesis, infants do not point simply to obtain an adult's attention to themselves. They are more satisfied when the adult also attends to the referent which they point at (in fact, then the adult attends even less to the infant because he divides his attention between infant and object). Third, it is unlikely that infants want the adult only to behaviorally orient and relate to a referent. Instead, they really want him to see and attend to what they attend to. And finally, infants do not simply request an adult to positively emote when mutually attending to an event, as if they imperatively requested a positive object-related comment. Instead, infants point to initiate a joint bout by offering to share their interest in an event.

Theoretically, it is possible that infants also point interrogatively, to receive information about the referent, e.g. its valence or its word label. On such an account one would expect infants to point irrespective of how E commented (i.e., positively or neutrally), as long as he provided information. However, in the current situation infants selectively preferred a positive comment over a neutral. Further, in the second study, they were never provided with the actual word label of the referent, and this did not affect their pointing substantially compared to the first study. Whether and when infants point interrogatively thus remains an empirical question — in the current context they pointed to share attention and interest.

Social-cognitively, first, findings show that infant pointing reveals an understanding of other persons' attention. Results show that infants differentiate between conditions in which the recipient is and is not attending to what they point at. This is consistent with recent results on gaze and point-following which show that 12-month-olds understand what other persons are looking at (Deák, Flom, & Pick, 2000) even in the presence of distractors and when the target is behind their own visual field. Infants follow others' looks and points over their first year of life, attending to what others are attending to (e.g., D'Entremont, Hains, & Muir, 1997) and come to reverse roles when they point at objects to direct others' attention to what they attend to. Twelve-month-olds thus understand that other persons' attention can be aligned to an object, just as their own can be.

Social-cognitively, second, infants' motive to share interest suggests that they conceive of others as persons with attitudes towards the environment. Just as infants come to understand that they can follow others' attention, infants

also experience over their first year of life that other persons express to them their psychological relations, that is, their attitudes towards the environment (see also Hobson, 1994). For example, when adults direct infants' attention they also express their attitude about the mutually attended to referent towards the infant, which is often one of positive interest (in other situations adults might also direct attention to provide information, e.g. to tell them where a toy is [see Behne et al., in press], or to request an object when it is in the infant's possession [see Camaioni et al., 2004]). Studies on social referencing have shown that infants can link a person's comment selectively to objects (Moses, Baldwin, Rosicky, & Tidball, 2001). However, social referencing is more about the referent, to discern ambiguity of situations or objects, than it is about sender and recipient. Therefore, it has been suggested that infants apply the adult's comment only to the object, as its valence, and do not understand the comment as the adult's psychological relation to the object (Egyed, Kiraly, & Gergely, 2004). Pointing to share attention and interest, however, is not only about the referent. It is a joint, cooperative activity, for both sender *and* recipient. Results show that the way an adult comments to the infant about a referent influences the infant's incidence of subsequent offers to share attention and interest. When pointing, infants conceive of a recipient's comment as expressing his attitude about the referent. If the attitude is similar to their own, they share this attitude which, in the case of declarative pointing, is one of positive interest.

Motivationally then, pointing at 12 months already is an inherently social communicative act, intended for both sender and recipient, and not a solitary, self-centered activity of the infant. Infants' 'repair' of misunderstandings resembles conversational turn-taking structures and is helpful for a recipient in understanding the communicative intent. The cooperative structure underlying early communicative acts may be interpreted as uniquely human (Tomasello et al., in press) and as being at the roots of human sociality (see Enfield & Levinson, in press).

