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Benjamin Grant Purzycki
University of Nebraska-Lincoln

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Benjamin Grant Purzycki

Department of Anthropology and Geography
University of Nebraska–Lincoln
Lincoln, Nebraska 68588

ABSTRACT

Whether or not chimpanzees have the ability to mentally represent others' mental states or theory of mind (ToM) has yet to be definitively established. This results from three problems. First, modular theory of mind accounts lead researchers to adopt an either/or approach to psychological faculties which obfuscates both within- and across-species variability. Second, present research continues to rely on the continued trend to polarize nature and nurture. Third, the bulk of the work compares humans with chimpanzees rather than looking at the entire range of primate species. I propose "degree approach" by way of the Integrated Causal Model which particularizes the key components to ToM while maintaining the tenets of modularity theory. According to this account, while chimpanzees may not have a ToM that is equal to our own, they nevertheless exhibit behaviors that are indeed indicative of having one as illustrated by comparison to other extant primate research.

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Given our close genetic relationship to chimpanzees (*Pan paniscus*), much can be learned about our own cognitive processes by way of comparison. However, the reverse is also true; with what we know of our own minds, what can we learn about other organisms' mental activities, and what are the constraints that limit our ability to acquire such knowledge? The best prepared theory for making such an inquiry is that of the computational or modular mind (Fodor 1983). However, when comparing psychological faculties of two closely related species, new questions emerge that require rethinking previously held conceptions of the limits of particular faculties. Two primary problems arise upon examination of chimpanzee ToM within the modular framework: namely, the tendency to think of modules in an either/or manner ("you have the faculty or not," see Povinelli and Vonk 2004, Tomasello et al. 2003) and the tendency to polarize unnecessarily nature (what is innate) and nurture (what is learned). The difficulty of finding definitive evidence is quite a task to overcome, as we tend to anthropomorphize our subjects in order to explain their behavior.

MENTAL ORGANS AND HUMAN DEVELOPMENT

According to the most conservative definitions of modularity, there are four key components to a modular faculty of mind: encapsulation, domain specificity, inaccessibility, and innateness (Fodor 1983, 1998, Sperber 2002). Encapsulation, or "informational encapsulation" is the idea that within them, modules have hardwired information which informs perception. Domain-specificity is a given module's body of relevant knowledge; it is specifically designed for a particular body of information (Hirschfeld and Gelman 1994), e.g. language, a template-system of intuitive ontology, naive physics, etc. (Boyer 2001, Chomsky 2000, Vosniadou 1994). "Inaccessibility" refers to the idea that while incoming stimuli can alter neither the encapsulated information nor the state of the information therein, the target module cannot inform outside information (Fodor 1998). Put in an evolutionary perspective, the question becomes how such discrete cognitive functions evolve, given they are genetically determined.

Tooby and Cosmides (1992) aptly articulate the main theoretical difference between behaviorist and nativist approaches to the mind. They distinguish between what they call the Standard Social Science Model (SSSM) and the Integrated Causal Model (ICM). The SSSM is maintains that "the central concept in psychology [has been] learning," rather than innateness (1992). In other words, most behavior is learned, rather than an expression of genetically endowed faculties and their relationship with learned information. And such learning, according to the SSSM, must be

"equipotential, content-free, content-independent, general-purpose, domain-general...these mechanisms [of learning] must be constructed in such a way that they can absorb any kind of cultural message or environmental input equally well" (Tooby and Cosmides 1992). The ICM, on the other hand, attempts to locate specific "mental organs" (Chomsky 1980) of the mind, their function(s), and under what conditions are they function optimally. In sum, this dichotomy of nature/nurture is problematically too simple when confronted with the *growth* of mental faculties, and the dichotomy-based approach provides the first frame of dilemmas arising from previous investigations of chimpanzee and human ToM. There are two main assumptions that guide the following investigation: 1) some components of the mind are at the very least modular by Fodor's account (for a debate within the realm of computational psychology, see Fodor 2005, Pinker 2005a, 2005b) and 2) the ToMM (theory of mind mechanism or module) is a module in this sense at least in humans.

