

Understanding the Concept of Human Superiority: An Exploration of the Theory of Mind in Non-Human Species

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Abstract

The theory of mind is the ability for an organism to understand the mental state of other beings, and attribute and predict their behaviors based on this understanding. While humans demonstrate the innate mental content of a theory of mind, understanding whether or not other organisms have a theory of mind is more difficult, especially because it is viewed from a human-centric lens, leading people to wonder about other animals. This therefore begs the question: do non-human animals have the innate mental content of the theory of mind? This question can be explored through the perspective of high-intelligence non-human animals—primates, corvids, and canines—by comparing them to humans, in order to determine if there is a phylogenetic closeness to humans and the capacity to have a theory of mind in other animals. Considering this purpose, by comparing the cognitive ability of non-human and human animals in regard to a theory of mind, the possibility for a shared capacity to understand another animal's mind is better understood.

Keywords

Theory of Mind, Phylogenetics, False-Belief Tests, Social Cues, Mental States, Evolution, Anthropocentrism

1. Introduction

Humans have long been thought to be special and unique in their intelligence and understanding of others; this is the belief of anthropocentrism, or human superiority, which defines humans as above all other life forms. As explained by philosophy professor at the University of North Texas Adam Weitzenfield and

social psychologist Melanie Joy, anthropocentrism, "...has narcissistically privileged humans as the center of all significance, [but] is not an innate disposition..." (Weitzenfeld & Joy, 2014). However, anthropocentrism has been thought to hold some value, as people can think, to learn, to communicate and to impact the environment in grander ways than other animals. While anthropocentrism has led to the notion of human superiority over other animals in the animal kingdom, recent evidence has suggested that humans are not so exclusive in their understanding of themselves and the world around them. Animals with high levels of intelligence, such as chimpanzees, dogs, and ravens, also actively demonstrate possession of skills that were expected to be singular to humans; specifically, the theory of mind. The theory of mind is an innate ability that develops in early childhood for humans and allows for people to understand that others are motivated by their desires. The theory of mind is the ability to understand others by their mental states, and has long been thought to be exclusive to humans due to the preconceived notion that no non-human animal can parallel people, a belief that has been supported by the facts such as that humans have, "...11.5 billion cortical neurons—more than any other mammal, because of the human brain's high neuronal density," (Dicke & Roth, 2008). This, along with the theory of mind being far better understood in humans, led to the expectation that humans were superior to other animals.

While the theory of mind is well understood in human psychology, it is less understood for animals. Therefore, this research paper aims to understand and explore the theory of mind in three animals: chimpanzees, dogs, and ravens. These animals were chosen for their high levels of intelligence, and understanding their capacity for the theory of mind can reveal more about their ability to feel empathy, their social dynamics, and more. These three animals all have some sort of phylogenetic closeness to humans, some being closer than others, making them prime candidates for discussion in relation to theory of mind. Chimpanzees, for example, are noted for their tool use and intellect, and are one of the closest living relatives of humans; dogs have evolved alongside humans for centuries, and have adapted to learn human social cues; ravens, although more distant, convey intelligence and tool-usage as well, evidently making these three animals excellent selections to compare to humans in terms of theory of mind.

After discussing these non-human animals, this paper will move on to discuss the theory of mind in human children, and compare those results to that of chimpanzees, dogs, and ravens. As this review research paper explores the innate ability of theory of mind in these non-human animals, it is also important to consider their phylogenetic relatedness to humans. This would provide insight for the evolutionary roots of certain cognitions.

This paper will first provide evidence of theory of mind in chimpanzees, wolves, and ravens, and then explain the implications of such a finding in relation to the notion of human superiority. Overall, through research, this paper aims to better understand the cognitive abilities of non-human animals, and the

implications of how this will impact our understanding of animals—are humans truly superior to animals, or do animals have abilities that parallel people?

