Chimpanzees’ “Pointing”: Another Error of the Argument by Analogy?

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DO CHIMPANZEES POINT?

In this chapter, we explore the possibility that chimpanzees do not point. In doing so, it may seem as if we are intentionally exposing ourselves to the ridicule of many comparative psychologists, who find it self-evident that they do. After all, there can be no doubt that chimpanzees engage in behaviors that surely resemble pointing. Figure 3.1 illustrates an example of such a gesture by Megan, a chimpanzee in our own laboratory. How, then, can we seriously entertain the idea that chimpanzees do not point?

If one’s interest in “pointing” centers around a particular gestural form, and one is unconcerned with the psychological operations that attend (and perhaps cause) the behavior, then the case is already settled. Indeed, we invite the reader (such as the behaviorist) who is solely interested in a structural or functional analysis of pointing to stop here because we readily concede that chimpanzees perform gestures that structurally resemble pointing. Further, we concede that in captivity they learn to use these gestures to achieve a variety of ends. Yet for the reader whose interest in pointing stems from a desire to understand how language, cognition, and culture intersect (following the subtitle of this volume), we invite a critical evaluation of the assumption that similarity in the spontaneous behavior of two species guarantees psychological similarity. In what follows, we reject this centuries-old “argument by analogy” and, in doing so, show that the conclusion that chimpanzees “point” may just be one in a long line of inferential errors en-
couraged by a way of understanding the world that may be unique to our species.

To some extent, the claim that chimpanzees do not "point" is a definitional matter. Indeed, we are far less interested in establishing that chimpanzees do or do not "point" than we are in examining the kinds of psychological representations that are causally bound up with their gestures that look like pointing. To be clear, if it turned out that chimpanzees harbor no second-order intentional states—that is, if they do not see either themselves or others as possessing psychological states (such as attention, desires, knowledge, and belief)—then we would not want to use the term pointing to describe any gesture on their part. We recognize that others (such as the behaviorist) might wish to do so in any event. In response, we would merely assert that whatever the similarity in the structural form of their gestures, chimpanzees may mean such gestures in a manner different from us.

THE ARGUMENT BY ANALOGY: A PRIMER

The modern origins of the argument by analogy can be traced to David Hume (1739-1740/1978), who offered the following simple doctrine:
When . . . we see other creatures, in millions of instances, perform like actions, and direct them to like ends, all our principles of reason and probability carry us with an invincible force to believe the existence of a like cause. "Tis needless in my opinion to illustrate this argument by the enumeration of particulars. The smallest attention will supply us with more than are requisite. The resemblance betwixt the actions of animals and those of men is so entire in this respect, the very first action of the first animal we shall please to pitch on, will afford us an incontestable argument for the present doctrine. (p. 176)

Hume was at least right in believing that his argument was obvious, as a similar line of reasoning persuaded many other theorists as well. Not the least of these was Darwin (1871/1982), who was convinced by behavioral similarities that there "was no fundamental difference between man and the higher mammals in their mental faculties" (p. 446). Unlike Hume, however, Darwin at least felt obliged to present evidence to support this view, and to this end he devoted two chapters of The Descent of Man to recounting anecdotes about the intelligent behavior of animals. Near the end of Darwin's life, John George Romanes (1882, 1883) took up his approach, arguing that it could be used to establish a completely new field of science. In exactly the same way that anatomists compared the bodily structures of animals, Romanes reasoned, a new breed of comparative psychologists could compare the mental structures of animals. "Starting from what I know of the operations of my own individual mind," Romanes (1882) noted, "and the activities which in my own organism they prompt, I proceed by analogy to infer from the observable activities of other organisms what are the mental operations that underlie them" (pp. 1–2).

Since Hume, the argument by analogy has (in one form or another) intimately guided the history of our thinking about the psychology of other species.1 However, there are fundamental errors in the argument—errors that have been explored in detail elsewhere (Povinelli & Giambrone, 1999). Yet because there seemed to be no better explanation available, even Hume was led into believing that the mental states that attend particular behaviors are their direct cause, and therefore that the presence of similar behaviors between two species guarantees the presence of similar mental states. In this chapter, we focus on the case of pointing and show that similar behaviors in humans and chimpanzees may comfortably reside alongside profound differences in the mental states that accompany and/or cause them.

However, before turning our attention to chimpanzees, we need to detour and consider a number of issues concerning the development of

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1Bertrand Russell (1948) offered a formal version of the argument by analogy to provide a logical basis for believing in the existence of other human minds. For a detailed analysis of his argument, as applied in this context, see Povinelli and Giambrone (1999).
pointing in humans that, if not properly understood, will hopelessly confuse any attempt to understand the case of chimpanzees. First, what do we mean by pointing? Second, can we distinguish between the structure of the gesture and the underlying meaning and comprehension of the gesture? Finally, how do both the form and meaning of the gesture develop?

**DEVELOPMENT OF THE POINTING GESTURE:**
**IS THE INDEX FINGER PRIVILEGED?**

The first issue concerns what structural form we refer to when we discuss pointing. Franco and Butterworth (1996) offered the following definition of the pointing gesture: "the simultaneous extension of the arm and index finger towards a target" (p. 308). Throughout the remainder of this essay we are careful to restrict our use of the phrase the pointing gesture to this gestural form, whereas other means of indicating are referred to using different terminology. One important behavior that frequently accompanies the pointing gesture is the act of gaze alternation, in which infants look back and forth from the object or event to which they are pointing and their communicative partner.

The separate structural components of the pointing gesture (arm and index-finger extension), as well as behaviors that often accompany it (gaze alternation), do not develop in synchrony. For instance, infants as young as 18 days of age spontaneously extend their index finger from an otherwise closed fist (Hannan & Fogel, 1987). However, at this age, the index finger is not extended in the context of a communicative act, but rather as an ambient, undirected motor activity. By 9 to 12 months of age, the infant has combined the extension of the index finger with object/event-directed arm extensions so that the operational definition for the pointing gesture has been met. In addition, during this period, the infant begins to combine the action with gaze alternation (see Desrochers, Morisette, & Ricard, 1995; Franco & Butterworth, 1996; Leung & Rheingold, 1981).