Baron-Cohen (1999) notes that there are eight behavioral requirements that must be met in order to grant an organism a ToM, namely: 1) intentionally communicating with others; 2) repairing failed communication with others; 3) teaching others; 4) intentionally persuading others; 5) intentionally deceiving others; 6) building shared plans and goals; 7) intentionally sharing a focus or topic of intention; and 8) pretending. Baron-Cohen unnecessarily separates "persuasion" and "deception" as deception is simply a specific form of persuasion; deception is successful persuasion of something false. However, all of the above requirements spring from the core qualities of a ToM: understanding *beliefs, desires,* and *intentions* in others. As discussed below, chimpanzees fulfill most of these requirements primarily by way of Machiavellian intelligence (see below) which, not surprisingly, is the most difficult to isolate in an experimental setting.

Concerning the growth of innate faculties, our own species illustrates an interesting trend during development. Gopnik and Wellman (1994) note that there are three main stages of a child's cognitive development with regards to the ToM. At two years, a child is equipped with two basic categories of mental activity, namely desires and perceptions. In other words, a landmark achievement in childhood development is an understanding of others' mental states such as *needs*—the understanding that "what is in the mind can change what is in the world"—and the understanding that "what is in the mind depends on what is in the world" (Gopnik and Wellman 1994). By three years of age, an elaboration of mental activities and states occurs. Such concepts of "think, know, remember, make-believe, dream" are understood as mental activities, while 5-year-old mental states including "beliefs [and false-beliefs], pretences, and images" are but a few of the psychological categories acquired by normally developed children.

Baron-Cohen's (1997) groundbreaking essay on "mind-blindness" of autistic children who lack or have an impaired ToM illustrates that understanding mental states is quite a task—if possible—for individuals afflicted with such disorders. In this domain of cognitive processing, one would expect, then, that chimpanzees would behave in a similar manner to autists who have impaired theory of mind mechanism or module (ToMM). This raises the first problem with an Either/Or approach to ToM and modularity in general: if modules can be impaired, certainly there are aspects of a given faculty that are operational, therefore implying that modules have degrees of functionality. Take for instance, individuals who suffer from Asperger's Syndrome (AS). AS is placed on what is called the "Autism Spectrum," just short of high-functioning autism (Baron-Cohen 2003). Arguably, AS is a step above Attention Deficit Disorder (ADD) and Attention Deficit and Hyperactivity Disorder (ADHD) since the symptoms relevant to ToM (e.g. difficulty with empathy, poor social interaction, etc.) clearly overlap with that of AS and high-functioning autism (Booth et al. 2003, Clark et al. 1999, Williams 2004).

Individuals who are diagnosed with AS, ADD, and ADHD exhibit a number of behaviors that are found among autists who have impairments of what constitutes a ToM, ranging from a less functioning sense of empathy, difficulty in social settings, etc. Frith and Happé (1999) note that evidence suggests children with AS are not as good as normally functioning children at attributing mental states, but certainly improve their ability to do so as they develop, unlike those with autism. Such difficulties are the result of a less elaborate ToM. This, in turn, implies that ToM ought to be measured by way of a spectrum or "host of symptoms" rather than as a present/absent module.

Can such a spectrum, then, extend to chimpanzees? This question represents another problem with the Either/Or approach to modularity: if there is indeed variation within species in terms of the functioning of a module, is there inter-species variability of the *same* faculty? If we are to conceptualize modules as "mental organs," should we not then acknowledge the possibility for variability across species as we would understand differences in the heart, brain, eyes and other organs? Evolutionarily, the human eye was not selected for per se, but rather the gradual developments of the eye, however, were (Tooby and Cosmides 1992). We should think of modules in the same manner.

CHIMPANZEE THEORY OF MIND

Premack and Woodruff (1978) were the first to ask whether chimpanzees have a ToM, and by extension, a ToMM. They argue that an individual's ability to attribute mental states to another is not a recent development but rather an old faculty. The question of whether or not the chimpanzee (or human, for that matter) is *correct* in his/her inference of attributing a mental state to another is irrelevant (but interesting)—the question is whether such inferences *occur*. Byrne and Whiten (1992) elaborate: "If an individual is able to respond differentially, according to the beliefs and desires of another individual (rather than according to the other's overt behaviour), then it possesses a theory of mind." In sum, then, a behavior exhibiting a reaction based on an understanding of another's beliefs and desires would be the shadow cast from the substance of the ToMM.

