Introduction: Developments in Primate Gesture Research

Simone Pika[1] and Katja Liebal[2]

[1] Max Planck Institute for Ornithology, Research Group "Comparative Gestural Signalling", Eberhard-Gwinner Strasse, Geesehouse, 82319 Seewiesen, Germany

[2] Freie Universität Berlin, Berlin, Germany

Investigations into the gestural modality of humans have dramatically increased during the last two decades, focusing on a wide variety of topics ranging from the neural basis of gesture, over linguistic structures to cognitive functioning (e.g., Goldenberg & Strauss 2002; Goldin-Meadow 2003; Kendon 2001; McNeill 1992). These studies have also stirred new interest in uncovering the possible pre-cursors to language and the role gestural signals may have played during the dawn of human speech (e.g., Arbib, Liebal & Pika 2008; McNeill in press).

One useful avenue to unravel the mystery of language origins is the comparative approach, which pinpoints similarities and differences of communicative skills of non-human animals, especially our closest living relatives, the non-human primates. Although the vast majority of comparative researchers interested in language origins have neglected the gestural modality for a long time (for exceptions see; Corballis 2002; Hewes 1973), the first detailed descriptions of gestural signals of some great ape and monkey species have been provided by pioneers such as George Schaller (1964, 1965), Jane Goodall (Van Lawick-Goodall 1968a, 1968b), Jan van Hooff (1967, 1973), and Hans Kummer (1968). These ethograms contained many of the communicative gestures that have been observed in subsequent studies in the wild and in captivity and thus still represent very useful tools for current research. For instance in 2005, Pika and Mitani (2006) carried out a systematic study on a distinct gesture, the DIRECTED SCRATCH[1], which had first been described by Goodall (1968a) studying the Gombe chimpanzees in Tanzania. She noted: "Indeed, deliberate scratching movements, during a grooming session, often served as signals since the partner normally responded by grooming the part scratched". Pika and Mitani's study confirmed that this gesture truly is used as a communicative, referential signal to

[1] From here on gestures are depicted in SMALL CAPS.

direct the attention of recipients to distinct spots on the body to be groomed. In addition, they could show that DIRECTED SCRATCHES are mainly used between individuals with strong affiliative bonds such as "friends" and allies and acquire their meaning through dyadic shaping (Pika & Mitani 2009).

These first studies thus have and still do inspire several generations of researchers and also aided in developing new questions and research domains. One important domain in relation to language origins concerns the cognitive complexity underlying gestural usage; an area instigated by Frans Plooij (e.g., 1978, 1979). Studying the ontogeny of gestural signals in chimpanzees at Gombe, Tanzania, Plooij was the first to apply methods of Speech Acts Theory (Austin 1962) and parameters used in analyses of intentional behavior in human children (Bates, Camaioni & Volterra 1975; Bruner 1981; Piaget 1952). Plooij showed that chimpanzee infants' gestures are highly sophisticated communicative means (1) characterized by their flexible relation between means and ends (means-ends dissociation), and (2) used to attract and redirect attention. Means-ends dissociation implies that individuals are able to use (a) synonymous signals/gestures to achieve a certain outcome/goal, and (b) ambiguous gestures for different outcomes/goals. For instance the gestures TOUCHING and REACH OUT ARM are both used by chimpanzee infants to communicate to the mother to be picked up and thus carry the same message (Smith 1965)[2]. The gesture ARM RAISE on the other hand is used to solicit grooming but also to calm and appease an anxious conspecific (Plooij 1979). This gesture thus communicates and embodies different messages across contexts. Plooij (1978, p 127) noted: "This indicates the

[2] Smith (1965) introduced three distinct concepts to animal signalling: *message, meaning*, and *context*. The *message* of a signal may refer among other things to a generalized anxiety, an emotional state such as aggression or fear and does not necessarily imply the intention of a sender to communicate. The *meaning* is identified as the response selected by the recipient from all of the responses open to it, and the *context* refers to anything, which can be thought of as accompanying a signal.

ability to understand and to produce *new* meanings, and this suggest openness, which is one of the most characteristic design features of human language".