Povinelli and Davis (1994) proposed a morphological constraints model to account for the universality of the pointing gesture in humans. They argued that the gesture may be the result of species-specific morphological features of the human hand (i.e., differential tension of the index finger tendons), which predispose human infants to extend their index fingers relative to the other digits (Fig. 3.2; see Povinelli & Davis, 1994; see also Butterworth, chap. 2, this volume, for a complementary account). Povinelli and Davis speculated that as infants begin to express directed reaches toward objects or events, index-finger extensions initially merely "ride along" with such reaches. If adults within a given culture respond differentially to reaches with such index-finger extensions as opposed to those without such
FIG. 3.2. Differences in the resting state of the index finger in (a) chimpanzees and (b) humans relative to the other fingers of the hand. After Povinelli and Davis (1994).

extensions, infants may detect this contingency and modulate their hand form appropriately. Indeed, there is some evidence that by the time that infants are 9 months of age, parents spontaneously label objects to which infants point more than objects to which they reach. Thus, Povinelli and Davis envisioned that index-finger pointing may emerge from a fairly low-level morphological starting condition, coupled with differential reactions by adults. Furthermore, Povinelli and Davis provided experimental evidence that chimpanzee index fingers do not exhibit this differential action on the
tendons of the index finger (see Fig. 3.2), and suggest that this is why naturally occurring chimpanzee gestures that do involve arm extensions (such as those used in recruiting allies or food begging) do not typically involve index-finger extension (see also Itakura, 1996).

Some researchers object to focusing on the role of the index finger in pointing. Wilkins (chap. 8, this volume), for instance, downplays claims for the universality of the pointing gesture, noting that in certain cultures (such as speakers of Arandic languages) the pointing gesture may not be the only (or, in adults, even the most dominant) form of the indicating act. To be sure, other forms of indicating, such as using the whole hand, the lips, the thumb, or other bodily parts, exist within our species (see Wilkins, chap. 8, this volume). Furthermore, when the pointing gesture is present, it may possess numerous topographic variants. The model proposed by Povinelli and Davis explains why the universal pointing gesture is only one of many kinds of indicating gestures that are used by humans. If early-emerging morphological constraints tend to channel index-finger extensions into the reaches of young human infants, and if cultural and attributional influences simultaneously act to reinforce and “pull out” the pointing gesture, then differing cultural influences may act to broaden the range of indicating acts, or indeed channel them into other, culturally dominant forms.2 Finally, the pointing gesture may (in adults, at least) be deployed in certain circumstances, but not others (see Wilkins, chap. 8, this volume). However, to our knowledge, the pointing gesture has been found in every human culture examined thus far.

DO CHIMPANZEEs USE THE POINTING GESTURE?

We have now arrived at the critical crossroads between the form and meaning of the pointing gesture. First, we ask a simple question: Is the pointing gesture exclusively restricted to the human species, or is it exhibited by other species such as chimpanzees? For purposes of clarity, we restrict our focus to chimpanzees—not because they are the only species of interest, but because any similarities to humans are likely to be greatest in the case of chimpanzees, and hence it is here that the argument by analogy would seem to be on its strongest ground.

2Indeed, if future investigations were to reveal that the ontogeny of reaching in infants in the speakers of Arandic languages follows the same initial trajectory as infants in Western cultures, but that arm extensions containing index finger extensions are not reinforced (or only weakly so) relative to other, more culturally dominant gestural forms of indicating, then data such as those offered by Wilkins (chap. 8, this volume) could be interpreted as prima facie support for the Povinelli and Davis model. It follows from this that even if there were a handful of cultures in which the gesture were not present, this would not necessarily refute the Povinelli and Davis (1994) model.
Reports From the “Field”

There is no convincing evidence that natural populations of chimpanzees (i.e., chimpanzees with only marginal contact with humans) display the pointing gesture. Plooj (1978) conducted an analysis of the communicative gestures of young chimpanzees at Gombe and reported no evidence for the appearance of the gesture. Furthermore, neither of the two major long-term studies of the natural history of chimpanzees (which have each spanned nearly 40 years) have reported the presence of the pointing gesture in chimpanzees (Goodall, 1986; Nishida, 1970). Thus, despite intensive observations of the spontaneous interactions of free-ranging chimpanzees, there is no evidence that these animals approach one another and gesture with the arm and/or index finger toward other objects, animals, or events in space. Indeed, the absence of proto-declarative gesturing among wild populations of chimpanzees is simply so striking and overwhelming that the ambiguity of the one published report of what might or might not be a single, isolated instance of pointing (see Vea & Sabater-Pi, 1998), to our minds, simply further highlights the robust nature of this difference in the natural gestural systems of human and chimpanzees.

But what about other gestures that, although not meeting the definition of pointing outlined in the section “Development of the Pointing Gesture,” nonetheless appear generally similar in form and/or function? Chimpanzees do exhibit at least one gesture that bears some structural resemblance to the pointing gesture—holding out a hand (see Bygott, 1979; de Waal, 1982). The meaning of this gesture appears to be context specific; it can be deployed as a reconciliatory gesture, a food-begging gesture, a solicitation for bodily contact, or a call for support during a conflict (de Waal, 1982; Goodall, 1986). Even here, however, there is little or no evidence that chimpanzees conceptualize this gesture in proto-declarative (or even proto-imperative) fashion, nor has it been interpreted by field researchers as such.

Reports From Captivity

In contrast to free-ranging apes, chimpanzees and other great apes reared and tested in captivity by humans do display arm (or even leg) extensions that structurally (and functionally) resemble the pointing gesture in that they are directed at particular objects, locations, or persons (Call & Tomasello, 1994; Gómez, 1990; Gómez, Sarria, & Tamarit, 1993; Povinelli & Eddy, 1996a; Povinelli, Nelson, & Boysen, 1992; Premack, 1984; Savage-Rumbaugh, 1986; Woodruff & Premack, 1979). Indeed, this similarity has been exploited by a number of researchers who have used such gestures as the dependent measures in studies in which the subjects make a choice be-
tween one of several people or locations (see Fig. 3.1). For example, Povinelli, Nelson, and Boysen (1992) trained chimpanzees to extend their arm toward a location where food was hidden. In these contexts, a number of researchers (including ourselves) have frequently glossed such gestures as “pointing.”

More recently, several researchers have claimed that the structural similarity is even greater, arguing that captive chimpanzees and orangutans can, in fact, be observed to use the complete pointing gesture in concert with gaze alternation (Krause & Fouts, 1997; Leavens & Hopkins, 1999; Leavens, Hopkins, & Bard, 1996; Miles, 1990). Some researchers have even reported that in their studies the indexical pointing gesture by their subjects was the most common form of the gesture observed (Krause & Fouts, 1997). For some, then, the case can be settled here: Chimpanzees point. If we were behaviorists, we would be forced to agree.

