1. Would Humans Without Language Be Apes?

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THE POSTULATE OF MENTAL CONTINUITY

The bedrock of comparative psychology of cognition, especially where non-human primates are concerned, rests on Darwin's famous account according to which continuity would be the main trait leading from the animal to the human mind. This idea was popularized through the statement in which Darwin postulated only quantitative differences between humans and the other species, namely "the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind" (Darwin, 1871, p. 128).

We can only agree with Darwin's continuity position as concerns the existence of some kind of mental organizations in animals, in particular in nonhuman primates, as a necessary part of the perception of objects and their localization and interrelationships in space and time (Walker, 1983) and in many adaptive functions, including problem solving and memory (e.g., Vauclair, 1996). In effect, human and animal brain functions show sufficient similarity to allow comparisons if one assumes that animal brains are devices for selecting and organizing perceived information, and that the neural systems that accomplish perception and memory exhibit evolutionary continuity. It thus appears that these global functions are performed by the animal in ways that are basically similar to human performance, that is, through the construction and use of representations of various degrees of schematization and abstraction (Roitblat, 1982).

One of the main assignments of comparative psychology of cognition is to attempt to describe similarities between animals and between animals and humans. But its task is also to uncover possible differences between two or more species. Primate communication and language (including the attribution of mental states to others: Povinelli & Edy, 1996) are obviously good candidates for revealing such differences. However, a close inspection of the available literature in relation to other aspects of general human cognition (e.g., spatial behavior, co-ordination of movements in hand usage) can also help to shed light on the issue of resemblance and difference between human and nonhuman primates.

THE LANGUAGE ISSUE: A CASE OF DISCONTINUITY

I plan to show that animal communication and human language differ in some crucial ways that are related both to the structure of these communicative systems

and to their functional use. This demonstration will be made by borrowing examples from natural and spontaneous communications among primates as well as from experiments that attempted to train ape species to use some of the features of human language.

To return to evolutionary theory, Darwin also considered that some characteristics of human behavior were clearly more on the discontinuous side than on the continuous one. The following excerpt illustrates such a view: "The development of the moral qualities is a more interesting problem [...]. A moral being is one who is capable of reflecting on his past actions and their motives-of approving of some and disapproving of others; and the fact that man is the one being who certainly deserves this designation, is the greatest of all distinctions between him and the lower animals" (Darwin, 1871, pp. 426-427). Furthermore, Darwin also proposed that the universal belief in "spiritual agencies" represented "the most complete of all the distinctions between man and the lower animals" (Darwin, 1871, p. 430).

Considerations about beliefs and intentions in ethology and in animal psychology have been tackled more recently within the field of "cognitive ethology" (e.g., Griffin, 1984; Allen & Bekoff, 1997) and with the concept of "theory of mind," proposed by Premack and Woodruff (1978). As concerns moral issues, these questions have been addressed only indirectly, for example by Lorenz (1970). The attribution of moral attitudes to animals (de Waal, 1996) has been challenged, however, notably by Kummer (1978).

It seems that the issue of the importance of the discontinuities in the mind introduced by the human specificity of language, moral qualities, and beliefs in some kinds of transcendental values ultimately refers to language understood as a system of exchanges and values (Bronckart, Parot, & Vauclair, 1987; Vauclair, 1990, 1995).

About Some Structural Differences Between Animal
Communication and Human Language

It is necessary first to characterize the structure of human language with respect to the communicatory systems of animals. The well-known system of alarm calls emitted by vervet monkeys is probably a good example that illustrates some of the differences between the two organizations. Vervet monkeys have three classes of predators-leopards, snakes (pythons), and eagles-the presence of which is signaled by three different alarm calls (Strushaker, 1967). The production of each type of alarm calls evokes a different and appropriate response in conspecifics, which (1) look up and run into dense bush in response to eagle's alarms; (2) flee up to the trees in response to leopard's alarms; (3) look at the ground around them in response to python's alarms.