While most argue that "reading minds" is an innate faculty of our species and—by extension—chimpanzees, others argue that such a trait is wholly learned. For instance, Perner et al. (1994) argue that children with more siblings learn to infer others' mental states quicker than those with fewer siblings; and, therefore, a ToM is learned. The main problem with the thesis of Perner et al. is the fact that they confuse *mastery* of mind reading with the *ability* to read minds. In other words, if a child is not employing or "exercising" this faculty, they will not be as adept at identifying false-beliefs, intentions, etc. to a given agent. It should be argued, however, that having more siblings better *prepares* the ToMM, rather than actually "bestowing" it upon an individual. Perner et al. (1994) contend that their findings create a "serious problem for nativist proposals and various developmental explanations relying on internal maturation." Unfortunately, these authors remain unclear regarding the distinction between *learned* vs. *developed* (what is already there) when they claim that "the finding that siblings help develop a theory of mind is compatible with the sociocognitive tradition [which emphasizes] intellectual progress as a function of social interaction among peers and view intellectual growth as a process of internalizing the knowledge already incorporated in the social interaction" (1994).

In sum, the data of Perner et al. do not create problems for "nativist proposals" as they claim—if anything they support them, as "poverty of the stimulus" arguments contend (see below for "Plato's problem"). Put differently, Chomsky (1980) argues that "a central part of what we call 'learning' is actually better understood as the *growth* of cognitive structures [which are innately endowed] along an internally directed course under the triggering and partially shaping effect of the environment." If this truly is the case, one may feasibly pose the question to Perner et al.: where did only-children "learn" a theory of mind?

If the answer is from the parents, that would certainly not disqualify a single child from "learning" a theory of mind, but rather reducing the amount of stimulation that engages the ToMM. But "poverty of the stimulus" arguments contend that the *stimulus itself is impoverished* (in this case, behavior)—a great deal of our thinking is the result of inference-making by way of innate cognitive structures rather than a recording of all behaviors and outcomes (Boyer 2001). What we see is extremely limited—what we intuit is just as, if not more, important than the behaviors that stimulate mental activity (Fodor 1984). In sum, then, the question of ToM should not spring from the all-too simplistic dichotomy of nature/nurture but rather how these two interact (Richerson and Boyd 2005). The same may be said of chimpanzees raised in captivity that "learn" behaviors indicative of a ToM as discussed below.

Machiavellianism has been defined as "a strategy of social conduct that involves manipulating others for personal gain, often against the other's self-interest" (Wilson et al. 1996, quoted in Byrne and Whiten 1997). If a chimpanzee fools another in order to, acquire resources (sexual or nutritional) for example, the "fooling" alone does not necessarily suggest a ToM immediately. On the other hand, such acts of deception which rely on "whether an individual can discriminate another's *false belief* would be the most convincing way to demonstrate a true reading of 'mind'" (Whiten 1997). Has this been demonstrated?

Franz de Waal (2000) recounts how a chimpanzee called Yeroen mildly hurt his hand in a fight with another chimp named Nikkie. One observer noticed that Yeroen only limped when Nikkie was around. Franz de Waal confirmed this when he noticed that once Yeroen was out of Nikkie's field of vision, he would walk normally. Not only does this imply that chimpanzees are aware that "seeing is knowing" (see below), but also that an individual chimp *wanted another to believe he was hurt*. This behavior lasted a week, during which Yeroen monitored Nikkie to see if he was being watched (Ibid.). This example fulfills not only the "pretending" qualification of possessing a ToM but the "persuasion" and "deception" components as well. The next grouping of criteria falls under the general heading of "social" or "shared intentions."

Tomasello et al. (2004) argue that the primary distinction between our own psychological faculties and that of other species is the ability to cooperate with other individuals to accomplish the same goal, a trait with which human individuals affected by autism and

AS have troubles. What immediately comes to mind is the question of chimpanzee collaborative hunting, which Tomasello et al. (2004) consider. The authors determine such cooperation has no difference from hunting carried out by other social mammals (e.g. lions and wolves), which operates on impulse and opportunistic frenzies. In addition, they find it "almost unimaginable that two chimpanzees might spontaneously do something as simple as carry something together or help one another make a tool." In the case discussed below, it is clear that chimpanzees—if given the chance—will behave in a manner that benefits the agent solely rather than any cooperative behavior that would indicate a shared intention.

