cess) of the presence of the predator than when he is knowledgeable (has perceptual access). Such behaviour is often followed by the partner's movement away from the testing arena into safety. These data seem to meet Tomasello et al.'s criteria for *dyadic engagement* and may even approach *triadic engagement*: the chimpanzees may be perceptually monitoring the goal-directed behaviour and perceptions of their partners, and engaging in informative signal production, possibly toward the shared goal of the endangered chimpanzee's safety. This type of design combines the competitive elements that are ecologically relevant to chimpanzees (e.g., opposition to a third party) and the cooperative elements that are essential to sharing intentions (e.g., between the two chimps). We offer this as a stepping-stone for the future comparative examination of shared intentionality and argue against dismissing these abilities completely in nonhumans so early in the research endeavour.

Of course, the very fact that we have to design particular types of tasks to find evidence of shared intentionality capacities in nonhuman primates speaks to some obvious differences between us and them. As detailed in the target article, humans do this flexibly across a variety of situations. But do humans do it equally across all situations? Do situations differ in terms of the level or type of motivation for social engagement? Perhaps humans, too, are more likely to engage in shared intentionality – and exhibit it earlier in development – when the stakes are high (e.g., working together against a common enemy), compared with situations in which the goal is less evolutionarily relevant.

Just how good are we at shared engagement, and what cognitive mechanisms might underlie it? An examination of the conditions under which humans *fail* to engage in shared intentionality may help to shed light on the mechanisms underlying the ability (in much the same way that examining the specific conditions under which humans fail to appreciate fully what others know helps characterize *theory of mind*, [e.g. see Birch & Bloom 2004]). In fact, as humans, we must spend a lot of time enculturating shared intentionality in children (e.g., group projects in school, team sports). As much as we seem to develop an intrinsic social motivation to engage in some truly collaborative activities, we also sometimes require external motivation. In this way, the relationship with the development of culture appears bidirectional – shared intentionality can enable culture creation, and culture can encourage shared intentionality.

In sum, the function and existence of shared intentionality even before the second year of life is made quite clear by Tomasello et al., and we agree that it is a strong candidate for an important socio-cognitive difference between humans and other animal species, including our closest primate relatives. However, we propose that a detailed characterization of the social motivation underlying shared intentionality is still required and may be achieved by identifying both abilities and limitations in humans as well as nonhumans.

Shared intentions without a self

Michael Lewis

Robert Wood Johnson Medical School, New Brunswick, NJ 08903.
lewis@umdnj.edu url: http://www2.umdnj.edu/iscdweb/

Abstract: Shared knowledge of intentionality as well as shared knowledge of anything depends on the organism's understanding of itself, others, and the possible relations between self and other. This understanding involves mental representations of *me*, which emerges in the second half of the second year in the human infant, and it is this ability that gives rise to humanlike social understanding and complex self-conscious emotions.

The problem Tomasello et al. present is an important one for it asks how shared intentionality comes about and, most importantly, how the use of shared intentionality becomes the basis of all human exchange. Their premise is that the understanding of intentionality of others is not sufficient for humanlike cultural activities; what is needed, in addition, is shared intentionality, the motive to share things with others.

In the study of social cognition, we, as well as others, have argued that a person needs knowledge of themselves, others, and the relationship between self and other (cf. Asch 1952; Hamlyn 1974; Lewis & Brooks-Gunn 1979a, 1979b; Merleau-Ponty 1964). I have suggested that the development of social cognition proceeds in the following order: (1) I know, (2) I know I know, (3) I know you know, and finally (4) I know you know I know (Sullivan et al. 2003). R. D. Laing's *Knots* (1970) makes a similar point when he speaks of the complex interconnection between people, best captured in such meaningful language phrases as "I know, you know, that I know, you know that I will go to the football game on Saturday." The target article speaks to this same issue.