2. Theory of Mind in Chimpanzees

First, this paper will examine the theory of mind in chimpanzees. As great apes, there is an understanding that chimpanzees are intelligent. However, a deeper understanding of the mind of a chimpanzee can provide insight into how intelligent they are—specifically, how the theory of mind portrays their comprehension of empathy, social dynamics, and more. Researcher at University College London’s Department of Psychology Cecilia Heyes describes theory of mind in animals as playing a, “...role in generating behavior and infers the presence of mental states in others by observing their appearance and behavior under various circumstances,” (Heyes, 1998). As the closest relatives to people, chimpanzees exhibit a high level of intelligence, and understanding of beliefs and intention, suggesting that they possess a theory of mind. Furthermore, a study conducted by Fumihiro Kano from Institute for Advanced Study, Kyoto University, and his colleagues in 2019 determined that chimpanzees and other apes, “...used their own past perceptual experiences to determine an agent’s perceptual access and anticipate how the agent would behave” (Kano et al., 2019). During the experiment, apes would watch a video of a version of the Sally-Anne Test—a common false-belief test that indicates theory of mind—and then were introduced to either an opaque or see-through barrier in real life. Actors would place an object behind a barrier, and when they left, their object would be moved to the other barrier. The study aimed to determine if apes could predict where the actor would search based on their understanding of the actor’s belief about the object’s location by tracking their eye movement, and found that the differential learning score (the total viewing times to target minus total viewing times to distractor, divided by the sum of these values) was biased. Great apes were able to take in different visual cues and their own past perceptions to anticipate and understand an actor’s behavior during the experiment, which demonstrates the theory of mind in chimps and other apes. This demonstrates the theory of mind in chimpanzees because it proves that the chimpanzees can understand the inner processes of the actor—if the actor was not present when their item was being moved, then they would check in the place where it was originally placed, as they would not be aware that it was moved—which exhibits that they can ascribe a mental state to another being and predict their behavior based off of the predicted mental state.

As further evidence of this, animal behavior researcher at the BBC Wildlife Magazine Leoma Williams explains that when given a false-belief task, “...apes predicted that an actor would search for an object where he has last seen it and therefore believes it to be, even if the apes themselves know that it is no longer there,” (Williams, 2019). False-belief tests are commonly used to determine the theory of mind in human children, as it assesses a child’s ability to understand

that people may act upon their beliefs, even if those beliefs are not true. Since, similarly, chimpanzees and other apes have demonstrated that they understand false beliefs, conveying that they do in fact have a theory of mind.

Evidently, chimpanzees have proven to have the theory of mind. An exploration of their phylogenetic closeness to humans would provide a better understanding of this, as well as convey future implications. Chimpanzees (as well as bonobos) are the closest living relatives to humans, sharing 98.8% of their DNA, and humans and chimpanzees descended from a single ancestor species that lived six to seven million years ago. According to the American Museum of Natural History, humans and chimps share the genes for blood clotting (HEMB), facial development (CPX), chromosome maintenance (SMC1L1), and red color vision (OPN1LW). Furthermore, a study conducted by Monica Uddin and her colleagues from the Center for Molecular Medicine and Genetics, the profiles of the anterior cingulate cortex (ACC), a crucial part of the brain in regard to cognition, decision-making, and intelligence, was analyzed in humans, chimpanzees, gorillas, and macaques. Using ACCs in humans, chimpanzees, gorillas, and macaques, the researchers built a phylogenetic tree that showed that humans and chimpanzees are extremely closely related, and that there is an up-regulation of genes related to neuronal function and aerobic energy metabolism as one traverses up the phylogenetic tree and gets closer to humans. The neural evidence identified in this study provides a better understanding of human-chimpanzee relatedness; this relatedness then ties into support for theory of mind in chimpanzees, as it makes logical sense that animals that are closer to humans demonstrate aspects of the theory of mind if not having the theory of mind.