**Chimpanzees Use Their Index Fingers!**

At this juncture, it is necessary to address the claim that captive chimpanzees display the full pointing gesture (including the index-finger extension). Recall that Povinelli and Davis (1994) proposed that index-finger extension in the pointing gesture is the result of species-specific morphological features of the tendons on the human index finger. It is important not to misinterpret this claim as meaning any of the following: (a) Chimpanzees cannot extend their index finger, (b) chimpanzees do not extend their index finger, and/or (c) chimpanzees cannot learn to extend their index finger in the context of arm extensions and gesturing. None of these claims were made by Povinelli and Davis. Indeed, as we have noted elsewhere, chimpanzees often use their index fingers to probe at objects or to pick at food (see Povinelli, Reaux, Bierschwale, Allain, & Simon, 1997). Figure 3.3 provides an example of this kind of phenomenon from our laboratory.

However, Povinelli and Davis (1994) did argue that pointing with the index finger does not typically emerge in chimpanzees. Indeed, evidence from the wild provides us with no reason to modify this claim. So what do we make of recent demonstrations that chimpanzees gesture with index-finger extensions? Do they falsify Povinelli and Davis’s (1994) morphological constraints model, as Krause and Fouts (1997), for example, have maintained? More generally, do such demonstrations imply the presence in chimpanzees of a homologous gestural form, or merely an artificial convergence of form due to the peculiarities of their interactions with humans?

First, the experiments in which indexical pointing has been reported in chimpanzees were typically conducted in enclosures surrounded by cage mesh (e.g., Krause & Fouts, 1997; Leavens & Hopkins, 1998; Leavens et al., 1996). This cage mesh is too small for juvenile and adult subjects to fit their
FIG. 3.3. Chimpanzees frequently (and perhaps preferentially) use the index finger for inspection of objects and bodily parts.
hands through, and thus they must poke one or several fingers through. As far as we are aware, all of the indexical pointing gestures occurred in this manner—with the index finger resting on the mesh (see Fig. 3.4). We do not doubt the occurrence of this kind of phenomenon—we frequently witness such index-finger extensions in precisely this context (see Fig. 3.4). However, Povinelli and Davis accounted for the universal presence of index-finger pointing in humans as emerging from a natural tendency for the index finger to extend—not from some incidental shaping that occurs as the result of wanting to extend the whole hand through a small opening.\

Second, some of the apes that have been reported to display indexical pointing have been involved in extensive training to produce hand signs used in American Sign Language (chimpanzees: Fouts, Hirsch, & Fouts, 1982; Gardner & Gardner, 1975; Krause & Fouts, 1997; orangutans: Miles, 1990). This training involves many signs in which extension of the index

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3Leavens et al. (1996) maintained that in their study the cage mesh cannot explain why the index finger was shaped over other fingers. Yet this ignores that chimpanzees preferentially use the index finger to touch or pick at objects and that the index finger (independent of the morphological constraints model) is differentially exposed compared to any other fingers (except the thumb, which is truncated; see Fig. 3.3).
finger serves a primary role (i.e., the signs for "me" and "you"). Third, there is no evidence that even these chimpanzees use this gesture (or any other kind of pointing gesture) with each other—a fact consistent with the idea that the pointing-like gestures they learn are tightly connected to a procedural routine that, from their perspective, just so happens to elicit a certain reaction from humans, but not fellow chimpanzees.

Although we are getting ahead of ourselves, it is important to reiterate that the particular form of the pointing gesture may not be a critical issue with respect to the cognitive structures that support and/or attend it. Because we are primarily interested in the underlying cognitive mechanisms engaged by pointing, it is important not to be misled into treating index-finger extension as the issue itself. In this sense, the presence of the extension of the index finger is no better evidence of referential indicating than arm extensions without index finger extensions. As Povinelli and Davis (1994) noted, if chimpanzees were capable of representing the attentional states of others, “more well-developed pointing gestures ought to develop, even if they [did] not exclusively involve the index finger” (p. 135). Thus, although the question of index-finger extension is of interest to the question of the form of the gesture in humans, it is largely irrelevant to the question of whether chimpanzees appreciate the joint-attentional implications of pointing.

DO CHIMPANZEE S INDICATE? THE ARGUMENT BY ANALOGY

Having established that chimpanzees display gestures remarkably similar to the pointing gesture (and in certain cases perhaps identical), we now ask whether they understand the gesture in the manner that we do.

First, a comment about humans. Regardless of the exact timing of the development of various aspects of infants’ understanding of pointing, one thing seems certain: Humans do come to appreciate pointing as a means of connecting to the inner psychological states of others (for discussions of the timing of this development, see Baldwin, 1991, 1993a, 1993b; Franco & Butterworth, 1996; Franco & Wishart, 1995). This is not to say that pointing is always produced for such reasons by the agent, nor that it is always interpreted in such a manner by the observer. Nonetheless, it appears clear that the pointing gesture becomes intimately bound up with our second-order intentional states. As we show, however, the exact causal role between specific second-order intentional states and the production of the gesture is likely to be complicated (see Povinelli & Giambrone, 1999).

Do chimpanzees also develop this understanding of pointing? Several researchers recently examined captive chimpanzees’ use of the gestures just
described, and all have concluded that chimpanzees exhibit referential pointing (Krause & Fouts, 1997; Leavens & Hopkins, 1998; Leavens et al., 1996). These researchers stressed that chimpanzee pointing-like gestures serve a communicative function, and therefore they have comfortably assumed that young children and chimpanzees must understand the gesture in a similar manner. In doing so, they have relied heavily on the argument by analogy. Leavens et al. (1996) make the point clearly: “We would not support an interpretation that explained, for example, the pointing behavior of chimpanzees in operant terms and the pointing behavior of human 12-month-olds, or adults, in cognitive terms” (p. 351). Although these alternatives constitute an unnecessarily extreme dichotomy, part of our conclusion (see the section “Toward an Integrated Account of the Form, Function, and Meaning of the Pointing Gesture in Humans and Apes”) is that different interpretations may be warranted for the same behavior depending on the species producing it.

