How Prejudice Affects the Study of Animal Minds

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Doctor of Philosophy

in

Philosophy

Waterloo, Ontario, Canada, 2017

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Abstract

Humans share the planet with many wonderfully diverse animal species and human-animal interactions are part of our daily lives. An important part of understanding how humans do and should interact with other animals is understanding how humans think about other animals. In this thesis, I argue that how humans think about the minds of other animals is marked by prejudice and that this prejudice fosters epistemological, metaphysical, and ethical problems related to study of, the conception of, and the conclusions we draw about animal minds. I begin by examining conceptions and representations of animals in popular culture and arguing that they exhibit and foster a problematic prejudice, what I call "animal prejudice." I then examine how this prejudice affects the general study of animal minds and argue that it leads to epistemological problems that interfere with the aims of science. After reviewing the effects of animal prejudice on the study of animal minds generally, I more closely examine the effects of animal prejudice on the scientific study of animal problem solving, learning, tool use, language, emotion, and empathy. In addition to identifying areas where animal prejudice is negatively affecting the study of animal minds, I also offer suggestions for avoiding and mitigating these effects. To conclude, I review the ethical implications of animal prejudice and its effects on the study of animal minds. Together, these chapters offer an important philosophical contribution to the understanding of animal minds and provide a basis for further discussion on how humans should interact with other animals.

Acknowledgments

I am so grateful to have been a graduate student at the University of Waterloo and to have had Dr. Paul Thagard as my supervisor. Dr. Thagard's diverse expertise and academic guidance have been integral to my experience as a graduate student. I owe him my sincerest thanks for allowing me to pursue my interests freely, while also ensuring I pursued them constructively.

I also owe many thanks to my thesis committee, whose comments and feedback have strengthened this thesis. I am especially grateful to Dr. John Turri, who has provided me with a wealth of academic and professional advice and a number of opportunities throughout my time at Waterloo. Thank you to Dr. Katy Fulfer for your constructive comments and for pointing me in the direction of great sources. Thank you to Dr. Andrew Fenton for contributing your time and knowledge to my project and for the great advocacy work you do. Thank you to Dr. Alice Kuzniar for introducing me to a different perspective from which to view animals and for the many stimulating conversations we have had.

While at Waterloo, I have been fortunate to be part of an environment that promotes collaboration both within and across disciplines. Special thanks to Dr. Tim Kenyon, Dr. Doreen Fraser, and Dr. Shannon Dea for your contributions to my academic and professional growth. I could name my fellow graduate students one by one and list the ways in which they have enriched my experience at Waterloo and influenced me academically and personally. I am lucky to have been surrounded by so many inspiring individuals working on diverse and incredibly important issues. I am especially grateful to Ben Nelson, Jay Michaud, Sara Weaver, and Jim and Shelly Jordan for their friendship and moral support.

Thank you to Paul Meyer for your excellent proofreading and loving encouragement. Thank you to my family for their unconditional love and support. And last, but certainly not least, thank you to Hua and Kevin, my tiny four-legged co-authors, who sat next to me (and sometimes on top of me) while I researched and wrote this thesis.

Dedicated to the wonderful animals
who have enriched my life
and taught me to be a better human.

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Chapter 1: Animal Prejudice

1.1. Introduction

There are an estimated 8 million animal species on Earth, of which humans are just one (Mora, Tittensor, Adl, Simpson, & Worm, 2011; Mora C. T., 2011)). While humans are members of the animal kingdom, we have a remarkable tendency to forget this. At the time I am writing this, Google Search's top predictions (based on search popularity) for the incomplete phrase "are humans" are: "are humans animals," "are humans mammals," "are humans primates," "are humans apes," and "are humans still evolving." These popular search phrases are comically telling of just how uncommon it is for humans to think of themselves as belonging to the same categories as sharks, sheep, monkeys, or chimpanzees. The last popular search phrase, "are humans still evolving," further reflects just how uncommon it is for humans to think of our species as continuously evolving. The very possibility that humans could be done evolving suggests that humans could have somehow reached the "top" of an evolutionary scale, on which all other animals are below them. This notion is misguided and fails to recognize both the scientific evidence that humans are still evolving and the complexity with which the fitness of a species is measured (Balter, 2005). This popular assumption that humans reign supreme on a one-dimensional scale, along with other popular conceptions of animals, sets an important tone for all human-animal relationships.

