

**Exceptions.** The evidence presented here weighs in support of the notion that children with autism are indeed acultural. However, there may be some exceptions to this.

(a) Some adolescents with autism do begin to show an interest in fashions (e.g., girls wearing lipstick, etc.), suggesting a partial awareness of some cultural norms and a desire to conform to these (Schopler & Mesibov 1986). I say "partial," in that these same individuals may still show a blindness to many other cultural norms, for example, the appropriate distance to stand from someone else so that their "personal space" is not invaded, or the appropriate use of eye contact (Argyle & Cook 1976; Baron-Cohen et al. 1993; Mirenda et al. 1983).

(b) Some adults with autism develop hobbies that lead them into special interest groups, which may have their own cultural norms (e.g., chess clubs, etc.). Such cases of apparent cultural participation would merit closer investigation.

(c) If children with autism really were acultural then one would expect to see few if any cross-cultural differences in behaviour between children with autism in, say, India, and those in, say, France. The relevant cross-cultural studies remain to be done.

In summary, autism may provide a model of what is needed in order to be cultural. Tomasello et al. suggest that this requires the capacity for cultural learning, for which a theory of mind seems to be the main prerequisite. As they point out, this probably has its origins in joint attention (Baron-Cohen 1989; 1991). The biological basis of joint attention and theory of mind may therefore hold the key to the biological basis of the capacity to be cultural.

## Sharing a perspective precedes the understanding of that perspective

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In their target article, Tomasello et al. identify three processes of cultural learning (imitative, instructed, and collaborative) which are linked to three concepts of agency that appear developmentally at 9 months, 4 years, and 6 years (i.e., intentional agent, mental agent, and reflective agent, respectively). In the present commentary we focus on the relationship between cultural learning processes and the concepts of agency and suggest that although Tomasello et al. have provided a generally accurate characterization of the different types of cultural learning and the social-cognitive concepts of agency, they have misconstrued the relationship between these two components of the model. In brief, Tomasello et al. assert that each of the identified levels of cultural learning relies on a social capacity to share a perspective with another individual, usually of the same species. They further assume that in order to share a perspective, one must understand that the other is the type of agent that can have such a perspective. It is this latter assumption that we believe is unnecessary and mistaken. In what follows we suggest that the formation of a concept of person as intentional, mental, and reflective follows as a consequence of sharing a perspective at these three levels, but that it is the formation of the concept of agency at one level that allows the child to *become* an agent at the next level and thereby come to share perspectives at that level.

At the first level of cultural learning, the 9-month-old child may be capable of sharing an intentional perspective with another individual, through imitation, for example. However, such sharing does not require a concept of a person as an intentional agent. All that is required is that the infant be able to

enter into intentional relations with objects and that, through the imitative process, the infant be capable of adopting the same intentional relation as the other. For example, the infant can share a visual perspective with another, by imitating the action of the other in looking in a particular direction and then noting the object that is found in that direction. For such sharing to occur, the infant need not be aware that a perspective is being shared (Moore & Corkum 1992).

Empirically, a concept of an intentional agent can only be said to be unambiguously in place when the child is able to recognize that the other is in a different state from the self and vice versa, or, in other words, that diversity is possible in the intentional relations of self and other. We suggest that this concept is not fully acquired until around 18–24 months. It is only at this time that infants can distinguish their own intentional attitudes toward objects from the attitudes of others and learn to respond differentially to the attitudes of others. For example, it is at about 18 months that infants know that another may see an object that they cannot see because it is behind them (Butterworth & Cochran 1980). Infants can also recognize differences in emotional attitudes toward objects at this time and can respond with sympathy to others, whereas earlier in development infants share, through contagion, the same emotion as the other (Hoffman 1977). Self-recognition with a mirror also occurs at this time, providing evidence that infants have developed a concept of self as an object of the same kind as other individuals (Lewis et al. 1989). Together, these phenomena suggest that the infant's concept of intentional agent, which can be applied equally to self and other, first appears at 18–24 months, not, as Tomasello et al. claim, at 9 months.

