Indiana Undergraduate Journal of Cognitive Science 5 (2010) 15-27
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The Connection between Compositional Language and the Theory of other Minds

Evan Galup

Indiana University

Abstract

In this paper I wish to disambiguate the components of TOM, analyze them, and focus on the single pre-requisite that is commonly said to "systematically aid" TOM, namely, compositional language (Fitch, 2004). I will argue that compositional language is neither necessary nor sufficient for having a theory of other minds, and support this thesis with examples from animals that do not have compositional language, but do exhibit characteristics of TOM, and examples from organisms with compositional language, but do not provide evidence for having a TOM. The paper culminates with a call for further conceptual analysis of TOM, and suggests a promising direction of building layers of attribution of the concept as "sorites" type, admitting of degrees of ascription.

A. Introduction

When a predator is approaching, a doe that is separated from her fawn will act depending on the movement and direction of the predator. Specifically, if a predator is equidistant from both the doe and her fawn, and it begins to move towards the fawn, the mother will make herself the object of a chase seemingly to avert the impending attack. She runs up towards the predator and moves so as to explicitly prompt the predator to chase her. If, however, the predator is close to the fawn but moving away from it, and towards the mother, she will stand and wait in observance of the situation. This indicates that the doe seemingly possesses a capacity to infer from the behavior of the predator whether it is planning to attack the fawn (Byers, 2002)

This example, of a non-human animal, from here on animal, inferring the mental state of another invokes an important question about mental state attribution in the fields of Philosophy, Psychology, and Animal Cognition. Can we freely attribute a 'theory of minds,' hereby TOM, to the doe in this example?[1]

B. Prevalent conception of TOM

1 'Theory of mind' and 'theory of other minds' are often used interchangeably and ambiguously in the literature to denote attribution of mental states to self and to others. In this paper, I will use TOM to mean 'theory of other minds,' indicating attribution of mental states to others.

Throughout the literature, the definition of TOM is often vague and thus it is it difficult to clarify what exactly constitutes having TOM. The clearest reading of the culmination of these definitions can be taken from a paper written by Penn and Povinelli, hereby PP-TOM. What can be gathered is that the prevalent conception is that TOM is the theory describing how an agent infers and predicts behavior (states) of other agents based on a theory about the relation between observable elements and unobservable states of mind (Penn and Povinelli, 2007).

By this definition we should be able to predict someone's behavior based on something observed about them, something unobserved, and what we can infer about both. For example, I walk into a room and I see a man throwing a chair at another younger man. In this scenario, I have observed a man behaving in a certain way, e.g. throwing a chair, and can infer based on this behavior that he must be angry, or have an unobservable state of anger. Another example may be that I ask my friend how she is, and she says that she is fine but she nervously looks around when she answers. In this case, I am observing my friend say that she is fine, and I also observe that she nervously looks around. From this, I infer that she must be feeling something else besides fine or she would not have nervously looked around (an unobservable state of mind).

However, this conception leaves room for many questions to be answered. One question that needs attention is what kind of relation between observable behaviors and unobservable states of mind is needed in attributing TOM. Often times, correlation between events is confused with causation. So, observing a behavior may correlate with an unobservable state of mind, or the observed behavior causes, or brings about, the unobservable state of mind. This definition does not clearly state what kind of relation, whether correlational or causal, exists between the behavior and the state of mind.

PP-TOM also leaves room for debate about what the necessary conditions for having TOM are. We know that there is an unobservable state of mind and an external cue, but is there a domain of relevant states of mind when attributing a TOM? In other words, are there particular states of mind that should be emphasized according to how relevant they are to the situation?

Finally, PP-TOM does not address the preconditions for having TOM. We do not know, from this definition, what, if any, are the predispositions necessary for having TOM. The ambiguity of PP-TOM facilitates ease of depriving or attributing TOM to agents. Although the definition seems intuitive and acceptable *prima facie*, it can be used to support a superior position about the cognitive status of humans. Human language is the only language that can satisfy the three assumptions underlying this definition.