Twelve-month-olds point informatively to help others

In another recent study (Liszkowski et al., in press), we further explored infants' motives for directing other persons' attention when pointing. Infants' repair of misunderstandings can be interpreted as helpful in proto-conversational turn-taking. As Bratman (1992) has argued, human shared cooperative activity involves helping a partner in keeping up his part. We therefore

investigated whether infants might indeed, in some situations, be motivated to help a recipient when pointing. As adults we often point to help others by providing information, maybe even more than we point to share interesting events. For example, when we see a person searching for something (e.g., walking or turning around, looking into various directions, inspecting various locations — looking *for something*), we often help that person by pointing out for her what she is looking for (or what we believe she might be looking for). Clearly, in such a situation we neither point to request the referent for ourselves, nor to express our excitement about it. Instead, one points to inform a person about an object's location, to help her find it. Interestingly, we helpfully point things out for persons who we do not know and might never see again (e.g., on the street, in a concert, on a train, etc.), without direct benefit to ourselves. Such helping behavior can be interpreted as part of a cooperative activity (being *together* on a street, in a concert, in the same political party, in a social psychology experiment; see Clark, in press). It might also be interpreted as altruistically helping a stranger, although there are arguably no 'high' costs involved (e.g., risk of life), and it might not extend to 'non-peer' strangers (e.g., radical opponents of one's favorite soccer team, political party, etc.). In any case, such type of pointing is informative in helping another person find what she is looking for. The motive of informative pointing thus departs from the classical dichotomy of imperative and declarative pointing in infancy because it is neither *to obtain an object for self* nor *to share interest* in it. Instead, the motive is *to helpfully provide information for the other*.

In this study we investigated whether infants point informatively. In the main experiment, a female experimenter (E) demonstrated on each of twelve trials an action to the infant, which always involved one of two objects (the target). Then, both objects (target and distractor) disappeared out of E's but not the infant's view, for example they were dropped accidentally, displaced on a shelf behind E, or used up while replica objects remained visible to the infant. After the disappearance, E attempted to repeat the action and began searching for the target object. She first looked for herself, then emphasized her search with an unspecific verbal cue ("where is it?") and then explicitly asked the infant using the object label ("[Name], where is the [target]?").

Results were that infants pointed in such a situation, even when potentially interesting sounds or movements of the referent were absent, or when there was no displacement at all (e.g., when the objects were used up). Infants pointed significantly more to the target which E was looking for than to a distractor simultaneously displaced (see Figure 3). Requestive accompaniments

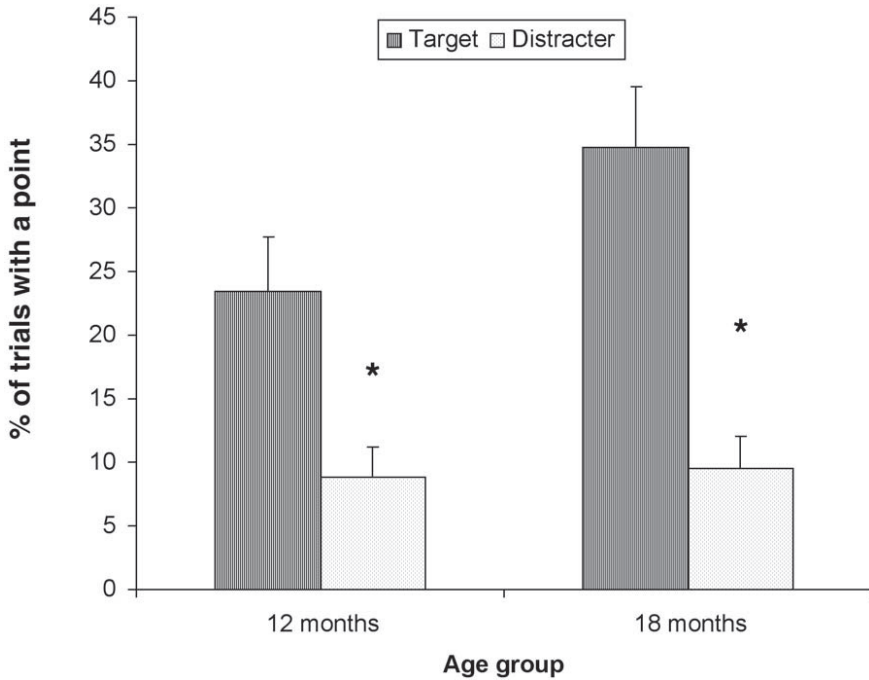


Figure 3. Study 3. Percent of trials with a point to target and distracter. * indicate statistically significant differences ($p < .05$).

or repeated pointing after E had retrieved the object were rare and infants pointed mostly before E verbally asked about the object.

