Tacit Assumptions & Methodologies in Animal Cognition Studies

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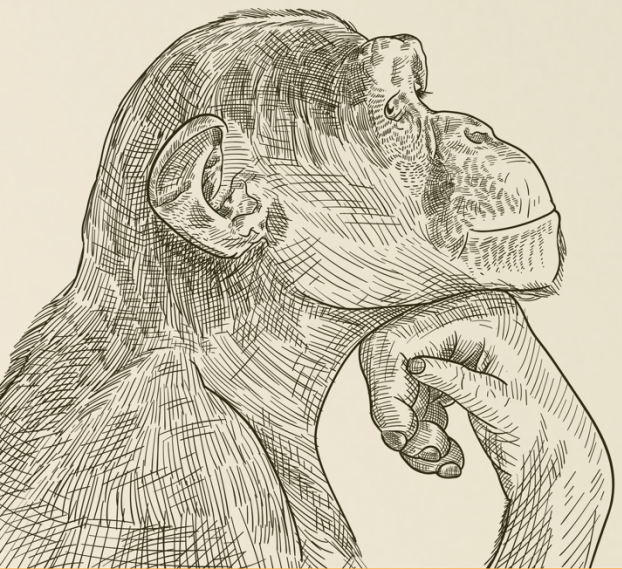

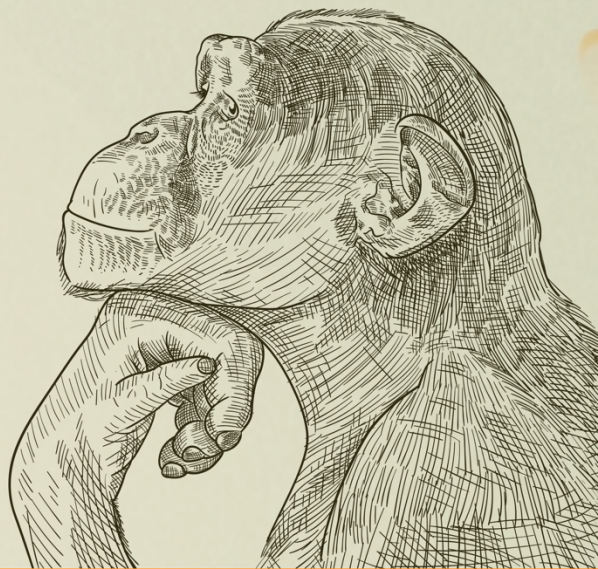

Abstract

Animal cognition research has gone through significant developments over recent years, the biggest of which is adopting biocentric methods for evaluating cognitive traits. Certain tacit philosophic assumptions have affected research methods in behavioral animal cognition studies and inhibited progress in the field. I argue that a major tacit assumption is that cognitive traits are clustered while they are in fact discordant. Such an assumption has led to humans and nonhuman animals being put on different grounds for research, leading to an unproductive conversation on the nature of cognition and cognitive traits. Instead, I argue to "de-anthropomorphize" humans by prioritizing the environmental niche as the ground upon which conclusions should be derived. This paper is in line with Darwinian thinking and borrows major ideas from Brauer, Prat, and Millikan.

The Animal/Human Distinction[1]

The difference between humans and the rest of the animal kingdom (non-human animals) has been a matter of enduring debate in scientific fields from epistemology to contemporary behavioral science. The biological community at large has historically denied a qualitative distinction between humans and animals at least since Darwin. However, I argue that some assumptions on qualitative distinctions between animals and humans in terms of cognition persist in actual research. One such tacit assumption, the animal/human discontinuity, hinders research on animal minds. Progress continues to be made by many contemporary scientists, addressing this issue by analyzing

[1] In this paper, I will be referring to human animals as "humans" and non-human animals as "animals" for readability.

the effects of the assumptions found within research questions regarding animal minds and how these questions are answered.[2][3][4] This paper attempts to add to that progress.

