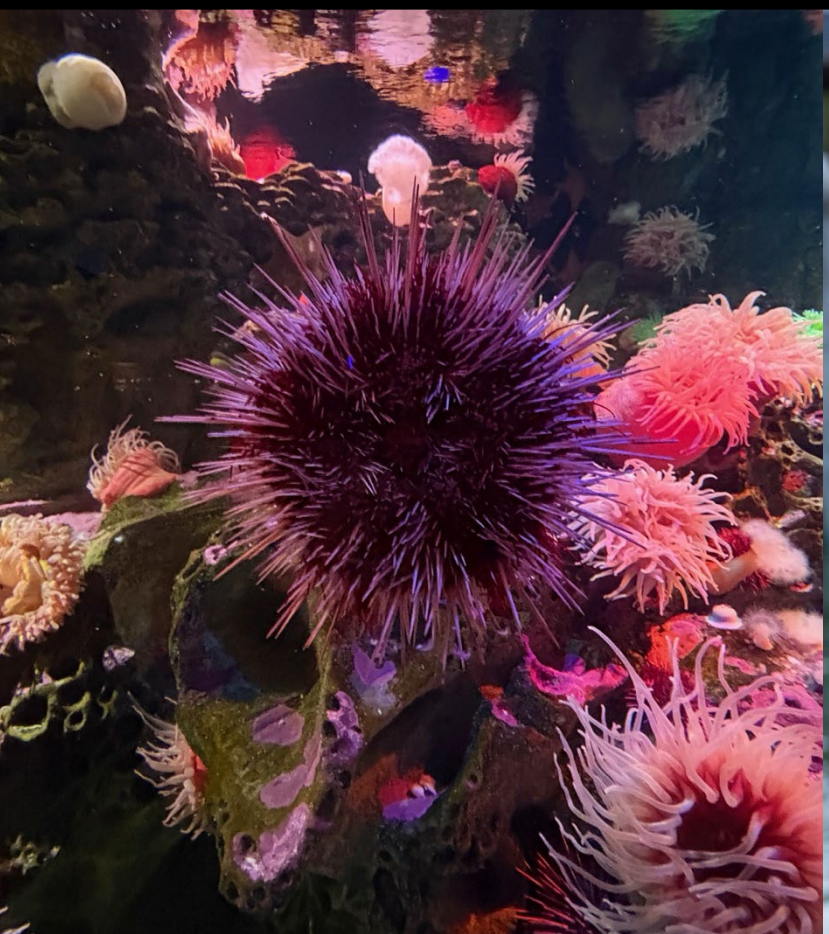
Comparing Empathy for Wildlife Across the Animal Kingdom



Comparing Empathy for Wildlife Across the Animal Kingdom

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Quick Guide: Comparing Empathy for Wildlife Across the Animal Kingdom

People feel different levels of empathy for different animals, and the reasons behind this are complex. While we generally tend to connect more easily with mammals and charismatic species, research shows that strategic programming can help zoo and aquarium visitors develop connections with all wildlife, including insects, reptiles, and other underappreciated animals.

Key Strategies Based on Identified Empathy-Eliciting Characteristics

Research identified five key areas that influence empathy levels for animals. For each underappreciated species, consider which characteristics can be strategically emphasized:

- Movement and Behavioral Characteristics
- Cognitive and Emotional Characteristics
- Physical Characteristics
- Familiarity and Experience
- Safety and Threat Perception

Critical Anthropomorphism: A Strategic Approach

Critical anthropomorphism involves describing animal behaviors in relatable, human terms while maintaining scientific accuracy. This powerful tool helps visitors connect with animals without misrepresenting their biology.

Designing for Awe and Wonder

Emerging research reveals awe as a new frontier in helping develop empathy for conservation action. Awe-inspiring encounters create stronger connections to nature, building empathy, and increasing wildlife-friendly behaviors.

Making It Work in Practice

- **Address the empathy gap**: Recognize that some animals need extra interpretive support and use targeted strategies to help visitors connect with them.
- **Consider your audience**: Tailor programming for different demographics such as urban vs. rural visitors, different age groups, and cultural backgrounds.
- **Train empathetic staff and volunteers**: Look for team members who naturally demonstrate empathy and comfort with less charismatic species and provide training to help all staff build their empathy skills.
- **Use strategic design**: Immersive habitats and staff facilitation work just as well (maybe even better) than technological features for empathy development.
- **Document your success**: Evaluate programs to contribute to the growing understanding of empathy across animal groups.

Every animal has the potential to inspire empathy and conservation action. Success comes from understanding what makes each species relatable and providing visitors with the right support to make those connections.

Part 1: Introduction

Empathy in humans—defined in this report as a person's reactions to the experience of another entity (e.g., a person, an animal, or a plant)[1]—encompasses both cognitive (thinking) and affective (feeling) components that work together to help people connect with the perspectives and emotions of others.[2] While research shows that non-human animals (particularly social species such as bonobos and chimpanzees) are also capable of empathy,[3] this review focuses on empathy experienced by people. For zoo and aquarium professionals, empathy is of interest because our capacity for emotional connection extends beyond people to other living beings and the natural world—we can feel distress at animal suffering, concern for endangered species, and emotional connections to natural places.[4]

Zoo and aquarium professionals are often interested in developing empathy in guests to encourage wildlife caring and conservation behaviors.[5] For a more in-depth discussion of empathy and how it relates to wildlife conservation, please see the first report in this series, entitled, *Building Empathy for Wildlife in Zoos and Aquariums: What We Know About Inspiring Conservation Action and Caring*.[6] In that report, we present compelling evidence that when people feel empathy for wildlife, they are more likely to take conservation action.

The first review also uncovered an intriguing complexity: while conventional wisdom suggests people feel higher levels of empathy for certain animal groups (e.g., mammals), the research showed mixed findings that did not always align with what might be expected. Moreover, zoo and aquarium professionals have observed empathy-related behaviors that often contradict predictions based on species charisma. Charismatic species are animals whose appealing traits inspire people to care about them and want to support their conservation. Yet visitors sometimes express stronger emotional connections to fish, birds, and invertebrates, which are not often thought of as charismatic species. This disconnect between assumptions and reality raises questions for institutions working to foster meaningful human-wildlife connections and provided this review with its guiding question: **How does human empathy for animals vary across different groups of animals and what factors and strategies influence these empathy responses?**

To answer this question, we identified relevant research by searching academic databases, tracking down citations, and asking zoo and aquarium professionals to submit evaluations and unpublished work. We found over 70 studies that investigated how concepts other than empathy vary across different animal groups. For example, research examined differences in the following concepts:

- Attitudes towards animals[7]
- Attributions of cognition and emotions to animals[8]
- Connections to animals[9]
- Emotions expressed for animals[10]
- Perceptions of animals[11]
- Popularity of animals[12]
- Visitor interest in and viewing preferences of wildlife[13]

- Willingness to support animals[14]

For this review, we focused on empathy and identified 12 academic studies that explicitly compared empathy levels across animal groups. Based largely on an in-depth review of 12 academic studies, this guide translates research findings into practical information and strategies for wildlife education and interpretation. We also incorporate what we learned from our review of other relevant studies, evaluations, and unpublished work.

What is in this guide?

- **Part 2** examines the current research landscape that is looking at differential empathy (how people's empathy levels vary across different groups of animals), including analyzing what animal groups researchers study, how empathy is measured across different settings, and key findings.
- **Part 3** explores the factors that influence empathy differences, organizing them into three categories: animal characteristics, personal characteristics of visitors (including demographics and cultural background), and environmental factors (such as exhibit design and staff facilitation). This section also presents established models from psychology and conservation research that address why empathy might vary across species.
- **Part 4** translates research findings into actionable strategies for zoo and aquarium professionals: addressing the empathy gap, considering visitor demographics in program design, using anthropomorphism strategically, and designing for awe and wonder.
- **Part 5** provides a summary of the report and lists possible next steps and directions for research and practice.

This report emphasizes that empathy patterns and bias do exist across different animal species. While these patterns can be difficult to predict, thoughtful interpretation and exhibit design can help visitors develop meaningful connections with all wildlife.

Part 2: Research on Empathy for Wildlife Comparing Different Groups of Animals

There is a lot of research on human-animal relationships that explores how people's attitudes, preferences, emotions, and willingness to support wildlife (among other variables) vary across different groups of animals. However, there is less research focused specifically on how empathy for wildlife differs across distinct groups of animals. Human empathy for wildlife is an emerging research topic, driven largely by research linking empathy with conservation action and pro-environmental behaviors.[15] In our search for relevant research for this guide, we found many references about how empathy is assumed to vary across different animal groups, but we found just 12 studies that explicitly compared empathy levels across different animal groups. This suggests that this topic is a specialized area within empathy-conservation research with lots of room for growth! Of the 12 studies, the earliest was published in 2008, and eight of the 12 studies were published after 2018, further reflecting an emerging and expanding area of research.

In this section, we focus on the 12 studies we uncovered in our search. We discuss the different animal groups that researchers have chosen to study, we talk about where and how researchers are investigating differential empathy, and we conclude the section with an overview of major findings and research gaps. First, however, we present a summary of each of the 12 studies.

Study summaries

See Appendix B for additional details for each study.

- **da Silva et al. (2023)**: Interviewed 667 Brazilian students (ages 9-17) in school settings using self-report empathy scales. Students showed greater empathy for fish, birds, and mammals, with less empathy for reptiles and amphibians, reflecting evolutionary and cultural factors.
- **Grover (2018)**: Surveyed 119 adult zoo visitors in the United States using self-report empathy scales. Surveyed visitors showed slightly higher empathy levels for polar bears compared to jellyfish.
- **Harrison & Hall (2010)**: Conducted an online survey with 114 respondents using self-report empathy scales (no geographic setting specified). Findings indicated increased empathy for animals with greater phylogenetic relatedness to humans.
- **Kansky et al. (2021)**: Surveyed 1,126 farmers in and around conservation areas in Zambia and Namibia using self-report empathy scales. Found differences in empathy levels for different species that varied somewhat by country.
- **Knudson (2019)**: Observed 258 adult aquarium visitors in the United States, measuring empathic behaviors through direct observation. Found empathic behaviors towards charismatic animals were higher than those for non-charismatic marine invertebrates.
- **Miralles et al. (2019)**: Conducted experimental forced-choice tasks with 1,134 European adults online. Reported that people's empathy for a species varied significantly across species, primarily influenced by their phylogenetic distance from humans.