However, Tomasello et al. overlook the fact that chimpanzees will act cooperatively by forging coalitions to overthrow an alpha male, let alone work together to perpetuate the reign of an alpha (de Waal 2000, Goodall 1990). It should be noted that coalitions are created at fantastically frequent rates, (ca. 1,000-1,500 per year in captivity), but the overthrowing of an alpha does not (de Waal 2000). If this irrefutable fact of coalition-building to overthrow an alpha were a result from "observation" (that is, assuming chimpanzees are true behaviorists), it would be quite a feat to explain coalition forging and alpha-overthrowing in such terms. Individuals participating would collectively have to understand that their goal is, indeed, to get rid of an existing alpha. If chimpanzees were incapable of doing so, all those involved in the toppling of an alpha would have to have already *observed* not only the removal of an alpha but also a collaborative effort to do so. Moreover, they would have to be able to understand the outcome as a result from the collaborative effort if they are to repeat the process. Individuals who build coalitions are obviously goal-oriented and require assistance from others to achieve this goal. This suggests, indeed, that chimpanzees have a basic ToM.

Mundane, everyday behaviors, however, are far better indicators for shared intentionality. Franz De Waal (2000), for instance, observed that individual chimpanzees will hold enormous branches for others to climb into trees guarded by electrical fence. The branches are placed in a manner that requires one individual to reinforce the instability of the branch while another climbs the branches in order to gather otherwise unobtainable leaves. Even an adult helping an infant out of a tree indicates that there is some degree of sharing intentions by way of understanding another's predicament. Moreover, after engaging in conflict, chimpanzees will avoid each other until one of the combatants expresses a behavior indicative of a truce (e.g. extending a hand). Such a "collaborative" avoidance not only indicates mutual animosity, but also suggests that each individual involved in a conflict "keep in mind" that alleviating the tension has yet to occur (de Waal 2000).

Turning to a related question: *is seeing believing or indicative of understanding another's mental states*? More specifically, *does joint attention imply shared intention*? Flombaum and Santos (2005) recently published findings that suggest rhesus monkeys (*Macaca mulatta*) are equipped with the understanding that a researcher's inability to see a hidden grape provides an opportunity to steal it. This begs for more research conducted with the full range of primates available for study (see below for anecdotal evidence). Povinelli and Eddy (1996a) conducted a study to determine whether chimpanzees followed a human's gaze. In one case, the human looked at a specific location with only his eyes, while in another case the human looked with both eyes and head. They found that "subjects looked where the human was looking equally often whether or not the head was moved, demonstrating the efficacy of eye direction alone" (Tomasello and Call 1997).

In another experiment (Povinelli and Eddy 1996b), researchers stared directly at a Plexiglas wall that was between the chimpanzee and a distant wall. The assumption was that the chimps would bypass the wall, rather than inspect it, if the line of gaze were of no particular significance in the chimps' minds. However, chimps consistently looked at both sides of the partition—with particular emphasis on the side available to the researcher's view—rather than exhibiting a primary concern with the wall at the end of the room. In sum, chimpanzees determined that the Plexiglas wall was of the *researcher's* interest, rather than blindly following his line of vision.

Franz de Waal (2000) also reports an occasion when researchers hid a number of fruits in an enclosed area. Chimpanzees in an area close saw the researchers enter the area—with a box full of fruit—then leave the area with an empty box. When the chimps were allowed into the area, they searched "madly" without finding any of the fruit. One chimp, Dandy, passed by the hidden fruit without acknowledging them. Later, when the other apes were sleeping, Dandy made a "beeline" to the fruits, dug them up and quietly ate them without the others' awareness (2000). Even if this were *not* the first time Dandy behaved with such cunning, he still would require an understanding that if he suppressed acknowledgment of the fruit, others would not enjoy the bounty. Not only was Dandy planning, but also intentionally, and probably *consciously*, deceiving others in order to better himself.

Elsewhere, Byrne and Whiten (1992) review the complexity of tactical deception. Obviously, "Acts of deception involve *other primates*: as objects to be manipulated, as social tools to manipulate others, or even

sometimes as the resource to be gained." On the other hand, it also implies that the deceivers/deceived must be able to both retaliate *and* remember. The authors note that "the two *Pan* species and the *Papio* baboons are significantly overrepresented in records of deception. By contrast, *no clear case of deception has yet been reported for strepsirhine primates or tarsiers*" (Byrne and Whiten 1992). The data collected by Byrne and Whiten were exclusively anecdotal, which opens the procedural doors to many problems. Povinelli and Vonk (2003) rightly suggest that anecdotal evidence often "presupposes a behavioral abstraction" because *our own ToMs are at work* as mentioned below in the squirrel example. However, note that even with Byrne and Whiten's study, researchers potential ToM attribution *stops* with a large body of the Prosimii suborder indicating that such "presuppositions" are selective.