The battlegrounds for cognition discontinuity are many. They are most intense in discussions on language, tool use, theory of mind, etc. The definition of "cognition" is not important for the purposes of this paper. For this project, our everyday conception of "cognition" will do. In fact, it is important to keep "cognition" undefined if openness to empirical discovery continues to be our goal. Here, we are attempting to discover what "cognition" is, rather than postulating it *a priori*. A philosophical precept's main utility lies in guiding the questions asked and methodologies followed by researchers.[5] I maintain that any categorical definition of a concept based on a philosophical precept is rendered hollow by scientific findings. I will follow Collin Allen's (2017) treatment of "cognition." He writes, "Philosophers seeking a unique 'mark of the cognitive' or less onerous but nevertheless categorical characterizations of cognition are working at a level of analysis upon which hangs nothing that either cognitive scientists or philosophers of cognitive science should care about."[6] That is to say, our current understanding of "cognition" is vague, so it is important to define our treatment of the concept of cognition.

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[2] Brauer, Hanus, Pika, Gray, and Uomini. "Old And New Approaches to Animal Cognition: There Is Not 'One Cognition.'" *Journal of Intelligence* 8, no. 3 (July 2, 2020).

[3] Hauser, Marc D., Chomsky, and Fitch. "The Faculty of Language: What Is It, Who Has It, and How Did It Evolve?" In Cambridge University Press eBooks, 14–42, 2010.

[4] Fedorenko and Varley. "Language and Thought Are Not the Same Thing: Evidence From Neuroimaging and Neurological Patients." *Annals of the New York Academy of Sciences* 1369, no. 1 (April 1, 2016): 132–53.

[5] Colin, "On (Not) Defining Cognition," *Synthese* 194, no. 11 (June 3, 2017): 4233–49.

[6] Collin, "On (Not) Defining Cognition," 4233.

We are not trying to postulate what cognition is but instead trying to discover its nature and properties. This is a mistake often made in the subject; when treating cognition as a science, we are to define it rather than as a science we are trying to discover. Instead, we should emphasize the expansion of our prior understanding of cognition from what we discover. Collin explains that the boundaries between "higher" and "lower" cognition are too vague to be used for a productive and inclusive treatment, further supporting the theory that our treatment of cognition as it stands has too many holes to correctly map out onto the animal kingdom, i.e. to have ecological validity. That is to say that cognition has the same structure as the animal/human continuity long held in biology since Darwin. I argue, however, that this seemingly obvious thesis is not reflected in actual research on non-human animal cognition.

Assumptions of Animal/Human Discontinuity Persist

Some studies of animal cognition with imprecise assumptions have risked adopting a methodology that is contrary to the comparative approach itself. The biological community at large agrees that the difference in all traits between humans and animals is that of *degree* (quantitative) and not of *kind* (qualitative). I will refer to the qualitative thesis as the "animal-human discontinuity thesis." However, recent literature on animal cognition has shown that many of the studies conducted–for instance, on intelligence–assume qualitative traits that are unique to humans and rely

on the animal-human discontinuity thesis.[7][8][9] For instance, in comparative studies of animal language, Prat writes, "It is certainly plausible that some of these elements [e.g. vocal production learning, hierarchical syntax, and semantics] are unique to human language, and I do not intend to contradict this possibility here. However, I do claim that despite the common belief and the widespread assumption of 'human' uniqueness, the scientific evidence supporting these uniqueness assertions is far from being sound (and indeed hardly exists)."[10] Prat's conclusion is that the literature on animal language has not treated animals and humans *with the same standards*. The literature relies on the animal-human discontinuity thesis. The lack of the same standards is the key issue. It ends up nullifying the standards of the comparative approach. A comparative model will define a trait and set a normalcy standard in order to see how it differs across populations. This kind of treatment has been neglected in contemporary science.