We believe that a similar developmental sequence occurs for the age 4 transition involving the concept of mental agent. The results reviewed by Tomasello et al. (e.g., on false belief, Wimmer & Perner 1983) indicate that the concept of mental agent occurs at about 4 years, because it is at this point that the child understands the possibility of diversity among mental states. We also agree with Tomasello et al. that instructed learning requires the child to have the capacity to enter into shared mental relations. However, in this case we differ about when instructed learning involving the sharing of a mental attitude first begins. In our view, once children have formed a concept of an intentional agent, they have then in effect become a mental agent, that is, they can think about the intentional activity of an agent. The 2- or 3-year-old child is in a position to share a mental attitude with an instructor; otherwise, the instructions of the other could not regulate behaviour. As in the case of sharing a perspective at the earlier level, however, the child need not yet have a concept of a mental agent. All that is required is the ability to adopt the mental relation of the other. Hence we again contend that the sharing of perspective precedes the appearance of the concept.

The formation of a concept of a mental agent at about 4 years allows the child to become a reflective agent in the sense described by Tomasello et al. At this level the child can share a perspective. In this case, what is shared is a reflective awareness of the mental activity of an agent, whether it be about self or another. Collaborative learning requires this sharing of perspective. However, at this stage the child merely acts as a reflective agent. It is only later, at about 6 to 7 years, that the child can form a concept of the activity of a reflective agent.

In sum, our view is that the sharing of perspectives is a precursor to the formation of the concept of a person as an agent having a perspective of that kind, and that this applies to all three of the levels described by Tomasello et al. Furthermore, we claim that there is a reason for this sequence. To develop a concept of a particular type of agency that can be applied uniformly to self and others, it is necessary to appreciate the equivalence of two qualitatively distinct types of information of the agency, namely, the information of the agency from a first-

person perspective and the information of the agency from a third-person perspective (Barresi & Moore 1992; Moore & Barresi 1993). Without a sharing of perspective at a particular level of agency between self and other, the individual could not come to appreciate the equivalence of the perspective of self and other at that level of agency. It is the cases where a pair of agents share an instance of a perspective at a certain level that provide the concurrent source of self and other information that can be integrated to grasp conceptually that level of perspective. Such conceptualization therefore only follows the sharing of perspective, as one becomes aware of similarity and diversity of perspective between self and other.

### Towards a new image of culture in wild chimpanzees?

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Tomasello et al.'s three levels of cultural learning are presented as strictly human because captive chimpanzees do not perform them in tests. "Encultured" chimpanzees are recognized as capable of imitation and the authors propose that human language training has allowed new dormant abilities to be expressed. Besides noting the impossibility of explaining how such abilities could have been favoured by natural selection if they have no use, I suggest that we could just as convincingly propose that captive chimpanzees live in strongly impoverished conditions. Any enrichment is badly needed and so the language training that some captive individuals were lucky to get improved their cognitive development along lines similar to those occurring in human populations; the higher the educational level, the more complete the cognitive development (Dasen & Heron 1981). I suggest that wild chimpanzees live in a permanent training condition where survival and reproductive success are the teachers and I would expect them to be more intelligent than their captive counterparts.

Contrary to what Tomasello et al. suggest, the teaching instances in Tāi chimpanzees were performed by mothers who changed their behaviour when they noticed their infant's difficulties (they were not cracking nuts themselves at the time), specifically performing in front of their infant an action that was directly related to the technical problems faced (they did not merely slow down their tool use, as Tomasello et al. state), letting the infant crack further while they waited nearby. In at least one instance it was clear that the infant learned from the mother's demonstration (Boesch 1991). Thus, Tāi chimpanzees are capable of instructed learning.

I have not yet published detailed observations of the collaborative hunting in Tāi chimpanzees but I can confirm here that some hunters do precisely monitor both the actions of other hunters and their effect on the movement of the prey. This is especially obvious with hunters closing an encirclement; this can only be done after such monitoring because they must anticipate the other movements in order to reach the strategic position in time. Thus, collaborative learning is at work in Tāi chimpanzee hunting behaviours.