In other words, anecdotal "evidence" for chimpanzees' mental representations inherently relies on the assumption that representations of behaviors already occur—something which has yet to be proven, according to Povinelli and Vonk (2003). So, for instance, if one were to observe a chimpanzee deceiving another into thinking he does not have food, the observer is already attributing an understanding of mental states to the chimpanzee without *testing*. The problems with experimental procedures that attempt to reveal definitively that chimps have an understanding of others' mental states, however, are equally problematic for a variety of reasons.

DISCUSSION

One must be wary when regarding certain behaviors as indicators of a ToM. Take, for example, a squirrel that takes flight each time a human approaches. While it may be inferred that the squirrel has a ToM because it has an understanding of the human's mental state (e.g. "wanting to eat it"), such a conclusion ignores the possibility that the squirrel is reacting to *the human* and *not* its mental states. However, the reverse tactic of "turning off our ToM" creates even more problems. Gopnik creates a first-person narrative describing the world according to an autist. People sitting around the individual are described as "bags of skin [that] are draped over chairs, and stuffed into pieces of cloth, they shift and protrude in unexpected ways" (unpublished essay quoted in Baron-Cohen 1997). Are we to believe, then, that chimpanzees *truly* look at the world—especially their fellow chimps—in this manner? Unfortunately, we tend to grant agency without necessarily being *aware* of it. In other words, much of the time we do not look at others and acknowledge the fact that we are seeing much more than "hats and coats which could conceal automatons" (Descartes 1998). The information that is encapsulated is the attribution of *agency*, and arguably with experience, this attribution is elaborated and specified: in the case of our own species, the mental states "dreaming" and "making-believe" are not innate, but elaborations or outgrowths of an agency-detection system (i.e. the ToMM). In the case of chimpanzees, ToM seems less specific or sophisticated—rather than completely absent (see below). The question, then, turns itself inward: are we simply anthropomorphizing chimpanzees because of our own innate faculties?

Anthropomorphism has been included in Brown's human universals, a characteristic that is demonstrated around the world by all peoples (Brown 1991). While Brown notes that this trait is generally found in religious contexts, anthropomorphizing occurs in other contexts as well. One common view of anthropomorphism is the notion that our species animates certain entities (e.g. gods, ghosts, chimpanzees, etc.) in order to understand them better and to mitigate fears surrounding them. Boyer (2001) rightly observes that firstly, "gods and spirits are not represented as having *human* features in general but as having *minds*, which is much more specific" and secondly, "the concept of a mind is not exclusively human," meaning we attribute *agency* to all entities rendered *intentional*. In other words, we intuitively (i.e. naturally) attribute *a will* and *desires* to animate entities—this is the crux of anthropomorphism. Are primate psychologists guilty of inappropriately attributing "a mind" to chimpanzees in this case?

Povinelli and Vonk (2003) suggest that the chimpanzee mind seems so much like our own because "the human mind may have evolved a unique mental system that cannot help distorting the chimpanzee's mind, obligatorily recreating it in its own image." Like religious ideas, we may be projecting our own qualities on chimpanzees by granting them a ToM because *of our own ToM*. However, if in fact chimpanzees *do* have such an understanding of others' mental states, and we agree that they do, we would still be anthropomorphizing—we would simply be *accurate* in our inference-making. Moreover, "turning off" our own ToM in order to understand another's mental states is not a logical possibility; we require our ability to represent mentally other's mental states in order to determine whether or not he/she/it is able to do likewise. In other words, determining whether a chimpanzee has a ToM (a mental state) is possible only if we are allowed to infer mental states.