The animal-human discontinuity thesis relies on a circularity in the interpretation of the research. The conclusion of animal-human discontinuity functions as a premise in the methodology supposed to demonstrate the thesis. Strictly speaking, the thesis of animal-human discontinuity is not a conclusion; it is the very basis of how research is often done. It is a set of assumptions guiding

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[7] Yosef Prat. "Animals Have No Language, and Humans Are Animals Too." *Perspectives on Psychological Science* 14, no. 5 (August 9, 2019): 885–93.

[8] Charles T. Snowdon. "Language Capacities of Nonhuman Animals." *American Journal of Physical Anthropology* 33, no. S11 (January 1, 1990): 215–43.

[9] Yosef Prat, Lindsay Azoulay, Roi Dor, and Yossi Yovel. "Crowd Vocal Learning Induces Vocal Dialects in Bats: Playback of Conspecifics Shapes Fundamental Frequency Usage by Pups." *PLoS Biology* 15, no. 10 (October 31, 2017).

[10] Prat, "Animals Have No Language, and Humans Are Animals Too," 886.

the research. Prat argues that one of these assumptions is that humans have certain *unique traits* that separate them from animals. He argues that this assumption stands on false grounds.[11] Such an assumption results in the conclusion that language is, in one way or another, unique to humans. The evidence for cognition is extracted from humans and nonhumans in two different ways. So, any study that we conduct with that assumption will always result in the conclusion that animals and humans are different, thus reinforcing the original tacit assumption. The point here is not that humans lack unique qualitative traits that separate them from the rest of the animal kingdom. The point is that the way that we study these traits, though empirical, is tautological; the conclusion of uniqueness is itself within a premise of the argument.

So, how do we modify our methodology to avoid that assumption completely? An easy solution to this problem would be to put humans and animals on the same grounds. But what are those grounds? Can the comparative approach accommodate such a change without losing its informative nature? While chimpanzees have been regarded as unable to produce human-like speech, elephants have been celebrated as able to do that on multiple occasions. Elephants have been recorded imitating their trainer's voice and truck sounds from more than 3 kilometers away. These findings are usually used to point out that the subject species can process and produce sophisticated sounds.

The issue in these findings is that if we were to treat such a finding as a comparative one and put both animals and humans on the same grounds, we would be led to the interpretation that elephants are much more capable than humans at speech since humans cannot imitate elephant sounds in a way that elephants can understand. Even if we were to test it and humans were found to

[11] Prat, "Animals Have No Language, and Humans Are Animals Too," 890.

be capable of being trained to imitate animal sounds to the point of communicating with animals (like some trained African Grey parrots can with humans), such a finding would likely be trivially interpreted as a function of plasticity or physiology rather than cognition. These findings are likely to be interpreted as cases of imitation or human-style cognition as opposed to species-specific cognition. All these behavioral studies can be very useful. However, their utility is not robust in helping us understand the animal's own cognition according to the general standard of ethological practices.

While it is widely accepted that there are human-animal continuities and that humans do not have a monopoly on cognitive skills, we are still operating in the old paradigm. For instance, if we understand cognition to be whatever is closest to humans (as human categories of cognition), then humans are always going to be more cognitively competent. This is an important point made earlier on the effect of false or misplaced tacit assumptions on building hypotheses and following them with appropriate experimental design. These assumptions are not stated but instead shown and seen through the methodology followed. The crucial issue in this assumption is that it is simply circular. But where does it come from? I argue that it comes from another assumption.

The target assumption that is hindering scientific progress in animal studies is the assumption that cognition is *a cluster of skills that all develop and evolve together.* It is often taken for granted that cognition is a set of deeply connected skills. In a recent paper titled "Old and New Approaches to Animal Cognition: There is Not 'One Cognition,'" Brauer et al. (2020) criticize the assumption that cognition is more unified than it really is. Such studies assume that the traits forming animal intelligence develop and evolve together. Brauer cites abundant contemporary evidence showing that cognitive traits are both (1) discordant and (2) determined by the environmental pressures of an animal's niche. The standard approach for animal studies has been the comparative approach,

comparing two or more species. Brauer argues for a biocentric approach in cognitive animal studies, which studies animal traits in terms of the animal's problems.