This common conception of what it means to have TOM assumes three capacities about the organism that has TOM and how it attributes mental states. First of all, it assumes understanding of the concept of "mental states." Secondly, it assumes having a "theory." And finally, it assumes having prerequisite skills of inference and prediction. Moreover, this definition is assuming that an agent can recognize a relation that seems to occur between states of mind and behavior from specific instances. So, agents are generalizing from instances to form a broader theory that enables them to have a system of recognizing this pattern of behavior. The only type of agent that could form a broader concept of specific

instances would be one in which the language enables them to generalize and create an abstraction from particular instance. The intuitive conception of TOM, thus, presupposes conceptualization, inferences, and abstraction that are commonly associated with agents who have compositional language.

C. Compositional language and TOM

A compositional language is one in which the compound units (e.g. sentences) are built systematically and in accordance with specific rules from atomic components (e.g. words). This property of a language has three major consequences. First, the syntactic value of the compound is a function of the values of the parts. The semantic value of the compound, e.g. the meaning of a sentence, is a function of the values (meanings, references) of the components. Most importantly, a compositional language has the property of productivity. It allows speakers to create and understand an infinite number of compounds from a finite number of building blocks.

A debate exists as to whether a theory of other minds can exist without compositional language. PP-TOM implies that pre-lingual babies and non-human animals may never have TOM. Babies would have the potential of acquiring TOM as they acquired language, but in the case of animals, they would never have the possibility of having TOM. On the other hand, agents with language, such as Autistic people, would be likely candidates for having TOM.

D. Proponents of TOM attribution to animals

In 1978, David Premack and Guy Woodruff published an article that strived to answer the question of whether chimpanzees have a theory of mind. They provided chimps with various videos of people encountering problems that they needed to solve. The experimenters then showed videos of solutions that corresponded to the problems portrayed in the videos. If the chimpanzee matched the solution video with the problem video correctly, which they did, then the experimenters concluded that the animals had a theory of mind. This paper sparked a heated debate then and is still popular in modern day animal cognition research.

Michael Tomasello and his group reexamine the question of whether the chimpanzee has a theory of mind in response to the article by Premack and Woodruff in 1978. Tomasello et al. wanted to sift through evidence supporting that animals have TOM by performing a series of experiments that they feel are the most revealing of the true nature of the chimpanzee's abilities. As a result, they derived several experiments that examined the chimps' ability, or lack thereof, to understand goals and intentions, to understand others' perception and knowledge, ability to follow gaze, and communication by gesturing and had positive results (2003). Taking into account the evidence produced by the experiments, Tomasello et al. conclude that chimpanzees have a theory of mind in a broad sense; but in a narrow sense, they may not because they don't have the ability to discern false beliefs (Tomasello et al., 2003).

Dale Jamieson is a very strong proponent for claiming that animals have minds. In his paper "Science, Knowledge and Animal Minds," he addresses this issue and offers theories as to why we attribute or fail to attribute mental states to animals. Ultimately, he argues that knowing animal minds is not so different from knowing human minds. In his opinion, the capability to make an inference from behavior becomes a matter of interpretation, familiarity, and shared conventions (Jamieson, 1998).

E. Opponents of attributing TOM to animals

Even though several proponents claim that animals have TOM, many researchers are still reluctant to label animals as having TOM. Daniel J. Povinelli and Jennifer Vonk hold firmly onto the position that the type of evidence researchers have used to support the idea that animals have a theory of mind is not adequate to support the narrower claim that chimps possess a theory of mind. They believe that the type of data accumulated by studies helped an interpretation that misconstrues the animal behavior as attribution of mental states. Because of the way humans view their own minds, they project this onto how they view the minds of other animals, especially a species like the chimpanzee, which is so evolutionarily close to humans (Povinelli and Vonk, 2003).

Another opponent to endowing animals with TOM is Clive Wynne. In his book, *Do Animals Think?* (2004), Wynne defines 'theory of mind' as the "ability to act on the basis of the contents of the mind of another being," (162). As he breaks down former experiments and evidence for theories, he ends up concluding that the amount of complex information needed to explain the happenings of the animals' minds, in fact, takes away from the validity of the arguments proposed by supporters of attributing TOM to animals. In Wynne's words, "But so long as simpler explanations of an animal's behavior are available, the jury must stay out…" (182).

Similar to the arguments brought forth by Povinelli and Vonk, and Wynne , in 1998 C.M. Heyes in her work "Theory of mind in non-human primates," finds similar problems with the research undergone with primates to assess their cognitive capabilities. Like Wynne, she feels that some of the explanations presented for animals' behavior are interpreting the behavior into something that it is not. In other words, she finds it important to only use mentalistic explanations in the face of evidence that clearly indicates that the response of the animal is beyond a simpler explanation (Heyes, 1998).