- **Mota Pereira et al. (2023)**: Surveyed 700 Brazilian university students online using self-report empathy scales. Found higher levels of empathy for large, charismatic mammals compared to reptiles, amphibians, and less charismatic species, with species perceived as beautiful and useful receiving greater conservation support than those viewed as ugly or harmful.
- **Phan et al. (2025)**: Conducted experimental studies with 358 Vietnamese university students in lab settings using self-report empathy scales. Found that cute animals and feeling emotionally connected to an animal increased empathy, while being familiar with a species did not make people feel more empathetic.
- **Prguda & Neumann (2014)**: Conducted experimental studies with 69 female Australian university students in lab settings using self-report empathy scales and physiological measures. Found empathy increased according to phylogenetic similarity to humans, with human infants receiving higher empathy ratings than human adults, but adult wild animals receiving higher empathy ratings than their infant counterparts.
- **Swim et al. (2023)**: Conducted experimental empathy selection tasks with 375 adults in the United States in lab settings. Reported greater empathy for animals that people stereotyped as intelligent and friendly versus those seen as unintelligent or threatening, likely because empathizing with certain animals felt cognitively harder, so people avoided the emotional effort.
- **Westbury & Neumann (2008)**: Conducted experimental studies with 106 Australian university students in lab settings using self-report empathy scales and physiological measures. Found that the more phylogenetically similar an animal was to humans, the stronger the empathic response.
- **Westbury Ingham et al. (2015)**: Conducted experimental studies with 86 Australian university students in lab settings using self-report empathy scales. Showed empathy ratings decreased as animal groups became more phylogenetically distant from humans.

What groups of animals are researchers comparing?

Researchers can use a range of categories and frameworks when looking at how empathy varies across different groups in the animal kingdom. The 12 studies used a variety of groupings, including: phylogenetic relatedness to humans, comparison of charismatic species to non-charismatic species, taxonomic classifications, and a four-category system based on perceived competence. The sections below describe the categorizations in more detail and additional information (including the specific animals included in each study) is provided in Appendix B.

Phylogenetic Relatedness to Humans

Phylogenetic relatedness is a scientific term to describe how closely related different species are on the evolutionary tree of life.[16] While modern genetic tools have helped clarify and expand this idea, it is grounded in Charles Darwin's theory that all living things share common ancestors.[17] Phylogenetic relatedness suggests that the more recently two species branched off from the same ancestor, the more related they are. For example, humans and chimpanzees are very closely related because we shared a common ancestor relatively recently (about 6-8 million years ago), while humans and fish are more distantly related because our most recent common ancestor lived hundreds of millions of years ago.[18]

Researchers have used phylogenetic relatedness to examine biological and ecological concepts, such as ecosystem community assembly, species coexistence, and evolution of ecological traits.[19] In conservation psychology and related fields of study, researchers have explored how phylogenetic relatedness impacts people's relationships with animals by investigating its influence on human-wildlife interactions,[20] perceptions of animal cognition,[21] depictions of animals in social media,[22] and conservation preferences and behaviors.[23] In these empathy studies, researchers examine people's intuitive sense of similarity or connection to animals, rather than their explicit knowledge of evolutionary relationships. When someone feels more empathy for a chimpanzee than a fish, this likely stems from perceived behavioral and physical similarities rather than conscious awareness of the scientific concept of phylogenetic relatedness (shared ancestry). Of the 12 studies we found that looked at empathy across different animal groups, five had a major focus on phylogenetic relatedness.[24] Two of these studies occurred in virtual environments (via online surveys) with no geographic location specified.[25] The remaining three studies were conducted in lab settings in Australia.[26]

Charismatic vs. Non-Charismatic Animals

Charismatic species is a term used to describe animals whose attractiveness or charm seems to inspire people to care about that species and support their conservation. These species are typically large, recognizable mammals like pandas, polar bears, wolves, tigers, dolphins, and whales that have aesthetic appeal and cultural significance, though what makes a species "charismatic" is subjective and can vary across different populations and cultures.[27] In conservation campaigns, charismatic species are often used as flagship animals, which are animals used to raise awareness of conservation issues, solicit financial support, and motivate pro-conservation behaviors that benefit other species in that ecosystem.[28] The use of charismatic species can be controversial—supporters argue that charismatic species effectively engage the public but critics argue this approach can create bias that leads to the neglect of less appealing but ecologically crucial species like insects, plants, and invertebrates.[29] Two of the 12 studies compared empathy levels between charismatic and non-charismatic animals, with both studies conducted in zoos or aquariums in the United States.[30]

Various Approaches to Comparing Animal Groups

The remaining five studies used diverse selection strategies that prioritized specific research questions or theoretical frameworks. Two Brazilian studies with students selected species across five vertebrate classes (mammals, birds, reptiles, amphibians, and fish).[31] Their selection criteria prioritized other factors, such as cultural significance, local ecological relevance, human-wildlife interactions, and public appeal, over phylogenetic considerations. An experimental study in the United States organized 16 animal species into categories based on people's stereotypes about each animal's competence (related to their perceived intelligence and skills) and warmth (seen as non-threatening and friendly).[32] In their study of farmers in Zambia and Namibia, researchers focused on five animal species involved in human-wildlife conflicts that pose challenges for farming communities around conservation areas.[33] Finally, an experimental study that took place in a lab in Vietnam compared four endangered species across animal characteristics of cuteness, familiarity, and emotional closeness.[34]

How are researchers comparing empathy for different groups of animals?

The 12 studies used a range of research designs and methods to compare how empathy toward animals varies based on different animal groups. Six of the studies used an experimental design, five studies used descriptive surveys or interviews, and one observational study involved observing zoo and aquarium visitor behavior. There was also variation in how the animals were presented to participants (what researchers call "stimuli", basically, what people looked at or experienced during the study). In two studies,[35] participants actually interacted with live animals at zoos or aquariums in the United States. In seven studies, researchers showed participants photos or images of animals when asking about empathy levels, and in one study, researchers used video clips of animals. In the remaining three studies,[36] researchers simply asked participants about their empathy for specific animals using words only; no live animals or images were shown.

When using images of animals to assess empathy levels, researchers often spend time thinking about how the animals are depicted in the images. For some studies, this was a major focus, and researchers made specific decisions about how to depict animals, often hoping to manipulate images to capture different levels of empathy. For example, in three studies,[37] the animals were shown in distressing situations, which included images of injured, abused, or confined animals. The researchers used distressing images because they believed such images trigger higher levels of empathy, making it easier to compare empathy levels across different animal groups. Additionally, in one of the studies,[38] images were selected to show animals as both babies and adults, to help test the "nurturance hypothesis", the idea that baby animals should receive higher empathy (similar to how human babies do), but their findings showed an opposite pattern for animals. The researchers hypothesized that adult wild animals received higher empathy ratings than infant wild animals because the distressing images made adult animals appear to suffer more visibly and intensely than infants. This contradicted the typical "baby schema" effect seen with images of people in distress, where infants received more empathy than adults. The researchers suggested that when animals are depicted in extreme distress, the severity of apparent suffering might outweigh the natural tendency to empathize more with young, vulnerable creatures.

There was also variation in how researchers measured and documented empathy levels, reflecting ongoing debate about the best way to assess empathy.[39] Zoo and aquarium professionals have observed that existing empathy measurement tools may be better suited for charismatic megafauna, which usually feature human-like characteristics and behaviors, and may not adequately capture visitors' empathy toward less charismatic species, which may have features and behaviors that people find harder to connect with. Researchers investigating knowledge and attitudes about insects, for example, recognize the need for insect-specific measurement scales.[40]

The most common approach across the 12 studies was self-report scales, used in nine studies, though the specific scales varied considerably. Some studies used or adapted existing scales

(e.g., the Balanced Emotional Empathy Scale or the Interpersonal Reactivity Index), while others came up with custom scales to fit their specific research questions and context. Two studies used innovative ways to compare empathy level: one study had people make choices between different animals to see which ones they felt more empathy toward,[41] and another study[42] asked participants to choose whether they wanted to take an empathetic or objective perspective when looking at different animals. In the one observational study,[43] the researcher observed empathic behaviors of aquarium visitors using an existing observational instrument (Empathy Towards Animals: Observational Assessment Framework[44]). Finally, two studies included physiological measures to help track empathy levels.[45] These measures included skin conductance responses (which measure emotional arousal through changes in skin moisture), heart rate changes, and facial muscle activity.

Where are researchers doing this work?

The 12 studies took place in geographic settings across the globe, involving participants from all six inhabited continents, which is important because contextual differences can affect how people relate to and feel empathy for different species.[46] The studies were conducted across multiple countries: three in Australia, three in the United States, two in Brazil, one in Vietnam, and one spanning both Zambia and Namibia. Two studies did not specify geographic location as data were collected online, but in one of these studies, the researchers limited data analysis to respondents of European nationality, in recognition of the role culture can play in determining empathy responses.[47]

In terms of specific study settings, a total of three studies were conducted virtually using online surveys. Five studies took place in research labs, providing a controlled environment but lacking real-world context. For example, one study brought participants into labs where they watched film clips or looked at photos of animals while researchers measured their emotional responses (through surveys) and physical reactions (like changes in skin conductance and heart rate).[48] Two studies collected data in everyday settings in local communities in Brazil, Zambia, and Namibia, and two studies collected data in zoos and aquariums in the United States.

How do empathy levels compare across different groups of animals?

Results from the reviewed research shows that people do indeed feel different levels of empathy toward different groups of animals. This common finding emerged across varied groups of participants from different cultures, and in studies using an array of research methods across settings. ***This consistency of evidence suggests that these empathy patterns truly reflect how people naturally respond to different animal groups rather than occurring as a result of specific research methods***. However, while there are certainly differences, the differences in people's levels of empathy that emerged between certain animal groups were not always what researchers expected to find (see Surprising Results on page 13).