That we share our planet with so many wonderfully diverse animal species is reason enough to understand them. It would be very difficult to find even a single individual whose life is free from all animal interaction. Regardless of geographical location, humans live with and amongst animals in our daily lives. Even in the densest of cities, where you may find more concrete than grass, those who live there are part of an ecosystem that includes many different

animal species. The structures we build, the chemicals we release into the air and water, and even the routes we choose to travel all have a significant impact on the animals around us. In addition, we also directly affect the lives of animals when we domesticate, capture, care for, protect, experiment on, and kill them.

Humans have many different relationships with other animals, and the nature of these relationships is complicated. It can be loving, heartwarming, and even symbiotic. Pets are regularly regarded as important members of our families (Archer, 1997), there are numerous accounts of animals coming to the aid of humans (Campbell, J., 2014), and there are instances where humans and animals rely on each other for accomplishing certain tasks (Webb, 2016; Lasa, Ferriero, Brigatti, Valero, & Franchignoni, 2011). While it can be easy to get wrapped up in the feel-good stories of humans and other animals happily coexisting, it is important to remember that the relationships between humans and other animals can also be marked by oppression, exploitation, and cruelty (Kenner, Pearlstein, & Roberts, 2008; Cowperthwaite, Despres, & Zimmermann, 2013; Monroe, 2009; Brown, B., 2005; Lambert & Moore, 2015).

Debates about human-animal relationships and how they should be conducted are contentious. Social psychologists refer to three central concepts when trying to understand inter-group relations: stereotypes (cognition/representation), prejudice (attitude/bias), and discrimination (behaviour) (Mackie & Smith, 1998). The relationships between these three concepts are complicated, but traditionally, social psychological theory views stereotypes as contributing to prejudice, which in turn contributes to discrimination (Dovidio, Brigham, Johnson, & Gaertner, 1996). Given that the behavioural aspect of inter-group relations is influenced by the attitudinal and cognitive aspects, a logical first step in trying to understand the relationships between humans and animals is to examine our attitudes toward them and

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representations of them. That is, before we try to understand how humans do and should interact with animals, we should first try to understand how humans think about animals. This is a sizable goal and it is one that requires the efforts of many over many projects. This thesis is one of those projects. In this thesis, I address a specific and important aspect of how humans think about animals: how humans think about animal minds.

In this thesis, I argue that how humans think about animal minds is marked by prejudice and that this prejudice fosters epistemological, metaphysical, and ethical problems related to study of, the conception of, and the conclusions we draw about the minds of other animals. I will begin in this chapter, by outlining the prejudice that humans have against other animals. I will examine conceptions and representations of animals in popular culture and argue that they exhibit and foster a problematic prejudice. In chapter 2, I will examine how this prejudice affects the general study of animal minds and argue that it leads to epistemological problems that interfere with the aims of science. The prejudice outlined in chapter 1 and the epistemological problems discussed in chapter 2 can lead to metaphysical problems related to the conception of animal minds. In chapters 3 and 4, I will more closely examine the scientific study of specific cognitive abilities in animals and the problems that are caused by animal prejudice. In chapter 3, I will examine the study of animal problem solving, learning, tool use, and language and in chapter 4, I will examine the study of animal emotion and empathy. In chapter 5, I will conclude with a discussion of the ethical implications that can result from the epistemological and metaphysical problems discussed in the previous chapters. Together, these chapters offer an important philosophical contribution to the understanding of animal minds and provide a basis for further discussion on how humans should interact with other animals.

I begin chapter 1 by addressing the question of whether humans are prejudiced against other animals. In section 1.2, I will briefly review the general debate about human-held prejudice against other animals (what I will call here, "animal prejudice"). In section 1.3, I will examine some of the common stereotypes of animal minds and morality in English-speaking Western popular cultures that contribute to animal prejudice. In section 1.4, I will outline some of the characteristics of animal prejudice and in section 1.5, I will lay the foundation for the argument that animal prejudice is problematic. While this argument will begin in section 1.5, it will be continued throughout this entire thesis.