Even though these calls could be considered arbitrary with respect to the predators they designate, such arbitrariness is different from that of linguistic signs for at least two main reasons (see Figure 1.1). First, this arbitrariness in the vervet
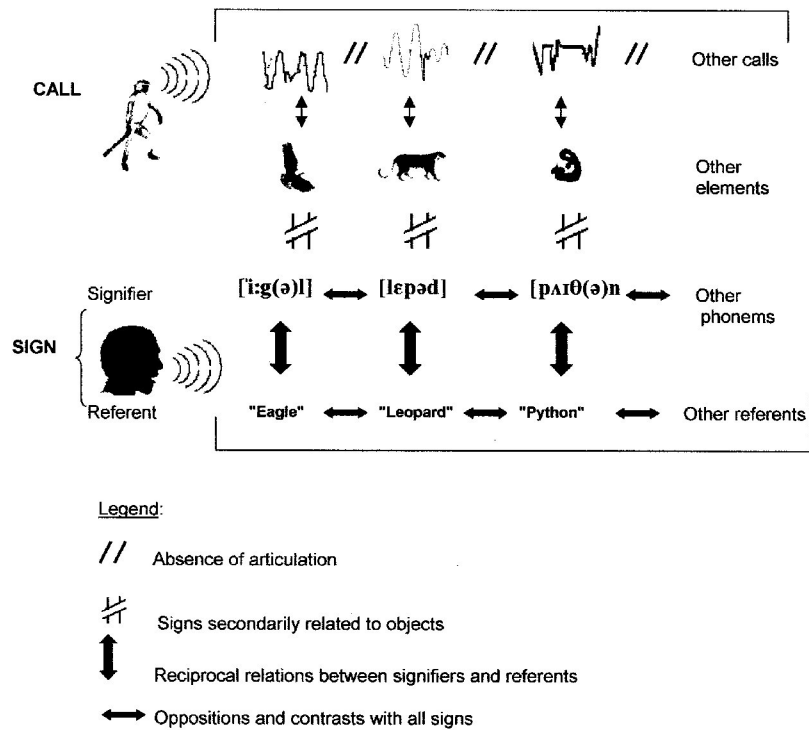
Legend:

//   Absence of articulation

丗   Signs secondarily related to objects

↕   Reciprocal relations between signifiers and referents

⟷   Oppositions and contrasts with all signs

Figure 1.1.

Differences between Animal Calls and Linguistic Signs

monkey does not imply the intervention of a duality of patterning between a sound, or a phonemic level, and a concept or a semantic level (Hockett, 1960; Bickerton, 1990). Second, the arbitrariness implied in the vervet's alarm system is not related to a conventionalization that ties together the level of phonemic and semantic representations. If young vervets have to learn to produce more specific calls in response to a given class of predators, they do not have to learn a conventional rule associating such or such a call to such or such a predator (Cheney & Seyfarth, 1990). Finally, each category of the vervet's alarm calls appears to be strictly linked to the predator (or category of predators) to which it refers. Thus, its specific meaning is not the result of oppositions to other categories of calls produced in the species (Figure 1.1).

Briefly, what the vervet's alarm calls might send is information about a global configuration. This proposition has also been made by Bickerton (1990), for whom animal communication is holistic because it is concerned with the communication of whole situations. For example, the units of animal communication convey whole chunks. These chunks as they are expressed, for example, in the

vervet alarm calls are roughly equivalent to "A predator just appeared!" or "Look out! A leopard's coming!" By contrast, language deals mainly with entities, that is, other creatures, objects, or ideas to which states or actions are attributed.

An additional property of the linguistic sign, the feature of displacement (e.g., Hockett, 1960), also seems to be lacking in animal communicatory systems. This feature concerns the fact that a linguistic sign can be detached or decontextualized from the element (object, event, or state) to which it relates or that its meaning is available regardless of the contextual situation in which it appears (Gärdenfors, 1996). Following this concept, a sign might become a symbol equivalent to a verbal sign when it can be used without direct connection to an experimental context. Von Glaserfeld (1977) has argued that animals' communicatory signals fail to achieve this transformation, because a mere delay (distance in time and space) does not change the one-to-one correspondence between the sign and the situation. In brief, a linguistic entity connects not only an object with a sign, but signs themselves.

To summarize, one could say that the mastery of signs in human language can be mostly characterized as an activity that consists of detaching the sounds and the words (i.e., phonemes and morphemes) from the configuration of the objects they represent and to conventionally relate these signs together, according to structures of phonemic and semantic equivalences and oppositions. These structures can be defined as "paradigmatic" because each item (sound or word) takes sense by distinction and by opposition to all other items that can commute in a given position, like linguistic units can commute in any position in a sentence (Saussure, 1966). For example, in the sentence "this animal is an eagle," the item "animal" takes sense by opposition to the other expressions that could come to the same place ("moving object," "organism," "being," "thing," "bird," etc.). Within the same logic, the item "is" takes its meaning by opposition to "has been," "will be," "looks like," etc.; and the meaning of "eagle" is specified by its opposition to "leopard," "python," "predator," or "vulture" (see Figure 1.1).

