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Comprehension of iconic gestures by chimpanzees and human children

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ABSTRACT

Iconic gestures—communicative acts using hand or body movements that resemble their referent—figure prominently in theories of language evolution and development. This study contrasted the abilities of chimpanzees ($N = 11$) and 4-year-old human children ($N = 24$) to comprehend novel iconic gestures. Participants learned to retrieve rewards from apparatuses in two distinct locations, each requiring a different action. In the test, a human adult informed the participant where to go by miming the action needed to obtain the reward. Children used the iconic gestures (more than arbitrary gestures) to locate the reward, whereas chimpanzees did not. Some children also used arbitrary gestures in the same way, but only after they had previously shown comprehension for iconic gestures. Over time, chimpanzees learned to associate iconic gestures with the appropriate location faster than arbitrary gestures, suggesting at least some recognition of the iconicity involved. These results demonstrate the importance of iconicity in referential communication.

Introduction

The communicative abilities of humans are remarkably flexible. Both adults and children are able to communicate a wide variety of messages even when the necessary linguistic abilities are lacking.

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Intuitively, they create gestures on the spot to make themselves understood. The pointing gesture is most often used to single out referents in the immediate perceptual context. In contrast, iconic gestures are often used to single out displaced referents outside of the immediate perceptual context. For example, one might request a glass of water (across a noisy room) by pretending to hold a glass and drink from it. Thus, iconic gestures may be considered "natural" acts of reference because they *re*-present the intended referent and thereby induce the recipient to imagine the gesturer's communicative intention (Tomasello, 2008). Importantly, this does not require that the gesture is part of a shared and conventional communicative system among the interlocutors. Therefore, this natural referential potential of iconic gestures has been recognized in theories on the development of linguistic abilities (Perniss & Vigliocco, 2014; Piaget, 1951; Werner & Kaplan, 1963) and more recently in several theories of language evolution (Arbib, Liebal, & Pika, 2008; Armstrong & Wilcox, 2007; Corballis, 2011; Donald, 1991; Sterelny, 2012; Tomasello, 2008). These evolutionary theories assume some kind of continuity in the communicative abilities of humans and their ancestors. Comparing human children and their closest living relatives, the great apes, might help us to get a more fine-grained understanding of the evolutionary foundations as well as the development of human communication (Liebal & Haun, 2012). If we find evidence for similar abilities in apes and humans, the biological and genetic foundations enabling the development of these abilities most likely evolved at an earlier point in time. To understand the evolutionary history of human communication it is crucial to specify which abilities are unique to humans and which are shared with our closest living relatives.

Large-scale observational studies in captivity and in the wild find no evidence for the use of iconic gestures in chimpanzees (*Pan troglodytes*) or other great apes (Call & Tomasello, 2007; Genty, Breuer, Hobaiter, & Byrne, 2009; Hobaiter & Byrne, 2011). Nevertheless, there are some studies that report production and comprehension of iconic gestures in great apes. Russon and Andrews (2011) reanalyzed observational data collected with forest-living rehabilitant orangutans (*Pongo pygmaeus*) over 20 years and reported a total of 18 anecdotes of communicative pantomiming toward humans and conspecifics. More systematically, Tanner and Byrne (1996) described a number of seemingly iconic gorilla gestures. In a captive group at the San Francisco Zoo, a male gorilla indicated iconically to a female playmate the action he wanted her to perform or the direction he wanted her to move. For example, he swung his arm under his body and tapped his genitals. The authors interpreted this gesture as an invitation to come to the indicated location for sexual contact. Call and Tomasello (2007) suggested that these gestures could also be ritualized intention movements and that the iconicity could be an interpretation by the human observer. In another recent study, these same gestures were found in other groups of gorillas and have been interpreted as belonging to the genetically predisposed natural repertoire of gorilla gestures (Genty et al., 2009).

In a similar way, Genty and Zuberbühler (2014) observed a beckoning gesture in bonobos that could be interpreted iconically as indicating the way in which a conspecific should move her body. However, the authors emphasized that they could not claim with confidence that the iconicity of the gesture was clear to the gesturer. In addition, Pika and Mitani (2006, 2009) argued that high-ranking chimpanzee males used a so-called "directed scratch" in mutual grooming sessions to request grooming of certain body parts. One chimpanzee performed a loud and exaggerated scratch on a part of his body while his partner was watching. This led to increased grooming of the scratched spot. But it is also possible that the scratcher was really scratching and that the groomer then searched for fleas there.

Thus, although a few observational studies have reported rare instances of iconic gesture use in great apes, the iconicity of these gestures is debated. In the only existing experimental study, Grosse, Call, Carpenter, and Tomasello (2015) found no evidence for the production of iconic gestures in chimpanzees and bonobos. They created a situation in which a knowledgeable participant had the opportunity to instruct a naive experimenter how to operate an apparatus that delivered a reward to the participant. Whereas 2- and 3-year-old children readily used iconic gestures to instruct the experimenter, only 1 of 13 apes produced a bodily movement that was somehow related to the corresponding action (not a hand movement but rather a head tilt in the direction the apparatus needed to be turned). This individual had been extensively trained in imitation previously (Hribar, Sonesson, & Call, 2014). However, when participants had access to a duplicate of the apparatus, they showed some signs of comprehending the correspondence between the two by manipulating the corresponding