

Anthropomorphism's Role in Fostering Empathy for Wildlife and Advancing Conservation

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Purpose: This report was created by Woodland Park Zoo's Advancing Empathy Initiative staff as a resource for the Advancing Conservation through Empathy for Wildlife (ACE for Wildlife) Network to explore the role of anthropomorphism and perceptions of animals in motivating conservation action and to help clarify how its use factors into fostering empathy for wildlife.

Introduction

Empathy is a powerful emotion that relies on the ability to perceive, understand, and care about the experiences or perspectives of another person or animal.¹ Feelings of empathy can drive conservation behavior by prompting people to connect their concern for the well-being of individual animals to the importance of preserving healthy environments for species to thrive.² In addition to building scientific knowledge into interpretation about animals' natural history, the ACE for Wildlife Network advocates for imparting a cohesive and relatable story about zoo animals' daily lives, behaviors, and preferences.

Several effective interpretive practices have been identified that aim to foster empathy for animals, including framing conversations about animals as unique individuals and encouraging guests to consider their perspectives.³ Studies have repeatedly shown that though sharing information about challenges animals face in the wild is important, it is insufficient to inspire behavior change.⁴ One interesting discovery from work within the Network has been the effectiveness of the careful use of anthropomorphism in zoo and aquarium narratives. Since this may be a dramatic shift in practice and raise concerns for some people in the field, we analyzed existing research to understand the purpose and potential impact of using techniques considered to be anthropomorphic in engaging with audiences.

Research has shown that the strategic and science-based use of anthropomorphism:

- Increases connectedness with the being that is anthropomorphized;⁵
- Is closely related to developing empathy for that being;⁶
- Changes perceptions of that being in a positive way;⁷ and
- Increases a willingness to act on that being's behalf.⁸

Concerns about the use of anthropomorphism when talking about wildlife surface regularly as zoos and aquariums begin to incorporate empathy for wildlife into trainings and programs. We felt it was important to consider the following questions to address these concerns:

- What type of anthropomorphism are we encouraging?
- If anthropomorphism is controversial, why use it and when?
- What is the relationship between anthropomorphism and empathy?
- What value, if any, is there in using anthropomorphism in promoting our conservation missions?

To explore these questions, we investigated the anthropomorphism literature locating about 100 articles, books, and conference proceedings. We started with key word searches in Google Scholar on “anthropomorphism + conservation,” “critical anthropomorphism,” and “anthropomorphism + animals,” then identified other citations from those initial articles until reaching a saturation point on cross-referencing and content.

In the following sections, we share the relevant research on our areas of questions.

Anthropomorphism Overview

What type of anthropomorphism are we encouraging?

Anthropomorphism is defined as the attribution of human characteristics to nonhumans, particularly those “believed to be uniquely or typically human.”⁹ When a characteristic applies to other species, such as having two legs, it is not anthropomorphic to note that. Research has demonstrated that people engage in anthropomorphism more commonly when there is a perception of shared features in animals like: pro-social behavior, intelligence, and ability to suffer.¹⁰

Traditionally, the use of anthropomorphism in the biological sciences, including within the zoo and aquarium field, has been deemed unscientific. Yet, anthropomorphism is something humans engage in naturally, especially when they see animals.¹¹ Where concerns arise is when someone overestimates commonalities in their use of anthropomorphism, which is known as uninformed anthropomorphism.¹² This happens when people assume their own feelings and perspectives about a situation equate to those of the animal. Making inferences about the unknown by connecting new, unfamiliar experiences or observations with known and familiar concepts is how humans make sense of the world and experiences.¹³ Misattributing human senses and feelings to animals, however, “reflects more on human sensibilities than a real understanding of the state the animal may be experiencing.”¹⁴ For example, if a guest were to say, “Look at how that gorilla is staring at me, we are totally connecting!”, they are assuming that sustained eye contact behavior has the same positive meaning for a gorilla as it does for humans, rather than exhibiting a sign of threat.