Cognitive Traits are Discordant

For this section, I review Brauer's thesis that cognitive traits are discordant and that viewing them as unified has affected the way that we study cognition in animals. I will argue that the notion of cognition used by researchers is based on human cognition and negates the animal's ethological experience. Contemporary research tends to couple various strands of intelligence into a single unified phenomenon, but this practice is contrary to much of the available evidence. I intend to demonstrate that current evidence supports the discordant thesis. It is widely assumed that cognitive traits come in a cluster of skills that develop and evolve together, such as tool use and language.[12] The view that cognitive traits are linked originates from "general intelligence" hypotheses, such as the Social Intelligence Hypothesis [13] or the Domestication Hypothesis. [14] General intelligence

[12] Pérez-Barbería, F. Javier, Susanne Shultz, and Robin I. M. Dunbar. "EVIDENCE FOR COEVOLUTION OF SOCIALITY AND RELATIVE BRAIN SIZE IN THREE ORDERS OF MAMMALS." *Evolution* 61, no. 12 (October 3, 2007): 2811–21.

[13] "The Social Intelligence Hypothesis—also termed the Machiavellian Intelligence Hypothesis or Social Brain Hypothesis (Dunbar and Shultz 2007; Humphrey 1976; Jolly 1966; Byrne and Whiten 1988)—seeks to explain the origins of primate intelligence in their sociality. It predicts that natural selection favored those individuals living in complex social environments, such as fission–fusion societies, for their ability to deal with the frequent unpredictable situations that occur in social interactions in such societies. Thus, intelligence is triggered by the demands and complexity of sociality"(Brauer, 2020).

[14] "The Domestication Hypothesis (Hare and Tomasello 2005; Hare et al. 2012) proposes that selection for reduced aggression in some species, such as in domesticated species like dogs, but also in wild bonobos (Pan paniscus), caused

hypotheses are non-exclusive and inexhaustive, but they all make the following assumption: in humans, social intelligence, problem-solving skills, memory, wisdom, empathy, etc. are *a priori-linked,* therefore, they must evolve together. This view of cognition contradicts abundant contemporary evidence that shows that cognitive traits (e.g. spatial and symbolic intelligence) are, in fact, discordant.

Brauer's central thesis is supported by examples of animals excelling (and often outperforming humans) in certain cognitive traits but performing poorly in others, showing the discordant nature of cognitive traits. For example, crows were shown to perform poorly in problem-solving and connectivity perception tasks compared to other animals with less advanced tool-making skills. Pigeons and rats have been studied to perform better at rule-based and information integration category-learning tasks than humans, such as the Monty Hall problem. Squirrels and some bird species are also well-studied for their highly advanced memory which cannot be matched by humans. Moreover, chimpanzees were shown to acquire cognitive abilities previously thought to be unique to humans, such as understanding false beliefs, high-level object permanence, etc. Some of these traits were found to be shared by elephants, and some others were observed in dolphins.

Discrete vs. Generalized Traits

The controversy of whether cognition is unified or discordant is over the relationship between traits. Another point in need of discussion is what defines a trait. This question defines what we mean by "cluster of skills" and "cognitive traits." We postulate that there are *discrete* and

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a set of cognitive changes, including increases in levels of social tolerance, sensitivity to social cues, cooperation, risk aversion, occurrence of juvenile behaviors, and reduction of spatial memory"(Brauer, 2020).