The Phylogenetic Distance Pattern: Closer to Humans = Higher Empathy

Given that many of the studies focused on phylogenetic relatedness to humans, it was not surprising that one of the findings with the most support was that empathy levels follow a

predictable hierarchy based on how closely related animals are to humans evolutionarily. This pattern, called the phylogenetic similarity hypothesis,[49] appears across different research approaches and populations and suggests the following empathy hierarchy (see Fig.1):

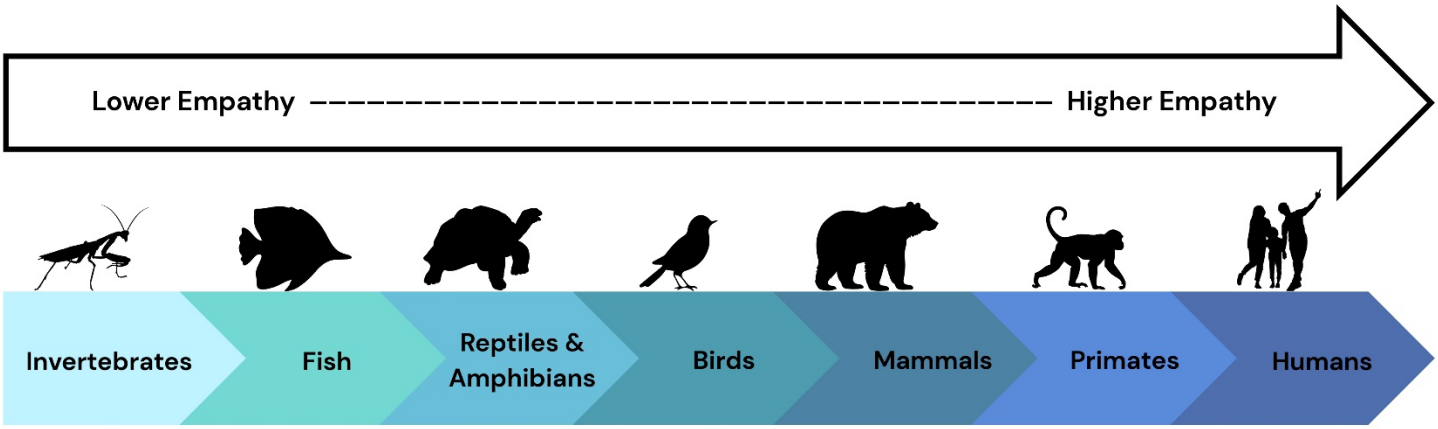


Figure 1. Empathy hierarchy based on phylogenetic relatedness to humans

A group of researchers reported this pattern not only in self-reported empathy measures but also through physiological measures like skin conductance, showing that people's bodies literally respond more strongly to animals that are more like humans.[50] While there is strong evidence for this pattern, the studies also raise some interesting questions. The researchers reported that they were investigating phylogenetic relatedness, rather than just how closely an animal's physical appearance matches a human's appearance. Phylogenetic relatedness and looking physically similar to humans are often correlated since shared evolutionary history typically produces both genetic and morphological similarities; however, there are interesting exceptions to this that the studies did not explore. For example, a bat is closer on the evolutionary tree to humans than a kangaroo is, but people likely express more empathy for a kangaroo than they do for a bat. Phylogenetic relatedness may help partially explain why people have different empathy levels for different groups of animals, but it is not the only reason (see Part 3: Factors that Influence Empathy for Wildlife).

Charismatic vs. Non-Charismatic Species: Charisma Helps!

Beyond evolutionary relationships, researchers explored the relationship between charisma and empathy, reporting results showing differing empathy levels for species deemed to be charismatic and non-charismatic. Charismatic species, animals that evoke strong positive emotional responses due to traits like large size, perceived beauty, relatability, or cultural significance,[51] often received higher empathy ratings than non-charismatic species.[52] In one study,[53] results highlighted the role of culture and aesthetics in charisma, as bats (mammals) received lower aesthetic and empathy ratings than sharks and turtles despite bats being more closely related to humans. The researchers suggested that lower empathy for bats is influenced by cultural views of bats and their perceived ugliness, highlighting an instance where targeted interpretation can help overcome initial negative impressions and foster deeper appreciation.

Surprising Results!

One study found that clownfish received the highest empathy ratings among all 25 species tested, even higher than mammals, as well as birds, reptiles, and amphibians.[54] The researchers attributed this to the fish's colorful appearance and influence from the popular animated movie *Finding Nemo*, demonstrating how an animal's looks and media representation might be capable of overriding evolutionary distance. Meanwhile, an observational study found that among non-charismatic marine animals, sea stars triggered more specific empathetic behaviors from aquarium visitors—particularly corrections of others' behavior—compared to sea urchins and sea anemones.[55] This was unexpected since all three species are similar invertebrates (i.e., they are all marine invertebrates in the same touch tank environment), but something about sea stars specifically evoked different responses. The researcher suggested this may have been because sea stars are more familiar to people, they are easier to handle in a touch tank compared to sea urchins and sea anemones, and there were more sea stars in the touch tanks.

What are the research gaps?

While these 12 studies provide insights into how human empathy toward different groups of animals can vary, gaps remain in our understanding and ability to draw firm conclusions. For example, there is a **lack of peer-reviewed research conducted in zoo and aquarium settings**. Out of 12 studies, only two studied people in these environments where millions interact with animals each year.[56] Zoos and aquariums offer an ideal setting as they are public spaces where people encounter live animals they might never see, often in habitats designed to foster emotional connections. These in-person encounters may elicit different empathy responses than the photo-based or scenario-based methods used in most studies. For example, zoo and aquarium visitors might report more empathy for birds and fish in these settings as they may be more active and social in zoos and aquariums in comparison to large mammals that are often solitary or in small groups and rest during much of the day. At the same time, zoos and aquariums can lead to methodological challenges for researchers that are not present in a controlled lab setting. Existing empathy measurement tools may be ill-suited for dynamic, real-world settings, creating **a need for empathy measures designed for use in zoos and aquariums**. A study at aquarium touch tanks was particularly valuable because it observed actual behavior rather than just asking people how they felt, watching how visitors interacted with invertebrates like sea stars and anemones.[57] We need more research like this to understand how animal experiences can develop empathy in practical settings.

Despite an increase in empathy research overall, we only found 12 studies specifically examining differences in empathy levels across different animal groups. **Because of this small number of studies, many variables, populations, and animal groups remain understudied**. Only four studies examined non-Western perspectives (Brazil, Vietnam, Zambia, and Namibia), leaving gaps in our understanding of how culture influences animal empathy. This limitation is problematic because other research acknowledges the role culture plays in shaping the connections between people and wildlife[58] and the few comparative studies across different contexts that do exist show meaningful differences. For example, one study found that Zambians and Namibians had different empathy patterns for the same animals,[59] while another study described how Brazilian students showed unexpectedly high empathy for fish, possibly due to cultural factors.[60]

Additionally, for their study samples, five of the 12 studies relied on university students, who may not represent how the general population responds to animals—more research needs to be done with people across generations and from all kinds of backgrounds (and as noted previously, in real-life settings rather than controlled labs). Many animal groups were also underrepresented or completely absent from this research. Very few studies examined empathy toward insects, for example, despite their ecological importance.

Another big challenge is that **the studies used different methods to measure empathy**, making it hard to directly compare findings. Some studies used self-report scales, one used behavioral observations, and still others used physiological measures. Even among self-report studies, different questionnaires and rating scales were used. Additionally, these instruments often measure different types of empathy (e.g., dispositional, stimulated, cognitive, affective, and motivational) or define and subdivide empathy in varying ways, meaning we are not always discussing the same, exact concept when comparing empathy across species. This inconsistency in design and methods across studies means we can identify general patterns (like the phylogenetic similarity effect) but cannot tell how strong these effects are or how they compare to other factors. For example, it is hard to say whether evolutionary relatedness is more important than cuteness in determining empathy because different studies measured these factors in completely different ways (more on this in Part 3). Another methodological limitation involved the use of distressing imagery. Research that showed adult animals receiving higher empathy than baby animals used images depicting extreme distress.[61] Future studies should examine empathy responses to healthy adult and baby animals to isolate the effect of developmental stage without the influence of distressing conditions.

What does evidence from program evaluations have to say?

As part of our review, we also examined program evaluations submitted by zoo and aquarium professionals, either in response to a request for relevant work for a previous review on empathy's link to wildlife conservation or to a new request specific to this review (see Appendix D for a list of the reviewed evaluations). Looking across the submitted evaluations, we noted the following trends:

- Zoo and aquarium professionals observe differences in visitors' (and their own!) preferences and attitudes for different groups of animals but usually did not address the root causes of such differences. For example, visitors in one study were asked about their attitudes and perceptions about owls, vultures, and opossums.[62] Pre-program data showed more positive attitudes towards owls and more negative attitudes towards vultures and opossums. Another evaluation shared that visitors reported more positive attitudes towards jaguars compared to tiger rat snakes.[63]

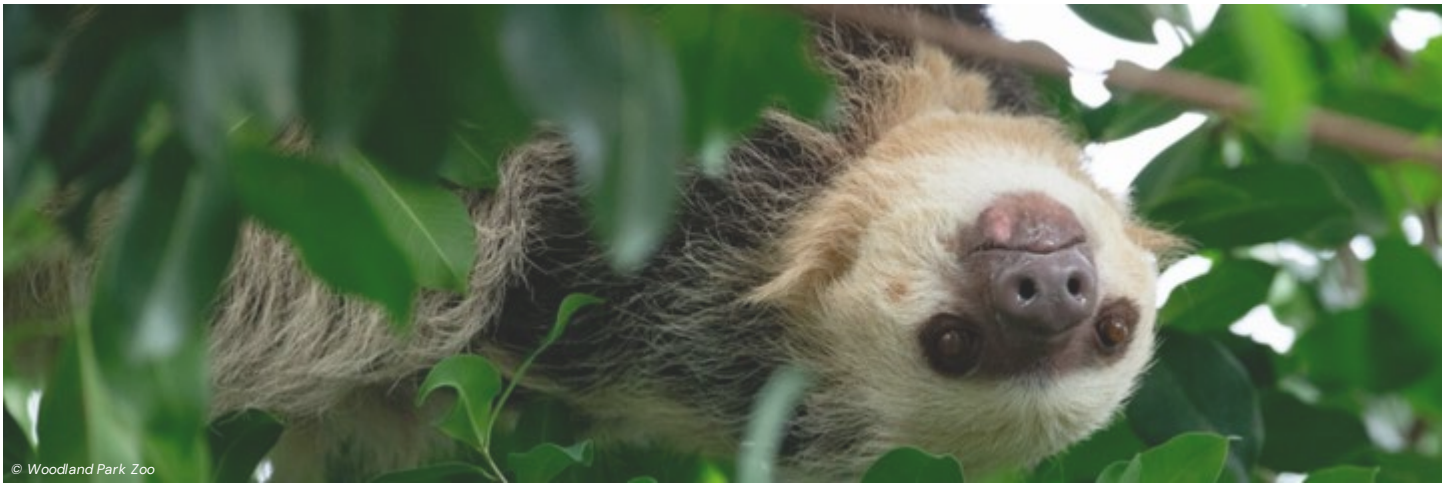
  In one report, the evaluators presented data from a question that asked zoo staff to rank six animals (jellyfish, red pandas, hornbills, cockroaches, lizards, and opossums) based on their desire to help those animals.[64] The most frequently chosen animals were red pandas or hornbills, with way fewer staff choosing jellyfish or opossums, and no one choosing cockroaches. The evaluators described an ensuing discussion among the staff where they

concluded people have "individual experiences, good and bad, that influenced how they ranked the set of animals." By and large though, the evaluations did not cover why such differences in visitor and staff preferences, attitudes, and empathy levels might differ across animal groups. Possible explanations such as feelings of fear and disgust[65] and similarity to humans[66] were presented but were not the focus of the evaluations.