Rather than encouraging guests to generalize their own experience to animals, we suggest guiding guests’ natural inclination to attribute human characteristics to nonhumans into the more productive space of critical anthropomorphism. This type of anthropomorphism uses familiar and approachable language to interpret phenomena when they are:

- Backed by scientific findings and
- It is productive to simplify complicated behaviors into more understandable terms.¹⁵

Use of critical anthropomorphism should highlight characteristics a species already possesses, giving animals “just enough recognizable human characteristics to make it a credible and positive social actor.”¹⁶ For example, instead of saying, “One way wolves communicate is through the depositing and smelling of urine markings,” you could say, “Pee is like wolves’ social media. They can ‘check into a location’ so other wolves know who has been there, how long ago and with whom, find a date, and inform other wolves about their recent goings-on.” This simplified language communicates the biological behavior of wolves in a way that is more accessible and likely more memorable to guests.

Importance of Anthropomorphism

If anthropomorphism is controversial, why use it and when?

As animal neurobiology and behavior research is a constantly evolving field, we are learning more about the depth of emotions and traits other animals have all the time. Advances have demonstrated that there are traits and behaviors shared across species that were previously thought to be unique to humans. For example, elephants and orcas mourn the death of family members,¹⁷ chickens understand object permanence,¹⁸ and bees play.¹⁹ Research demonstrates that by highlighting similarities, we can further empathize and connect with animals.²⁰

While we cannot always know what an animal is capable of, “absence of evidence is not the same as evidence of absence.”²¹ Naturally, we should seek to avoid overestimating an animal’s characteristics, but we should seek to avoid underestimating them as well. The absolute dismissal of using any form of anthropomorphism is perhaps more problematic as it further distances humans from the natural world. This devaluation can lead to anthropocentrism, which views “humanity as not only separate from, but also superior to, other species.”²² This sort of worldview can undermine our connection to wildlife and nature, which is the opposite of what we are seeking to do.

Perhaps the most important implication of anthropomorphism is that perceiving an agent to be human renders it worthy of care and consideration.²³ Since humans have a natural tendency to anthropomorphize, critical anthropomorphism can help establish ground rules to this practice.²⁴ By using critical anthropomorphism to develop research questions about animal traits, studies can “result in publicly verifiable data that move our understanding of behavior forward.”²⁵

Since humans tend to anthropomorphize animals more often that look and behave human-like, it is important to counter misconceptions that might lead to misplaced empathy with those types of animals. For example, coprophagy, or eating of feces, occurs in gorillas in the wild and in human care. You could explain that it is not necessarily a sign of distress (as it would be if a human were to do so), but that gorillas do not have very efficient digestive systems for a high fiber diet. While humans may take a probiotic or eat yogurt, sometimes gorillas eat their food a second time to complete digestion and keep healthy bacteria in the digestive system. Pointing out this contrast to human behavior can help audiences to understand gorilla behavior and dispel concerns when they are not warranted.

Meanwhile, with animals less like humans in appearance or behavior, highlighting similarities through critical anthropomorphism can help stimulate accurate empathy for animals typically feared or disliked. For instance, “Artie the cockroach really likes to eat fruit more than veggies – which do you prefer? Right now, he looks like he is really enjoying that apple. Is he a messy eater? Do you make a mess when you eat?” By pointing out similarities, you can help overcome some of the objectification or gross factor. When audiences learn about how animals behave and what they are capable of thinking and feeling, they are more likely to develop accurate empathy for these animals.

The next two sections will delve more deeply into the vital role that critical anthropomorphism can play in increasing connectedness with the being that is anthropomorphized, fostering empathy, and ultimately encouraging pro-environmental behaviors.

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Anthropomorphism and Empathy

What is the relationship between anthropomorphism and empathy?

There is debate surrounding the nature of the relationship between anthropomorphism and empathy, but the research points to a strong correlation.²⁶ Some researchers posit that empathy is an outcome of anthropomorphism.²⁷ “Others described empathy as the core or driving force of anthropomorphism.²⁸ “Given these different views it is possible that the anthropomorphism-empathy with animals link should be regarded as bidirectional” until further research establishes otherwise.²⁹

As introduced in the overview section, we would argue that uninformed anthropomorphism (when a person assumes that an animal would feel the same as we do about a situation) does not necessarily stem from or lead to empathy, because it is not based on an informed understanding of who the animal is. It is related to misplaced empathy, “where there is little understanding of the other’s experience, and we simply project our own feelings onto the other. Misplaced empathy is likely to lead to inappropriate attitudes and behavior that can do the other more harm than good. It seems to be the source of the objection to anthropomorphism.”³⁰ Misplaced empathy is not truly empathy, for it lacks the core of

Without acknowledging [animals] are unique and have minds, we can’t truly empathize, and without empathy, we don’t care enough to help them.

taking another’s perspective. For example, expressing the sentiment, “That jaguar must be lonely as he has no friends around,” because a human might feel that way, disregards the fact that jaguars are solitary animals and would experience stress if they had to share a living space.