This cognitive approach to gestural signaling was continued and expanded by Michael Tomasello, Josep Call and their students. The earliest studies focused on gestural development, flexibility and underlying learning mechanisms of chimpanzees in captivity (Tomasello, Call, Nagell, Olguin & Carpenter 1994; Tomasello et al. 1997; Tomasello, George, Kruger, Farrar & Evans 1985; Tomasello, Gust & Frost 1989), and were later extended by us to include the three other great ape species along with one species of small ape, respectively: bonobos (*Pan paniscus*; Pika 2007a; Pika, Liebal & Tomasello 2005), gorillas (*Gorilla gorilla*; Pika 2007b; Pika, Liebal & Tomasello 2003), orangutans (*Pongo pygmaeus*; Liebal 2007a; Liebal, Pika & Tomasello 2006) and siamangs (*Symphalangus syndactulus*; Liebal 2007b; Liebal, Pika & Tomasello 2004c).

This first comprehensive database on gestural signaling of all ape species provided evidence that ape's gestural competence is far more complex and sophisticated than their vocal abilities, showing that apes

- use open-ended, multifaceted gestural repertoires, including *species-distinctive* and *species-indistinctive* gestures, whose meaning and usage has to be learned (Pika et al. 2003; Tomasello & Call 2007);
- use gestures as flexibly produced intentional strategies, based on key characteristics utilized in studies of intentional communication in human children such as (a) recipient specificity, (b) persistence to the goal (e.g. repetition of a gestures or use of a different one until the goal has been achieved), (c) means-ends dissociation (see paragraph above) and (d) adjustment to audience effects such as (1) adaption of signal

category to the attentional states of recipient, and (2) locomoting in the visual field of the recipient before producing a visual gesture (Liebal, Call & Tomasello 2004a; Liebal, Pika, Call & Tomasello 2004b; Tomasello & Call 2007); and

- develop group-specific traditions of gesture (Pika et al. 2003, 2005), implying underlying social learning processes involved.

Tomasello summarized the impact of these findings on scenarios of language evolution by noting: "In all, I personally do not see how anyone can doubt that ape gestures—in all of their flexibility and sensitivity to the attention of the other—and not ape vocalizations—in all of their inflexibility and ignoring of others— are the original font from which the richness and complexities of human communication and language have flowed"(Tomasello 2008: 55).

However, have we comparative psychologists and primatologists truly understood the phenomenon gesture? McNeill stated recently quite provocatively: "Despite the theory's name, the primatologist, neuroscientist, developmental psychologist, anthropologist, sign-language linguist, regular linguist, computer scientist, etc. proponents of gesture-first seemingly lack any serious acquaintance with gesture other than (it appears) its folk culture portrayals (so they do not recognize the key point of this book: that language is misconstrued if it is not seen as a unity of language and gesture)" (McNeill in press: 10).

We do not think that the lack of serious acquaintance with gesture and/or its relation with language is the main problem, but the lack of interdisciplinary exchange and the scientists' preponderance to use the same terms to talk about different things in addition to definitions of terms tailored to specific research objectives.

To address these problems, in 2004 we organized the first multidisciplinary workshop on "Gestural communication in non-human and human primates", resulting in a stimulating, interdisciplinary exchange and enterprise (Liebal, Müller & Pika 2007).

In addition, the last decade has seen a considerate increase of interest in gestural abilities of non-human primates. Although studies are still biased toward gestural behavior of apes in captivity (e.g., Cartmill & Byrne 2007; Pollick & De Waal 2007; Schneider, Call & Liebal 2010), there has been a considerate increase concerning gestural skills of apes in their natural environments (e.g., Genty, Breuer, Hobaiter & Byrne 2009; Hobaiter & Byrne 2011b; Pika & Mitani 2006) as well as research on monkeys (e.g., Hesler & Fischer 2007; Laidre 2008; Meguerditchian & Vauclair 2009; Smuts 2002).

In 2010, we thus initiated a second workshop at the European University Viadrina in Frankfurt (Oder), Germany to focus on "Current developments in primate gesture research". This time we were especially interested in enhancing and stirring debate(s) concerning:

- historical origins of gesture research;
- application and use of gesture definitions;
- importance and application of reliability measures;
- newest developments and trends in gesture research;
- influences on theories of language evolution.

This book presents almost all of the papers of this workshop and some additional contributions, which originated and/or derived from lively exchange and discussion during and after it.

The book begins with an introductory reflection by Jan van Hooff, one of the leading pioneers of the field. Jan van Hoof started his influencing work over 50 years ago and provides insight into the historical roots of communication research with a special focus on facial expressions, gestures and vocalizations but discusses also the current state of the art in relation to language origins.