Although the requirements for experimental evidence made by Povinelli and Vonk, Wynne, and Heyes are seemingly appropriate, their reluctance to attribute TOM is unwarranted. They want assurance that animals are not acting on a mere behavioral code; however, a similar argument could be made regarding the attribution of TOM to humans. A theory of other minds is implemented in order to help explain behavior, and the reluctance to attribute TOM on the basis that animals act from a behavioral code would actually be further reason to look into what is prompting the animal to act in such a way.

F. Compositional language is not sufficient for having TOM

Autism is a disorder that has symptoms that fall on a spectrum from mild to severe. However, most cases usually "…are characterized by varying degrees of impairment in communication skills, social interactions, and restricted, repetitive and stereotyped patterns of behavior," (NIMH, 2009). Autistic people, here on AS adult or AS child, are commonly said to not have a theory of other minds based on a series of experiments that should provide evidence of the absence of certain cognitive abilities. AS children are given a list of tasks to perform and each task tests a specific cognition. If they fail these tasks, they are said to not have TOM. Examples from the autistic spectrum show that having compositional language is not sufficient for having TOM. If compositional language is sufficient for having TOM then it follows that if there is compositional language then there is also TOM. If AS children have a compositional language but are said to not have TOM, then we can conclude that compositional language is not sufficient for having TOM.

Research compiled by Simon Baron-Cohen tested the ability of people with autism on various cognitive abilities and they are the following:

1. mental-physical distinction
2. understanding mental functions of the brain
3. appearance-reality distinction
4. first order false belief tests and second order false belief tests
5. "seeing leads to knowing"
6. deception
7. recognizing words that indicate a mental state and distinguishing them from other words
8. usage of mental states words in spontaneous speech
9. spontaneous pretend play
10. imagination
11. monitoring one's own intentions
12. understanding causes of emotion
13. inferring from gaze direction when a person is thinking or what a person might want
14. understanding metaphor, sarcasm and irony/understanding in a context
15. correlation with real life situations

One test measured AS children ability to *distinguish mental properties from physical properties*. The test began by someone reading a story to both AS children and normal children. In the story, two characters talked about their experience with a dog; one of which had a mental experience with the dog, e.g. wishing for a dog, and the other character had a physical experience, e.g. holding the dog. Then the children were asked questions about the experiences of the characters (Baron-Cohen, 2000). For example, the children might be asked, "who can want to buy a dog tomorrow?" or "who can play fetch with the dog?" Clearly, the answer to the first question would be the character having the mental experience, e.g. wishing for a dog, and the answer to the second question would be the character that is having the physical experience, e.g. holding a dog. By the age of four, children without autism can successfully make the distinction between mental and physical whereas AS children cannot.

In addition to having difficulties distinguishing between mental and physical properties of experiences, AS children also cannot differentiate between *mental and physical functions* of the brain. The majority of normal functioning children age three to four know that the brain serves both mental and physical purposes. They know that things such as dreaming, wanting, thinking, etc. are considered mental functions. They can distinguish the mental functions from the physical ones such as moving or running. AS children, when asked to tell the two types apart cannot decipher the difference (Baron-Cohen, 2000) By virtue of their difficulty with this type of problem, they are also having a problem rooted in the failure to simulate. In this scenario, AS children are not able to put their mental states and physical states into words. They experience both, but when asked to distinguish they cannot represent the experience in their minds in order to attach a mental state or physical state word to it.

Another distinction that is crucial to independent survival is the ability to tell the difference between what is *apparent* versus what is *real*, or as Baron-Cohen calls it in his research, the "appearance-reality distinction". The experiment performed was one in which children, with and without AS, were given an object that looks like something else and they were told to say what it actually is. In this particular instance, they were given a candle shaped as if it were an apple. When presented with the question of what the object was, children without autism would successfully say that the candle looked like an apple, but actually was not actually an apple. However, when AS children were asked the very same question, they would say that the candle shaped like an apple actually was an apple (Baron-Cohen, 2000). In this example, the children fail to have a sense of physical perspective. They cannot distinguish the apparent from what is real. For example, to look at a road continuing ahead gives the illusion that the outside lines of the road will converge, when they will actually remain parallel. Similar to this metaphor, AS children cannot decipher when something is apparent versus when it is real.