When critical anthropomorphism is utilized to convey a science-based understanding of an animal’s natural history and behaviors instead, one can promote accurate empathy based on a more informed understanding of the nature of the other. “Such understanding depends upon careful observation, and can be validated to some extent by how well we are able to predict subsequent behavior. Accurate empathy is much more likely to motivate attitudes and behaviors that benefit the other, and to guard against objectification in the case of animals.”³¹ Whether the relationship is causal, correlational, or bidirectional, research demonstrates that empathy and anthropomorphism go hand in hand. “Without acknowledging [animals] are unique and have minds, we can’t truly empathize, and without empathy, we don’t care enough to help them.”³²

Anthropomorphism and Conservation

What value, if any, is there in using anthropomorphism in promoting our conservation missions?

The use of critical anthropomorphism not only makes for compelling narratives about zoo animals, but, perhaps more importantly, there is also consistent evidence that its use can play a role in promoting pro-environmental and conservation behaviors. Recognition of similarities between animals and humans, both cognitively and physically, can increase the perceived importance of threatened species, which in turn can lead to interest in protecting those species and their ecosystems even if sacrifices are needed.³³ In the following studies of the use of anthropomorphism, drawing attention to the animals’ cognitive abilities (i.e., belief in animal mind), physical similarities to humans (i.e., face, arms, legs) and utility (i.e., benefits of an animal to humans) were impactful. “If the public recognizes these similarities, they may act

more responsibly...It is much harder to ignore and harm sentient, likeable organisms with human characteristics than mindless creatures with alien features.”³⁴

Belief in Animal Mind

Belief in animal mind (BAM), which describes the attribution of characteristics such as intention, consciousness, thought, and intelligence to animals, has been tested extensively and seems to play a significant role in fostering empathy and moving people toward conservation action.³⁵ In a comprehensive review of research around this question, 25 studies (seven experimental, 18 correlational) were systematically analyzed to investigate whether there was a significant association between anthropomorphism and pro-environmental behaviors.³⁶ Authors also appraised the findings based on the quality of the studies conducted (good/fair/poor). Evidence from high quality studies found that mind attribution to animals or nature was associated consistently with pro-environmental variables.³⁷ We recommend reading the complete article for specifics, but the review concludes, “There is relatively good evidence that anthropomorphism increases connectedness to nature and that this in turn increases other pro-environmental attitudes and behaviours.”³⁸

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The following studies provide some examples of the importance of BAM in promoting conservation behaviors. Kim-Pong Tam conducted experiments with undergraduate students from Hong Kong and Singapore which found “anthropomorphism of nonhuman animals was correlated with environmental movement support.”³⁹ In a second article about different aspects of this same dataset, Tam et al. asked respondents the extent to which nature has “a mind of its own, free will, consciousness, intentions, and emotional experience.”⁴⁰ The research “...shows that in general anthropomorphism of nature fosters conservation behavior. Moreover, when nature is anthropomorphized, people feel more connected to it; this sense of connectedness mediates the association between anthropomorphism of nature and conservation behavior. These findings contribute to the understanding of anthropomorphism and that of human–nature relationship.”⁴¹

Further studies on individuals residing in the US, Great Britain, Romania and Poland support this relationship. Manfredo et al.’s correlational study in the US found that mind attribution to carnivores involved in human-wildlife conflict reduced support for lethal management instead viewing them as part of the larger community, “deserving of rights and caring treatment.”⁴² Knight et al. found a higher BAM was associated with lower British support for animal experimentation and exploitation.⁴³ A correlational study in Romania found significant positive correlations between BAM and more positive attitudes toward animals even when controlling for factors like age, gender, pet ownership, education, residence, empathy to animals, empathic concern, and perspective taking.⁴⁴ Niemyjska et al. found in a study of 300 Polish university students that participants were comfortable eating “mindless” animals.⁴⁵ The study concluded, “Higher levels of animal anthropomorphism predict greater empathic concern for animals, which in turn predicts a greater role for animal harm in the decision about meat consumption and hence reduced meat consumption.”⁴⁶ Complimentary results were found across several studies where participants’ judgements about animals’ mental capacities were correlated with the purpose they serve (i.e., those considered to be raised as food being more associated with mind-denial).⁴⁷