compound traits. Discrete traits are those we can easily test for comparatively by defining them in a standardized way. Certain efforts have been made to combine different animal traits into an ontology to allow for better comparison, analysis, etc.[15] [16] For example, visual acuity is measurable by a number of physiological markers, and it can be tested comparatively by (1) defining concretely and (2) comparing across species based on the definition. However, if we look more closely, we find that some traits are made up of *compound* concepts. *Compound* traits are made up of clusters of different traits and concepts that make up a facet of behavior. For example, the trait of tool use is a combination of visual processing, working memory, problem-solving (itself a compound cluster of traits), cognitive plasticity, and relevant physiological traits such as thumbs. Each trait has its own legitimate role that fills a niche in the environment. Compound traits are useful for research because they allow us to make specific claims about an animal's behavioral capabilities based on their genetic makeup. Likewise, discrete traits are a legitimate and convenient way of talking about and sorting evidence. It is easy to define discrete traits as they lend themselves to cross-species comparisons. Compound traits are much harder to deal with in that regard. These two concepts can be easily conflated if we are not careful. For the purposes of this paper, we postulate that intelligence is a *compound* cluster of many traits. We still use the word "intelligence" because it is still useful, but we need to recognize that it is made up of different *discrete* traits. Concepts such as this one are useful

[15] L. M. Hughes,, J. Bao, Z-L. Hu, V. Honavar, and J. M. Reecy, "Animal trait ontology: The importance and usefulness of a unified trait vocabulary for animal species," *Journal of Animal Science* 86, no. 6 (2008): 1485-1491.

[16] Thiago Gonçalves-Souza, Beatriz Milz, Nathan J. Sanders, Peter B. Reich, Brian Maitner, Leonardo S. Chaves, Gabriel X. Boldorini et al, "ZooTraits: An R shiny app for exploring animal trait data for ecological and evolutionary research," *Ecology and Evolution* 14, no. 5 (2024).

but can be misleading. They are misleading because *we* create these compound concepts. These compound concepts arise from our (human) experience.

Discrete traits are easily identifiable in a comparative analysis. Compound traits require a higher order of classifications and risks human categorization.

Discrete traits are not controversial in comparative studies. For a compound trait found in humans (such as the use of symbolic language), we find it difficult to test it comparatively in animals because we define the compound trait by using humans as the assumed model. Analogous compound traits might not have the same properties, especially as they relate to the organism's environment. We run into the problems of circularity mentioned above. For a compound trait in animals and not in humans, we run into the issue of translatability of evidence. What we refer to here are those traits that define a species' realm of function based on their general physiological abilities and the requirements of their niche. In this, we find that there is a very real difference between a comparative and a biocentric approach in conducting a study.[17]

If animal skills are composed of discordant traits as the evidence indicates, this is how it would look. If we look at a list of traits and regard their prevalence in animal species, we find that humans have a certain combination of them. Let us call these traits 1, 2, 3, and 4. These are *discrete* traits defined and easily comparable across species. Let us say that the literature finds evidence that chimpanzees have at least 1, 2, and 3. This shows that humans have a trait that chimpanzees do not have, namely 4. However, if we regard the literature on naked mole rats, for example, we might find

[17] Here, I assume that a comparative and a biocentric approach are mutually exclusive. This is an inaccurate assumption, but the point I am trying to make is that we can abandon the comparative approach in lieu of a solely biocentric one.

that they have traits 1 and 4. While they do not have 2 or 3, they have a trait that is unique to humans in comparison to chimpanzees. We can multiply the number of traits by thousands. Many discrete traits have analogs in many animal species, but a species is roughly defined by the unique combination of traits that the highest portion of the population shares. This combination of traits largely evolved through the trait/niche relationship. This is in line with Darwinian thinking. In fact, this is not a controversial claim, since we define *discrete* traits as placed on a spectrum of traits across evolutionary history and discovered in terms of their utility to the individual i.e., the trait's relationship to the environment. For example, the octopus' ability to camouflage can hardly be explained without describing the environment which allows and requires the phenotype first. A camouflaging behavior seen in a vacuum has very little meaning to a researcher as they would have the regard the niche in their analysis.