Leavens et al. (1996) conducted a retrospective analysis of chimpanzees’ reactions when food rewards accidentally spilled out of a testing apparatus beyond their reach. The subjects were observed to protrude their fingers through the mesh toward the food reward, and at least one of the apes looked to the human who was present. The authors note that their data “are amenable to both cognitive and behaviorist interpretations” (p. 351). Similarly, Leavens and Hopkins (1998) placed a banana on the ground in front of a chimpanzee’s cage and then left the area. Another experimenter then approached the cage and made eye contact with the chimpanzee. The chimpanzee was given the banana as soon as he or she either (a) gestured (through the mesh), (b) gestured and vocalized, or (c) gestured or vocalized and looked back and forth from the banana to the human. The chimpanzees’ gestures and vocalizations were both accompanied by gaze alternation. The authors conclude that “[t]he use of the whole hand in pointing suggests that these chimpanzees . . . may have ‘invented’ the gesture as part of a problem solving tactic involving the instrumental manipulation of a social agent” (p. 819).

Before critiquing this research, let us note some points of agreement. First, surely these gestures are at least simple communicative acts. Communication minimally involves information being transmitted from one individual to another individual. Thus, the chimpanzee who gestures toward an out-of-reach banana in the presence, but not in the absence, of a human is surely communicating. Likewise, the honeybee whose “waggle dance” informs other bees of the direction and distance of flowering plants is com-

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4We assume a non-Gricean notion of communication. Thus, in this context, communication may be said to occur without reasoning about the psychological states of the communicative partner (or, for that matter, oneself).
municating, as well as the dog snarling at the postman wandering onto its territory. Significantly, note that the bee, or the dog, may neither frequently dance nor snarl in the absence of other individuals. However, insofar as it involves the transmission of information, and influences the behavior of others, communication need not require the sender to understand anything at all about the mental states of the recipients (e.g., their attentional states). Are there any other aspects of these spontaneous acts that might suggest that the chimpanzees are, in fact, reasoning about the psychological states of their communicative partners in this context?

Leavens et al. (1996) believed so. For example, they referred to their chimpanzees' gestures as *referential* pointing (see also Krause & Fouts, 1997) largely because the animals exhibit gaze alternation: "We consider these data to be evidence of perspective-taking in that it seems unlikely that the gaze alternation we observed . . . could be parsimoniously explained without invoking the same functional explanation invoked for gaze alternation in human infant pointing" (p. 351). Leavens et al. (1996) explained their chimpanzees' gaze alternation while pointing to out-of-reach food items by stating that their chimpanzees "recognized the necessity of capturing the attention of human observers in order to achieve desired goals" (p. 350). In other words, by alternating their gaze, the chimpanzees are envisioned to be checking the observers' attentional state in relation to the item of reference, in this case food that had fallen beyond their reach. Leavens and Hopkins (1998) reported that no subject looked at the food item (an out-of-reach banana) without also looking to the experimenter, and that every subject who both vocalized and gestured toward these objects, these authors found, also exhibited gaze alternation. Similarly, Krause and Fouts (1997) reported that two chimpanzees pointed to a bowl containing food while alternating their gaze between the bowl and the observer.

A moment's reflection, however, will reveal that although gaze alternation may signal some sensitivity to the posture of the communicative partner, it may or may not imply an understanding of the psychological aspect of attention. The literature on human development does, indeed, implicate gaze alternation as the mechanism by which an understanding of attentional states emerges. However, we should be wary of such a naked inference. It is not the gaze alternation alone that warrants the conclusion. If it

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5It is unclear the kind of social understanding that Leavens et al. (1996) envisioned as accompanying these acts in chimpanzees. On some occasions they appeared to maintain that these behaviors are simply a form of intentional communication, whereas at other times (as in the cited text) they maintained that the execution of the behavior implies an understanding of the internal visual (attentional) states of others. Indeed, their use of the term *attention* was somewhat ambiguous. At times they appeared to restrict the term to refer to postural or behavioral states, whereas in other cases they appeared to imply the second-order intentional state of attention.
were not for other, independent evidence that slightly older infants do possess the capacity to represent the psychological states of others, we would not seriously entertain the conclusion that gaze alternation alone signifies an understanding of such states (at that younger age). Captive chimpanzees are routinely exposed to situations where desired objects are just out of their reach, and probably initially reach for those objects anyway. On seeing this, human observers are likely to interpret this behavior—and rightly so—as the chimpanzee wanting the object, and therefore observers hand the object to the animal. After several such responses from humans, a gesture resembling pointing with the whole hand might become conventionalized (for evidence concerning this process of gestural development in chimpanzees, see Tomasello, Gust, & Frost, 1989; Tomasello, Call, Nagell, Olguín, & Carpenter, 1994). In this context, gaze alternation may merely reflect the chimpanzee’s understanding of this behavioral routine. Thus, the subject alternates looking at the two items of interest: the object the subject wants, and the human whom the subject expects to hand it to him or her.

Yet if such conventionalization processes can account for the presence of pointing-like gestures and gaze alternation, why are Leavens et al. (1996) persuaded that such acts are evidence of “perspective-taking”? The answer is because of their implicit reliance on the argument by analogy: This is how we understand the act of gaze alternation in ourselves as well as young infants. Indeed, most researchers in this area seem to be wary of arguing for one interpretation of the gesture when it is produced by chimpanzees and another when it is produced by human infants. However, as we see, this may be exactly what is required.

“DO CHIMPANZEEs INDICATE?” REVISITED

In this section, we attempt to move beyond the argument by analogy by critically examining chimpanzees’ use of pointing-like gestures. We ask several questions:

1. Do chimpanzees understand the attentional space that psychologically surrounds their gestures?
2. Do they comprehend pointing gestures when they are used by others?
3. What is the significance of gaze alternation in the context of these gestures—for example, do they understand that their gestures need to be seen in order to be effective?

In short, we examine whether they understand the psychological grounding of the gesture in the manner that humans do. To explore these ques-
tions, we review recent empirical research from our laboratory and elsewhere.

Do Chimpanzees Know That Their Gestures Must Be Seen?

First, although chimpanzees naturally deploy visually based gestures such as those just described, do they understand that these gestures must be seen to be communicatively effective? We have attempted to answer this question through an extensive series of studies with a cohort of seven chimpanzees. We conducted the initial studies when the animals were 5 to 6 years of age, and conducted additional studies when they were 7 and 8 to 9 years of age. Our results suggest that despite their use of such visually based gestures—and despite their simultaneous interest in and sensitivity to the postures, faces, and eyes of others—chimpanzees may know very little (if anything at all) about attention as a psychological state. Indeed, although we do not review this work here, we have obtained evidence that they appear to understand little about any psychological states at all.