And finally, Hills found that empathy was positively correlated with subjects' belief in mental experiences of animals.⁴⁸ "Cognitive judgments of similarity appear to be associated with feelings of identification and

Mind attribution to carnivores reduced support for lethal management. . . where animals are viewed as part of the larger community, "deserving of rights and caring treatment."

the experience of empathy, and cognitive judgments of dissimilarity appear to be associated with feelings of alienation and the 'deactivation' of the empathic response."⁴⁹ This breadth of findings points to the importance of sharing about zoo animals' cognitive abilities and highlighting similarities to foster accurate

empathy. For example, highlighting similarities between humans and bats in describing how bats are attentive mothers can help overcome the ick factor, turning ewws to awws. "Such an approach offers a way of integrating knowledge with feeling, and capitalizing on the motivational power of feelings."⁵⁰

Physical Similarities

Another area where use of anthropomorphism can be an effective tool is in pointing out physical similarities between humans and animals. Multiple sources have shown that perception of an organism's similarity impacts the level of anthropomorphism and empathy shown for that individual. One study of 104 undergraduates demonstrated, "Participants' perception of an organism's similarity to humans was highly related to their perception that the organism possesses advanced cognitive abilities, including the capacity to infer the intent of others."⁵¹ Another study of 114 participants had similar results, finding that phylogenetic similarity (i.e., evolutionary closeness) to humans "plays a role in people's tendency to anthropomorphize. Our data show that the more distant an animal's phylogenetic position is from humans, the less empathy we report showing for that animal. We found this to be a near-perfect relationship; only about 11% of the variance in empathy for a given animal is not explained by its phylogenetic similarity to people."⁵²

In an analysis of anthropomorphic factors of threatened species and conservation funding allocations in Spain, Martín-Forés et al. found, "...many conservation choices are made on subjective grounds, that is, anthropomorphic factors. Consistent with the conclusions of Metrick and Weitzman, we showed that likeability factors or 'visceral' characteristics, including physical size, relative weight, and relative eye size, as well as whether the animals were higher life forms, play a more important role in setting priorities for vertebrate conservation."⁵³ They also warned that while anthropomorphism could be a tool for conservation, it may skew funding toward more charismatic species rather than those in greatest need. The authors instead recommended:

It is essential to intensify efforts in providing information to the whole society about less cute and charismatic species through adequate environmental education programs. In order to create an environmentally responsible population that contributes to biodiversity conservation, we need to develop programs of environmental education beyond aesthetic appealing that address the ethical and instrumental values of the whole species diversity.⁵⁴

These results reinforce the importance of pointing out a less familiar animal's body parts when not easily identifiable and highlighting similarities when possible.

Animal Utility

While not directly anthropomorphism, a related approach that may also be useful in promoting guest connection with traditionally maligned animals is in describing an animal's utility, or how humans benefit

from an animal's role in nature. Particularly during conflict, another's positive or negative utility for oneself played a stronger role than similarity in determining an animal's value.⁵⁵

In a survey of 649 visitors to Doñana National and Natural Park about their willingness to pay (WTP) for biodiversity conservation, researchers found that phylogenetic similarity (i.e., evolutionary closeness) and utilitarian value factors played a more important role than scientific considerations in both WTP and human attitudes toward species, particularly for those with "lower levels of knowledge and concern towards environmental issues (one day visitors, beach tourists and pilgrims)."⁵⁶ Scientific considerations in prioritizing WTP appeared only with well-informed audiences.⁵⁷ This finding is particularly relevant for zoos and aquariums who tend to be staffed by informed individuals but are visited by those that may lack in-depth knowledge of animal biology and environmental issues.

In terms of conservation, Opatow suggested using utility particularly for:

Unattractive animals (e.g., bats, snakes, and insects) ...describing a species as useful provides a more stable basis for protection than describing it as similar. This finding may be valuable in the conservation of unfamiliar animals, such as invertebrates, whose importance to humanity is great but whose similarity to people is scant. This is especially true for insects. As a group, they have the largest number of endangered species and are important to our well-being, but with the exception of butterflies, their conservation is not a popular cause.⁵⁸

For example, without the biting midge fly, there would be no chocolate as cacao bean pollination is completely dependent on this "pest."⁵⁹ This approach can be helpful in moving zoo visitors' perceptions of animals away from undesirable toward curiosity if not appreciation.