With discrete cognitive traits that we define as unique to humans, we often find that uniqueness does not apply to the entire species, but rather only to some humans. It is important to note that the traits I use for this example are *discrete* traits put under the same standard with the underlying assumption that they are highly comparable. If someone believes in human-animal continuity, then they must believe in some form of trait continuity. These don't have to be high-level traits, like navigating streaming websites, but can be lower-level traits such as identifying an object, which navigating streaming websites consists of. Biologists accept this premise, but they often fail to distinguish between discrete and compound traits. This is especially true for cognitive traits. But how do cognitive traits fit in the picture of discrete versus compound traits?

Cognitive Traits May Be Incommensurable

Some animal traits cannot be compared with human traits in a way that preserves the animal's inner life. Humans do not have a variation of all animal traits, therefore humans are not sufficient to be the standard off of which comparative research is conducted.[18] Some traits can be productively defined on the same grounds and thus are comparable. For instance, some physical traits lie on the same spectrum, such as visual acuity and wavelength discrimination. There are bees that detect ultraviolet light and snakes that detect infrared light. These traits are measurable and commensurable. But we cannot assume that all traits are commensurable. This is especially true for cognition. Cognition is not as precisely preserved in those parameters. Instead, it is composed of concepts and categories that can rightly be described as "human." It's widely understood that the categories of memory and intelligence include widely disparate cases in humans but are often standardized into very narrow terms in animal research. Categories such as memory and intelligence are useful at a certain level but falter when applied to the inner lives of nonhuman animals. While discrete traits have clear physical parameters, cognition (which is composed of compound traits) does not yet have such easily definable traits. In short, when we compare the memory of a squirrel and that of a human, it's not clear we are talking about the same thing at all.

If we go back to our analogy, we assume that cognitive trait 1 – existent in both humans and chimpanzees – is comparable across the two species. Let's assume that trait 1 is Piaget's stage 5 object permanence. We have found that chimpanzees can pass stage 5 of object permanence as well as humans aged five or older. This is a discrete and isolated cognitive trait that is comparable across both species and therefore testable; some animal species do not have such a trait. However, it is not

[18] Thomas Nagel. "What Is It Like to Be a Bat?" *The Philosophical Review* 83, no. 4 (October 1, 1974): 435.

controversial to say that there are some traits that certain animal species do not share with humans. We introduce trait 5 which is prevalent in whales but not in humans, e.g. sonar.[19] Since this trait is unique to one species but not the other, it is *incommensurable,*[20] meaning that we find ourselves unable to *productively* compare the two species in terms of the trait's acuity or internal properties. The comparative method here is only productive in that it shows one species has it and the other does not. To examine this trait more closely, we must look at the relationship between the animal and its environment. This is the biocentric ecological approach. This model works for physiological traits. I argue that the application of the biocentric approach is especially important for cognitive traits. That is because, for most cognitive traits, we apply physiological traits to the animal's niche, likely running into an incommensurable trait that we cannot discuss without having a human concept of the trait. Object permanence works for comparison, but memory between humans and squirrels likely does not. There are some cognitive traits that are *discrete* and *comparable*, such as object permanence, but many cognitive traits are not *discrete*, but so far *compound* and rely on human concepts. While we can show that squirrels have a "better" memory than humans when it comes to collecting food; the fact that humans are so much better at recognizing symbols suggests that there is more to it than what the comparative approach can tell us. Our questions thus become how is it that dolphins are able to incorporate syntax within their communications and how does it arise? What

[19] While humans do have sonar machines, it is different from whale sonar in that in the case of whale, they can see inside the objects. Their perception can see inside of objects[]. Their experience is thus very different from that of humans. That is precisely what I mean by incommensurable. It's a modally different sensory experience. This reiterates on a point mentioned in the previous page, namely that abstract concepts are only useful on a certain level.

[20] There is an argument here to be made on whether we can speak on the cognitive faculties that arise from this discrete physiological trait, but the point still stands that it is a trait that paints the cognitive world of the species in a completely different light.

are the limitations of that? What do those limitations tell us about the way in which dolphins develop syntax? If we find some form of answers to those questions, they will likely be removed enough from human language that the comparison is rendered obsolete.