The second part of the book concerns empirical studies on gestural communication of humans and of non-human primates in captive settings and their natural environments. It starts with two chapters concerning the underlying learning mechanisms involved in the acquisition of gestures. This topic has recently stirred a lot of interest since scholars of one research group argue that apes do not learn their gestures (c.f. Tomasello & Call 2007) but simply rely on a genetically fixed, species-typical repertoire of unusually large size (Genty et al. 2009; Hobaiter & Byrne 2011b). This hypothesis however does not solve the question why distinct gestures such as for instance the GROOMING-HAND-CLASP and LEAF-CLIPPING are used by some but not all chimpanzee communities in the wild (Whiten et al. 2001), and why some individuals use some gestures not utilized by any other group member (see picture 1, idiosyncratic gesture used by a single adult male, Dolphi, at Ngogo, Kibale National Park, Uganda; ©Langergraber).

- insert picture 1 here –

In their empirical study, Paula Marentette and Elena Nicoladis add fuel to this debate by questioning whether children acquire some of their earliest gestures through a process of individual learning called *conventionalization* or *ontogenetic ritualization* (Clark 1978; Lock 1978; Tomasello 1996). They address this question by focusing on

the use and development of five different gesture types in children between the ages of 6.5 and 11.5 months.

Marcus Perlman, Joanne Tanner and Barbara King illuminate the topic of gesture acquisition from a different angle, by addressing the question whether gesture originates from instrumental action. To do so, they focus on the use of PUSHES, performed by a gorilla mother to direct her offspring around the enclosure.

The fifth chapter by Sebastian Tempelmann and Katja Liebal provides insight into the use of gesture sequences in orangutans with a special focus on the underlying linear structures and/or semantically referential information. This research area has received relatively little research attention and produced so far mainly conflicting results (Cartmill & Byrne 2010; Genty & Byrne 2010; Hobaiter & Byrne 2011a; Liebal et al. 2004a).

In the sixth chapter, Bill Hopkins and colleagues (Simone Pika, Katja Liebal, Amanda Bania, Adrien Meguerditchian, Molly Gardner, and Steven Schapiro) present the first meta-analysis of data on handedness for manual gestures in all great ape species. They analyze species-level asymmetries in hand use and consistency of asymmetries across species to investigate whether left hemisphere lateralization for language in modern humans evolved from an existing lateralized system for gestural communication in the common ancestor of humans and apes.

The last two chapters of this subsection represent the cut set of empirical research and new trends in primate gestural communication. Mark Lairdre focuses in his chapter on form and function of visual gestures in a monkey species, the mandrill. He thus adds to the debate concerning gesture acquisition (see also Marentette and Nicoladis this volume; Perlman et al. this volume) and strengthens the view that in

order to gain serious acquaintance with gesture we need to avoid "chimpocentristic" (Beck 1982) and "ape-centristic" views only.

Subsequently, Catherine Hobaiter and Richard Byrne present an empirical study on the use of gestures during consortships in chimpanzees at the *Sonso* community, Budongo Forest Reserve, Uganda. They suggest that gesture use is not always limited to evolutionary non-urgent functions (c.f. Tomasello & Zuberbühler 2002), and thus provide further evidence that the phenomenon gesture can only be understood in its full complexity if we study species living under natural selection pressures and in their natural environments (see also; Boesch 2007).

In the third part of the book, we intended to take the reader on a journey to explore and discover new trends and current debates in primate gesture research.
This third part starts with a chapter by Nicole Scott and Simone Pika, highlighting an ongoing debate on the application and use of gesture definitions (Liebal, Müller & Pika 2005). The authors show that definitions vary so tremendously between but also within scientific fields that significant comparisons of gestural complexity are not possible. In early ethological studies for instance, the term gesture is used without a definition (e.g., Van Lawick-Goodall 1968b), quite naturally implying that "everybody knows what it is" (James 1890). In our own work (e.g., Liebal et al. 2006; Pika 2008; Tomasello & Call 2007), we only consider those communicative signals as gestures, which are directed toward a recipient, are mechanically ineffective (which means, they are not designed to act as direct physical agents), and receive a voluntary response. Contrary, McNeill in his newest book defines a gesture as "an unwitting, non-goal-directed action orchestrated by speaker-created significances, having features of manifest expressiveness" (in press, p 12), limiting the phenomena gesture to the human species only. By combining McNeill's Gesture Continuum with

Tinbergen's famous "four why's", Nicole Scott and Simone Pika therefore offer a new framework to gestural studies, intended to unite all gesture researchers within and across scientific fields.