Based on this evidence, what are the implications? As previously discussed, there is the notion that animals also have traits that were once thought to be unique solely to humans. Therefore, evidence of the theory of mind in chimpanzees holds novel implications for understanding primate behavior in the future, as well as understanding of psychology between animals. As actively demonstrated, non-human primates do possess a theory of mind; not only do they have the capacity to understand the mental states of others, but they are also able to predict and react to the behavior of others based on their ascribed mental states.

3. Theory of Mind in Dogs

Dogs have evolved over centuries alongside humans, and therefore, it is likely that they also have a theory of mind to better understand human behavior. Canine researcher Stanley Coren from the University of British Columbia states that a dogs' mental abilities are close to human children who are about 2-2.5 years old, that dogs can learn up to 165 words, and that dogs can solve arithmetic and spatial problems (American Psychological Association, 2009). Given their high level of intelligence, along with the fact that they evolved alongside humans, it is reasonable to suspect that dogs may possess a theory of mind. As a matter of

fact, "... domestic dogs are sensitive to a variety of human social cues, including pointing with the hand and arm," (Dorey et al., 2010), which indicates theory of mind because it implies that dogs can understand the cognition of another species—they understand to look where the human is pointing because the human wants to show them something. In addition, according to a study conducted by animal behavior psychologist Emily Bray and her colleagues, puppies are born understanding human social cues and mental states, and that a large portion of this understanding is genetic (Bray et al., 2021). Since the theory of mind is also an innate ability, and these puppies were able to understand the mental state of the human experimenters (by understanding what they want when they point), this points to dogs possessing the theory of mind.

Further evidence of dogs possessing the theory of mind is demonstrated in a study conducted by Britta Schünemann and her colleagues from the Department of Developmental Psychology from the University of Göttingen in Germany. The study aimed to determine whether dogs could distinguish between intentional and unintentional withholding of treats, as this would indicate whether or not dogs could understand the mental state of the treat-giver (whether or not they were intentional or unintentional with denying the dogs treats). According to the study, dogs, "...waited significantly longer before approaching a reward that the experimenter had withheld intentionally than a reward that had not been administered [intentionally]," (Schünemann et al., 2021). This conveys that the dogs were able to differentiate between intentional and unintentional actions, portraying how they do possess theory of mind and understand human intention.

As discussed with chimpanzees, a phylogenetic relatedness to humans is connected to theory of mind in non-human animals. Now that this paper has provided evidence behind why dogs possess a theory of mind, it will explore the phylogenetic relationship between dogs and humans. A study conducted by researcher Attila Andic, who is affiliated with Eötvös Loránd University, and his colleagues, found that when listening to audios of human and dog sounds while under an fMRI, both humans and dogs activated the bilateral temporal junction areas of their brain, suggesting that, "...that voice areas may have a longer evolutionary history than previously proposed..." and that this dates, "...back to the common ancestor of dogs and humans some 100 million years ago..." (Andics et al., 2014). Since the same areas of the brain light up at the same time in response to both human and dog vocalizations, the evidence presented by Andic and his colleagues conveys a close phylogenetic relatedness between the two, which relates to the notion that possessing the theory of mind has relation to humans. The closer a mammal is to humans on the phylogenetic tree, the less rudimentary and more advanced their theory of mind is. Moreover, during a phylogenomic study that included humans and dogs by researcher Gina Cannarozzi, Adrian Schneider, and Gaston Gonnet at ETH Zürich University explored the relationship between human and dog relatedness more in depth with data from completely sequenced nuclear genomes. By measuring genomic distances of amino

acid replacement, synonymous nucleotide substitutions, and gene reordering, Cannarozzi and her colleagues found that the data from their nuclear genomes, “...strongly suggested a sister relationship between human (primates) and dog (carnivores)...” (Cannarozzi et al., 2007).