In language, the relation between referent and signifier is qualified as arbitrary, because there is no physical or analogical resemblance between the sequence of sounds and the content that is represented. In this respect, most of Washoe's gestures (Gardner & Gardner, 1969), Sarah's tokens (Premack, 1971), and the lexigrams operated by Austin, Sherman, and other language-trained chimpanzees (e.g., Savage-Rumbaugh, Rumbaugh, & McDonald, 1985) indeed entertain an arbitrary relation with the various aspects of the reality they represent. For linguists (Saussure, 1966), however, the "radical arbitrariness" that characterizes verbal units is of a higher level of difficulty than the simple relation between two realities (see also Bickerton, 1990, and Vauclair, 1990). In fact, two types of material reality need to be processed by the subject in order to comprehend or to produce a verbal sign: there is, on the one hand, the acoustic property of the sign and, on the other hand, the material property corresponding to the content expressed by the sign. Thus, a verbal sign is not simply a relation between mate-

rial elements (sounds) and the content to which they refer (objects or actions). It is, rather, the product of two representations, one built on the acoustic material and the other built on the meaning (conceptual image). The relation between the two images is said to be arbitrary because all natural languages have selected a sequence of sounds to stand for a particular concept in an arbitrary manner and through social convention. It is precisely this conventional and arbitrary relation between a signifier and its referent that is called *radical arbitrariness.* Although the construction of conceptual and acoustic images is typically an individual activity, the basic operation of language, that is, the designation or creation of signs, is nevertheless performed through social convention.

How can this analysis based on human languages help to clarify the issue of the linguistic nature of the chimpanzee's production of symbols? In order to demonstrate that an ape (or any other animal) uses symbols that are equivalent to verbal signs, one should, from the present perspective, be able to show (1) that the ape possesses an individual representation of the signifier (e.g., of a gesture) and of its content or meaning; (2) that a social convention has made the analysis of the representation possible; and (3) that the representation can be grasped by opposition to other signs. Clearly, such requirements await demonstration in the field of comparative investigations of "linguistic" abilities of nonhuman primates.

About Some Functional Differences Between Animal Communication and Human Language

It could be argued that the structural differences mentioned earlier between human language and animal communication are somewhat trivial because they compare a very sophisticated medium for conveying information and intentions (i.e., language) to a phylogenetically less advanced system (i.e., animal communication). In this respect, the comparison   might appear somewhat unfair because it is likely (also still not proved) that contemporary languages represent a rather recent form of expression that could have evolved from simpler modes of social exchanges (either gesturally or acoustically based). This notwithstanding, it appears that typically human communicatory systems (including gestural and spoken language but also prelinguistic manifestations) have specific modalities that are apparently not shared by any animal communicatory system.

Following the pioneering work of Bühler (1934), two principal modalities can be distinguished in the linguistic as well as in the prelinguistic communication among humans (Bates, 1979). The primary function of language is to exchange information about the world. Such an *informative function* takes two forms: a declarative form that serves for representing states of the world (e.g., "John comes") and an interrogative form. The other function is *injunctive* (imperative) and *exclamatory* and mostly expresses itself with requests and demands (e.g., "Come!"). Developmental studies with young children have shown that the

use of declaratives (e.g., Wetherby et al., 1988; Bassano & Maillochon, 1994) becomes the dominant mode of communication between 1 and 2 years of age (about 60% of all utterances).

It happens that a major difference between humans and nonhuman primates is that the use of a signal or a learned symbol by the latter is restricted largely to its imperative function, whereas humans will use a word predominantly as a declarative. Declaratives (Bates, Camaioni, & Volterra, 1975) can be words or gestures, **and they function not** primarily to obtain a result in the physical world, but to direct another individual's attention (its mental state) to an object or event, as an end in itself. Thus, a human toddler might say "Plane!" apparently to mean "It's a plane!" or "Look, a plane," and so on. In such cases, the child communicates simply to share interest in something that he or she sees, that this object is a plane, and that the child has identified it and finally that he or she wants the partner to look at it.