Further demonstrating what might be species bias even among some zoo and aquarium professionals, recent research that examined how zoos and aquariums communicate about a specific group of non-charismatic animals (marine animals without faces) reported that these animals were featured on less than half of these organizations' websites.[67] When marine animals without faces were featured online, there was minimal use of empathy-building techniques (such as strategic, or critical, anthropomorphism or storytelling), which could lead to even greater psychological distance between such animals and the general public.

- Zoo and aquarium professionals are working to address these varying preferences and responses through specific initiatives and programming, which include the use of empathy-based practices. Targeted species include reptiles, insects, spiders, opossums, deep sea animals, and vultures. This trend suggests zoo and aquarium professionals believe these animals possess inherent appeal that is often underappreciated by the public, and that intentional education and interpretation can help reveal their remarkable qualities. It is unclear exactly how zoos and aquariums are choosing which species to focus on. This selection process likely varies, depending on factors such as species abundance in collections, interpreter preferences, animal willingness to consistently participate in programs, or compelling narratives available for each species.

  Some of the evaluations focused on or included a component that examined their staff's use of empathy-based practices in their work. For example, one evaluation documented how the implementation of empathy-based practices varied across different groups of animals.[68] Empathy-based practices were used less frequently with marine invertebrates compared to mammals with the evaluators hypothesizing this could be due to a focus on animals that are more like humans and different interpretive styles associated with specific habitat designs.



Part 3: Factors that Influence Empathy for Wildlife

In Part 2, we provided an overview of research that compared empathy levels across different groups of animals. We reported that the 12 studies we identified revealed that differences in empathy levels do exist for different groups of animals and briefly touched on some of the variables that researchers think are causing these differences. In this section, we dive more deeply into the variables discussed in the 12 studies and then pivot to talking about some of the different models used to explain empathy development in research and practice more broadly.

What factors influence empathy levels for different groups of animals?

Researchers who looked at how empathy differs across different groups of animals reported on several variables that we grouped by source. These are variables that originate from the animal being considered, variables related to the person feeling (or not feeling) empathy towards the animals, and variables related to the environment where the animal is observed (see Fig. 2 and Table 1).

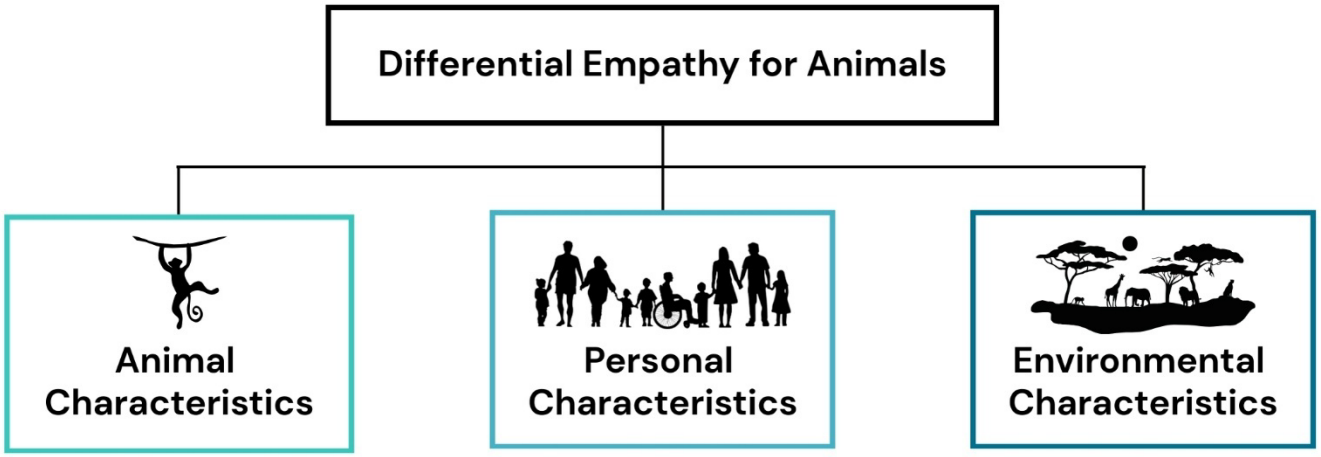


Figure 2. Factors that Impact Empathy Levels for Different Groups of Animals

Table 1. Factors Reported to Impact How Empathy Differs Across Different Animal Group

Animal Characteristics		Personal Characteristics	Environmental Characteristics
Biological	***Subjective***		
• Phylogenetic distance [69] • Taxonomic classification [70]	• Cuteness or aesthetics [71] • Emotional closeness [72] • Perceived usefulness [73] • Perceived risk/danger [74] • Perceived value/importance to nature [75] • Perceived conservation support [76] • Perceived warmth [77] • Perceived competence [78] • Charisma [79]	• Geographic location (Rural, Urban) [80] • Age [81] • Gender [82] • Culture [83]	• Policy effects [84] • Visitor experience [85]

Animal Characteristics

Much of the research focused on how various animal characteristics influence how much empathy people feel for different animals. These characteristics can be further grouped based on categories of biological (such as phylogenetic distance from humans, size, shape) or subjective, meaning they come from how a person views an animal and their relationship with that animal (such as cuteness, emotional closeness, or perceived similarity).

In terms of **biological characteristics**, the phylogenetic similarity hypothesis predicts that animals who are evolutionarily closer to people should receive higher empathy levels compared to animals who are further away from people on the evolutionary family tree. By and large this is what researchers found when examining concepts such as *phylogenetic relatedness* and *taxonomic differences*. Empathy levels decreased as animals moved further away from humans following the pattern of primates → other mammals → birds → reptiles → amphibians → fish → invertebrates. A major exception was noted in one study where clownfish received higher empathy than many mammals. Such a contradiction highlights how multiple factors interact in ways we do not yet fully understand.

Subjective animal characteristics also proved important in shaping how people empathized with different animal groups. While some of these characteristics reflect cultural interpretations (such as perceived cuteness or warmth), others are subjective responses to objective biological realities (such as being a predator or providing ecological services). The following variables were reported as influencing empathy for different groups of animals:

- *Cuteness or aesthetic appeal* increased empathy, with animals displaying visually attractive features receiving higher levels of empathy.
- Greater *emotional closeness*—the degree to which people reported to feel personally connected to an animal—was also associated with higher levels of empathy. This affective connection goes beyond just familiarity or recognition with an animal, instead referring to when people report feeling a genuine emotional investment in an animal's wellbeing.
- *Perceived usefulness* to humans also impacted which animal groups received higher levels of empathy, with animals seen as useful receiving more empathy than those considered to be less useful to people. This usefulness included working animals and broader ecological services (e.g., animals as pollinators or decomposers).
- Animals *perceived as important to nature* or deserving of conservation support earned higher levels of empathy.
- Animals viewed as *warm* (friendly, gentle) and *competent* (intelligent, capable) received greater empathy than those seen as cold or incompetent.
- On the other hand, *perceived risk* or danger reduced empathy levels, particularly for species like snakes and predators that evoked fear.
- Perceptual factors (e.g., aesthetics appeal, perceived warmth) often combined with other factors (e.g., phylogenetic similarity, positive cultural association) to create broader classifications of *charismatic versus non-charismatic* species. In what is referred to as the "charisma gap", charismatic animals received higher levels of empathy compared to non-charismatic animals.

Personal Characteristics

While most of the research on differential empathy that we identified focused on the impact of characteristics of the animal on empathy levels, one study examined how characteristics of the people doing the empathizing also influences empathy levels across different animal groups.[86] The researchers reported on several demographic and social factors that likely shape how people respond to various animal species. In this study, the participants were all students, ages 9-17 years old, and impactful factors identified were:

- *Geographic location on the rural/urban spectrum* influenced empathy patterns, with urban students showing higher empathy toward different animal groups compared to rural students.
- *Age* affected empathy intensity, with younger students expressing more empathy toward different animal groups than older students.
- *Culture* shaped empathy through local beliefs and folklore, particularly influencing negative attitudes toward certain groups like owls, which were associated with bad omens and death despite posing minimal physical risk to humans.

These findings suggest that empathy toward different animal groups is influenced by multiple factors, including both personal characteristics of the observer and biological characteristics of the animals themselves.

Environmental Characteristics

The two studies that explored empathy levels in zoo and aquarium visitors noted how environmental factors can influence empathy towards different animal groups. Aspects of the *visitor experience*, including interpretive design, staff facilitation, and caregiver interactions, affected how people developed empathy for different species during zoo and aquarium visits.

- In a study comparing empathy levels for polar bears and jellyfish, traditional exhibit elements like theming/props and animal habitat were reported to be most effective in promoting empathy, contrary to expectations that technological features (videos and interactive elements such as touchscreens, kiosks, and pushbuttons) would be more effective.[87]
- In observations of aquarium touch tank interactions, staff facilitation increased empathy behaviors. Visitors with facilitated interactions were more likely to touch animals multiple times, observe closely, seek information, and show appreciation compared to non-facilitated encounters.[88]
- Caregivers at visiting aquarium touch tanks with children were less likely to touch animals themselves when they reinforced their children's positive behaviors or corrected negative behaviors. The researcher attributed this to caregivers being more focused on their children's experience than their own personal engagement with the animals, suggesting that empathy development for adults with children may be more indirect when compared with adults who are not supervising children during their visit.[89]

What models are being used to explain why empathy might differ for different groups of animals?