This leads us to a different but highly related point and that is the translatability of evidence. Is it translatable at all? In the metaphysical sense, no. But that does not matter since the same point applies to humans, making the distinction uninformative. The assumption that evidence can at least sometimes be translatable may be metaphysically unsupported, but its utility can be seen in the roots of all humanities and psychological sciences. The problem with the translatability of evidence is simple: humans can talk, and nonhuman animals cannot. Humans have ready access to each other's inner life through symbolic language.[21] Therefore, we can neither have a clear understanding of their inner representations nor have clearly comparable evidence between animal traits and human traits.[22] This limits our body of evidence of cognitive abilities to an animal's behavior towards its environment. For example, while we can easily ask a human if they have a metamemory, we have had to construct elaborate and often convoluted experiments to test for in animals. The biocentric approach does away with the translatability issue by regarding an animal's environment as the main anchor, but it has its own setbacks, namely being less divisive and harder to derive precise and strong conclusions - too inclusive and thus inconclusive.

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[21] This claim is debatable among many philosophers, but for this instance I assume that we have *some* form understanding of what's going on in other people's heads by speaking with them.

[22] Lawrence Weiskrantz, "Roots of blindsight," *Progress in brain research* 144 (2004): 227-241.

Biocentrism, Anthropomorphism, and the Comparative Approach

In prior work on animal cognition, there are the comparative and the biocentric approaches. By definition, the comparative approach cannot but set humans as the anchor. The biocentric approach sets the niche as the anchor.

The comparative approach can pinpoint similarities and differences between human and nonhuman animals, and from there draw inferences about the evolution of human behavior and cognition. Our categories of intelligence have been to compare humans with nonhuman animals, two categories as such.[23] This is the foundation behind an important tacit assumption that underlies some comparative literature comparing human and nonhuman animal intelligence. What these studies are actually doing is studying animal cognition based on its human categories in a controlled human environment. This necessarily results in evidence for animals being less competent in that human environment. But again, the source of such a methodology is the tacit assumption that traits are clustered, which informs a hypothesis that is actually anthropomorphic; a study that applies animal faculties to human categories. With the evidence that cognitive traits are discordant, that framework changes from comparing humans and nonhuman animals as two categories to having humans inhabit one point on a vast spectrum on which species exists. There is enough variation between animal species that the original categorization framework cannot hold.[24]

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[23] This too is rooted in the assumption that cognitive traits are clustered together.

[24] Perhaps controversially, one can see the similarity between this line of thought and race and gender theory: the definition of "animal" functions to affirm the concept "human" by othering it. The rest is just a symptom of this underlying belief that tends to reinforce itself whenever it is tested. Seeing this analogy on such a well-studied and mature topic appeal to the behaviorist and the dualist; let's assume there is no actual difference between humans and

The implicit assumption that cognitive traits are non-discordant is really an example of the persisting anthropomorphism in animal studies. A commonly acknowledged error is for an animal researcher to anthropomorphize their model organism i.e., assigning human emotion and desire to animals when there is no evidence of such traits. If there is no evidence for a trait, one should not assume the existence of that trait. However, we often use general human categories to describe animal faculties, and that is unavoidable. The error arises when we use these categories to derive specific claims on animals' inner lives. The implicit assumption that traits are discordant leads to an assumption that animals are fundamentally incapable of thought, which in turn springs the (albeit valid) "rule" that one should not anthropomorphize animals. This is a rule for scientific methodology that springs from a simple deduction from Morgan's Canon. However, considering there is such a gap in what we can know about the mental life of animals compared to humans on account of language, I argue that this rule does not hold. I argue that one should "deanthropomophize" humans. That is, one should identify the obvious limitations in the methodology of animal cognition. For example, one should regard the fact that if we are to set out studying humans in the habitat of alpaca and ignore any sign of symbolic language they might use, we would be just as inept in extracting any form of mental representations out of them as their nonhuman counterparts. Thus, to assume that animals do not have mental representations due to lack of evidence of such representations is to contradict the principles of the scientific method, not the other way around.