The implications of the theory of mind in dogs, as well as the relationship between this innate ability and phylogenetic closeness to humans are profound. Alexandra Horowitz from the Department of Psychology of Barnard College states that dogs seem, “...to be operating with regard to some mediating element between others’ appearance and their behaviors, this behavior could be described as a rudimentary theory of mind” (Horowitz, 2011). While this finding once again reminds people that humans are not unique or superior in their cognitive abilities, there does seem to be a connection between the closer an organism is to humans phylogenetically, the more similar their theory of mind is in comparison to humans. While both dogs and chimpanzees possess a theory of mind, chimpanzees are able to comprehend more concepts than dogs, whose understanding of theory of mind, especially in regard to understanding humans, may be in part to their close evolution with humans, and not just their status as a mammal.

4. Theory of Mind in Ravens

Ravens are the least related to humans of the three non-human animals discussed, as ravens are not mammals, and therefore, it seems unlikely for them to possess the theory of mind. The theory of mind is understood to only be found in animals of a higher intelligence, which often are mammals. However, ravens are highly intellectual, which leads to one wondering if they do possess a theory of mind. An experiment conducted by Thomas Bugnyar and his colleagues at the University of Vienna found that, “...ravens can generalize from their own perceptual experience to infer the possibility of being seen by others who are not visibly present,” (Wong, 2016). The experiment involved putting two ravens in two separate rooms, with a window in between both rooms that could be opened or closed. When the window was opened, and the ravens could see into each other’s rooms, they hid their given foods much faster than when the window was closed. The ability of ravens to perceive the mental states of surrounding ravens (surrounding ravens likely want to take their food, so a raven hides its food), may be evidence towards them having a theory of mind; however, the evidence is inconclusive, as this could also just point to ravens knowing to be more careful around others when caching food, which could just be a characteristic of their species.

A paper written by Nathan Emery from the sub-department of Animal Behavior at the University of Cambridge further contributes to the idea of ravens having a theory of mind; he explains that ravens cache food behind large natural barriers and reposition themselves so others cannot see them. In addition, he expounds how a, “...subordinate [raven] that had visual access to the location of

hidden food led a dominant [raven] away from the food, before attempting to access the food themselves,” (Emery, 2006). As evident, ravens display a high level of awareness for the mental state of others, especially when it comes to caching behaviors.

This paper will now delve into the phylogenetic closeness between ravens and humans, as it did with chimpanzees and dogs. Unfortunately, however, there is not much conclusive data on the full phylogenetic history and relationship between humans and birds, so this paper has summarized most of what is known. Ravens are not as closely related to humans as chimpanzees and dogs are the last common ancestor of humans and birds that lived around 320 million years ago, which suggests that their cognitive abilities evolved convergently. This is unique and interesting as there is an underlying assumption that one can only possess the theory of mind through evolution with a common ancestor who had the theory of mind. However, ravens and other corvids juxtapose this notion, as their rudimentary/potential theory of mind evolved separately, most likely due to the demands of their environment and to increase their odds of survival. Furthermore, humans and birds share about 65% of their DNA (Garrett-Hatfield, 2014), and this is enough DNA in common, as diseases can be spread from bird to human and vice versa. It is well known that ravens and other corvids possess many abilities that human toddlers have—namely tool use, facial recognition, and mimicry of voices. In fact, as established by two researchers from Lund University, “Corvids are the only nonhomicide animals that have experimentally demonstrated planning beyond the current moment,” (Kabadayi & Osvath, 2017).

Finally, this paper will discuss the implications of ravens possessing the theory of mind. As previously stated, ravens are the least-related to humans of the three non-human animals covered in this paper. However, their intelligence and grasp of the theory of mind suggests that the concept of superiority no longer belongs to just mammals (as chimpanzees and dogs disproved that this perception is singular to humans), but rather, can be found throughout the animal kingdom. Since results are currently inconclusive and unclear, this leads to several questions that will remain unanswered for now: how far does the theory of mind go? Can much simpler organisms also possess the theory of mind? Since there has not been sufficient research into the theory of mind for ravens, this paper will present some other ideas of how to test for the theory of mind in ravens: ravens could be given a more simplified version of either the Sally-Anne test, like what is given to chimpanzees and humans, and a test to determine if ravens can distinguish between intentional and unintentional treat withholding, like dogs. Another test that could be conducted to test for the theory of mind in ravens may be to determine how ravens respond to different facial expressions in humans; since ravens are already known to have the ability to remember human faces, a human individual who has bonded with a raven (such as at an animal sanctuary) could be used for this test. If the raven responds appropriately to dif-

ferent facial expressions (example—remaining calm around a happy face, moving away when presented with an angry face, etc.), it could be another indicator of theory of mind. Overall, these ideas would be interesting to test in the future to determine if ravens truly have some level of a theory of mind or not.