Tomasello et al. hypothesize that human cultural learning can only occur if imitative, instructed, or collaborative learning is at work. However, everyone can think of a typical cultural behaviour in humans that does not require the acquisition of a new behaviour (which is part of their definition of imitation). For example, hand shaking, embracing, or hat lifting to greet somebody in some cultures does not require the acquisition of any movement that cannot be seen being used by young children when playing. It is the *context* in which this behaviour is produced that is new and could be learned through social facilitation (or local enhancement). I do not deny that imitation

plays a role in human cultures but I wish to emphasize that lower forms of social learning are also part of cultural transmission processes in humans. Thus, Tomasello et al.'s presentation of the three essential characteristics of human culture (sect. 5) are more relevant than the more limited scope of the analysis of some of the transmission mechanisms.

These characteristics are that cultural behaviour should be performed by all group members, that its form should be a faithful reproduction of that of the model, and that an accumulation of modifications must exist. These points are very important and deserve a fair review of the knowledge on chimpanzee traditions. First, besides termite fishing, activities such as ant dipping, nut cracking, leaf clipping, leaf grooming, and others have been proposed to be cultural. I shall discuss here the behaviours I have observed myself. In Tāi chimpanzees, the nut-cracking behaviour was performed by all group members over 2 years of age (N = 99 chimpanzees), the only exception being one juvenile female whose hands were both badly impaired and unable to hold a hammer. Similarly, the leaf-clipping was for years performed by all adult males, and only them, because it was a component of the drumming display performed completely only by adult males (Boesch, in preparation). Ant dipping was observed in 4 males out of 7 and 17 females out of 22. This is a rare behaviour but on all occasions the females present dipped for ants whereas males tended to take them directly with the hand. The differential use of ant dipping represents a sex difference in feeding on ants (Boesch & Boesch 1990). Thus, in Tāi chimpanzees cultural behaviours are learned by virtually all group members.

Concerning the second point, it is important to realize that this is a question of the level at which one compares inter-individual performances. At a general level, all French people shake hands in a very similar and standardized way but if one looks at a finer level it would probably be difficult to find two individuals that present the hand, press the other's hand, and let go afterward in exactly the same way. Obviously, if one looks at the finest details, Tāi chimpanzees show individual variations in nut cracking, such as the positions of the fingers holding the hammer, but at a higher level of comparison the most striking feature is that all group members crack nuts exactly the same way, holding the hammer in the same way, hitting with the same part of the hammer, and so on. Even throughout ontogeny I rarely observed young chimpanzees attempting to crack nuts with another movement, or trying other material or positions, or hitting the nuts with some part of the body or even throwing them against a hard surface. This standardization in form is also observed in ant dipping; in this case this is important because the form of ant dipping is different in the two chimpanzee populations performing it (Gombe and Tāi) but the same within each one (Boesch & Boesch 1990). Similarly, leaf clipping is performed by all males exactly in the same way (Boesch, in preparation). Thus, *copying the precise movement of the model* is very strong in the cultural behaviours of Tāi chimpanzees.

The third point is a very important one: Do chimpanzees have fashions like humans that spread rapidly in the group and appear independently of any ecological stimuli? Recently two appearances of fashion-like behaviour have been observed. The leaf clipping that was used for years only by males in the drumming context started within a month to be used in an additional and new context – resting. Not only did all males do it but other age/sex classes also started to perform leaf clipping for the first time in this new context (Boesch, in preparation). Second, in Gombe chimpanzees the leaf grooming was for years performed as a kind of redirected behaviour without any specific purpose (Goodall 1986). Lately, I observed that all group members I am performing it (N = 24) did so in order to squash small ectoparasites before eating them (Boesch, in preparation). These observations not only show that chimpanzees can accumulate modifications over generations but that the function of some of these behaviours are pure social conventions: Leaf clipping is