Recommendations for Practice

Critical anthropomorphism combines scientific findings and approachable language to interpret phenomena to deepen our audiences' understanding of animals. As demonstrated in the aforementioned studies, critical anthropomorphism can play a vital role in increasing connectedness with the being that is anthropomorphized, fostering empathy, and ultimately encouraging pro-environmental behaviors. Highlighting commonalities between a maligned animal and a human can help create that perception of similarity to build the connection with that animal "...to be regarded as something worthy of moral consideration."⁶⁰

Therefore, the more we can do to accurately highlight BAM, physical similarities and animal utility, particularly with those animals that do not naturally elicit empathy from humans, the more likely we will be able to encourage audiences to act on their behalf. As this analysis has demonstrated, the use of critical anthropomorphism, based on scientific fact:

- Increases connectedness with the being that is anthropomorphized;⁶¹
- Is closely related to empathy for that being;⁶²
- Changes perceptions of that being in a positive way; ⁶³ and
- Increases a willingness to act on that being's behalf.⁶⁴

Many experts believe we may now be in the midst of the sixth mass extinction, driven primarily by human activity.⁶⁵ At a time when audiences are more disconnected to nature than ever, it is important

to facilitate that connection in whatever ways we can that is scientifically accurate. This is not about telling stories of doom and gloom about the future or about candy coating the lives of our animals. This is about helping audiences to understand what many of us already know – all animals are unique individuals, with preferences and habits worthy of our respect and care. We know that feeling connected to wildlife is a critical motivator for people to take conservation action. By creating a foundation of both science-based understanding and emotional connection, we can encourage both caring and conservation action, furthering the mission of accredited zoos and aquariums around the country.

Appendix A Key Terms

Types of anthropomorphism

anthropomorphism – “the attribution of human characteristics, believed to be uniquely or typically human, to nonhumans, overestimating commonalities.”⁶⁶ Individuals are more likely to utilize anthropomorphism when there is a perception of shared features in the animal like being pro-social, intelligent, and are able to suffer.⁶⁷

critical anthropomorphism – the attribution of human characteristics, believed to be uniquely or typically human, to nonhumans, when scientifically justifiable. Originated in the 1980s by Animal Behaviorist Professor Gordon Burghardt, this term “helps to establish ground rules for dealing with the inevitable anthropomorphic tendencies that we, as sentient human beings, confront in trying to understand the behaviour of other species... [It] involves not only careful replicable observation, but also knowledge of the natural history, ecology, and sensory and neural systems of animals as well.”⁶⁸ Burghardt recommends using critical anthropomorphism “to formulate research agendas that result in publicly verifiable data that move our understanding of behavior forward.”⁶⁹

In the audience engagement arena, we recommend only using anthropomorphism when it is scientifically supported and when it is productive to simplify complicated behaviors in more understandable terms.

uninformed anthropomorphism – what we seek to counter at zoos and aquariums. This occurs when a person assumes that an animal would feel the same as we do about a situation. It reflects more on human perceptions and behavior than a true understanding of what the animal may be experiencing.⁷⁰

Related terms to this study

anthropocentrism – literally, human-centered, but in this context, it is “...seeing humanity as not only separate from, but also superior to, other species.”⁷¹

anthropodenial — Coined by behavioral biologist and professor Franz de Waal, “the a priori rejection of continuity between humans and other animals [that] has led people to systematically underestimate animals.”⁷² Whereas anthropomorphism is accused of overestimating commonalities, this concept highlights the risk of underestimating commonalities.⁷³ de Waal uses this concept to warn against “...a blindness to the humanlike characteristics of other animals, or the animal-like characteristics of ourselves.”⁷⁴

anthropomorphic metaphors – a technique used when applying critical anthropomorphism to a non-scientific audience, a simplification of scientific terminology using human metaphors, but not to be taken literally.⁷⁵ For example, “As a member of Nature’s clean-up crew, turkey vultures are always on the clock. By eating the rotten, and even diseased carrion that other carnivores don’t, vultures help keep the environment clean for everyone.”