My concern here is how "by 9 months . . . infants understand that people have goals and persist in behaving until they see that their goal has been reached . . . [that people are] happy when the goal is reached and disappointed if it is not" (sect. 2.4, para. 1). Certainly, we have learned that infants know a lot. In fact, the history of infant research in the last 45 years has been one in which the infant has gone from the James (1950) insensate unformed organism to a highly complex one. But the question remains as to what kind of knowledge is responsible for these newfound skills and abilities? As Putnam (1981) has warned us, just because an ant can trace a face in the sand does not necessarily imply that the ant knows anything about faces. Indeed, I should like to argue that just because the 9-month-old infant can perceptually discriminate between two conditions does not necessarily mean that the infant knows about them if we mean that they know as we adults know. Perhaps we are back to the rheostat – in this case a very complex one. As I have tried to argue, the first step, "I know," is equivalent to machine or zombie knowledge. It is not until the second step, "I know I know," that we can distinguish between machine ability and mental states – in particular, the mental state of *me* – for not until we have such a mental state of me, "I know I know," is it possible to have the fourth step or true social cognition, namely, the interaction of symbols and knowledge between two humans. This shared intentionality is possible only between two selves, both of which have knowledge about themselves and others. Certainly, there may be early precursors of such knowledge. There is no question that the complexity of the machine that exists in infants at very young ages can allow for subsequent shared intentionality. Nevertheless, it is not enough.

Our work (Lewis 2003; Lewis & Ramsay 2004) has shown a slow development toward the mental state of the idea of me. We have shown that starting around 15 months, infants exhibit three classes of coordinated behavior – self-recognition, personal pronoun usage, and pretend play – which suggest the emergence of this mental state. Moreover, there is little evidence to indicate that the emergence of this mental state has much to do with environmental causes (Lewis et al. 1985). In fact, data from magnetic resonance imaging studies strongly suggest the importance of maturational factors, in particular the myelination of brain regions thought to support this mental state of me (Carmody et al. 2004). Such data suggest that the maturation of particular brain regions may be the cause of the emergence of the mental state of the idea of me – the "I know I know" and "I know you know" – which then subsequently allows for "I know you know I know." There is little doubt – at least at this point – that the earlier capacity of the machine as exquisitely described by Tomasello et al., can possess this knowledge. The complexity of the organism from early ages on may become the material used once the mental state of me emerges. However, it may not be the cause of the mental state itself. Rather, it remains to be shown that much of the abilities ascribed to infants reflect only "machine ability," and not until the emergence of the mental state of the idea of me can this machine ability be put to use in a humanlike fashion.

Interestingly, the emergence at 15 months of this capacity "I

https://doi.org/10.1017/S0140525X05390121 Published online by Cambridge University Press

know I know" also gives rise to complex humanlike (also found in some apes) emotions – those I have called the self-conscious emotions, such as shame, guilt, embarrassment, and pride (Lewis 1997) as well as the social skills of imitation, empathy, and sharing (Lewis 2005).

Finally, a word about motivation. It would seem that a self – a system with knowledge about itself – would be interested in and be motivated by the similarities and differences between the self and others. "Like me" or "not like me" becomes an important feature in the world – one that becomes part of the cultural knowledge, the transmission of ideas, and the cause of likes and dislikes. Without an understanding of the mental state of the idea of me, without the knowledge of "I know I know" (whether conscious or not), the understanding of human behavior and human artifacts is incomplete.

Motivation is not enough

Derek E. Lyons, Webb Phillips, and Laurie R. Santos

Department of Psychology, Yale University, New Haven, CT 06520.
derek.lyons@yale.edu **webb.phillips@yale.edu**
laurie.santos@yale.edu **http://pantheon.yale.edu/~lrs32**

Abstract: Tomasello et al. provide a new account of cultural uniqueness, one that hinges on a uniquely human motivation to share intentionality with others. We favor an alternative to this motivational account – one that relies on a modular explanation of the primate intention-reading system. We discuss this view in light of recent comparative experiments using competitive intention-reading tasks.

In the 1990s, Tomasello and colleagues argued that the ability to represent mental states was a uniquely human capacity. They further argued that it was this representational capacity that accounted for the singular attainments of human culture; without the ability to represent mental states, nonhuman primates (hereafter primates) were consigned to remain in our species' cultural dust (Tomasello et al. 1993). Over the past few years, Tomasello and colleagues have gathered a wealth of compelling empirical evidence suggesting that their initial hypothesis was mistaken: primates can in fact reason about the mental states of others in some (usually competitive) contexts (e.g., see Hare et al. 2000, 2001; see also Flombaum & Santos 2005). As a result, there must be more underlying our cultural uniqueness than simply the ability to represent mental states. In the target article, Tomasello et al. revise their prior conclusions to account for these new data. They posit a new feature of human cognition to explain our cultural sophistication – one that that is argued to be absent in primates. This time that feature is our unique capacity for shared intentionality.