One important note that I wish to make before getting too far into this thesis concerns terminology. Many different terms have been used to refer to the group that is made up of all animal, minus humans. These terms include "beasts," "brutes," "critters," "non-human animals," and simply "animals." The first two terms are associated with predominantly negative images of mean, scary and even evil animals. A simple Google image search of these terms provides a good illustration of this. The term "critters" is probably more neutral than "beasts" and "brutes," but despite being defined simply as "non-human animals," it too can be associated with specific images. For some, the term "critters" can be associated with negative images of creepy, and sometimes fictional, animals (for example, the film series "Critters" (Herek, 1986; Garris, 1988; Peterson, 1991; Harvey, 1992)). For others, and this seems to be the most popular association, the term "critters" is associated with smaller animals, such as mice and insects (for example, the book series "Little Critter" (Mayer, 2017); the "Calico Critters" line of toys (Calico Critters, 2017); entertainment programming, such as "Undercover Critters" (Stones & Zaslove, 1991)). Because of their associations with specific images or kinds of animals, I will not adopt the terms "beasts," "brutes," or "critters" here. The terms "non-human animal" and "animal" both reflect a

potentially problematic distinction between humans and other animals. The term "non-human animal" seems to distance other animals from the category of human in a way that other species are not distanced from each other, by setting "human" as a kind of standard. The term "animal" seems to distance humans from other animals by ignoring the fact that humans are also animals. The term "non-human animal" is perhaps the most technically accurate term, but is less convenient than the term "animal."

In this thesis, I will often use the term "animal" to refer to non-human animals, despite the fact that humans are also undeniably animals. I consider all living organisms that belong to the Animal Kingdom to be animals. When I use the term "animal minds" in this thesis, I am focusing on the minds of non-human animals, but to be clear, I consider human minds to be a variety of animal minds. That is, humans have human minds, donkeys have donkey minds, chameleons have chameleon minds, but they all have animal minds. My using the general term "animal" to focus specifically on non-human animals is merely for convenience.

Finally, what I mean when I refer to "minds" is not something that adheres to any strict definition. Instead, I mean something like what Paul Thagard outlines in *Brain-Mind* (2017). In place of a strict definition, Thagard prefers a method he calls "3-analysis" for outlining what minds are. Through 3-analysis, a concept is explained by outlining three aspects of that concept: exemplars, typical features, and explanations. In this case, exemplars of animal minds include the animal cases I will discuss in this thesis. The typical features include the same typical features outlined by Thagard: acting, communicating, deciding, feeling, learning, perceiving, problem solving, sensing, and thinking. The explanations are also similar to what Thagard outlines: minds explain behaviours, and minds can be explained by neural evidence. For a more detailed review of what minds are, see chapter one of *Brain-Mind* (Thagard, 2017).

1.2. Views on Prejudice against Animals

Humans have a long history of exhibiting prejudice toward particular groups. Human craving for hierarchy has led to numerous groups within the human species believing that they are superior to other human groups (Sidanius & Pratto, 2001). This is the foundation of sexism, racism, classism, ageism, heterosexism, etc. There are a plethora of examples of prejudice that have existed and continue to exist and while many of these prejudices are directed toward various human groups, human-held prejudice is not restricted in scope to our own species.

Animal prejudice, a bias that humans have in favour of their own species and against other species (to varying degrees), has been discussed by a number of scholars, usually with an emphasis on how this prejudice manifests into discrimination in the farming and fashion industries and in animal experimentation (Singer & Mason, 2007; Adams, 2015; Regan, 2001; Williams, 1980; Cavalieri, 2003). Indeed, Meredith Williams argues that "our typical attitude towards animals, especially those we raise for food and use for experimentation, is one of prejudice," (Williams, 1980, p. 149). Some scholars have adopted the term "speciesism" to refer to this prejudice. Coined by Richard Ryder (Godlovitch, Godlovitch, & Harris, 1972), and popularized by Peter Singer, speciesism can be defined simply as "a prejudice or attitude of bias in favor of the interests of members of one's own species and against those of members of other species," (Singer, Animal liberation, 1995, p. 35).