Another way that researchers have tested the cognitive faculties autistic spectrum disorders is by measuring how AS children detect *first order false beliefs* (Baron-Cohen, 2000). A first order false belief is when one agent, B, knows that another agent, M, holds a belief that is not true. These tests assessed the abilities of normal functioning children, and AS children to make a distinction between their own belief and someone else's belief. One ways to examine their ability to recognize two persons' differing beliefs is by looking at "Snow White", a fairy tale, in which the characters hold differing beliefs from each other, and from the readers of the story. So, in "Snow White", Snow White believes that the old woman she encounters is innocent, even though the reader knows that the old woman is actually the evil witch. Based on this experiment, children can be measured on their ability to discern a false belief. If a child can discern what the character thinks is true, versus what is actually true, then they have recognized a false belief. When AS children are reading or listening to this fairy tale, they say that Snow White thinks she is getting an apple from an old woman, but that they (the children) know that the old woman is actually the witch in disguise. On the other hand, when provided with the same story, AS children cannot recognize that Snow White is holding onto a false belief. When faced with the same question of the identity of the old woman, AS children will repeat what they know from the plot of the story. In other words, the would say that the old woman is just an old woman with an apple,

instead of recognizing what the plot tries to hint which is that the old woman is actually the evil witch in disguise (Baron-Cohen, 2000). The ability to detect when someone holds a false belief is crucial for knowing what action to take in light of the circumstances of a situation. Whether it is detecting a first order false belief or a second order false belief, both require the ability to have mental perspective. To have mental perspective is to be able to recognize the difference between what I know and what another person B knows.

The communicative device of knowing who knows/does not know something in order to determine the appropriateness of informing someone of something (*p)* is what Baron-Cohen calls *"seeing leads to knowing."* AS children and normal functioning children are different in the way they understand where knowledge comes from and their ability to extract from this knowledge who knows *p* and who does not know *p*. The experiments designed to measure this ability revealed that some AS children did not understand this concept (Baron-Cohen, 2000). As humans, we try to inform people of what they do not know rather than telling them what they already know. Also, we may say things we know as a realization when we find out something for the first time. This ability is a prerequisite for deception. In other words, I know *p* and I know that B does not know *p* (Baron-Cohen, 2000).

The ability to deceive people is practiced by children of four. Again, *deception* requires understanding of other minds because I know *p* and I know that B does not know *p.* So, I know that I can tell B *p* even if it is false. AS children usually cannot deceive someone else, nor can they detect when they have been deceived. One game Baron-Cohen used to test how AS children deceive was to engage in a game where an AS child had to hide a penny in one hand and not tell the other person which hand it was in. Instead of allowing the other person to guess randomly, the AS child would keep the hand closed that held the penny, but they would open the empty hand, so as to give away which hand the penny was in by the disjunctive property. Some other things they would do would be hiding it but then hint to the person where the penny was hidden (Baron-Cohen, 2000).

AS children cannot recognize *words indicating a mental state* such as "think," "dream," and "desire," and they cannot recognize them as different than *words indicating a physical state* (Baron-Cohen, 2000). Baron-Cohen holds this to be indicative of a narrow mental vocabulary, although it also shows that AS children lack a sense of familiarity or recognition of recurrent mental state words.

When measuring how often AS children "make-believe" or *pretend play*, Baron-Cohen found that they engage in doing so far less than other children (Baron-Cohen, 2000). He attributes it to potential problems with imagination or attention, but it could also be attributed to an inability to imitate. For example, if I want to pretend that I am drinking tea, I cannot do so without having seen someone else drink tea. I cannot imitate *x,* so I cannot pretend that I am doing *x.*

If it is a problem with imaginative faculties, it could be due, again, to a problem of *simulation*. Moreover, to imagine an idea, I need to represent something that I have not seen previously in my mind. In the Baron-Cohen experiments, imagination was measured by asking AS children to draw things that do not exist and found that they hesitated to do so or had less success when they did try (Baron-Cohen, 2000).