The subsequent two chapters by Tim Racine and David Leavens focus on a contemporary debate over the phenomenon of POINTING, which has been long heralded as a human species-unique gesture. However, although POINTING has also been observed in non-human great ape species (e.g., Gardner & Gardner 1969; Inoue-Nakamura & Matsuzawa 1997; Miles 1990; Patterson 1978; Savage-Rumbaugh, McDonald, Sevcic, Hopkins & Rupert 1986; Woodruff & Premack 1979), some scholars argue that on a cognitive level human *pointing* differs fundamentally from *pointing* in apes (e.g., Butterworth 2003; Tomasello 2006; Tomasello, Carpenter & Liszkowski 2007). Contrary, other scholars suggest that POINTING is, to a relatively high degree, shared by all great ape species (e.g., Leavens & Racine 2009; Leavens, Racine & Hopkins 2009; Savage-Rumbaugh, Rumbaugh & McDonald 1985). To strengthen the latter viewpoint, Tim Racine provides an archaeology of the conceptual foundations of POINTING as exemplified through a critical analysis of one of the most influential theories in the field (Tomasello 2008; Tomasello, Carpenter, Call, Behne & Moll 2005; Tomasello 2009). Subsequently, David Leavens illustrates motivations and contexts of human POINTING to challenge the view that hypothetical motivations underlying pointing differ fundamentally in human and non-human great ape species.

The last chapter of this subsection by Ray Wilkinson, Ivan Leudar and Simone Pika symbolizes another new trend in gesture research, — the necessity and fruitfulness of adapting existing and developing new methodological tools. Ray Wilkinson and his colleagues combine methods of contemporary comparative research with a micro-analytic approach in the form of conversation analysis,

previously used for human action only (ten Have 2007). They then apply this new tool to provide the first detailed insight in communicative sequences of chimpanzees during meat-sharing episodes at the Ngogo community, Kibale National Park, Uganda.

The final article by Sherman Wilcox leads us back to the uniqueness of human gesturing by focusing on the phenomenon of sign languages, which function without any use of speech (Klima & Bellugi 1979). This article pinpoints the developmental routes by which non-linguistic gestures become incorporated into the linguistic system of signed languages: one leading from gesture to word to grammatical morpheme, and a second leading from gesture to prosody to grammatical marker. Sherman Wilcox thus offers a new perspective to comparative gestural approaches but also links back to Jan van Hooff's introductory reflections and the evolutionary origins of human language.

References

Arbib, Michael, Liebal, Katja and Pika, Simone. 2008. "Primate vocalization, gesture, and the evolution of human language". *Current Anthropology* 49(6): 1053-1076.

Austin, John L. 1962. *How to do things with words*. New York: Oxford University Press.

Bates, Elizabeth, Camaioni, Luigia and Volterra, Virginia. 1975. "The acquisition of performatives prior to speech". *Merrill-Palmer Quarterly* 21(3): 205-226.

Beck, Benjamin B. 1982. "Chimpocentrism: Bias in cognitive ethology". *Journal of Human Evolution* 11: 3-17.

Boesch, Christophe. 2007. "What makes us human (Homo sapiens)? The challenge of cognitive cross-species comparison". *Journal of Comparative Psychology* 3: 227-240.

Bruner, Jerome. 1981. "Intention in the structure of action and interaction". In *Advances in Infancy Research*, Lewis P. Lipsitt (ed.), Vol. 1, 41-56. New Jersey: Ablex, Norwood.

Butterworth, George. 2003. "Pointing is the royal road to language for babies". In *Pointing: Where language, culture, and cognition meet*, Sotaro Kita (ed.), 9-33. Mahwah, New York: Erlbaum.

Cartmill, Erica A. and Byrne, Richard W. 2007. "Orangutans modify their gestural signaling according to their audience's comprehension". *Current Biology* 17(15): 1345-1348.

Cartmill, Erica A. and Byrne, Richard. W. 2010. "Semantics of primate gestures: Intentional meanings of orangutan gestures". *Animal Cognition* 13(6): 793-804.

Clark, Russell A. 1978. "The transition from action to gesture". In *Action, Gesture, and Symbol*, Andrew Lock (ed.), 231-260. New York: Academic Press.

Corballis, Michael C. 2002. *From Hand to Mouth, the Origins of Language*. Princeton, New Jersey: Princeton University Press.