It can be asserted with some confidence that the use of protoimperative signals is the exclusive mode of communication by animals of different phyla. When, for example, your cat vocalizes at you in the vicinity of the window and at the same time glances back and forth from the window to you, the cat is using a protoimperative signal that can be interpreted as "I want to go out." But it is very unlikely that your cat would use these same communicative signals to let you know that it has noticed something interesting in the garden.

This imperative function also appears to be the predominant (if not exclusive) mode used by "linguistically" trained apes. To illustrate this question, the case of the bonobo Kanzi studied by Savage-Rumbaugh (e.g., Savage-Rumbaugh et al., 1986) can be used. Studies reveal that (1) Kanzi had more or less spontaneously learned the symbolic function of a visual signal and (2) could (at the age of 8 years) comprehend English sentences at a level similar to that of a two-year-old child (Savage-Rumbaugh et al., 1993). But interestingly, and contrary to human children who use language to make indicative or declarative statements, 96 percent of Kanzi's productions were requests (Savage-Rumbaugh, Rumbaugh, & McDonald, 1985). Thus, the difference between Kanzi's modality of communication and the typical declarative mode observed by humans is striking. In effect, communication in the apes has essentially an imperative function (this appears to be the rule for all animal species, and this mode is sufficient to fulfill the biological requirements as, for example, to warn again predators; see above the case of vervet monkeys' alarm calls). By contrast, humans use not only linguistic signs but also prelinguistic means of communication such as gestures (e.g., pointing) for both imperative and declarative purposes (e.g., two persons sharing an interest toward a third person, object, or event: Bard & Vauclair, 1984; Vauclair, 1984).

The Future of the Study of Linguistic Skills in Apes

I have tried to point out in this section both the structural and functional differences in the spontaneous communicative signals as well as trained symbols

used by nonhuman primates as compared to human language. The conclusion that two chief achievements of human language are lacking in animals does not imply that research on this issue with nonhuman primates or any other animal species must be abandoned. It is quite the reverse, because a proper identification of the main features of a given system should help in defining a better program for further studies. Three directions for such investigations can be briefly mentioned: (1) It is likely that the limitation in the types of productions made by trained animals might be due in part to constraints inherent to the experimental environment. For example, this environment has strongly encouraged Kanzi and other trained apes to formulate mostly requests for activities or objects. Thus, an environment that would facilitate more spontaneous expressions on the subject's part could better reveal its real accomplishments (Bodamer et al., 1994). (2) It is possible that deficits in the informative modality in apes could be due to their difficulty to express attention-related demands. This constituent of the declarative mode could thus be studied along with the ability of nonhuman primates to emit emotions (e.g., exclamatory function) through the symbolic system they are exposed to. (3) Focusing on the use of declaratives in nonhuman primates (in natural communication and in the lab) and the capacity for joint attention to objects (Bruner, 1983) could help to recognize the antecedents of these possibly unique features of human language and could set a framework that allows the development of mental attribution of beliefs, knowledge, desires, and intentions to social partners (e.g., Vauclair, 1982; Tomasello, 1998). After all, gestural and spoken declaratives constitute an elaborate form of joint attention, by which a given speaker attempts to affect the listener's mind. In this same line of thinking, protodeclarative and declarative behaviors may be precursors to the development of a theory of mind (Baron-Cohen, 1992).

   Another remark is in order. The fact that nonhuman primates lack language does not mean that these species cannot show peculiarities in their behavior that bring them closer to humans compared to any other animal species. A series of investigations on spatial representations recently carried out in our laboratory clearly shows this. These investigations were based on the work of Hermer and Spelke (1994, 1996), which has examined the abilities of 18- to 24-month-old human children to combine geometric with nongeometric information in order to properly reorient in space. These authors found that toddlers were limited in their spatial behaviors in that they used only the shape of the experimental environment to reorient, even when more salient nongeometric information was available. In this sense, young children behaved like rats or chicks (e.g., Cheng, 1986), whereas human adults reoriented in a more flexible way. To explain this source of flexibility, Hermer and Spelke (1996) have argued that language is necessary to combine geometric and landmark-based information. More precisely, these authors propose that the age at which children begin to successfully locate a target using geometric and nongeometric information (at about 6 to 6.5 years of age) approximately corresponds to the age at which they begin producing sentences that would uniquely specify object location and orientation, such as "near" or "to the right/left" (MacWhinney, 1995).