How have we reached this conclusion—one that seems to fly in the face of what our intuitions demand? To begin, we examined our chimpanzees' natural inclination to direct a pointing or begging gesture to familiar human caregivers (usually in contexts where they want out-of-reach food or other objects). Initially, we simply created a standardized context in which the subjects could use these gestures. Each subject was separated from the group and placed in an outdoor waiting area (a process with which the subjects were very familiar). The area was connected by a shuttle door to an indoor testing unit. While the subject waited outside, a familiar experimenter inside either sat or stood in front of a Plexiglas partition (that we use to separate the apes from the experimenters). This person positioned him- or herself behind a hole in the Plexiglas on either the right or left side of the partition, just out of reach of the apes. Next, the shuttle door was opened, allowing the subject to enter and freely respond. The apes quickly learned to enter, reach their arm through the correct hole (the one directly in front of the experimenter), and beg for a food reward (see Fig. 3.5). They also frequently glanced back and forth from the food on the floor and the experimenter.

Of course, we already knew that our apes would do this—they had been deploying such gestures since they were infants. As we have seen, some researchers would be content to label this behavior "pointing"; however, we sought to determine whether the subjects understood that their visually based gestures are "seen"—that is, whether they understand the gestures as part of an attentionally based interaction. To do so, we first studied their spontaneous play behavior and from this derived a number of conditions that would allow us to ask this question. For example, we had frequently wit-
FIG. 3.5. After shuttle door opens, a chimpanzee (a) enters test unit and approaches a familiar experimenter, (b) deploys species-typical begging gesture through hole toward experimenter, and (c) is given a food reward.

nessed our apes placing their hands over their eyes and wandering about the compound until they bumped into something. Further, we had seen them placing plastic buckets and bowls and burlap sacks over their heads in a similar way, and even occasionally lifting them—to peek, as it were. But did they understand what they were doing in terms of the conceptual notion of “seeing”?

These observations inspired an initial set of experimental conditions to ask the apes what they knew about seeing (see Fig. 3.6a). The idea behind all of these conditions was the same: one person who could see the apes and another person who could not. How did the animals react to confronting
FIG. 3.6. (a) Conditions (modeled after spontaneous play behavior of the chimpanzee subjects) used to test subjects for their understanding of seeing/not seeing. (b) Mean percent correct (±SEM) in blocks of two trials. The dotted line indicates levels expected by chance.
these conditions? Before answering this question, however, it is important
to note that the animals performed almost perfectly on control trials in
which both experimenters could see them, but one was holding out food
and the other was offering a block of wood. Here, where no understanding
of the internal subjective state of the experimenters was required, the apes
performed almost without error. They entered the lab, paused, and then
immediately gestured to the experimenter holding out the food. Thus, they
were clearly motivated to receive a reward and would look for, and act on,
the relevant and observable aspects of the experimenter’s location and ac-
tions.

In direct contrast, a very different picture emerged on the critical see-
ing/not seeing trials. On the blindfolds, buckets, and hands-over-the-eyes
trials, the subjects were just as likely to gesture to the person who could not
see them as to the person who could (Fig. 3.6b). The apes entered the lab,
paused, but then went on to deploy their gesture as if unaware that only one
person could see them! There was, however, one notable exception—the
back-versus-front trials. Here the apes performed correctly from their very
first trial forward. We found these initial results difficult to understand. Af-
ter all, how could the apes not understand such a (seemingly) critical as-
pect of this interaction? In an initial set of 14 studies, we tested a number of
ideas about how our apes were reasoning about this kind of situation. First,
we pursued the question of why the apes responded nearly perfectly in the
back/front condition, but not in the other conditions. Two possibilities
suggested themselves. On the one hand, maybe back/front was simply the
instance of seeing/not seeing with which our apes were most familiar—or
perhaps it was just the most obvious of the instances that we had selected.
On the other hand, perhaps in truth they had no understanding of “seeing”
at all, and were merely responding to the general frontal orientation of the
experimenter; something they do naturally (see Tomasello et al., 1994)
and, indeed, something we had reinforced repeatedly in their initial train-
ing. In other words, maybe they just knew a rule that might verbally be de-
scribed as “Gesture to the person facing forward.”

To test this idea we created a new naturalistic condition—one that we
felt was just as obvious an instance of seeing/not seeing as the back/front
condition, and one that the animals experience many times a day in their
natural interactions with each other, as well as with us. This new condition,
looking-over-the-shoulder, involved both experimenters with their backs to
the apes, but one of them looking over his or her shoulder toward the ape
(see Fig. 3.7a). The significance of this condition is that it allowed us to pit
the competing interpretations of the back/front performance against each
other. After all, if the animals were simply relying on the frontal aspect of
the person to solve the back/front problem, they could not do so here. In
response to confronting this treatment, the apes entered the lab, paused,
and then proceeded to gesture as often to the person not looking over his or her shoulder as to the person who was (Fig. 3.7b).

We would be remiss if we did not point out that with experience on some additional conditions, such as the screens condition depicted in Fig. 3.8a, the apes did begin to learn to respond correctly—that is, to the person who could see them (Fig. 3.8b). However, there were at least two potential explanations of this learning. First, because the apes were only reinforced (that is, handed the food reward) when they gestured to the person who...
could see them, they may have simply learned a second rule (e.g., "Gesture to the person whose face is visible") when the first rule could not be satisfied. Yet maybe they had just needed more experience to figure out that the problem was about seeing. One way of addressing these competing ideas was to determine if their learned success on the screens conditions would transfer to the other conditions. The low-level model predicted that this understanding would transfer to all of the previous conditions except one—blindfolds. The low-level model envisioned that the subjects had learned

FIG. 3.8. (a) Screens condition along with (b) mean percent correct (±SEM) in blocks of four trials. The dotted line indicates levels expected by chance.
another rule about gesturing to the person whose face is visible. The blind-folds condition was the only one of the original conditions in which this rule could not work. Just as the low-level model predicted, this was the only condition in which the apes performed randomly.