Findings show that infants point informatively to provide information for another person. Pointing in such a context is not so much about a sender's relation to a stimulus, to share it, than about a recipient's relation to it, to help him. The results show that infants do not only direct an adult's attention in response to externally salient, exciting events (e.g. Butterworth et al., 2002) but also because of a recipient's relation to the referent, e.g. to find it. There are good reasons to believe that infants did not simply request the object for themselves, nor to have the adult simply do an action. First, requestive accompaniments typically associated with imperative pointing were very rare, and when E had retrieved the object, infants rarely attempted to obtain it. And second, most of the actions were not particularly interesting, without specific effects, and infants were never involved in them (they simply watched E). In addition, in a prior experiment (reported in Liszkowski et al., in press), the objects which disappeared were previously not involved in a particular goal-directed action and infants still pointed.

Social-cognitively, first, informative pointing reveals infants' understanding of a recipient's relation to an object. To point informatively, one must understand what the addressee wants. In this context, infants understood E's intention to find an object and continue an action, and helped to complete his goal by pointing out the object. Results thus reveal an understanding of others' goals and intentions to be present in infant pointing at twelve months. Second, in line with the two previous studies on declarative pointing, our findings of informative pointing foster the interpretation that infants conceive of others as persons with attentional states who can sometimes lack relevant information. This is consistent with recent results by Tomasello and Haberl (2003) who showed that 12-month-olds can discern what is new for someone else. The findings extend previous work on older children's informational exchange in declarative (Franco & Gagliano, 2001) and imperative (O'Neill, 1996) contexts, and suggest that infants' informative pointing already reflects an understanding of persons having information states about the environment.

Motivationally, findings are that infants provide information freely without concern for immediate personal benefit which reveals the prosocial motivation of helping a communicative partner. This extends previous work by Rheingold (1982) who showed that older infants participate in joint actions, like cleaning up or opening things. In this study, physical assistance was not required and it may be that humans are especially inclined to help communicatively. Helping others is an integral part of human cooperation (Bratman, 1992). This study therefore supports the interpretation that infant pointing is a humanly cooperative, communicative act. The motivation to provide information and help other persons might be seen as the initial ontogenetic emergence of the uniquely human ability to teach and instruct other persons. Parts of such cooperative instructing are suggested to emerge early in ontogeny, before language, in communicative behaviors like informative pointing.

Conclusion: Infant pointing is a cooperative, communicative act

New findings of three recent experimental studies presented here (Liszkowski et al., 2004, 2005, in press) show that human pointing, when it has just emerged, is a communicative act which involves the intentional transmission of information by directing another person's attention to an indicated object or event. Liszkowski et al.'s new approach to pointing which considers motives instead of a general differentiation between different types of pointing shows that infants'

motives of pointing are humanly cooperative in nature. Specifically, infants' pointing at 12 months is motivated by mutually sharing interest in an event with a communicative partner. Moreover, in addition, infants point to help by providing information for another person, a motive which has previously not been investigated even though it is very common in adult everyday pointing. Findings thus do not support lean accounts of early infant pointing which have suggested that it is initially non-communicative, does not serve the function of indicating, or is purely self-centered. Therefore, it also seems that human pointing in ontogeny is already fundamentally different in its function and use to the gestures exhibited by apes in captivity. Future research needs to empirically investigate developmental antecedents of infant pointing by investigating the role of early social interaction in the ontogenetic emergence of reference and, interwoven with the emergence of referential behaviors, the motivation to cooperate with and help each other.

Acknowledgements

This paper is in memory of Luigia Camaioni. I am thankful to Emily Wyman and Mike Tomasello for comments on a previous version. Parts of this paper were presented at the Workshop for Gestural Communication in Non-human and Human Primates, Leipzig, Germany, 2004, and at the Wenner-Gren Foundation for Anthropological Research, Symposium 134 "Roots of Human Sociality: Culture, Cognition, and Human Interaction", October 2–9, 2004, Duck, North Carolina, US.

Note

1. I am thankful to B. Delgado and J. C. Gómez for insightful discussions on this point.

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