We have recently demonstrated (Gouteux, Thinus-Blanc, & Vauclair, 2001), however, that rhesus macaques were able to jointly use geometric and landmark-based cues when presented with the same set-up as the one used with young children. These findings tend to demonstrate that spatial processing became more flexible with evolution; and we have hypothesized that such a flexibility could have evolved in nonhuman primates independently of specifically human cognitive features such as symbolic representation and language (a different example requiring representation of spatial relations by monkeys can be found in Vauclair, Fagot, & Hopkins, 1993).

HAND COLLABORATION AND THE REPRESENTATION OF VISUO-GESTURAL MOVEMENTS

The comparison of human and nonhuman primates has too often been exclusively based on language because the latter is more or less implicitly assumed to represent the hallmark of the species homo *sapiens.* I believe that this view is reductive and neglects other important features that seem to be as important as linguistic signs for a proper characterization of the human nature. The following sections will therefore be devoted to considering two of these (related) features. The first one concerns the apparently original way (division of labor between hands) humans act on objects; the second one is related to the existence in humans of genuine visuo-gestural representations that are manifested in the use of specific techniques such as weaving. Finally, a third section will contrast the developmental pathways of human and nonhuman primates in the acquisition of manipulatory behaviors, including the use of tools, by stressing the role of the social context in these acquisitions.

Differences in Laterality and Hand Use in Primates

A domain that is rarely considered in the comparative approach of cognition between human and other primates concerns the patterns of coordination required to perform food processing and other related activities. This field is interesting because it shows that at some point in the process of hominization, forces have acted on the way the brain machinery (and thus the behavioral outputs) perform in order to fill new demands for adapted actions on the environment.

To discuss this question properly, it is necessary first to summarize the current state of knowledge concerning manual organization and hemispheric lateralization in nonhuman primates. Contrary to humans who show a strong bias for using the right hand, nonhuman primates express individual patterns of laterality but no bias toward the left or toward the right at the population level (Ward & Hopkins, 1993). However, hand laterality in these species was shown to depend on the nature of the task as well as on postural constraints related to hand usage (Fagot & Vauclair, 1991). Thus, manual activities requiring strong visuospatial demands induce a preferential use of the left hand both in gorillas

and baboons (Vauclair & Fagot, 1987, 1993). With the exception of chimpanzees, which, as a species, show a weak preference for the right hand (60%: Hopkins, 1994; for a review see Hopkins, 1996), nonhuman primates do not display, at the group or population levels, any systematic predominance of one hand over the other.

The above patterns of nonhuman primate lateralization are mostly obtained from the investigations of unimanual actions. But interspecies differences in hand use are also apparent when the overlapping manual activity in the manipulation of objects by human and ape infants is considered. An instance of overlap is counted when manipulatory events involving both right and left hands occur concurrently. In such cases, human infants exhibited greater variety and differentiation than did ape infants (Vauclair & Bard, 1983). Furthermore, this flexibility in the activity of the human infant appeared in the many instances where objects were transferred from one hand to the other during active manipulation. No case of such transfer was reported for the young apes.

Other differences between nonhuman primates and humans can be observed in the ways hands are used to handle tools. With respect to hand coordination in humans, Guiard (1987) has identified three basic models (orthogonal, parallel, or in series) describing hand coordination in right-handed subjects. The two hands of an operator of a milling machine can serve to illustrate the orthogonal assemblage. In this case, the operator moves a piece in a horizontal plane by acting on the crank with one hand (the left) according to the Y-axis, whereas the other hand (the right) acts on the crank to move the object on the X-axis. In parallel assemblages, both motors act in a synergistic fashion, essentially by adding their respective efforts (an example is provided by the weightlifter or by a child with a skipping rope). In the model of serial assemblage, the action of one hand produces a frame of reference upon which the second hand will act. Sewing activities and writing offer examples of such an assemblage. In the case of hand-sewing, for example, the left hand (of a right-handed person) manipulates the fabric relative to the body or to the table, while the other hand manipulates the needle relative to the fabric.

Interestingly, only the serial model implies differentiation in the role of each hand and thus an asymmetrical organization. It might thus be stated that this last kind of assemblage could explain lateral specialization among humans. We know that such a division of labor between hands appears early in ontogeny. For example, by 6 months of age, the human infant reaches for objects with bimanual coordination: a hand lands on the support near the object and then the other hand comes into contact and grasps it. This bimanual behavior (in right-handed subjects) is conceived of as one hand (the left) providing the spatial conditions necessary for reaching by the other hand (de Schonen, 1977).