belief in animal mind (aka mind attribution or mind perception) – people perceive the minds of others in terms of two broad sets of mental capacities: agency and experience.⁷⁶ “Agency refers to the ability to think, formulate intentions, and choose. Experience involves the ability to sense, feel, and be conscious of one’s environment and experience.”⁷⁷ Belief in animal mind makes anthropomorphism occur more naturally and can impact individual willingness to act on the animal’s behalf (see Anthropomorphism and Conservation Action Section).

emotions versus feelings – emotions are visible (heavy breathing, sweating, crying), the physical sensation Use emotion to talk about the physical experience. Feelings are our perception of those

sensations: “the subjective interpretation of our physical response.”⁷⁸ We start to cry, then we process that cognitively as we feel sad.⁷⁹ These terms are relevant in that we can describe animal emotions since those are visible, but discussing feelings can be more controversial as it can get into anthropomorphic interpretation of why the animal is feeling that way.

empathy – as defined by the ACE for Wildlife Network, a stimulated emotional state that relies on the ability to perceive, understand, and care about the experiences or perspectives of another person or animal.

empathy, accurate – “such understanding depends upon careful observation, and can be validated to some extent by how well we are able to predict subsequent behavior. Accurate empathy is much more likely to motivate attitudes and behaviors that benefit the other, and to guard against objectification in the case of animals.”⁸⁰ This type of empathy is related to critical anthropomorphism and based on knowledge of animal natural history, ecology, and sensory and neural systems of animals.

empathy, misplaced – when someone thinks they are feeling what the animal feels, but it is based on the misattribution of human characteristics to animals, so not accurate.⁸¹

Morgan's canon on anthropomorphism – “dictates that no nonhuman animal behavior may be interpreted at a higher level if it can be explained at a lower level.”⁸² Proposed in 1892 by British zoologist C. Lloyd Morgan as a rule for interpreting animal behavior as evidence of animal minds: “In no case is an animal activity to be interpreted in terms of higher psychological processes if it can be fairly interpreted in terms of processes which stand lower in the scale of psychological evolution and development.”⁸³

phylogenetic similarity to humans – according to research, this plays a role in people’s tendency to anthropomorphize. “The more distant an animal’s phylogenetic position, or evolutionary relationship, is from humans, the less empathy we report showing for that animal.”⁸⁴

Appendix B Recommended Background Readings

While a complete reference list is included below, here are seven sources that were particularly insightful in developing this report.

[Bekoff, M. \(2003\). Minding animals, minding Earth: Old brains, new bottlenecks. *Zygon*, 38\(4\), 911–941.](#)

Explains deep ethology as a different approach to considering the world from animal's perspective, an alternative to anthropomorphism

[Chan, A. A. Y. H. \(2012\). Anthropomorphism as a conservation tool. *Biodiversity and Conservation*, 21, 1889-1892.](#)

Good overview, persuasive argument for anthropomorphism as a conservation tool

[Keeley, B. L. \(2004\). Anthropomorphism, primatomorphism, mammalomorphism: understanding cross-species comparisons. *Biology and Philosophy*, 19, 521-540.](#)

Discussion of human exceptionalism, digging into what anthropomorphism really is and is not.

[Plous, S. \(2003\). Is there such a thing as prejudice toward animals? In S. Plous \(Ed.\), *Understanding prejudice and discrimination* \(pp. 509–528\). McGraw-Hill.](#)

Interesting article about terminology used with animals to desensitize people to animal pain and cognitive abilities.

[Root-Bernstein, M., Douglas, L., Smith, A. & Verissimo, D. \(2013\). Anthropomorphized species as tools for conservation: Utility beyond prosocial, intelligent and suffering species. *Biodiversity and Conservation*, 22, 1577-1589.](#)

Strong review of research on construction of anthropomorphic meaning with both positive and negative effects for humans, animals and conservation. Considered the question "How do we decide what is a human experience?"

[Sheets-Johnstone, M. \(1992\). Taking evolution seriously. *American Philosophical Quarterly*, 29\(4\), 343-352.](#)

Helpful philosophical argument about anthropomorphism

[Williams, M. O., Whitmarsh, L., & Christ, D. M. G. \(2021\). The association between anthropomorphism of nature and pro-environmental variables: A systematic review. *Biological Conservation*, 255, 109022.](#)

Systematic review of 25 studies to address the hypothesis that there is a significant association between anthropomorphism of nature and pro-environmental variables, and that anthropomorphism has a beneficial causal role.