Our review of the 12 identified studies suggests that empathy levels for different groups of animals may vary due to a mix of factors/characteristics associated with the animal, the person, and the environment (see Figure 1). Broadly looking across research on empathy for wildlife, several other models or frameworks emerged as explanations that researchers use to explore why and how empathy varies across animals groups. In this section, we introduce several of these models.

1. **Myers Model:** [90] Based on research from developmental psychology, Myers named four characteristics of animals thought to influence how much empathy people might feel for that animal. [91] According to this thinking, the more an animal has of each of these characteristics, the more likely a person will feel empathy for that animal.
    - **Agency** is an animal's ability to move on their own and perform behaviors like eating, crawling, looking around, and playing.
    - **Coherence** describes how easily an animal can be thought of as an organized whole rather than a collection of separate parts.
    - **Affectivity** is an animal's ability to show emotions, particularly observable patterns of arousal and feeling states like excitement and relaxation.
    - **Continuity** relates to familiarity, suggesting that through repeated experiences, an animal becomes a familiar individual to the person.

2. **The Big Four:** [92] Based on research from the 1970s and supported by over 40 years of study, four other animal characteristics have been identified that are thought to influence empathy levels for different animal groups. These have been referred to as "The Big Four":
    - **Perceived intelligence** refers to how smart and self-aware people think an animal is, with greater levels of perceived intelligence linked to increased empathy.
    - **Size** of the animal matters, with studies suggesting that larger animals elicit more empathy, possibly because they are thought to feel more pain due to more elaborate nervous systems or more visible pain reactions.
    - **Aesthetic appeal** refers to physical attractiveness and includes a tactile aspect with greater perceived beauty, softness, and "fuzziness" thought to lead to more empathy. One researcher described how butterflies are given more empathy than caterpillars even though both are the same animal but at different life stages.
    - **Lack of harmfulness** relates to how predatory or dangerous a person perceives an animal to be. Although there are exceptions, in general predatory or dangerous animals (like sharks and snakes) receive less empathy. Researchers think this could be because fear translates into less empathy or people feel harmful behavior should not be rewarded with positive feelings.

3. The **Perception-Action Model (PAM):**[93] A model of empathy from cognitive psychology and neuroscience that says that when a person sees someone in pain or distress, their brain automatically activates the same neural circuits as if they were experiencing that pain themselves. The stronger the similarity between the person and the other person (or animal), the more intense this automatic empathy response becomes. Researchers have used this model to explore why empathy might vary for different animal groups, suggesting these factors determine how much empathy people experience for different groups of animals:
    - **Similarity** is how similar a person thinks an animal is to them and can be based on physical appearance and animal behavior. The more similar a person thinks an animal is to them, the more likely a person will experience greater levels of empathy for that animal group.
    - **Familiarity** refers to how much a person knows about or has experience with an animal. Animals which people feel more familiar with may elicit greater levels of empathy.
    - **Past experience,** while related to familiarity, is about specific prior encounters with an animal**.** A person might know about sharks (i.e., be familiar with them) from watching documentaries or movies about sharks but never have actually encountered a shark. Past experience has more to do with emotional responses to an animal based on prior interactions (e.g., being bitten by a dog as a child versus having a beloved relationship with a pet) whereas familiarity has more to do with knowledge. Past experience can increase or decrease empathy based on what type of experience occurred.
    - **Salience** has to do with how much something about an animal grabs a person's attention. According to the Perception-Action Model, animals that are more noticeable or dramatic may trigger more empathy. For example, a brightly colored bird might elicit more empathy than a camouflaged bird.

4. In a study of wildlife tourism experiences,[94] researchers proposed a model where **awe** from wildlife encounters leads to stronger **connectedness with nature**, which then builds empathy toward animals, ultimately increasing animal-friendly behaviors. Awe is defined as an emotional response to an experience that overwhelms current ways of thinking and feeling.[95] This research also found that **animal welfare literacy**[96] strengthens this entire process. Animal welfare literacy refers to how much people know about animal welfare and how willing they are to act on that knowledge. Wildlife tourists with higher animal welfare literacy showed stronger responses at every step in this model. They felt more awe, developed stronger nature connections, gained more empathy, and were more likely to behave in animal-friendly ways. This model suggests that empathy development is a complicated process involving multiple stages rather than a simple, automatic response. An important takeaway from this model is that awe can play a major role as the initial trigger that sets the entire empathy-to-conservation pathway in motion. Fig. 3 shows the model presented by the researchers.

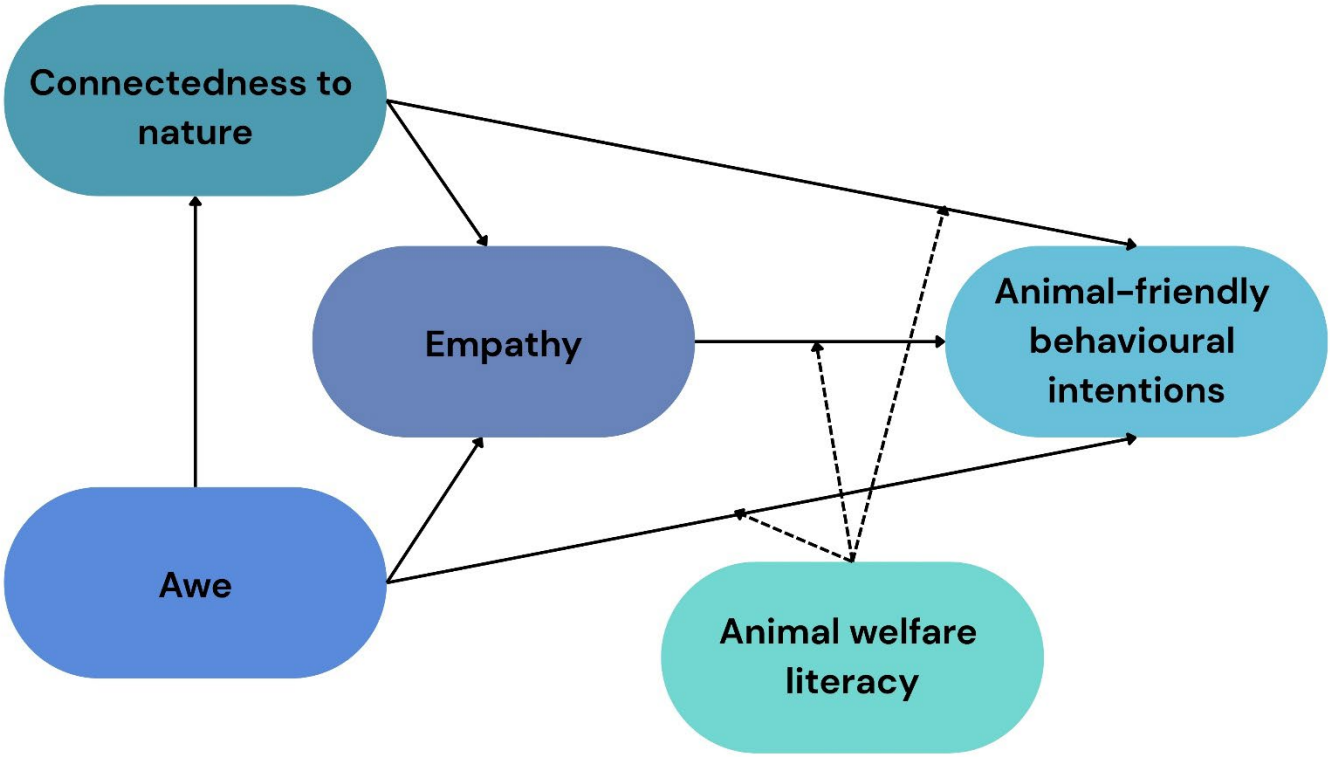


Figure 3. Model showing proposed relationships among empathy, awe, connectedness to nature, animal welfare literacy, and animal-friendly behavioral intentions (Adapted from Wang & Lu, 2025[97])

5. While not a model or framework, the concept of **anthropomorphism** is referenced by many researchers as a key mechanism for understanding why people express more empathy for certain animals. Anthropomorphism occurs when people attribute human characteristics to animals, particularly characteristics believed to be uniquely human.[98] Critical anthropomorphism, which uses familiar language to interpret animal behaviors when backed by scientific findings, can increase people's emotional connection to animals and motivate them to empathize with and protect wildlife.[99] In one study, researchers suggest that anthropomorphism is what drives different levels of empathy across species.[100] They found that people's tendency to attribute human qualities to animals varies by phylogenetic distance, and this anthropomorphism correlates with how much empathy people feel. The researchers suggest that because people naturally anthropomorphize animals that are more similar to us, they end up feeling more empathy for those species. In other words, anthropomorphism acts as the mechanism that creates unequal empathy: we care more about animals we see as having human-like minds and experiences. This understanding suggests using critical anthropomorphism strategically by emphasizing human-like qualities for phylogenetically distant species (to increase empathy) while de-emphasizing such comparisons for species already perceived as similar to humans (to avoid overuse of anthropomorphism).

Part 4: Suggested Strategies for Developing Empathy for Different Groups of Animals

Many of the 12 studies that focused on differential empathy did not provide practical suggestions for practitioners as this was not the focus or motivation of the research, with the main exception being the two studies conducted in zoos and aquariums.[101] ****Therefore, the strategies presented in this section are largely interpretations and applications of research findings rather than extensively tested recommendations.**** Appendix A provides a step-by-step guide to increase visitor connections with underappreciated animals based on the below recommendations. For additional guidance on working with specific animals, Appendix C provides research findings and strategies organized by specific groups of animals, such as spiders, snakes, and insects.

As a quick note before we dig into the strategies, there are many available resources on how to develop empathy for wildlife in general on the ACE for Wildlife® website. We encourage you to check those out as they provide a good foundation for empathy practices in general.

1. Address the empathy gap for underappreciated animals

For zoo and aquarium professionals, understanding differences in empathy across animal groups can facilitate strategic thinking about how to support empathy development for animals that might be overlooked. We refer to such species as **underappreciated animals**. Examples of underappreciated animals might include species that are evolutionarily distant from humans (like invertebrates and reptiles), considered non-charismatic species (such as insects, spiders, and less visually appealing marine animals), and animals with negative cultural associations (like snakes, bats, or scavengers). The goal of practitioners is not to fight against or ignore natural or cultural tendencies, but to work with them to expand visitor empathy (and therefore action) for all wildlife.