Although the literature on ape tool use is extensive, few reports have focused on the ways hands are employed during complex manipulations (McGrew & Marchant, 1997). A survey of this literature suggests the following picture regarding hand use and hand collaboration. It appears that most tool use

behaviors performed by nonhuman primates are realized unimanually. One study on ant fishing by chimpanzees (Nishida & Hiraiwa, 1982) has provided data with respect to hand use during tool use behavior. The authors observed that 65 percent of the feeding bouts involved the use of only one hand. In bouts where both hands participated in the activity of inserting the probe into the nest, there is no evidence that the hands were used in accordance with the serial model.

When force is required, as when chimpanzees crack hard-shell nuts (Hannah & McGrew, 1987), movements are bimanual but bilateral; that is, both hands act together in parallel. I am not aware of any case of spontaneous tool use that is realized according to an asymmetrical division of labor between the hands that is so common for most complex human activities. Some kind of division of labor can appear between both hands acting symmetrically and the mouth or the foot performing a specific action (generally in food processing). This organization can already be seen among marsupials and several other mammals (e.g., rodents, squirrels) and, of course, monkeys and apes. Most forms of nonhuman primate tool use appear thus to be predominantly performed unimanually (ant dipping by chimpanzees is a notable exception, McGrew, 1992), whereas human tool use activities almost always imply the collaboration of both hands. It happens that none of the manual behaviors realized by nonhuman primates have ever achieved the functional complexity and potential variability found in the asymmetrical lateralized hands of humans (Vauclair, 1993). From this perspective, serial assemblage must represent a uniquely human feature that appears early during human ontogeny (Connolly & Dalgleish, 1989) and that reflects a hierarchical division of labor between the hands for coordinated actions.

Visual Imagery and Visuo-spatial Expressions

For those interested in the phylogeny of cognitive processes between human and nonhuman primates, interspecies comparisons cannot be limited to language but must encompass the whole range of achievements that appear to develop somewhat independently from language. If, as I have postulated elsewhere (Vauclair, 1996), following Vygotsky (1962; see also Zivin, 1979), language is a system that is both communicatory and representational and that most of the representations we use are of linguistic support, it is also necessary to consider the existence in humans of nonverbal representational capacities. Among those abilities, we can mention the capacity to envision possible alternatives or to use references that do not exist in situ. Such competencies can be seen in visual gestural expressions used, for example, in tapestry and weaving and which require highly elaborated spatial representations that can neither be reduced to language nor be explained by it (Bresson, 1976). They express themselves in the use of spatial frameworks in the above-mentioned gesturo-visual activities. In these behaviors, hand movement coordinations in space do not rest on concrete supports but are framed by the complementary roles of the two hands, where one hand (the left

hand in right-handed subjects) provides the spatial conditions necessary for the manipulations performed by the other, so called dominant, hand. Interestingly, the manual coordinations required by these complex spatial activities (e.g., in tapestry) develop and are taught in a way that is, to a great extent, independent of language, namely via direct observation and/or motor imitation. The fact that these activities cannot be taught by verbal means does not imply that verbal commentaries cannot be useful in attracting attention or scanning the operations involved in the complex coordinations of actions required in the above-mentioned tasks. Because they can be taught to blind people, they cannot be considered to be purely visually guided activities (Bresson, 1976). Another interesting feature of these activities is that that they have been found in all human societies. But, and this is my main point, it is worth noticing that such activities with the corresponding levels of difficulty seen in humans are lacking in the repertoire of animal species.' For example, no report is available showing that chimpanzees can be trained to make a knot (an ability found in 2- to 3-year-old human children)!

It thus seems that humans in the course of their recent evolution (it is likely that crafts appeared at the dawn of the Neolithic period) have developed sets of spatial representational abilities that are independent of language. Indeed, the fact that these skills are independent of language does not preclude the possibility that they develop, similarly to language, in children after the age of two years in accordance with increasing complexity of thinking during human development (e.g., Siegler, 1998). This raises the important question concerning the prerequisites for object manipulation and mastery of communicative skills (including language for humans) during early development. In this respect, it is necessary to consider comparative studies of nonhuman primates concerning the development of patterns of actions on objects and their relations with the development of cognitive capacities and referential communication.