Of course, there were many other possible interpretations of these data, many of which we systematically explored and ruled out. In the interest of space, let us just examine one of these possibilities. Perhaps the apes were basing their choices on the global presence or absence of the face simply because they were not carefully monitoring the eyes of the experimenters. We tested this by confronting the apes with the condition depicted in Fig. 3.9. As can be seen, in both options the experimenters’ faces (and eyes) are visible. The only difference is that one of them is looking toward the animal, whereas the other is looking away—above and behind the animal. In response to this condition, the apes entered the test unit and, on almost half of the trials, turned and followed the distracted experimenter’s gaze up into the corner of the ceiling behind them. Nonetheless, on those same trials, the apes were just as likely to deploy their visually based gesture to this distracted experimenter as to the one who was looking in their direction. (Additional tests with these same animals have now experimentally confirmed and extended this gaze-following ability. Indeed, we now have evidence that chimpanzees will follow gaze in response to head and eye movement in concert, eye movement alone, and will follow gaze into a particular quadrant of space; see Fig. 3.10 [Povinelli, Bierschwale, & Cech, 1999, Experiments 1 & 2; Povinelli & Eddy, 1996a, Experiment 12; Povinelli & Eddy, 1996b, 1997; see also Tomasello, Call, & Hare, 1998].)

Were these results just an indication of the young age of our subjects or did they reflect something intrinsic about the nature of chimpanzee social understanding? To explore this, we conducted several longitudinal follow-up tests with these same animals (see Reaux, Theall, & Povinelli, 1999). Thirteen months after the original tests were completed, when the apes were 7 years of age, we retested them using three of the conditions used previously—screens, eyes open/closed, and back/front. Recall that by the end of the original series of tests the subjects were performing excellently on the screens condition. Yet, to our surprise, the apes initially responded randomly on this condition. Indeed, it was only after 12 trials that the animals began responding significantly above chance (and even this level, 57% correct, was hardly impressive). The subjects had received far fewer of the eyes open/closed trials, and here, despite receiving 48 massed trials of eyes open/closed, the subjects did not learn to respond preferentially to the experimenter with his or her eyes open. In contrast, the animals responded at ceiling levels from trial 1 forward on the back/front trials. Furthermore, a year after this, when the animals were on the cusp of young adulthood (8 to 9 years of age), we returned with a full battery of the original tests. Al-
FIG. 3.9. (a) Attending-versus-distracted condition along with (b) mean percent correct (±SEM) in blocks of two trials. The dotted line indicates levels expected by chance.

though the animals showed some evidence of responding correctly on one of the conditions (buckets) within the first four trials, in general their responses were not impressive (see Fig. 3.11). However, after additional trials, their performance began to improve, at least in some of the conditions.

This learning raised a familiar, but still troubling, question. To what extent did the apes just need to reorient themselves to the general procedures, having understood “seeing” all along? Although it took many trials, perhaps they now—finally!—grasped what we were asking them. Perhaps
FIG. 3.10. Gaze following in a 6-year-old chimpanzee in response to head and eye movement of a familiar experimenter.

Year 3: Seeing/Not Seeing
(age 8-9 years)

FIG. 3.11. Mean percent correct (±SEM) at third longitudinal assessment (at 8 to 9 years of age) of a cohort of chimpanzees understanding of seeing/not seeing. See Figs. 3.6 to 3.9 for description of some of the conditions.
the most striking results came from an experiment in which we combined two of the conditions to produce the mixed treatment depicted in Fig. 3.12. This condition can be understood as a combination of the correct option from the looking-over-the-shoulder condition, and the incorrect option from eyes open/closed. The significance of this condition can be understood by hypothesizing that the apes had simply formed a series of rules in descending order of importance—frontal aspect > face > eyes. If so, they could be expected to perform well on looking-over-the-shoulder (neither frontal aspect is visible, so it represents a choice between face and no face). Likewise, in the eyes open/closed condition, both experimenters' frontal aspects were equally visible, and both faces were equally visible; thus, the apes would resort to the eyes rule and perform excellently. However, in the mixed condition, the frontal aspect of the incorrect experimenter (eyes closed) was visible, but not the frontal aspect of the correct experimenter (the one looking over her shoulder with eyes open). Thus, the low-level model predicted they would significantly prefer the incorrect experimenter—which is exactly what they did (Reaux et al., 1999, Experiment 4).

The results of this extended series of studies suggested that despite their natural use of the begging gesture, and despite their interest in the eyes and gaze direction of others, chimpanzees do not, in fact, understand a key

![Fig. 3.12. Mixed condition used to assess rules used by chimpanzees to decide to whom they should gesture. Subject preferred the experimenter facing forward with eyes closed.](image)
aspect of these gestures—namely, that the gestures must be seen by the recipients in order for the gesture to function. In contrast, by 2 years of age, young children seem to understand this aspect of seeing (Lempers, Flavell, & Flavell, 1977; Povinelli & Eddy, 1996a, Experiment 15).

Do Chimpanzees Comprehend the Pointing Gestures of Others?

The results discussed previously cast serious doubt on assuming that chimpanzees understand their visually based gestures in a similar manner to the way in which 2- to 3-year-old children do. We now ask whether they comprehend pointing gestures when they are used by others. Although early reports suggested that they might understand the referential significance of pointing acts (e.g., Call & Tomasello, 1994; Povinelli, Nelson, & Boysen, 1992), more controlled research has recently cast serious doubts on such a view.

For example, we trained our apes to respond to our pointing gestures to locate which of several locations contained a hidden treat (see Povinelli et al., 1997). As can be seen from Fig. 3.13a, we used the standard form of the gesture and its natural context of occurrence, with the experimenter’s hand closer to the correct location. The apes took varying numbers of trials to learn to exploit this gesture, but none of them did so immediately. This initial difficulty was of interest in its own right, because our apes had been exposed to human pointing since birth. Nonetheless, within several dozen trials the animals were responding in a highly accurate manner.

What did the initial learning signify? Had the apes understood all along (or at least now learned) that the experimenter was intentionally signaling one of the boxes through the pointing gesture, but merely needed a bit of time to orient to the task? Or had they just learned a conditional discrimination of one kind or another? For example, perhaps the apes had either just learned to respond to the local stimulus configuration of the experimenter’s hand and the box (a stimulus configuration rule), or to simply select the box closest to the experimenter’s hand (a distance cue). Although these two models are distinct, they both differ from the one that posits that the apes understand the referential significance of the gesture.

We conducted two experiments to test these ideas. In the first one, we simply increased the distance between the distal end of the experimenter’s pointing gesture and the correct location as shown in Fig. 3.13b. In this new position, the experimenter’s pointing hand was still closer to the correct box, and thus this condition could not distinguish between the high-level model and the distance model. However, it did allow us to distinguish between the distance model and the low-level stimulus configuration model. Remarkably, although the apes entered the lab and looked at the experi-
FIG. 3.13. Conditions used to assess chimpanzees’ understanding of the pointing gesture. See text for details of the conditions, hypotheses, and results.