The term "speciesism" is meant to highlight the analogy between prejudice against animals and prejudice against various human groups (for example, racism and sexism). People may be uncomfortable with the comparison of prejudice against animals to prejudice against human groups. One worry is that because instances of human prejudice can include comparisons of individuals to animals (implying that they have a "sub-human" or in some way "inferior"

status), comparing prejudice against animals to prejudice against humans can reinforce the initial prejudice against humans. Eva Kittay takes a stronger stance and argues that comparisons of humans with severe cognitive disabilities to animals "dehumanize" the individuals subject to the comparisons (Kittay, 2005). Another worry is that comparing human and animal prejudices trivializes the experiences of human victims of prejudice and is, according to some, "preposterous and indeed insulting," (Fox, 1986, p. 58). Defenders of speciesism argue that these worries are rooted in a prejudice against animals (Spiegel, 1996). Importantly, two prejudices do not need to be identical in order to both be problematic. Prejudices are complex and different prejudices can be complex in different ways. Many scholars who make the comparison between animal and human prejudices do so by highlighting the analogous relationship between them and not by claiming that they are exactly the same.

While "speciesism" has been adopted by a number of scholars in philosophy, the term is not always used consistently. Joan Dunayer (2004) has argued that there are actually two different levels of speciesism: old-speciesism and new-speciesism. According to Dunayer, old-speciesists do not advocate for any animal rights, new-speciesists advocate for some rights for some animals, and non-speciesists advocate for rights to life and liberty for all sentient beings.

What I want to focus on here is how prejudice against animals affects how humans conceive of and make claims about animal minds. In doing this, I will not be directly focusing on the issue of what rights animals should and should not have and so, I will not adopt the term "speciesism" here. Instead, I have chosen to use the term "animal prejudice" to refer to the bias that humans have in favour of their own species and against other species (to varying degrees). Furthermore, I will not be making any claims about the relative importance of animal prejudice compared to other types of prejudice. Prejudices against various human groups cause immense

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pain and suffering and the nature of these prejudices is incredibly complex. My focus here is simply on the epistemological, metaphysical, and ethical implications of animal prejudice. While other scholars have discussed the historical roots of animal prejudice (Singer, 1995, pp. 271-308) and the effect of prejudice on particular species (Reaktion Books: Animal Series, 2017), I will focus specifically on the expressions of animal prejudice in contemporary popular culture and against all species.

1.3. Animal Stereotypes

A stereotype can be defined simply as "a widely held but fixed and oversimplified image or idea of a particular type of person or thing" (Stereotype, 2017). Stereotypes have a number of important functions. They allow us to quickly process new information about our surroundings, assess situations, and make important predictions about a person's behaviour and how an event may unfold. However, stereotypes can also be damaging and they can foster prejudice and discrimination if left unchecked. In discerning the difference between the helpful and harmful effects of stereotyping, Stuart Hall (2013, pp. 228-229), drawing on previous work by Richard Dryer (1977) , makes a helpful distinction between "typing" and "stereotyping." According to Hall, typing involves simple characterizations that foreground particular traits, which change or develop little over time and which are taken to be representative of an individual and the group to which they belong. These characterizations serve as a helpful way of categorizing information about our social environments. In comparison, stereotyping involves extreme characterizations that are fixed in time and that in addition to foregrounding particular traits, reduce subjects (and other subjects that belong to the same group) to only those simplified and exaggerated traits (regardless of whether the subject actually exhibits those traits). Stereotype characterizations

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then, are more harmful and misrepresentative than typing characterizations. In this thesis, I will be focusing on these extreme, stereotyping characterizations.