Developmental Issues in Relation to Object Manipulations

Several studies have been carried out on the development of object manipulation in nonhuman primates (for reviews, see Vauclair, 1996; Tomasello & Call, 1997). This question can be illustrated by reporting the case of the development of object-directed behaviors as compared in three groups of primates (capuchin monkeys, chimpanzees, and humans), with special reference to the role of the social context in the acquisition of tool use (Vauclair & Anderson, 1995). Given the prime role of the social environment for simian primates, it is important to bear in mind that many of the manipulatory skills necessary for finding and preparing food, including the use of tools, originate and are perfected in a social milieu. From a comparative and evolutionary point of view, therefore, it is valuable to compare the relationships between the social context of object manipulation and tool use (i.e., technology) in human and nonhuman primates (Vauclair, 1982).

For example, with the goal of analyzing the communicatory behavior of adults in relation to infants' object manipulation, Bard and Vauclair (1984) asked: (1) whether adults acted on objects so as to engage the infants' attention with those objects, and (2) whether object manipulation by the adults influenced the infants' behavior with the objects. The results indicated that adult apes rarely acted on objects with the apparent intent of engaging an infant's attention, whereas adult humans manipulated objects primarily with the intent of stimulating, sustaining, or enhancing the infant's actions on the objects. Infant apes responded differentially; although they did not attend to the manipulations by adult apes, one of them did attend to, and even manipulated, objects when interacting with an adult human. More specifically, this infant ape (the famous bonobo Kanzi, who was later "linguistically" trained: see Savage-Rumbaugh et al., 1985, 1986) typically did not attend to the adult ape's actions. When he did attend, the mother was acting neutrally. This bonobo infant showed similar object-oriented responses to those of both the bonobo mother and the human caretaker, although these two adults acted differently. The human often attempted to engage the infant's attention with objects, but the bonobo infant typically did not attend to the adult's actions. The common chimpanzee infant, when in the presence of a human caretaker, showed object-oriented responses that were very similar to those observed in the human infant, including high frequencies of appropriate (i.e., infant attend) responses to the adult's attempts to engage, and a high proportion of instances in which the infant did not attend when the adult acted neutrally (Bard & Vauclair, 1984; Vauclair, 1984). Other data have confirmed that human-reared chimpanzee infants showed some early behavioral patterns more similar to those of humans than of mother-reared conspecifics (Bard & Gardner, 1996).

By considering different tool use behaviors (e.g., spoon use by humans, use of hammers by capuchin monkeys and chimpanzees), Vauclair and Anderson (1995) have described some of the resemblances and differences between human and nonhuman primates in the ontogeny of object manipulation and tool use, and the role of the social context in transmission of basic technological skills. The example of human infants learning to use a spoon illustrates the need to master the motor skills and the spatial and temporal components of tool use (see above). Similarly, young nonhuman primates have to master the movement constraints for efficient tool use, as well as the quality of the material to be used, whether it be a stick or twig for probing or a stone or piece of wood for nut-cracking.

The main difference between the two best-studied, tool-using nonhuman primate species (capuchin monkeys and chimpanzees) and humans is related to the social context in which object-oriented behaviors develop. A typical form of communication between the infant and a competent adult (e.g., the mother) arises in humans during object manipulation. This form is characterized by the mutual exchange between mother and infant regarding a large variety of discrete, moveable objects; for example, the mother encourages and sustains the infant's engagement with objects (Bard & Vauclair, 1983). By contrast, the nonhuman primate mother does not appear to intervene directly in the infant's object manipulations (but see Boesch, 1991, for exceptions in chimpanzees). In capuchin monkeys as

well as in chimpanzees, the prolonged dependency of the infant on the mother results in the infant receiving selective exposure to environmental stimuli, in particular those instances of object-object combinations leading to food. This prolonged relationship, backed up by trial-and-error learning, is probably sufficient to ensure the social transmission of tool behaviors (McGrew, 1977). The relative contributions of different mechanisms (local or stimulus enhancement, observational learning, and imitation) in the development of tool use remain to be clarified, but it is difficult to determine how this issue could be resolved in the wild. The apparent absence of a real capacity to imitate in capuchin monkeys and the presence of such a capacity in chimpanzees (see Custance, Whiten, & Bard, 1995) make it more likely that true imitation may play some role in the ontogeny of tool use in the latter species. In this context, as pointed out by McGrew (1992), negative findings regarding imitative skills in contrived laboratory conditions need to be taken with caution. Rehabilitant orangutans in free-ranging conditions show a number of tool-using acts that appear to have been imitated from humans (Russon & Galdikas, 1993), and the bonobo Kanzi, with an extensive history of rich and positive interactions with humans, learned how to flake stones and use the resulting cutting tools through observing humans (Toth et al., 1993).