5. Conclusion

In conclusion, understanding the theory of mind in chimpanzees, dogs, and ravens provides important insight into cognition and the theory of mind for non-human animals. These findings also break down the notion that humans are independent and superior in their cognition, as many other intelligent animals also possess the theory of mind—a trait once thought to be unique to humans. This paper first reviewed chimpanzees, humanity’s closest relative, and their ability to navigate false-belief tasks, as evidence for them having a theory of mind. Then, the cognition of dogs was explored, and their ability to understand the intentions behind human behavior and social cues also pointed to them occupying a theory of mind. Finally, this paper discussed ravens, and how their awareness of rivals when it came to food caching serves as an indicator that they too have a theory of mind. These animals were discussed in order of their phylogenetic relatedness to humans—a trait that directly correlates to how “much” of a theory of mind they possess. Chimpanzees, the closest relative to humans, possess the “most” characteristics of the theory of mind, while dogs possess a more rudimentary level, and ravens have the lowest level of understanding of the theory of mind.

Now, this paper will briefly compare these results to that of human infants presented with theory of mind tests. As summarized by Mark Sabbagh from Queen’s University and Lindsay Bowman from the University of California, Davis, the theory of mind is a crucial milestone in the social and cognitive development of children, and is often tested for (and often not present in neurodivergent children) through either the Sally-Anne test, which was previously discussed, or a Band-Aid test. In this Band-Aid test, children are presented with a closed box of band aids, with crayons hidden inside. Once the crayons are revealed, the children are asked if someone else who saw the box closed would answer that there are band-aids or crayons in the box; if the child answers “band-aids,” they have a theory of mind. Although theory of mind is an innate ability, children develop it as they grow. Therefore, it is not until around three years of age that children will answer “band-aids” in response to the Band Aid test or have the correct answer for other theory of mind tests (Sabbagh & Bowman, 2018). As evident, human children display a grasp on the theory of mind much quicker than other animals, and at a much deeper level. The distinction between human and non-human animals regarding theory of mind can be attributed to many factors, including genetic predisposition, brain development, social environment, and cultural evolution; further studies on the human mind would aid in better understanding the role of phylogenetics, and anthropocen-

trism, in the theory of mind.

Future studies could examine connections between humans and other non-human animals, such as bonobos and other primates that are closely related to humans, as well as other non-human animals that are domesticated and evolved alongside humans, such as cats, horses, or pigeons, to better understand the presence or absence of a theory of mind in them. In addition, other future studies on the human mind could focus on concepts such as better understanding why humans are the only organisms with the theory of mind, how the theory of mind is an innate ability, yet still requires careful development throughout childhood, or the roots of anthropocentrism, and how it affects studies centering on the theory of mind in non-human animals. Although as the most intelligent species, humans have the highest degree of theory of mind, it is evident that further studies on the human mind can be conducted to better understand these concepts.

Based on these conclusions, one can gather that possession of the innate ability of theory of mind relies on the intelligence of a species—the more intelligent and cognitive a species is, the “stronger” their theory of mind is. Again, the understanding that non-human animals possess the capacity to understand and predict others’ mental states has profound implications for our perception of non-human animals; the notion that humans are superior to animals in many aspects is no longer truth, as other animals possess traits humanity once thought was unique solely to people. Furthermore, this research offers a new lens through which to view the cognitive capabilities of non-human animals and understand the complexity of not only the human mind, but the mind of other animals as well.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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