In examining the role that stereotypes play in the oppression of human groups, Ann Cudd (2006) argues that stereotyping is harmful and can lead to injustice for stereotyped groups. While I will not be arguing that animals are oppressed, Cudd's discussion of the role that stereotypes play is still helpful for understanding animal prejudice. Similarly, in a branch of feminist philosophy sometimes called "ecofeminism," feminist scholars have argued that there is an important relationship between prejudice against women and prejudice against animals (Nussbaum, Compassion: Human and animal, 2012; Adams, 2015; Mies & Shiva, 1993; Merchant, 1981). Carol J. Adams (2015) argues that toxic metaphors play an important role in sustaining prejudice, by examining the role that they play in prejudice against women and animals. Importantly, she does not argue that all metaphors are problematic, rather she focuses on specific kinds of prejudiced (toxic) metaphors. Indeed, some metaphors are extremely valuable (Thagard & Beam, 2004). In section 1.4, I will argue that animal stereotypes, including tropes that serve as metaphors, exhibit and foster an animal prejudice that is harmful to how we think of and make decisions about animal minds. Before I begin this discussion, I will review some examples of animal stereotypes in popular culture.

Applications of stereotypes can be found in metaphors, tropes, idioms, pejoratives, generics, art, music – essentially anywhere expressions are made. I will focus on two applications of stereotypes in this chapter: pejoratives and tropes in film, fiction, and video games. The history of animal epithets is long and detailed and while the specific instantiations of pejoratives and tropes found in popular culture may have changed over time, many of the

animal stereotypes that the pejoratives and tropes are based on remain unchanged (Campbell, G., 2014).

1.3.1. Animal Pejoratives

Pejoratives provide good examples of applications of animal stereotypes. A pejorative is a term or phrase that expresses negative connotations about the person or thing to which it is applied. Table 1.1 shows some examples of commonly used pejoratives that appropriate animal names for describing human behaviour. The pejorative terms listed in the table 1.1 all have negative connotations (though some are more derogatory than others) and they all rely on negative stereotypes of animal minds or morality. The cognitive capacities most commonly reflected in the stereotypes listed in table 1.1 are intelligence, empathy, and morality (which relies on multiple cognitive capacities).

The meanings of these animal pejoratives are based on underlying stereotypes about the animals whose names the pejoratives appropriate. Calling someone a "birdbrain" would not be insulting unless we thought birds had relatively unimpressive brains. After all, if we thought birds had powerful and sophisticated brains, then calling someone a "birdbrain" would actually be a compliment. The pejoratives I chose to focus on here are the ones that rely on negative stereotypes of animal minds and morality. However, the examples listed in table 1.1 represent only a small sample of animal terms that are used as pejoratives. Other animal pejoratives that rely on non-mental and non-moral characteristics (such as appearance) also exist and are used widely in popular culture. For example, many scholars in feminist literature have noted the extensive use of animal pejoratives in sexist descriptions of women (Dunayer, 1995; Baker, 1975). Furthermore, the phenomenon of appropriating animal names for use as pejoratives is not

Pejorative	Meaning	Animal Stereotype
"Animal"	A person who behaves in a "bestial" or "brutish" manner	Non-human animals are unintelligent or immoral
"Ass"	A person who is stupid	Asses (donkeys) are unintelligent
"Batty"	The characteristic of being crazy or mentally deranged	Bats are insane
"Birdbrain"	A person who lacks intelligence of who makes stupid decisions	Birds are unintelligent
"Booby"	A stupid or foolish person	Boobies are unintelligent
"Cockroach"	A person with low moral character	Cockroaches have no moral worth
"Cold-blooded"/ "in cold blood"	Without emotion or intentionally cruel	Cold-blooded animals lack emotion or empathy
"Coot"	A foolish or eccentric person	Coots are unintelligent
"Crocodile Tears"	A false or insincere display of emotion	Crocodiles lack empathy or are dishonest
"Cuckoo"	A crazy or foolish person	Cuckoos are unintelligent
"Dodo"	A person who is stupid, an idiot	Dodos (birds) are unintelligent
"Dumb Bunny"	A person who is naïve and foolish	Rabbits are unintelligent
"Goose"	A foolish person	Geese are unintelligent
"Guinea Pig"	A person who is used as a puppet or tool for experimentation	Guinea pigs are mentally deficient
"Hog"	A person who is greedy and unfair	Hogs (pigs) are immoral
"Lemming"	A person who follows and is unable to think for themselves	Lemmings are unintelligent
"Loon"	A crazy or stupid person	Loons are unintelligent
"Monkey see, monkey do"	To unintelligently copy another	Monkeys are unintelligent
"Parroting"	To repeat mechanically without original thought	Parrots are unintelligent
"Pissant"	A person who is worthless	Ants have no moral worth
"Rat"	A person who lies or betrays a friend	Rats are immoral
"Shark"	A person who takes advantage of other's misfortunes	Sharks are immoral
"Sheepish"	A person who is meek or stupid	Sheep are unintelligent
"Shrew"	A "bad" or highly unpleasant person (usually a woman)	Shrews are immoral
"Silly Goose"	A person who behaves foolishly	Geese are unintelligent
"Snake"	A person who is disloyal or deceitful	Snakes are immoral
"Stupid cow"	A person (usually a woman) who makes stupid decisions	Cows are unintelligent
"Tit"	A stupid person	Tits are unintelligent
"Turkey"	A person who is stupid, an idiot	Turkeys are unintelligent
"Vulture"	A person who exploits others	Vultures are immoral
"Weasel"	A person who is sneaky	Weasels are immoral