Menter before responding on every trial, this simple manipulation caused 5 of the 7 subjects’ performances to drop from 100% correct to chance levels (50% correct). The implication was clear. Far from understanding the gesture in referential terms, most of the apes were simply focusing on the local configuration of the experimenter’s hand and the box. Young 3-year-old children, in contrast, performed at near-perfect levels from Trial 1 forward.

However, two of our chimpanzees (Kara and Apollo) performed quite differently from the others—they continued to respond well even with this increased distance between the experimenter’s gesture and the box. Did these apes, then, understand the referential nature of the act? As we explained earlier, the first study was designed to distinguish between the two low-level models; it did not allow us to distinguish between the distance
3. CHIMPANZEES’ “POINTING”  

based model and the high-level model. However, Kara and Apollo’s performance provided a reason to test the apes in a second experiment, which could distinguish between these accounts. Thus, in a second experiment, the experimenter pointed from several locations and postures. In one case the tip of his pointing finger was equidistant from the two locations (Fig. 3.13d), and in another it was closer to the incorrect location (Fig. 3.13c). As before, we included versions of these treatments in which the experimenter was and was not gazing at the location to which he was pointing (see Povinelli et al., 1997, for a complete description of the conditions).

The results of these tests cast serious doubt on the validity of the referential comprehension model. First, all of the apes continued to perform excellently when the experimenter’s pointing hand was near the correct box (within 5 to 10 cm; see Fig. 3.13a). In contrast, most of the apes continued to perform at chance level when the pointing hand was considerably farther away (80 cm) from the correct box, but still closer to it than to the incorrect box (see Fig. 3.13b). Third, the apes actually preferred the incorrect box when the experimenter’s body was positioned closer to it than to the correct box, even though his pointing gesture was clearly referencing the opposite box (see Fig. 3.13c). Fourth, and perhaps most important, when the experimenter’s body with gesture was equidistant from the two boxes, the animals performed randomly—including the two apes who had performed well in the initial experiment. Perhaps most striking of all was that in the cases where the experimenter was closer to one box than the other (see Fig. 3.13c), the subjects performed better when the experimenter gazed at the correct box without pointing, as opposed to when he both gazed and pointed! In previous studies we had explicitly taught the apes to choose the box to which an experimenter glanced (Povinelli, Bierschwale, & Cech, 1999; Povinelli et al., 2002). However, introducing the pointing hand misled the apes into choosing the incorrect box because the hand was closer to it than to the correct box. In contrast, 26-month-old human toddlers performed excellently on their very first trial with even the most difficult of these conditions (see Povinelli et al., 1997).

It is important to reiterate that these chimpanzees had been exposed to the pointing gesture (and many other indicating gestures) in their spontaneous interactions with their human caregivers (and later trainers) since birth. And it is surely our subjective impression that, in some sense or another, they learned to respond appropriately to these gestures. However, the results of our experiments clearly support the idea that they did not learn about the referential import of the gesture. Although the chimpanzees came to exploit the gesture, whether from trial-and-error learning or by the expression of some innate tendency to be attracted to those objects physically closest to another individual, it seems likely that lower level proc-
esses were at work. Indeed, similarities of this with stimulus enhancement are quite striking (e.g., Galef, 1988). The manipulation of an object, for instance, increases its salience, and thus it obtains a higher valence. In the context of our experiments, it seems likely that the experimenter’s hand acted in precisely this manner to enhance the salience of the nearest box. Although it was conducted for somewhat different reasons, and therefore lacks important controls, a recent experiment by Tomasello, Call, and Gluckman (1997) supports a simple discrimination model of pointing comprehension.

TOWARD AN INTEGRATED ACCOUNT OF THE FORM, FUNCTION, AND MEANING OF THE POINTING GESTURE IN HUMANS AND APES

The Reinterpretation Model

Although the strands of an alternative to the argument by analogy are already in place, in this section we provide an explanation of how it is that humans and chimpanzees can share so many behavioral patterns in common (including those under examination here) and yet understand them so differently. In short, we propose that social complexity evolved independently of psychological complexity. We speculate that primate social evolution (and the evolution of mammalian social communication in general) was driven by fairly ancient psychological processes, coupled with selection for certain physiological, attentional, behavioral, and morphological structures subserving these communicative acts. Thus, the behavioral forms that primatologists are fond of calling deception, empathy, grudging, reconciliation, and even pointing all evolved and were in full operation long before there were any organisms that could understand them in these terms. They evolved not because these primate ancestors possessed the means of representing the minds of their fellow groupmates, but because such acts became inevitable as selection honed behaviors that maximized each group member’s inclusive fitness given the constraints in place. Thus, contrary to the so-called “social intelligence hypothesis” (e.g., Humphrey, 1976; Jolly, 1966), we do not suppose that the psychological demands of living in a so-

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6Call and Tomasello (1994) claimed that an orangutan they tested displayed evidence of referential comprehension of the pointing gesture. However, as in other studies (e.g., Anderson, Sallaberry, & Barbier, 1995; Povinelli, Nelson, & Boysen, 1992), the pointing hand was much closer to the correct location than the incorrect one. If we compare conditions in which distance was not controlled, our subject Xara displayed better evidence for exploiting the gesture than did their subject. However, when the cue distance was neutralized, even Kara’s performance plummeted to chance.
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cial group required an understanding of others as psychological agents. On the contrary, we suspect that only one lineage—the human one—evolved abilities related to understanding others in mentalistic terms.

The significance of this proposal comes from considering what this means about human behavior. In evolving a cognitive specialization in representing mental states, humans did not (we propose) shed their ancestral behavioral patterns in favor of some dramatically new set of behaviors. We suspect that most of the basic behavioral patterns remained intact. What changed was that for the first time such behaviors became understood in mentalistic terms. In one sense, then, these ancient behaviors were reinterpreted in terms of an explanatory system we now call "theory of mind." Just as the addition of a device to represent the speed of an automobile—a speedometer—does not radically alter the basic propensities of the vehicle, so too can we imagine that humans evolved novel representational systems related to second-order intentional states without dramatically altering their ancient behavioral patterns (see Povinelli & Giambrone, 1999). Indeed, to push the example even further, just as the speedometer does not endow the automobile/driver system with a score of previously impossible behaviors, but rather makes certain behaviors much easier to accomplish, so too might the ability to understand ancient behaviors in explicitly mentalistic terms have made certain complicated behavioral routines much more likely.