For example, the two studies conducted in zoos and aquariums offered practical recommendations to help visitors overcome the charisma gap that occurs when people express more empathy for charismatic animals.[102] Physical design elements examined in the studies—particularly immersive theming, natural-looking habitats, and viewing opportunities that allow close observation—were more effective for building empathy than technological features like digital displays or videos. Direct, interactive experiences with animals, especially when facilitated by trained staff, improved empathetic responses compared to passive viewing. Staff facilitation was noted as valuable for non-charismatic species, as interpreters can guide visitors toward close observation and information-seeking behaviors that might not occur naturally. These experiences and findings suggest that empathy development relies on creating opportunities for meaningful, prolonged engagement between visitors and animals, with staff guidance playing a role in bridging the gap for underappreciated species.

We can also turn to the empathy-eliciting characteristics of animals suggested by the limited research on this topic, which we covered in Part 3. While there is not a lot of empirical evidence linking the suggested strategies below to increases in empathy for non-charismatic species, these approaches are grounded in psychological theories about how empathy develops and can serve as starting points for practitioners looking to expand visitor connections with underappreciated animals. Each strategy category below includes the relevant empathy-eliciting characteristics and its associated model (Myers, Big Four, or PAM). Many of these strategies align with best practices that zoo and aquarium professionals are already implementing.

Movement and Behavioral Characteristics: Agency (Myers), Behavioral Similarity (PAM)

- Schedule programming during animals' most active periods.
- Design habitats and provide enrichment that encourage natural movement and behavior expression.
- Use video or live feeds to show natural behaviors when animals are resting or out of sight.
- Draw explicit and accurate comparisons between animal and human behaviors (feeding, playing, problem-solving, social interactions), also known as critical anthropomorphism.

Cognitive and Emotional Characteristics: Affectivity (Myers), Perceived Intelligence (Big Four)

- Use training and enrichment demonstrations to showcase cognitive abilities of different animals.
- Highlight emotional states and behavioral responses during animal encounters.
- Share stories that highlight animal learning, memory, and decision-making.
- Showcase keeper-animal relationships that demonstrate recognition, bonding, and individual personalities, such as when a puffer fish recognizes and greets their familiar keeper.

Physical Characteristics: Coherence (Myers), Size (Big Four), Aesthetic Appeal (Big Four), Physical Similarity (PAM), Salience (PAM)

- Highlight aesthetic details (patterns, colors, textures) that make animals visually striking or unique.
- Use close-up viewing opportunities and detailed graphics or biofacts to showcase appealing physical features.
- Point out physical parts of the animals to help people see each animal as a unified whole or to highlight similarities to human body parts/processes (e.g., eyes, limbs, facial expressions).
- Explain how the animal is important to nature (e.g., beetles as nature's cleanup crew) and/or useful to humans (e.g., squirrels eat ticks).

Familiarity and Experience: Continuity (Myers), Familiarity (PAM), Past Experience (PAM)

- Encourage return visits to build ongoing relationships with animals.
- Create opportunities for repeated encounters with the same individual animals.
- Build visitor familiarity through storytelling about individual animal personalities and histories.

- Provide multiple touchpoints throughout the facility featuring the same species.
- Compare unfamiliar animals to more familiar ones when relevant (e.g., highlighting similarities between domestic cats and lions).
- Consider whether a species has been portrayed positively or negatively in popular culture (e.g., the clownfish in Finding Nemo vs. the hyenas in Lion King) to help determine what preconceived notions an audience may have about the animal to shape interpretive points.

Safety and Threat Perception: Lack of Harmfulness (Big Four), Past Experience (PAM)

- Address safety concerns through education rather than avoidance.
- Explain natural behaviors that might seem threatening but serve important ecological functions.
- Highlight the important ecological roles of predators and "scary" animals.
- Emphasize that predators are not just aggressive, they can be vulnerable and cautious too. For example, rattlesnakes can only bite and release venom once every three weeks, so they avoid confrontation when possible and seek comfort from other snakes after stressful confrontations (just like people seek out support from friends during stressful times!).
- Point out ways in which the animal is not harmful in relatable yet accurate ways (e.g., bats are attentive mothers who can identify their babies among hundreds of others by scent).
- Address negative past experiences through positive, educational encounters. It may not be possible to move someone from fear to fandom, but even just moving them from total avoidance to cautious tolerance is a step in the right direction.

2. Consider visitor demographics in program design

The research reveals that visitor characteristics can influence empathy responses to different animal groups. While we cannot control these factors, we can use audience segmentation to create more effective programming by tailoring messaging and activities to address a diverse range of visitors. Provide separate programming tracks or layered interpretation that simultaneously serve multiple audiences to account for personal differences such as:

- Urban visitors may be less familiar with certain wildlife but more open to empathy development, while rural visitors bring different baseline knowledge and relationships with animals.
- Younger audiences tend to show more extreme empathy and emotional responses, which can be channeled toward less charismatic species that adults might dismiss.
- Adults accompanying children require different approaches since they are often focused on teaching moments rather than personal engagement with animals. Additionally, adults often model their own fears of animals like snakes and spiders to children, so programming should encourage positive adult modeling when possible.
- For audiences already emotionally connected to animals, help them distinguish between appropriate and inappropriate anthropomorphizing. For example, explain that a solitary tiger is not lonely like humans would be, rather, being alone for a tiger is natural and less stressful than forced social situations. Also be sure to explain the downsides of trying to own an animal if perceived to be a potential pet (e.g., Asian small-clawed otters may look cute, but they mark their territory by smearing their feces around and can bite or scratch when stressed or unhappy- not great characteristics in a roommate!).

Several studies measured trait empathy, a person's general tendency to feel empathy regardless of the specific situation or species involved. People with higher trait empathy, also known as dispositional empathy, tended to show higher levels of empathy across all species. This finding suggests there is value in considering empathy traits when recruiting staff and volunteers, particularly for roles involving direct visitor interaction, educational programming, or animal encounters. Look for candidates who naturally demonstrate perspective-taking, emotional responsiveness to animals, and comfort with less charismatic species. These individuals can then model empathetic behaviors that can influence visitor attitudes during programming. Additionally, you can help staff build their empathy muscles through training and encourage them to practice empathy for the animals they are working with.

Researchers often talked about how cultural backgrounds also shape empathy for different groups of animals, but few measured or deeply explored cultural factors in their research. A general consensus is that educators and interpreters need to consider the cultural backgrounds of visitors when designing programming, but more research is needed to confirm the role of culture and how to best address cultural context in zoos and aquarium settings. Given this knowledge gap, organizations can proactively research and engage with different cultural communities before developing programming. This includes consulting with community representatives to understand cultural meanings and taboos associated with specific animals,

co-designing programs with diverse audiences, and avoiding potentially harmful situations (e.g., bringing owls to communities where they are considered omens of death). Additionally, organizations could prioritize hiring interpreters and educators who reflect the diversity of their audiences and empower these staff members to bring their cultural perspectives and knowledge to program development and delivery. Building these relationships, conducting cultural research upfront, and ensuring diverse representation on staff can prevent uncomfortable situations and create more inclusive, culturally sensitive programming. For more information on the relationship between culture and empathy practices in zoos and aquariums, see the report from the Minnesota Zoo, *Empathy for animals: Bridging the gap: The importance of considering cultural factors when teaching empathy for animals*.[103]

3. Use anthropomorphism strategically

When looking to explain higher empathy levels for charismatic species and animals that are evolutionary relatives, some researchers discussed anthropomorphism, which occurs when people attribute human characteristics to animals. The main idea is that we care more about animals we perceive as having human-like minds and experiences. A natural conclusion of this would be to use anthropomorphism in education and interpretation; however, anthropomorphism must be applied carefully to avoid misrepresenting animal behavior while still building emotional connections.

A best practice is to focus on genuine similarities between people and animals rather than projecting purely human emotions or motivations onto animals. The key is using *critical anthropomorphism*, which involves describing animal behaviors in relatable, human terms while maintaining scientific accuracy.[104] For example, describing wolf urine marking as "wolves' social media" where they can "check into locations" and "inform others about recent goings-on" communicates biological behavior in accessible, memorable ways. For detailed guidance on implementing these practices see the Woodland Park Zoo report, *Anthropomorphism's Role in Fostering Empathy for Wildlife and Advancing Conservation*.[105]

4. Design for awe and wonder

A trending topic in psychological research is the study of awe, which occurs when current ways of thinking and feeling are overwhelmed by an emotional experience.[106] Awe is being explored as a powerful pathway to empathy, pro-environmental actions, and wildlife conservation behavior.[107] Growing research is demonstrating awe's effectiveness in settings such as museums, zoos, aquariums, and wildlife tourism providing evidence that habitat and experience design can deliberately evoke this powerful emotion.[108]

For wildlife encounters specifically, researchers identified three factors of wildlife-inspired awe: beauty, transcendence, and threat, noting that awe captures both positive and negative emotional responses.[109] As discussed in Part 3, a model from another study shows how awe from wildlife encounters leads to stronger nature connectedness, building empathy, and increasing wildlife-friendly behaviors. An implication from this research is to design exhibits showcasing animals' impressive size, unique behaviors, or dramatic natural settings, while combining awe-inspiring encounters with educational content about wildlife conservation to strengthen the empathy-to-conservation pathway.

Success stories

Across research and practice, we have found reports of zoo and aquarium practitioners (and other educators) successfully providing extra support and targeted programming for underappreciated species. Sometimes these efforts involve small tweaks in facilitation and messaging. For example, at the Seattle Aquarium, wolf eels enjoy resting on the divers who feed the fish in the big aquariums. Aquarium staff are able to highlight this occurrence in a way that helps people connect to wolf eels, helping visitors overcome initial unfamiliarity with the species and any negative first impressions.

Other efforts to foster empathy for underappreciated species involve full-fledged programs. At Racine Zoo, over 150 elementary students took part in live virtual encounters with a Madagascar hissing cockroach with the goal of changing perceptions of these often-misunderstood insects. Initially, students showed negative or neutral reactions toward a Madagascar hissing cockroach. As part of the program, the instructor asked students to think about their pets' names at home before sharing details about the personality of the cockroach. The students then brainstormed a name for the cockroach based on the cockroach's personality. Following the lesson, students were asked how they felt about the Madagascar hissing cockroach: none of the students

expressed negative feelings and their attitudes had shifted toward being generally positive. These results demonstrate how educational encounters that use empathy practices (in this case, critical anthropomorphism) can change views of targeted species, especially when people are offered the chance to see an animal's unique traits in the context of individual experience and perspective.