Gardner, R. Allen and Gardner, Beatrice T. 1969. "Teaching sign language to a chimpanzee". *Science* 165: 664-672.

Genty, Emilie, Breuer, Thomas, Hobaiter, Catherine and Byrne, Richard. W. 2009. "Gestural communication of the gorilla (*Gorilla gorilla*): Repertoire, intentionality and possible origins". *Animal Cognition*.

Genty, Emilie and Byrne, Richard. W. 2010. "Why do gorillas make sequences of gestures? ". *Animal Cognition* 13(2): 287-301.

Goldenberg, Georg and Strauss, Stefan. 2002. "Hemisphere asymmetries for imitation of novel gestures". *Neurology* 59: 893-897.

Goldin-Meadow, Susan. 2003. *Hearing gesture: How our hands help us think*. Harvard: Harvard University Press.

Hesler, Nana and Fischer, Julia. 2007. "Gestural communication in barbary macaques (*Macaca sylvanus*): An overview". In *The Gestural Communication of Apes and Monkeys*, Michael Tomasello and Josep Call (eds), 159-196. Mahwah, NJ: Lawrence Erlbaum Associates.

Hewes, Gordon W. 1973. "Primate communication and the gestural origin of language". *Current Anthropology* 12(1-2): 5-24.

Hobaiter, Catherine and Byrne, Richard. 2011a. "Serial gesturing by wild chimpanzees: its nature and function for communication". *Animal Cognition* 14(6): 827-838.

Hobaiter, Catherine and Byrne, Richard W. 2011b. "The gestural repertoire of the wild chimpanzee". *Animal Cognition*.

Inoue-Nakamura, Noriko and Matsuzawa, Tetsuro. 1997. "Development of stone tool use by wild chimpanzees (*Pan troglodytes*)". *Journal of Comparative Psychology* 111(2): 159-173.

James, William. 1890. *The principles of psychology*. New York: Holt.

Kendon, Adam. 2001. "Gesture as communication strategy". *Semiotica* 2001(135): 191-209.

Klima, Edward S. and Bellugi, Ursula. 1979. *The Signs of Language*. Cambridge, Massachusetts: Harvard University Press.

Kummer, Hans. 1968. *Social organization of hamadryas baboons*. Chicago: University of Chicago Press.

Laidre, Mark. E. 2008. "Do captive mandrills invent new gestures?". *Animal Cognition* 11: 179-187.

Leavens, David A. and Racine, Timothy P. 2009. "Joint attention in apes and humans: Are humans unique? ". *Journal of Consciousness Studies* 16: 240-267.

Leavens, David A., Racine, Timothy P. and Hopkins, William D. 2009. "The ontogeny and phylogeny of non-verbal deixis". In *The prehistory of language*, Rudie Botha and Chris Knight (eds), 142-165. Oxford: Oxford University Press.

Liebal, Katja. 2007a. "The gestural communication of orangutans". In *The gestural communication of monkeys and apes*, Michael Tomasello and Josep Call (eds), 69-98. Mahwah, New York: Lawrence Erlbaum Associates.

Liebal, Katja. 2007b. "The gestural communication of siamangs". In *The gestural communication of monkeys and apes*, Michael Tomasello and Josep Call (eds), 131-158. Mahwah, New York: Lawrence Erlbaum Associates.

Liebal, Katja, Call, Josep and Tomasello, Michael. 2004a. "Chimpanzee gesture sequences". *Primates* 64: 377-396.

Liebal, Katja, Müller, Cornelia and Pika, Simone. 2005. "Introduction: Gestural communication in nonhuman and human primates". *Gesture: Special issue* 5(1/2): 1-4.

Liebal, Katja, Müller, Cornelia and Pika, Simone. 2007. *Gestural communication in nonhuman and human primates*. Amsterdam/Philadelphia: John Benjamins Publishing Company.

Liebal, Katja, Pika, Simone, Call, Josep and Tomasello, Michael. 2004b. "Great ape communicators move in front of recipients before producing visual gestures". *Interaction studies* 5(2): 199-219.

Liebal, Katja, Pika, Simone and Tomasello, Michael. 2004c. "Social communication in siamangs *(Symphalangus Syndactulus*): Use of gestures and facial expression". *Primates* 45(2): 41-57.