The ability to *monitor one's own intentions* was demonstrated to be deficient in AS children by asking them to do an activity in which the outcome was manipulated. For instance, they were asked to aim for a specific target, but an experimenter manipulated the outcome. As a result, their intention, even if they correctly aimed, did not necessarily align with the actual outcome. Most children, without autism, would answer that they meant to hit a specific target, even if they actually did not, whereas an AS child would state that his/her intended target was the target that was actually hit, even if the experimenter manipulated it (Baron-Cohen, 2000). Monitoring one's own perspective is also part of having correct mental and physical perspective; I need to know the difference between what I think/meant to do and what actually happened.

Understanding what *causes emotions* emerges in children around the ages of four to six years old. AS children typically have difficulty understanding the mental causes of emotion (Baron-Cohen, 2000). For example, I can be sad because I thought of something that I do not want to happen, and it would be a mental cause for sadness. The inability to understand a mental cause of emotion can be attributed to a difficulty to recognize familiar feelings or emotional states.

Humans gather large amounts of information from others' body language. Within the autistic spectrum, Baron-Cohen finds that AS children and adults cannot gather information from *eye gaze* specifically. Eye gaze can indicate how much information a person has from where they were looking and provides the ability for another person to make an inference about information obtained based on the direction of someone's gaze. A deficiency of such an ability would make an AS person unable to have perspective of information (Baron-Cohen, 2000).

Other experiments involving language and figurative speech showed that AS children had much less success than other children in understanding *pragmatic* elements of conversation, i.e. understanding in a context including understanding metaphor, sarcasm, and irony (Baron-Cohen, 2000).

Since the absence of these cognitive abilities renders AS children and adults as agents without TOM, each ability must be constitutive of having TOM. From this research, I have composed a list of components, both declarative and procedural, in which each is a component of TOM. They are as follows:

1. imitation
2. simulation
3. familiarity
4. the ability to read body language
5. having perspective—physical, mental, and informational
6. deception

It is possible to use this list in order to see if agents without compositional language, animals, show evidence of the constituents of TOM. If the animals, non-compositional language users, show evidence of the cognitive abilities lacking in people with Autism, then we can conclude that compositional language is not necessary for having TOM. In order to make the examples more vivid, I have restricted my research to examples of those animals in

the wild or under experimental conditions in which they were not taught any prerequisite abilities.

G. Compositional language is not necessary for having TOM

A study performed with the racket-tailed drongo species of bird revealed evidence of **imitation** of another in order to strengthen one's own success. In this observation, it was noted that racket-tailed drongos, when flying in a mixed species flock, would actually imitate the call of a different species within the flock. By attracting members of a different species, in addition to their own, they manage to increase the success of their foraging skills. So, the drongos used imitation for their individual purposes. In fact, when the researchers tested how appealing the calls were in a playback experiment, the calls with imitation were more attractive to the other species (Goodale, Kotagama 2006).

New Caledonian crows were the subjects of a study to discover if crows could do something "useful" by Joshua Klein. As it turned out, one of the crows named Betty, was able to solve a problem by **simulating** the solution. Betty needed to get a piece of food out of a long tube but she was only given a straight wire. After several attempts, Betty took the straight wire and fashioned it into a hook so that she was able to hook the food in the bottom of the tube. Betty successfully represented what she could do with her only tool, in other words she simulated a solution, in order to obtain the food (TED.com)

Pigs and sows also display components of TOM. In this case specifically, they show evidence of **familiarity** in social situations. In an experiment discussed in an article by Moore et al. three experimental groups were placed in a pen together for about two weeks. Then, the experimenters introduced ten new sows to each group of thirty pigs. They observed behaviors of the sows and pigs and noticed at a certain point in time that approximately 80 percent of newly introduced members were resting together in the same place while only about ten percent were resting in that same area. At 21 days of being together, with both old members and new, the animals were finally integrated randomly amongst each other (Moore et al. 1993). This shows that the sows and pigs had an awareness of what was familiar and what was not, and also, tended to prefer the familiar to the unfamiliar until better accustomed to the new environment.

A study done with chimpanzees shows that they are able to recognize **familiarity** and to **read body language**. Seven chimpanzees were placed in a situation with both unfamiliar and familiar people. The experiment was based on the observation of the unfamiliar people by the chimpanzees to assess if there is a change in behavior towards the unfamiliar people. The unfamiliar people either gave a treat consistently to other chimps or people with whom the seven chimpanzees were familiar, or consistently did not give to other chimps or familiar people. The author notes that the chimpanzees were not typically in favor of begging for food from strangers. Taking this into account, the results are even more remarkable. Despite their aversion to begging for food, the chimps eventually began to gesture to the unfamiliar people who they had observed to consistently give to their peers, and avoided those who consistently withheld the treats. In the next phase of the experiment, new unfamiliar people were brought in who continued to either give or withhold. From the chimps experience with other

unfamiliar people, the chimps took much less time in deciding whether to gesture and to whom. Upon first observation of a giving unfamiliar, chimps gestured to the person as soon as available (Subiaul, 2008).