Continuing a focus on cockroaches, we found research that supports the effectiveness of strategic empathetic approaches for this particular phylogenetically distant species. One study compared ecological versus empathetic presentation styles for cockroaches with elementary students participating in a summer camp at the Oklahoma City Zoo and Botanical Garden. They found that while both styles reduced negative associations, only the empathetic presentation significantly increased positive attitudes and emotional connections.[110] Importantly, the empathetic approach, which included giving cockroaches names and anthropomorphic characteristics, did *not* reduce biological accuracy, demonstrating that critical anthropomorphism can be both emotionally effective and scientifically sound. Another study with pre-service middle school teachers in the United States showed that sustained positive exposure to cockroaches reduced fear and disgust.[111] The study findings also showed that the changed perceptions translated into increased willingness to use cockroach education in their future classrooms, suggesting that carefully designed educational programs can overcome negative associations with an underappreciated species.

Finally, evaluations and unpublished work submitted in response to our call for relevant contribution often provided data that also suggested interpretation and education can increase knowledge about, attitudes towards, and empathy for underappreciated animals. Examples of this include:

- Visitors who attended a talk on spiders demonstrated more positive attitudes and behaviors towards spiders after the program.[112]
- One evaluation compared two insect habitats with different levels of empathy-based design, with one incorporating more intentional empathy elements. Visitors to the more empathy-focused habitat showed more empathy-related behaviors, were more likely to make personal connections with insects, and had better recall of conservation actions they could take.[113]
- Visitors who read empathy-based signage showed increased positivity towards animals, especially for less charismatic species like tiger rat snakes.[114]
- A raptor program evaluation found that while visitors held positive attitudes towards owls, they had neutral or negative opinions about vultures. Program participants showed improvements in attitudes toward vultures across all measured metrics after attending the show, with the greatest positive change in aesthetic appreciation, demonstrating that targeted programming can successfully shift attitudes toward less popular species.[115]

Based on this submitted work, several **recommendations for practice** emerged:

- Recommendations about signage, including using empathy-based language rather than traditional natural history approaches, with studies showing increased positivity toward

less charismatic animals like tiger rat snakes.[116] In general, **design and messaging strategies** that emphasize positive, empathy-related language and thematic elements that help visitors connect with animals as individuals seemed to help species that could be considered underappreciated.

- **Programming approaches** that proved effective include live interpretation, encouraging perspective-taking, using individual animal names and personal pronouns instead of species names and "it", and implementing behavioral mimicry activities where visitors act out animal behaviors.[117]
- **Training and staff development** should focus on empathy practices (e.g., perspective-taking techniques) that may not be commonly used in practice but have been shown (in either research or evaluation) to increase visitor empathy for wildlife.[118]
- **Species-specific interventions** include providing extended exposure time, creating strong emotional experiences that correlate with conservation action, and encouraging focused observation of underappreciated animals like reptiles and invertebrates. Multiple evaluations emphasized that engaging directly with trained staff enhanced visitor empathy more effectively than passive exhibit experiences alone.

Refer to Appendix A for a step-by-step guide to help you plan how to increase visitor connections with underappreciated animals.

Part 5: Summary and Next Steps

The 12 studies examining differential empathy, though limited in number, provide consistent evidence that empathy levels for animals differ across animal groups based on factors such as phylogenetic relatedness to humans, charisma, and cultural associations. Beyond identifying general trends, this review revealed the complex interplay of factors that influence empathy responses, yet there is little research clarifying this process or validating existing theories explaining the development of empathy for animals.

We presented a simple model of animal traits, visitors' personal characteristics, and environmental factors to help illustrate how much is involved in determining how much empathy a person experiences for a specific animal during a zoo or aquarium visit. We also explored existing models and frameworks addressing factors that influence empathy development for animals. The models explored—from Myers' four characteristics to the Big Four factors and the Perception-Action Model—offer practitioners multiple frameworks for understanding visitor connections with different animal groups. New research examining the role of awe and wonder in empathy opens a new frontier for understanding and designing transformative wildlife encounters.

The research, submitted evaluations, and anecdotes from the field informed recommended (even if not always rigorously tested yet) strategies for interpretation, exhibit design, and programming for underappreciated species. Success stories from cockroaches to sea urchins show that people can connect in meaningful ways with underappreciated animals.

Looking ahead

Significant knowledge gaps remain in our understanding of what influences empathy levels across different animal groups. Priority research areas include examining how these multiple factors interact, how cultural contexts shape empathy responses in different populations, and how specific design and interpretation strategies can most effectively bridge the empathy gap for underappreciated animals. The field would particularly benefit from studies that test the effectiveness of the models and strategies presented in this review within zoo and aquarium settings.

The research gaps identified throughout this review—particularly the need for more studies in zoo and aquarium settings, with diverse populations, and using consistent measurement approaches—represent opportunities for practitioners to contribute to this growing research field. Zoo and aquarium professionals are uniquely positioned to advance our understanding of how empathy develops across different animal groups through evaluation of their own programming and partnerships with researchers. Practitioners' knowledge and expertise can help translate and confirm findings from research studies conducted in labs and other controlled settings.

Appendix A: Step-by-Step Guide to Increase Visitor Connections with Underappreciated Animals

Phase 1: Assessment

This phase is about understanding the psychological and social factors at play before you design a program.

1. **Choose Your Animal and Identify Empathy Opportunities:** Select an underappreciated animal at your facility. Next, use the models (See Myers, Big Four, PAM described in Part 3, page 19 -21) to assess the animal's empathy-eliciting characteristic profile. What types of comments do you tend to hear from guests? What do you know about the animal that makes them special? For instance, if they express fear of the animal, you might want to highlight their **Lack of Harmfulness**.

2. **Understand Your Audience Demographics and Cultural Context:** Research your target audience to understand their unique characteristics. Consider factors like their age, urban vs. rural background, and prior experiences. Tailor your messaging based on these insights. For example, a young audience may be more receptive to emotional appeals, while adults may require approaches that acknowledge their existing knowledge and attempt to shift rather than contradict that. Proactively research and engage with different cultural communities to understand how they perceive specific animals, avoiding potential cultural taboos. And when your audience is varied, provide layered interpretation to simultaneously serve multiple audiences to account for personal differences.

3. **Assess Your Staff and Volunteers:** Evaluate your team's natural inclination toward empathy and the type of underappreciated animal. Those individuals with enthusiasm, understanding, and respect for a taxon will likely be better equipped to model empathetic behavior for visitors.

Phase 2: Planning

Now that you've identified your audience and the empathy gaps, you'll develop a concrete action plan.

4. **Select and Integrate Strategies:** Choose a mix of strategies from the categories provided to create a comprehensive plan. Weave them into a cohesive narrative or program, using:

    - **Movement & Behavioral:** Plan programming during active periods and use enrichment to showcase natural behaviors. Employ **critical anthropomorphism** to draw accurate, relatable comparisons between animal and human behaviors, such as describing wolves' scent marking as their "social media" (see pages 25-26 for more details).
    - **Cognitive & Emotional:** Highlight an animal's intelligence through training demonstrations and share stories that showcase learning, memory, and individual

personalities. Explain how they form bonds with keepers to demonstrate their capacity for relationships.
    - **Physical:** Emphasize the animal's unique aesthetic details or features, and highlight similarities to human body parts to help visitors see the animal as a unified whole.
    - **Familiarity & Experience:** Create opportunities for repeated encounters and build visitor familiarity through storytelling. Consider the animal's portrayal in popular culture (e.g., a clown fish in *Finding Nemo* vs. a hyena in *The Lion King*) to inform your messaging.
    - **Safety & Threat:** Address fears directly through education. Explain the behavioral or ecological purpose for animal behaviors that are often misinterpreted or may appear threatening. Emphasize that predators are not just aggressive, but can also be vulnerable and cautious. When relevant, point out how the animal contributes to their environment, such as eating bugs or carrion that may carry diseases.
    - **Awe and Wonder:** Deliberately design exhibits and encounters that evoke **awe** by showcasing an animal or species' attributes (e.g., beauty, dramatic behaviors, size). Combine this with educational content to strengthen the link between emotion and conservation action.

5. **Design the Experience with Layered Interpretation:** Design your programming to serve multiple audiences simultaneously. For instance, signage can have simple, engaging facts for children and more detailed information for adults. This approach accounts for personal differences without creating separate experiences.

6. **Train and Empower Staff:** Train your staff and volunteers to practice empathy for the animals they work with. Empower staff members to bring their cultural perspectives and knowledge to program development and delivery.

Phase 3: Implementation & Evaluation

The final phase is about putting your plan into action and measuring its effectiveness.

7. **Launch and Educate:** Implement your new programs, exhibits, or signage. Ensure all staff and volunteers are well-versed in the messaging and psychological principles behind it.

8. **Measure the Impact:** Use tools such as observational studies and visitor surveys to evaluate success. Look for a change in visitor attitudes, such as a shift from negative comments to positive, connection-based ones. Remember that even moving someone from "total avoidance to cautious tolerance" is a step in the right direction.

9. **Refine and Iterate:** Use your evaluation data to refine your strategies. If a particular approach did not work as expected, adjust your messaging or design. This is a continuous process of learning and improvement.

Appendix B: Studies Examining Differences in Empathy Levels Across Animal Groups

Study	Type	Country	Study Design	Sample	Sample Size	Setting	Group Comparisons	Measurement of Empathy	Main Findings Relevant to Differential Empathy
da Silva et al. (2023)	Journal article	Brazil	Interviews	Students (ages 9-17)	667	Schools	25 vertebrate species across 5 taxonomic classes	Self-report empathy scale	Greater empathy for fish, birds, and mammals, less for reptiles and amphibians, reflecting evolutionary and cultural factors.
Grover (2018)	Master's thesis	United States	Survey	Adult zoo visitors	119	Zoo	Charismatic vs. non-charismatic animals	Self-report empathy scale	Slightly higher empathy levels for polar bears compared to jellyfish.
Harrison & Hall (2010)	Journal article	Not Specified	Survey	Online survey respondents	114	Online	30 phylogenetic exemplars	Self-report empathy scale	Increased empathy for animals with greater phylogenetic relatedness to humans.
Kansky et al. (2021)	Journal article	Zambia, Namibia	Survey	Farmers in and around conservation areas	1126	Farming communities	5 wildlife species that potentially cause problems for farming communities	Self-report empathy scale	Differences in empathy levels for the different species were reported and differences varied somewhat by country.
Knudson (2019)	Master's thesis	United States	Observational	Adult aquarium visitors	258	Aquarium	Charismatic mammals vs. non-charismatic invertebrates	Observation of empathetic behaviors	Empathic behaviors towards charismatic animals were higher than those for non-charismatic marine invertebrates.
Miralles et al. (2019)	Journal article	Not Specified	Experimental	Adults of European nationality	1134	Online	52 macroscopic eukaryote species	Forced-choice task	People's empathy for a species varies significantly across species, primarily influenced by their phylogenetic distance from humans.