Liebal, Katja, Pika, Simone and Tomasello, Michael. 2006. "Gestural communication of orangutans (*Pongo pygmaeus*)". *Gesture* 6(1): 1-38.

Lock, Andrew. 1978. *Action, Gesture and Symbol: The emergence of language*. New York: Academic Press.

McNeill, David. 1992. *Hand and Mind*. Chicago: The University of Chicago Press.

McNeill, David. in press. *How Language Began: Gesture and Speech in Human Evolution*. Cambridge: Cambridge University Press.

Meguerditchian, Adrian and Vauclair, Jacques. 2009. "Contrast of hand preferences between communicative gestures and non-communicative actions in baboons: Implications for the origins of hemispheric specialization for language". *Brain and Language* 108(3): 167-174.

Miles, H. Lyn. 1990. "The cognitive foundations for reference in a signing orangutan". In *Language and Intelligence in Monkeys and Apes*, Sue T. Parker and Kathleen R. Gibson (eds), 511-539. Cambridge: Cambridge University Press.

Patterson, Francine. 1978. "Conversations with a gorilla". *National Geographic* 134(4): 438-465.

Piaget, Jean. 1952. *The Origins of Intelligence in Children*. New York: Norton.

Pika, Simone. 2007a. "The gestural communication of bonobos". In *The gestural communication of monkeys and apes*, Michael Tomasello and Josep Call (eds), 41-67. Mahwah, New York: Lawrence Erlbaum Associates.

Pika, Simone. 2007b. "The gestural communication of gorillas". In *The gestural communication of monkeys and apes*, Michael Tomasello and Josep Call (eds), 99-130. Mahwah, New York: Lawrence Erlbaum Associates.

Pika, Simone. 2008. "What is the nature of the gestural communication of great apes?". In *The Shared Mind*, Jordan Zlatev, Timothy P. Racine, Chris Sinha and Esa Itkonen (eds), 165-186. Amsterdam, the Netherlands: John Benjamins Publishing Company.

Pika, Simone, Liebal, Katja and Tomasello, Michael. 2003. "Gestural communication in young gorillas (*Gorilla gorilla*): Gestural repertoire, learning and use". *American Journal of Primatology* 60(3): 95-111.

Pika, Simone, Liebal, Katja and Tomasello, Michael. 2005. "Gestural communication in subadult bonobos (*Pan paniscus*): Gestural repertoire and use". *American Journal of Primatology* 65(1): 39-51.

Pika, Simone and Mitani, John C. 2006. "Referential gesturing in wild chimpanzees (Pan troglodytes)". *Current Biology* 16(6): 191-192.

Pika, Simone and Mitani, John C. 2009. "The directed scratch: Evidence for a referential gesture in chimpanzees?". In *The Prehistory of Language*, Rudie Botha and Chris Knight (eds), 166-180. Oxford: Oxford University Press.

Plooij, Frans X. 1978. "Some basic traits of language in wild chimpanzees?". In *Action, Gesture and Symbol*, Andrew Lock (ed.), 111-131. London: Academic Press.

Plooij, Frans X. 1979. "How wild chimpanzee babies trigger the onset of mother-infant play". In *Before Speech*, Margaret Bullowa (ed.), 223-243. Cambridge: University Press.

Pollick, Amy S. and De Waal, Frans B. M. 2007. "Ape gestures and language evolution". *Proceedings of the National Academy of Sciences of the United States of America* 104: 8184-8189.

Savage-Rumbaugh, Sue E., McDonald, Kelly, Sevcic, Rose A., Hopkins, William D., and Rupert, Elizabeth. 1986. "Spontaneous symbol acquisition and communicative use by pygmy chimpanzees (*Pan paniscus*)". *Journal of Experimental Psychology: General* 115: 211-235.

Savage-Rumbaugh, Sue E., Rumbaugh, Duane. M. and McDonald, Kelly. 1985. "Language learning in two species of apes". *Neurosciences and Biobehavioral Review* 9: 653-656.

Schaller, George. B. 1964. *The year of the gorilla*. Chicago: University of Chicago Press.

Schaller, George. B. 1965. "The behaviour of the mountain gorilla". In *Primate Behaviour*, Irven de Vore (ed.), 324-367. New York: Holt, Rinehart and Winston.

Schneider, Christel, Call, Josep and Liebal, Katja. 2010. "Do bonobos say NO by shaking their head?". *Primates* 51(3): 199-202.

Smith, W. John. 1965. "Message, meaning, and context in ethology". *American Naturalist* 908: 405-409.