David A. Leavens worked with orangutans and demonstrated orangutan's ability to modify communicative techniques based on how well they make a point and obtain the proper response. The orangutans in this experiment adjusted their communication based on "who knows what" and who does not. This is similar to the "seeing leads to knowing" principle of autistic deficiencies and, thus, a prerequisite for **deception**. A caretaker with food and the orangutan need to interact successfully in order for the orangutan to receive the food. The experiment reveals the various ways that orangutans are able to adjust their communication in accordance with what the caretaker gives, or fails to give, to the orangutan. In this experiment, if the caretaker was not looking at the orangutan, the orangutan would use auditory or tactile forms of communication. On the contrary, if the caregiver was looking at him/her, the orangutan would use visual means. Additionally, orangutans were able to repair "communicative episodes." For example, they would stop communicating totally if the experimenter delivered food they requested. However, if they were not given the correct food, they communicated persistently until they received it. Part of the experiment examined the relation between orangutans and their human caretakers, but it also studied communicative relations within the species. In this case, the orangutans altered their methods depending on how well they were understood by the other. Specifically, when they were partially understood, they persisted by repeating similar signals. Alternatively, when they were misunderstood entirely, they changed their methods by introducing new signals with hopes of making the exchange successful (Leavens, 2007).

Cuttlefish have a curious way of **deceiving** the very ones with whom they desire intimacy. Australia is home to the Giant Cuttlefish, but although the name may be misleading, not all of the cuttlefish in Australia live up to their title. Often times, the smaller males fall by the wayside when it comes to finding a female cuttlefish during the mating season. By size, the smaller cuttlefish do not have much of a chance of winning a female's attention. Consequently, they have adopted a strategy that helps to fool the females into selecting them as a mate. Due to the shifting nature of the cuttlefish's skin, they are very capable of blending in with an array of environments. Additionally, then can use this same skin shifting ability to change their skin to mimic that of a female cuttlefish. When they do this, they can swim alongside a female, getting her to think that he is actually a female and then successfully mate with her. In fact, the females have begun to actually select the male cuttlefish in disguise at a higher rate than that of selecting a larger, undisguised male (Sciencentral, 2009).

An example of **deception** can be seen when observing one species of jumping spider, *Portia*. This example is based on the behavior of *Portia* when stalking prey in the wild. In order to capture her prey, she performs a series of tricks to deceive before the attack. First, she plucks at her own web to simulate a wounded insect that is struggling to get out of the web. When this attempt fails to create notice, *Portia* creates " a kaleidoscope" of other methods to try to get the attention of the prey (Jackson and Wilcox, 2002). One of the signals achieves success and the prey moves closer to her. Noting the advance, *Portia* repeats the

signal and the prey continues to advance. When the wind blows, she uses it to her advantage to get closer to her prey. She moves towards the prey and actually takes a longer route in order to strike from an unexpected direction (Jackson and Wilcox, 2002).

H. Conclusion

From this research, we can generate the conclusion that TOM attributions do not necessitate language. If provided with the opportunity for further studies within this field, I would like to consider some suggestions for more effectively studying TOM. TOM does not have to be an “all or nothing” argument. Whereas multiple cognitions can comprise TOM, it is possible to have partial attribution of TOM. It is possible for a non-compositional language user to have TOM without having a complete set of components. They may have a disjunctive subset of necessary components that together, function as one sufficient condition for having TOM. And finally, attribution may not be psychological, but rather, functional. We can distinguish TOM from f(TOM), where TOM refers to the ability to read and attribute mental states to oneself and others, f(TOM) refers to the process by which agents function as though they do have a ‘theory of other minds’ and act as though they are goal-oriented. In this case, TOM is adaptive for the agent making attribution. In my future endeavors within this field of study, I will intently consider these suggestions in hopes of refining how we attribute TOM to cognitive agents.

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