As concerns social transmission techniques in objet manipulation and tool use, an interesting perspective consists in looking for correlation between these behaviors and the possession of some "mind-reading" skills. The apparent absence of the capacity for self-recognition in capuchin monkeys (Anderson & Roeder, 1989) and its presence in chimpanzees (Gallup, 1970) suggest that chimpanzees but not capuchins may possess the necessary skills to be able to engage in at least occasional rudimentary forms of teaching of tool use, as was reported by Boesch (1991) for chimpanzees' nut-cracking. In this context, teaching is held to indicate that individual A (the teacher) is aware of the lack of skill (mental or motor) in individual B (the learner), that is, individual A engages in theory of mind. As stated by Cheney and Seyfarth, "to teach, one must recognize a difference between one's own knowledge and someone else's knowledge and then take explicit steps to redress this imbalance" (Cheney & Seyfarth, 1990, p. 306). It is precisely this limitation in the mind-reading skills or attribution of mental states to others (Premack & Woodruff, 1978) that precludes the emergence of teaching attempts: "Without attribution, instruction cannot even begin, because those with knowledge do not realize that the information possessed by others can be quite different from their own" (Cheney & Seyfarth, 1990, p. 306). Of course, both ¡imitation and theory of mind skills are much more developed in humans, and it is in this species that imitation and teaching of tool use techniques, enhanced through linguistically based information transfer and other nonverbal means, are most important, at least once the earliest forms have been mastered.

CONCLUSION

Given our present state of knowledge, the answer to the question posed in the title of this chapter can be neither a definitive "yes" nor a definitive "no." If

language and its associated competencies, as I have listed them above, are the obvious apanage of humans, the human specificity is clearly not limited to linguistic features. Other forms of nonverbal behaviors linked to bimanual coordinations and gesturo-spatial representations also seem to be lacking in nonhuman primates, including apes. These behaviors constitute some of the primary ingredients of our human cultural heritage. But, both linguistic and nonlinguistic competencies indeed rest on one another and perhaps on the more fundamental peculiarity of the human nature, namely the fact that our cognitive achievements are grounded and, in large part, determined by social constraints. These constraints will shape the way we interact with each other as well as our actions systems (and their forms) on physical objects. Thus, our communicative behaviors are performed within triadic systems of interaction, whereas social interactions between animals have a dyadic structure. Triangularity characterizes exchanges within the linguistic system and links objects, symbols, and concepts. This feature is also evident in other expressions of nonlinguistic behaviors, such as in pretend play when the child not only plays with objects as if they were other objects, but also happens to treat them as companions (see the concept of *transitional object* proposed by Winnicott, 1971). In animals, communication is apparently performed within dyadic systems of relations. Situations in which one animal appears to show attention to a triadic relationship involving itself, another animal, and some third party appear in fact to be remarkably rare (Bard & Vauclair, 1984), and only a few cases have been reported in the primate literature, such as in the formation of coalitions by chimpanzees (de Waal, 1982). In other words, contrary to humans, animals do not seem to confront the other of the other.

If our nearest primate relatives like the chimpanzees display some aspects of these human forms of behaving and interacting, it appears that they have never expressed them in their full range, neither during their development nor after long training periods.

To finish, a word of caution must be made concerning the approach chosen by ethologists and comparative psychologists when they deal with comparisons between humans and other animal species. Most of the time, these comparisons are made with respect to the finality of the main biological functions. With this perspective, they may miss, as was eloquently observed by the French sociologist Edgar Morin (1973) "that *Homo sapiens is also Homo demens* which is recognizable not only for its brain and its tool making abilities as we used to say, not only for its language as we now say, but also for the magic, for the myths and the traumas that death inflicts to the most intimate parts of its consciousness."

NOTE

1. Animals in all phyla (mostly insects, birds, and primates) build nests of varying spatial structures and complexity. If nest building behaviors are often driven by preprogrammed schemas, it is also obvious that they are flexible with individual variations and

adjustments to changing conditions in the environment (Gould & Gould, 1994). However, the nature of action programs required in nest building is different from those involved in the visual and gestural organizations that underlie the human techniques we are dealing with.

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