In what may be the most comprehensive account of the complexity of the present debate, Heyes (1998) proposes an experimental study designed to test whether or not chimpanzees could follow the sight-path of researchers wearing different goggles (opaque and translucent). The chimps would be primed to learn the

difference between the goggles. The hypothesis was that if chimps did indeed have a ToM, they would not bother to follow the gaze of a researcher wearing the opaque goggles. Kamawar and Olson (1998) conducted this study with children. While 85% successfully passed the ToM tasks, *half of these* passed Heyes' experiment. In this case, researchers are demanding *more* from chimpanzees than humans. Andrews (2005) rightly argues that even a modified version of Heyes' experiment proposed by Povinelli and Vonk (2004) also assumes that human children do not have a ToM because of their reliance on the assumption that *predicting* behavior rather than *explaining* behavior is the best indicator of the presence of a ToM. Moreover, as argued below, all present experimental studies fail simply because they rely on behaviorist (i.e. a persistent failure of the SSSM) interpretations of mental activity (i.e. solved by the ICM).

False-belief tasks are designed to determine whether or not an individual is capable of understanding that others may entertain an incorrect perception. While chimpanzees have shown great difficulty with attributing a false-belief to other individuals compared to normally functioning children, some tasks they eventually learn (Call and Tomasello 1999). Autistic children fail these tasks consistently whereas children with Down's syndrome are successful (which is also indicative of a ToMM; Baron-Cohen 1997). However, there should be a clear distinction between the ability to understand that another may be entertaining a false-belief and the *prevention* of a belief that one may not want another to have. As with the above-mentioned case of Dandy's concealment of fruit, he has also been observed concealing erections from a threatening alpha male. There are other cases of another non-alpha keeping his backs toward an alpha male while attempting copulation, constantly looking over his shoulder at the alpha (de Waal 2000).

Gordon (1998) casts doubt that even *humans*, on the other hand, have a ToM because interpreting our own quotidian social behavior depends primarily on such rapid computations of behavioral subtleties (e.g. vocal inflections) that do "not await casual analysis." In other words, our minds react to these observed minutiae, rather than an active mechanism abstracting such details into a mental category. There are a number of problems inherent in this position. First, if all of these "subtleties" that Gordon (1998) refers to are actually the sum-total of the stimuli, and behaviors that are a response to the processing of that sum-total, this still does not deny the possibility of a ToMM because such a module *requires* stimulation for engagement. Secondly, such arguments foreclose on the possibility of a "creative aspect" of chimpanzee behavior. The point is, Gordon is taking a purely behaviorist approach to the ToM—mostly a *mental* activity.

In addition, what Gordon does not acknowledge, but alludes to (perhaps not consciously) is what Chomsky calls "Plato's problem": "How is it possible that we have the knowledge that we do have? What is the knowledge that we do have and on what basis could we possibly have acquired it?" (Chomsky 1980, 2004; Lightfoot 2005). The strict behaviorist assumes such knowledge is learned and behaviors are reacted to based on either previous experience or processing a number of subtle gestures that "do not await causal analysis." If such a suite of subtleties do not "await causal analysis," then such subtleties are arguably *purely instinctual*, rather than a *choice* on the part of an agent. This fits nicely with Fodor's definition of inaccessibility but denies the ability of researchers to explain such behaviors. In sum, then, *the existence of a ToM cannot be ultimately "proven" behaviorally or "behavioralistically."*

Many have called such abilities "metarepresentations" (Sperber 2000). Andrew Whiten (2000) differentiates two types of metarepresentations. Sense 1 is "A mental representation of a mental representation." An example of this is (in your, the reader's, mind) "John believes in ghosts." You understand that John's belief in ghosts is a mental activity—so John's representation is now yours, so to speak. Sense 2 is "A mental representation of a mental representation *as a representation* (Sperber 2000). So, your understanding that John's belief in ghosts is a representation *is itself a representation*. Do chimps have this ability?

Povinelli and Vonk (2003) note that there are two things which supporters of chimp ToM must establish: a) that chimpanzees are capable of abstracting behaviors and b) they can mentally represent mental states (Sense 1). They argue that for the entire body of data produced by chimpanzee observation to be of any explanatory value, only "*behavioral abstractions* will suffice." Similar observations made by Scott (2001) divide the approaches between those who attribute ToM to chimpanzees and those who simply learn "from past experiences," in other words a representational memory of behavior rather than a representational understanding of *others' representations*. However, as the elaborate experiments that Call et al. (2004) conducted indicate, chimpanzees not only have the ability—spontaneously—to interpret intentions (Sense 1), but also react to them based on researchers' intentions as untrained chimpanzees quickly learned to not bother waiting for food that researchers refused to give.