Smuts, Barbara. 2002. "Gestural communication in olive baboons and domestic dogs". In *The cognitive animal: Empirical and theoretical perspectives on animal cognition*, Marc Bekoff, Colin S. Allen and Gordon Burghardt (eds), 301-306. Cambridge, MA: MIT Press.

ten Have, Paul. 2007. *Doing Conversation Analysis*. London: Sage.

Tomasello, Michael. 1996. "Do apes ape?". In *Social Learning in Animals: The Roots of Culture*, Cecilia M. Heyes, Bennett Galef Jr. (ed.), 319-346. San Diego: Academic Press, Inc.

Tomasello, Michael. 2006. "Why don't apes point? ". In *Roots of Human Sociality: Culture, cognition and interaction*, N. J. Enfield and Stephen C. Levinson (eds), 506-524. Oxford: Berg.

Tomasello, Michael. 2008. *Origins of Human Communication*. Cambridge, Massachusetts: MIT Press.

Tomasello, Michael and Call, Josep. 2007. *The gestural communication of monkeys and apes*. Mahwah, New York: Lawrence Erlbaum Associates.

Tomasello, Michael, Call, Josep, Nagell, Katherine, Olguin, Raquel and Carpenter, Malinda. 1994. "The learning and use of gestural signals by young chimpanzees: A trans-generational study". *Primates* 35(2): 137-154.

Tomasello, Michael, Call, Josep, Warren, Jennifer, Frost, Thomas G., Carpenter, Malinda, and Nagell, Katherine. 1997. "The ontogeny of chimpanzee gestural signals". In *Evolution of Communication*, Sherman Wilcox, Barbara King and Luc Steels (ed.), 224-259. Amsterdam/ Philadelphia: John Benjamins Publishing Company.

Tomasello, Michael, Carpenter, Malinda, Call, Josep, Behne, Tanya and Moll, Henrike. 2005. "Understanding and sharing intentions: The origins of cultural cognition". *Behavioral and Brain Sciences* 28: 1-17.

Tomasello, Michael, Carpenter, Malinda and Liszkowski, Ulf. 2007. "A new look at infant pointing". *Child Development* 78(3): 705-722.

Tomasello, M., George, Barbara L., Kruger, Ann C., Farrar, Michael J. and Evans, Andrea. 1985. "The development of gestural communication in young chimpanzees". *Journal of Human Evolution* 14: 175-186.

Tomasello, M., Gust, Deborah and Frost, G. Thomas. 1989. "A longitudinal investigation of gestural communication in young chimpanzees". *Primates* 30(1): 35-50.

Tomasello, Michael and Zuberbühler, Klaus. 2002. "Primate vocal and gestural communication". In *The cognitive animal: Empirical and theoretical perspectives on animal cognition*, Marc Bekoff, Colin S. Allen and Gordon Burghardt (eds), 293-299. Cambridge: MIT Press.

Tomasello, Michael. 2009. *Why We Cooperate*. MA: MIT Press.

Van Hooff, Jan A. R. A. M. 1967. "The facial displays of the catarrhine monkeys and apes". In *Primate Ethology*, Desmond Morris (ed.), 7-68. London: Weidenfeld and Nicolson.

Van Hooff, Jan A. R. A. M. 1973. "A structural analysis of the social behaviour of a semi-captive group of chimpanzees". In *Social Communication and Movement, Studies of Interaction and Expression in Man and Chimpanzee*, Mario von Cranach and Ian Vine (eds), 75-162. London: Academic Press.

Van Lawick-Goodall, Jane. 1968a. "The behavior of free-ranging chimpanzees in the Gombe Stream Reserve". *Animal Behaviour Monographs* 1(3): 161-311.

Van Lawick-Goodall, Jane. 1968b. "A preliminary report on expressive movements and communication in the Gombe stream chimpanzees". In *Primates. Studies in Adaptation and Variability*, P. C. Jay (ed.), 313-374. New York: Holt, Rinehart, and Winston.

Whiten, Andrew, Goodall, Jane, McGrew, William C., Nishida, Toshisada, Reynolds, Vernon, Sugiyama, Yukimaru, et al. 2001. "Charting cultural variation in chimpanzees". *Behaviour* 138: 1489-1525.

Woodruff, Guy and Premack, David. 1979. "Intentional communication in the chimpanzee: The development of deception". *Cognition* 7: 333-352.