Study	Type	Country	Study Design	Sample	Sample Size	Setting	Group Comparisons	Measurement of Empathy	Main Findings Relevant to Differential Empathy
Mota Pereira et al. (2023)	Journal article	Brazil	Survey	University students	700	Online	17 animal species based on empathy or aversion; found in the area; varying levels of charisma, usefulness, stigmatized	Self-report empathy scale	Higher levels of empathy for large, charismatic mammals compared to reptiles, amphibians, and less charismatic species, with species perceived as beautiful and useful receiving greater conservation support than those viewed as ugly or harmful.
Phan et al. (2025)	Journal article	Vietnam	Experimental	University students	358	Lab	4 animals selected to vary across perceived familiarity, aesthetic appeal, and threat perception	Self-report scale of media empathy	Cute animals and feeling emotionally connected to an animal increased empathy. Being familiar with a species did not make people feel more empathetic.
Prguda & Neumann (2014)	Journal article	Australia	Experimental	Female university students	69	Lab	4 groups based on phylogenetic similarity to humans, both infant and adults	Self-report empathy scales, physiological measures	Empathy increased according to phylogenetic similarity to humans. Human infants received higher empathy ratings than human adults, but adult wild animals received higher empathy ratings than their infant counterparts.

Study	Type	Country	Study Design	Sample	Sample Size	Setting	Group Comparisons	Measurement of Empathy	Main Findings Relevant to Differential Empathy
Swim et al. (2023)	Journal article	United States	Experimental	Adults	375	Lab	16 species across 4 groups that varied across competence and warmth levels	Empathy selection task	Greater empathy for animals that people stereotyped as intelligent and friendly versus those seen as unintelligent or threatening. Likely happened because empathizing with "less appealing" animals felt cognitively harder, so people avoided the emotional effort.
Westbury & Neumann (2008)	Journal article	Australia	Experimental	University students	106	Lab	5 animal groups chosen based on a phylogenetic gradient	Self-report empathy scales, physiological measures	The more phylogenetically similar an animal is to humans, the stronger the empathic response.
Westbury Ingham et al. (2015)	Journal article	Australia	Experimental	University students	86	Lab	5 animal groups chosen based on a phylogenetic gradient	Self-report empathy scale	Empathy ratings decreased as animal groups became more phylogenetically distant from humans.

Supplementary information on species selected for study

Harrison and Hall (2010) approached their empathy study from the perspective of anthropomorphism, asking their participants to answer questions about 30 animals selected in a previous study.[119] The 30 animals were specifically chosen to represent different levels of phylogenetic relatedness to humans. The 30 animals, a mix of domestic and wild animals, included 27 animals from the five major vertebrate groups and three invertebrates:

- **Mammals**: cat, cheetah, chimp, cow, dog, elephant, goat, gorilla, human, monkey, pig, porpoise
- **Birds**: canary, chicken, eagle, parakeet, parrot, robin
- **Reptiles**: crocodile, snake, turtle
- **Amphibians**: frog, salamander, toad
- **Invertebrates**: cockroach, crab, worm

Miralles et al. (2019) used a sophisticated approach, calculating actual evolutionary divergence times from humans (how many millions of years ago humans and each species last shared a common ancestor). They strategically selected species (47 animals, 4 plants, 1 fungi) to make sure they had a range of species that diverged from humans at specific time points, ranging from our closest relatives (e.g., chimpanzees at 6.7 million years ago) to distant species that diverged much longer ago (e.g., plants at 1,496 million years ago). Using actual calculated divergence times allowed them to more precisely study how phylogenetic relatedness impacts how much empathy people feel for different groups of animals. The 52 species were:

- **Mammals**: human, chimpanzee, gorilla, orangutan, lar gibbon, Japanese macaque, capuchin, tarsier, ring-tailed lemur, hare, red squirrel, springbok antelope, brown bear, beluga whale, red fox, koala, Bennett's wallaby, echidna, platypus
- **Birds**: common blackbird
- **Reptiles**: Mississippi alligator, Madeiran wall lizard, Hermann's tortoise
- **Amphibians**: cane toad, European tree frog
- **Fish**: Queensland lungfish, gilled lungfish, barracuda, common clownfish, zebrafish, small-spotted catshark, great white shark, sea lamprey
- **Tunicates**: blue sea squirt, yellow sea squirt
- **Echinoderms**: ochre starfish, purple sea urchin
- **Protostomians**: bloody-nosed beetle, common cuttlefish, earthworm, peacock mantis shrimp, great scallop, Burgundy snail, diadem spider, tick
- **Cnidarians**: sea anemone, jellyfish
- **Fungi**: cep mushroom
- **Plants**: barrel cactus, oak tree, rockweed, rosebush

In two related empathy studies, **Westbury and Neumann (2008)** and **Westbury Ingham et al. (2015)** used images of animals in distressing situations (such as being injured, confined, or victimized) because they believed such scenarios were most likely to activate empathy, facilitating measurement of meaningful differences in empathy levels for different groups of

animals. While this approach may seem removed from zoo and aquarium contexts, a better understanding of empathy and how it works provides insight into how people form emotional connections with different animal groups. Although they did not name the exact animal species in their study, Westbury and Neumann (2008) named four categories they used to compare empathy towards groups with varying levels of phylogenetic relatedness: humans, non-human primates, quadruped mammals, and birds. Within the group of quadruped mammals, they included both companion animals and farm animals because they hypothesized that empathy might differ between these two categories of four-legged animals.

Westbury Ingham et al. (2015) expanded the Westbury and Neumann (2008) framework by adding reptiles, creating an additional category of animals that are further away from humans on the phylogenetic relatedness gradient. This resulted in five categories: humans, non-human primates, quadruped mammals (both companion and utilitarian mammals), birds, and reptiles. The researchers also included inanimate objects as a control group. While all the animals used in the study were not named, the researchers did provide some examples of included animals for some of the categories:

- **Non-human primates**: monkey
- **Quadruped mammals**: dog, sheep, cow, horse, pig
- **Birds**: chicken, pelican, tern, unspecified waterbird
- **Reptiles:** turtle, lizard

Prguda and Neumann (2014) also adapted the methods from the Westbury and Neumann (2008) study, using four categories to explore how empathy varied across groups of different phylogenetic relatedness. In this study, they included images of both infants and adults, making their design more about the interaction between phylogenetic similarity and developmental stage. All of the included animals were wild animals, and again, all of them (human and animal) were shown in distressing situations. The researchers did not report on the exact animals used for all categories, but did provide the following details for each group:

- **Humans:** human infants, human adults
- **Non-human primates:** infant non-human primates, adult non-human primates
- **Quadruped mammals:** infant mammals (bear and tiger cubs), adult mammals (bear, fox, and leopard)
- **Birds:** ducklings, adult ducks

Grover (2018) selected **polar bears** as the representative charismatic species and **jellyfish** as the non-charismatic species, basing these choices on previous research that described what animals typically qualify as charismatic and non-charismatic species. **Knudson (2019)** collected data about aquarium visitors' empathy for three non-charismatic invertebrates commonly found in aquarium touch tanks (**sea stars, sea urchins, and sea anemones**) and compared this data to existing data that looked at zoo visitor's empathy for two charismatic species (**gorillas and jaguars**).

da Silva et al. (2023) chose 25 species to represent a range of variables that included animals from the local area, exotic species, charismatic species, animals considered to be useful to people living in the area, animals with which people come into conflict, and animals that are commonly disliked or stigmatized. The 25 species were:

- **Mammals:** great fruit-eating bat, common marmoset, Brazilian guinea pig, six-banded armadillo, jaguar
- **Birds:** Southern caracara, American black vulture, ferruginous pygmy-owl, red-cowled cardinal, picazuro pigeon
- **Reptiles:** spectacled caiman, red-footed tortoise, cascabel rattlesnake, common green iguana, black-and-white tegu
- **Amphibians:** spotted salamander, Caatinga horned frog, Northeastern pepper frog, tree frog, Jimi's toad
- **Fish:** clown anemonefish, tiger shark, spot-fin porcupinefish, longsnout seahorse, trahira

Similarly, **Mota Pereira et al.'s (2023)** selected 17 species across a range of variables in an effort to elicit different levels of empathy. These researchers focused on animals common to the local area and specifically included examples of charismatic animals, animals deemed useful to humans, animals involved in human-wildlife conflicts in the local area, and animals that are commonly stigmatized or generally disliked.

- **Mammals:** dolphin, bat, jaguar, armadillo
- **Birds:** vulture, owl, parrot, heron
- **Reptiles**: snake, lizard, turtle, alligator
- **Amphibian:** frog
- **Fish**: shark, ray, tilapia, piranha

Swim et al. (2023) created four categories based on high or low levels of perceived competence and perceived warmth of each animal. The four categories were: (1) high-competence/high-warmth, (2) high-competence/low-warmth, (3) low-competence/high-warmth, and (4) low-competence/low-warmth. The 16 species were:

- **High-competence/high-warmth:** domestic cats, elephants, horses, domestic dogs (replaced by monkeys in a follow-up study)
- **Low-competence/high-warmth:** cows, ducks, hamsters, rabbits
- **High-competence/low-warmth:** bears, leopards, tigers, lions
- **Low-competence/low-warmth:** chickens, hippopotamuses, lizards, snakes

In their study, **Kansky et al. (2021)** wanted to explore empathy for animal species involved in human-wildlife conflicts that pose challenges for farming communities around conservation areas. They focused on five wildlife species: **kudu, lion, hyena, elephant, and baboon.** Finally, **Phan et al. (2025)** wanted to compare endangered species across animal characteristics of cuteness, familiarity, and emotional closeness. They selected four species: **giant pandas, koalas, African wild dogs, and crocodiles**.

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Appendix C: Sample of Research Studies on Select Groups of Animals

Amphibians

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Appendix D: Reviewed Evaluations, Reports, and Unpublished Work

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