Appendix C: References Cited

Articles completely underlined and in blue include links to the full articles.

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Endnotes

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- ⁴ Bolderdijk et al., 2013; Kollmuss & Agyeman, 2002
- ⁵ Epley et al., 2008; Tam, 2014; Tam et al., 2013; Waytz et al., 2010; Williams et al., 2021
- ⁶ Chan, 2012; Harrison & Hall, 2010; Hill, 1995; Loughnan & Davies, 2020; Marni & Bortolotti, 2006; Niemyjska et al., 2018; Royzman & Kumar, 2001; Urquiza-Haas & Kotrschal, 2015; Waytz et al., 2010
- ⁷ Chan, 2012; Manfredo et al., 2020; Martín-Forés et al., 2013; Niemyjska et al., 2018; Root-Bernstein et al., 2013; Williams et al., 2021
- ⁸ Chan, 2012; Manfredo et al., 2020; Martín-Forés et al., 2013; Niemyjska et al., 2018; Root-Bernstein et al., 2013; Tam, 2014; Tam, 2015; Tam et al., 2013; Williams et al., 2021
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- ¹⁰ Root-Bernstein et al., 2013, p. 1581
- ¹¹ Mitchell et al., 1997
- ¹² Daston & Mitman, 2005
- ¹³ Turner et al., 2023
- ¹⁴ Morton et al., 1990, p. 1
- ¹⁵ Akerman, 2019
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- ²³ Gray et al., 2007, p. 619
- ²⁴ Mitchell et al., 1997
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- ²⁷ Waytz et al., 2010; Chan, 2012; and Tam, 2015
- ²⁸ Rivas & Burghardt, 2002
- ²⁹ Niemyjska, et al., 2018, p. 22

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³¹ Hills, 1995, p. 141
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⁵⁴ Martín-Forés, Martín-López, & Montes, 2013, p. 7
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⁵⁶ Martín-López, Montes, & Benayas, 2007, p. 79
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⁵⁹ McAlister, 2017
⁶⁰ Gebhard, Nevers, & Billmann-Mahecha, 2003, p. 92
⁶¹ Epley et al., 2008; Tam, 2014; Tam et al., 2013; Waytz et al., 2010; Williams et al., 2021
⁶² Chan, 2012; Harrison & Hall, 2010; Hill, 1995; Loughnan & Davies, 2020; Mameli & Bortolotti, 2006; Niemyjska et al., 2018; Royzman & Kumar, 2001; Urquiza-Haas & Kotrschal, 2015; Waytz et al., 2010
⁶³ Chan, 2012; Manfredo et al., 2020; Martín-Forés et al., 2013; Niemyjska et al., 2018; Root-Bernstein et al., 2013; Williams et al., 2021
⁶⁴ Chan, 2012; Manfredo et al., 2020; Martín-Forés et al., 2013; Niemyjska et al., 2018; Root-Bernstein et al., 2013; Tam, 2014; Tam, 2015; Tam et al., 2013; Williams et al., 2021
⁶⁵ Bekoff, 2003; Cowie et al., 2022; Kolbert, 2014

Appendix A Key Terms Endnotes

- ⁶⁶ Daston & Mitman, 2005, p. 8
⁶⁷ Root-Bernstein et al., 2013
⁶⁸ Burghardt, 2004, p. 15
⁶⁹ Burghardt, 1991, p. 86
⁷⁰ Morton et al., 1990
⁷¹ Keeley, 2004, p. 534
⁷² de Waal, 2009, p. 175
⁷³ Daston & Mitman, 2005
⁷⁴ de Waal, 1997, p. 51
⁷⁵ Sealey & Oakley, 2013
⁷⁶ Gray et al., 2007
⁷⁷ Tam, 2015, p. 87
⁷⁸ Milton, 2005, p. 265
⁷⁹ Milton, 2005
⁸⁰ Hills, 1995, p. 141
⁸¹ Hills, 1995
⁸² Sheets-Johnstone, 1992, p. 119
⁸³ Sober, 2005, p. 88
⁸⁴ Harrison & Hall, 2010, p. 44