There is confusion about the continuity, or common origin, between animals and humans. Historically, pre-Darwin, the emphasis was on the *dis*continuity between animals and humans. Post-

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animals, without bringing humans down to animal conception, and see how the conversation goes from there. This is not necessarily an argument for abolishing meat eating, let's try to focus on theory of mind for this one.

Darwin the emphasis shifted to continuity between animals and humans. But that continuity came in a certain form, and that is we projected human traits on animals. The correction is not to be human-centered. Each species has its own problems and therefore has its own standard. Though humans and animals share a continuum or common origin, it does not follow that human categories are appropriate for all animals. A more revealing model would be to take any species, e.g. elephants, and imagine elephant biologists constructing an elephant account of all biology. That model can be multiplied across the animal world, giving us a more biocentric and less anthropocentric account. Our original assumptions simply lead to a narrow and unproductive methodology that stands to only affirm themselves by leading to an anthropocentric methodology.

Anthropocentrism as an approach tends to study how a nonhuman animal performs in cognitive tasks while ignoring the biological context of the behaviors. Instead, experiments are conducted in a "synthetic" environment where an animal is tested for a cognitive trait in a human environment with a human conception of the trait.[25] Such experiments risk serving to only support the prior hypothesis that humans are more intelligent than animals. If the definition of intelligence is anthropocentric, then any study of intelligence will be only reinforcing itself, concluding that nonhuman animals are less intelligent than humans since their capacities and capabilities have evolved to serve their own respective niches rather than those of humans.

In the already cited paper, Brauer *et al.* (2020) propose a biocentric approach to understanding animal cognition through its own environment. In this approach, animals are studied based on their own perceptual modalities and niches. The biocentric approach in comparative research can be a more productive approach as it can more accurately identify the cognitive abilities

[25] E.g., if I test a squirrel's memory by seeing how many sets of numbers it can recognize on a screen.

in non-human animals, how they arise, and their function in the animals' respective environments. This approach would be able to draw a more accurate depiction of non-human animal cognition since it studies each cognitive ability separately and in its relation to the evolutionary history of the individual animal.

Conclusion

It's widely accepted that we shouldn't anthropomorphize. We divide the world into animals and humans, but if cognition is discordant, then this is the wrong way of looking at it. In spite of the main scientific community criticizing anthropomorphism, it is still in practice. It is very hard to actually get rid of these ideas, they are tacit assumptions on which our hypotheses are found. If we assume cognition is not discordant, it's easy to assume that there are animals and humans, but now we can say that it's different. Animals are complex in their own ways and cognition is complicated in their own environment.

My claims are in line with traditional Darwinian thinking but can be expanded upon to include a theory of the potential mental life of non-human animals. Such a theory is in line with Ruth Millikan's research, especially with her definition of proper functions and the way biological history can construct the affordant world of an animal. Allen is calling for a new theory of behavior that can include all the discrepancies in cognitive traits across the animal kingdoms and the holes in the very definition. And finally, Merleau-Ponty introduced a theory of subjective reality centered around the world, identifying a person as a thing in the world. This theory is in line with all my claims and further introduces a very good way to lead a productive conversation into what consciousness means and what considers having consciousness, a conversation based on biology and contemporary science.

Animal experimentalists and theorists alike have struggled to find a way to unite human cognition and animal cognition under one theory of mind consistent with the Darwinian trait continuity hypothesis. Although scholars have come a long way to understand the underlying mechanisms of animal behavior in terms of their own cognition, and human behavior in terms of our own minds, the two have struggled to find a bridge that can explain humans as animals and vice versa. Is that because animals and humans are essentially different? Is it because humans are too "smart" to be compared to animals? How does the way we conduct our study of cognition influence our understanding of it?

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