The Reinterpretation Model Applied

How does the reinterpretation model help us to understand the similarity between human pointing and structurally similar gestures in chimpanzees? First, we know that chimpanzees and humans (like other nonhuman primates) exhibit visually guided prehension—that is, they reach toward things they want and visually monitor those reaches. Second, as part of a ritualized communicative signal (begging), chimpanzees extend their arms and hands toward things that they cannot take without the tolerance of others. Third, they extend their arms toward others as part of a communicative signal involved in reassurance after a fight or in ambiguous social situations. All three of these behaviors are displayed by chimpanzees in the field and in captivity. We presume many of the structural aspects of these gestures were in place prior to the evolutionary divergence of the human and chimpanzee lineages.

These primitive gestures may have provided the raw behavioral fabric out of which pointing as a referential gesture emerged in humans. We suggest that with the emergence of psychological innovations in social understanding (in particular, second-order intentional states), existing gestures or actions were explicitly reinterpreted as functioning to influence the
attentional/mental states of others. Although in one sense these behaviors did in fact function to influence the attentional states of others from their earliest inception, we advance the hypothesis that only the human lineage evolved the psychological faculties that made it possible to understand this fact. As we have argued elsewhere, this need not mean that each occurrence of such acts that can be understood in this manner will be so understood. On the contrary, we suspect that frequently such actions are not prompted by second-order intentional states (i.e., the representation of the mental states of self or other), but instead are controlled by lower level psychological processes. Just as the reading on the speedometer of an automobile need not directly cause the speed of the automobile in order to causally interact with it, we conclude that second-order intentional states need not directly cause the behaviors that they represent, or indeed even always causally interact with them.

What about the case of captive chimpanzees? Here we see a degree of functional similarity to human pointing not approximated by wild chimpanzees. It is not difficult to imagine how these ancient behavioral similarities might become shaped during interactions with humans to produce the kinds of gestures described earlier. Let us provide just two examples of how this might operate. First, in captivity, young chimpanzees invariably reach out toward observers who pass their enclosures. Also invariably, these human observers misinterpret this signal as indicating that the ape wants them to touch him or her. Thus, the human observers are usually a bit startled when, far from an enthusiastic reception, the apes withdraw their arms in alarm as the observers reach toward them. Although initially this constitutes an unexpected response, chimpanzees may rapidly learn a new function for this gesture: getting humans to approach them. A second case (mentioned previously) involves a chimpanzee reaching toward an object. Human observers correctly interpret this behavior as the chimpanzee wanting the object. Therefore, they pick up the object and hand it to the ape. Indeed, the more closely the gesture looks like a request (regardless of what the chimpanzee understands about the gesture), the more rapidly it will be interpreted as such by the human. In short order, then, chimpanzees may develop a gesture in the presence of humans that serves to cause the human to hand them what they want. We emphasize that this gesture is not reaching—it is a social signal that functions very much like pointing. But, as

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7 Call and Tomasello (1996) suggested an alternative to this view, namely, that chimpanzees (and perhaps other great apes) can, and at least some do, possess second-order intentional states but require human culture to shape their cognitive systems in this manner. This intriguing hypothesis suggests that a “theory of mind” is not a tightly canalized system that evolved exclusively in the human lineage. At this point, however, there is little or no direct evidence to support this hypothesis (see Povinelli, 1996).
we have seen, there is good reason to suspect that all of this occurs in the absence of the chimpanzee understanding the psychological states of his or her communicative partner. Indeed, the driving force shaping the chimpanzee’s gesture is the human’s representation of the chimpanzee’s psychological state. This would explain why these gestures are not exhibited by chimpanzees as they interact with each other.

Some researchers find these explanations unlikely, noting that their subjects’ “pointing” occurs significantly more often in the presence of an experimenter than in his or her absence (Krause & Fouts, 1997; Leavens & Hopkins, 1999; Leavens et al., 1996; see also Call & Tomasello, 1994, for similar findings with orangutans). Leavens et al. (1996) argued that if the gestures were simply “failed reaching attempts” (which is not the explanation offered here), then the apes would produce these gestures with equal frequency in the presence or absence of humans or when the experimenter’s back is toward them. However, such findings do not contradict the claim that chimpanzees know little or nothing about attention as a mental state. Not even radical behaviorists would deny that chimpanzees could readily learn the connection between the posture of a person and the effectiveness of a social signal in eliciting a desired behavior from him or her. Given that the presence and forward-facing posture of the human typically covary with chimpanzees’ success in using their visually based gestures, their perceptual and attentional systems would have to be extraordinarily different from ours indeed not to uncover this connection. Indeed, regardless of their understanding of the psychological states of others, it is hard to imagine how chimpanzees could not learn to avoid using visually based, social gestures when someone is facing away from them, or absent altogether. Indeed, our experimental work shows exactly how quickly these understandings can develop—and how narrowly restricted these understandings may be.

We end on what may be the central question of all concerning the argument by analogy. The question is best put simply: “Are not processes similar to ones explored here also at work in human infants and children? Are the same processes not responsible for their construction of an understanding of others as psychological agents?” The reinterpretation hypothesis offers a way out of this apparent impasse. If we grant that humans have evolved novel psychological specializations related to social understanding (and perhaps others as well), and if we grant that apes and humans share ancient behavioral patterns that evolved in the absence of these representational systems, then the answer to this question becomes straightforward. On the one hand, it may be that the processes that govern the emergence of gestural forms in humans and chimpanzees (especially those reared with humans) reflect genuine evolutionary homology. But this homology may, at each twist and turn in the developmental process, be associated with profound differences as well. In humans, the old psychological systems may develop alongside the new in
such a way that those looking for simple differences between humans and chimpanzees may come away unimpressed. The real differences may lie not in the dramatic appearance of a structurally new behavior per se, or even in old behaviors put to distinctly new functions. Rather, the ability to represent others as possessing internal, attentional states may have allowed existing gestural forms to be woven into a much larger, more efficient and productive system of communication—a system in which understanding the psychological meanings behind the gestures is just as important as the gestures themselves. Both systems involve a description of others, and both provide predictions for how others are likely to behave. But only one can be considered a genuinely psychological description of others. Humans—unlike other animals—appear to have evolved the latter. But in doing so, we did not discard the ancient in favor of the new. Rather, the two systems appear to have been combined in such a way that our efforts to specify the unique role that each plays in causing our behavior may turn out to be an impossible—and perhaps nonsensical—undertaking.

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