Tomasello et al.'s new account of human cultural uniqueness has a noticeably different flavor. The older account – that primates cannot reason about mental states – was a distinctly *representational hypothesis*. Primates lacked a crucial piece of cognitive machinery; they could represent the behavior but not mental states of others. Under the new account, however, primates *can* in fact represent the mental states of others. The distinction is that they are not *motivated* to share in these mental states. As they put it, "[O]ur claim [is] that there is a special kind of shared *motivation* in truly collaborative activities . . . each interactant has goals with respect to the other's goals" (sect. 3, para. 3, emphasis added). This motivation is what primates seemingly lack: "The overall conclusion would thus seem to be that although apes interact with one another in myriad complex ways, they are not motivated in the same way as humans to share emotions, experiences, and activities with others of their own kind" (sect. 4.1.2, para. 5). Note that there is a distinct epistemological difficulty with such a motivational argument. Whereas a representational account has the advantage of making firm predictions about the structure of primate thinking, an account expressed in terms of motivation is more poorly constrained. In particular, how would we go about defining motivation in an experimentally quantifiable way? We worry that the inherent subjectivity of motivation as an explanatory construct makes Tomasello et al.'s new hypothesis dangerously close to nonfalsifiable.

A further potential problem with Tomasello et al.'s explanation of human cognitive uniqueness is that it fails to account for an important pattern in the existing data on primate intention reading. As the authors note in their target article (and which has been reviewed elsewhere [see Hare 2001; Hare & Tomasello 2004; Tomasello et al. 2003]), chimpanzees' performance on intention-reading tasks is often context dependent. Hare and Tomasello (2004), for example, have demonstrated that chimpanzees exhibit significantly greater proficiency at an object-choice task when it is presented in a competitive rather than cooperative context. This result is just one instance of a larger trend in the recent literature – that primates' understanding of mental states is most strongly evidenced in competitive situations. Again, these researchers have tended to account for this empirical pattern in terms of motivation. With regard to the object-choice task, they argue that subjects performed better "because they were more motivated to succeed and paid more attention when competing" (Hare & Tomasello 2004, p. 580).

We, however, believe that the extant data support an alternative account. We favor the view that the intentional attribution abilities of nonhuman (and possibly human) primates are localized within a domain-specific module – one whose application in primates is confined to competitive social interactions. We use the term *module* to refer to a cognitive system that has access only to specific informational input and whose internal operations are hidden from external cognitive processes (see Fodor 1983; Scholl and Leslie 1999); the larger cognitive system, under this view, has access only to the module's final output. Note that these properties of modularity provide a sensible framework for interpreting the apparent context sensitivity of primates' ability to reason about the mental states of others. First, the existing data are consistent with a module whose input conditions are satisfied only by competitive social contexts. When such a competitive situation arises, the module provides output – presumably in the form of imputed goals or predicted behaviors – for external cognitive processes to manipulate; in noncompetitive situations, the module remains silent. Second, the modular account resolves an irksome "chicken and egg" problem: how do primates go about *detecting* competitive situations in the first place? It is difficult to imagine a means of detecting competitive situations that does not entail reasoning about the intentions of others, yet primates appear to reason about the mental states of others only in competitive situations. This seeming circularity is resolved by positing a modular process. Presumably the intention-reading module continuously receives input regarding the behaviors of conspecifics and uses this information to continuously predict future behaviors. These predictions, however, output to the rest of the cognitive system only when the inputs to the system are competitive in nature. In other words, a modularized mechanism enables detection of competitive contexts and subsequent intentional reasoning to be reduced to a single process.

The target article provides an excellent reflection of its authors' scientific rigor. We wish to commend Tomasello et al. both for their willingness to challenge their own prior conclusions and for generating some of the best experimental innovations in the field of primate cognition today. Our goal in this commentary has been to add to the valuable theoretical foment that this enviable intellectual productivity has made possible. We believe that the available data enable us to go beyond the potentially problematic notion of motivation and to posit instead a more readily testable architectural hypothesis.

https://doi.org/10.1017/S0140525X05390121 Published online by Cambridge University Press