Premack and Premack (1983, 2003) conducted a study in which the chimpanzees were shown video-

taped images of actors attempting to solve a number of problems. In the first test, an actor attempted to reach inaccessible bananas (hanging overhead, lying outside a cage, blocked by a large box). In another number of tests, actors were confronted with "malfunctioning equipment: a disconnected hose, a phonograph whose cord was unplugged, a gas heater that was unlit," etc. (Premack and Premack 2003). After viewing the videos, Sarah (the Premacks' test subject) was given an envelope with photos of the solution *and* solutions to other problems. Initially, Sarah chose the correct solution to 18 out of 20 problems. The Premacks note that her mistakes were likely due to "her ignorance of the difference between chimpanzee and human strength" (she "assumed" that a human could push a brick-filled box aside, rather than empty it) and "an unclear photo." Children, on the other hand who were presented with this task, failed 50 percent of the time. Even after altering the study to accommodate children's "suburban lifestyles" (e.g. cookies out of reach on top of a refrigerator), they continued to fail at the same rate.

The Premacks argue that the difference lies in the ability of chimps to identify, i.e. *mentally represent*, a "problem" rather than a simple sequence of events on a video. The chimps had to attribute a *goal* on the part of the actors presented in the film, whereas three-and-a-half year old children failed at a larger rate due to their failure to attribute a goal to the actors. It would be highly informative to give the same tests to older children, as their ToM is mostly fully functional (see above). Can one still maintain the stance that Sarah may have "learned" this ability—especially after being confronted with a novel test? Sarah represented not only the problem identified by the actors and the problem itself (Sense 1), but recognized it *as a problem* (Sense 2).

CONCLUSIONS

Is it then safe to think of the ToM in an Either/Or manner? If we discount the prescribed "collaborative intentionality," chimpanzees, it would seem, have the capacity to read other's minds—but with a limited number of abstraction-level mental state categories. The category which they fail to fulfill is likely concomitant to more socially complex animals—i.e. humans. If ToM is modular, "collaborative intentionality" should not necessarily be a condition—such an extra or more complex system of social cognition is likely equipped with another cognitive mechanism at work—rather than more encapsulated information. In other words, chimp ToM is likely only equipped with the mental abstractions of "seeing" and "desiring," with an emphasis on how to exploit *others* properly in order to benefit oneself (egocentric) whereas human ToM *can be employed* to accommodate collaborative intentionality—arguably made possible only by another psychological mechanism.

What a "degree" model would throw into question is how developed *our own* ToM truly is in terms of informational encapsulation and/or the limits of the representational outgrowth of this mechanism. For instance, it is probably not so much the case that "dreaming" is an innate concept, but such innate mental abstractions such as "knowing" or "believing" are evolutionarily sound mechanisms to have. It is also more likely that such initial characteristics of human ToM are not much different from a chimp's—we simply obtain more stimuli, both quantitatively and qualitatively, which would expand our categories of others' mental states. In sum, then, a ToM spectrum should stimulate the question that there may be some variability in the information encapsulated within our modules (as indicated by those with AS and high-functioning autism), just as there is variability in our eyes, stomachs, etc. In addition, it opens yet another question: is there variability in translation from essential information to behavior? Put differently, if our ToMM contains the same essential elements that a chimp's does, why is there a cognitive limitation on how it is used?

The debate need not be black or white in the case of ToM. The question should not be whether or not chimpanzees have a ToM, but rather to what degree. Even from the skeptics' corner (Povinelli and Vonk 2004), we see evidence of "seeing as knowing" in chimpanzees, but when compared to other primates, there is a clear divide. Conducting the same experiments with other primates, particularly the prosimians, will offer a truly robust body of comparative knowledge. From an evolutionary standpoint, the chimpanzees' understanding of others' mental states may simply be regarded as less developed or more restricted than humans' yet more articulated than other primates as recent research suggests. Moreover, determining whether any organism has a ToM requires one but also requires not relying solely on our own tendencies to infer mental states. Future experiments should be designed for chimpanzees to attempt to deceive others in order to solve a particular task without reflexively inferring that this already occurs. Observational and anecdotal data are equally important in order to observe chimpanzees and other primates interacting naturally.

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