Table 1.1: Common examples of pejorative terms that rely on negative stereotypes of animal minds and morality. Examples were obtained through purposive sampling (a non-probability sampling method, wherein examples are chosen based on their characteristics and the author's judgment).

limited to the English language (Chamizo Domínguez & Zawislawska, 2006). These pejoratives also contribute to the sustaining of negative animal stereotypes and the general prejudice against animals, though I will not be focusing on them here.

1.3.2. Animal Tropes

In film, literature, and video games, a trope is an overly used theme, device or cliché. In this thesis, when I use the word trope, I am referring to an overly used and cliché characterization. Countless children's stories make use of animal characters and with such an extensive library of resources to draw from, animal tropes are easily identified. Table 1.2 shows some examples of common animal tropes that rely on negative stereotypes of animal minds and morality. Tropes in children's animated films make it easy for us to anticipate an animal character's role in the story based on their species alone. For example, we would likely anticipate the lion, dog, and horse, characters to be heroes, while we would anticipate the crocodile, wolf, and rat characters to be villains. When animal characters who specifically break their expected stereotypes are introduced in a story, it is striking and often commented on within the story itself with regard to the fact that these characters are not normal or typical examples of their species. Examples of characters who do not conform to their expected stereotypes are: Bruce the vegetarian shark in "Finding Nemo" (Stanton & Unkrich, 2003); Louis the friendly jazz-loving alligator in "The Princess and the Frog" (Clements & Musker, 2009); and many of the characters from "Zootopia" - an academy award-winning animated film that directly confronts issues of animal stereotypes - (Howard, Moore, & Bush, 2016). Though not all animal characters are examples of tropes, tropes still play an important role in the representation of animals in stories.

Animal Trope	Example Characters
Alligator & Crocodile "The evil alligator or crocodile"	-Brutus and Nero in "The Rescuers" (Lounsbery, Reitherman, & Stevens, 1977) -Gumbo in "Darkwing Duck" (Stones, 1991-1992) -Captain Crocodile in "Robin Hood" (Reitherman, 1973) -Tick-Tock in "Peter Pan" (Geronimi, Jackson, Luske, & Kinney, 1953) -Kremlings and King K. Rool in "Donkey Kong Country" (video game) (Rare, 1994)
Bat "The insane, evil bat"	-Batty Koda in "FernGully: The Last Rainforest" (Kroyer, 1992) -Fidget in "The Great Mouse Detective" (Clements, Mattinson, Michener, & Musker, 1986) -Bartok in "Anastasia" (Bluth & Goldman, 1997) -The Great Animal in "The Swan Princess" (Rich, 1994)
Bear "The dopey, dimwitted, lazy bear"	-Winnie The Pooh in "The Complete Tales of Winnie-the-Pooh" (Milne, 1994) -Yogi Bear in "The Yogi Bear Show" (Hanna & Barbera, 1961-1962) -Baloo in "The Jungle Book" (Reitherman, 1967) -Fozzie Bear in "The Muppet Show" (Henson, J., 1976-1981) -Br'er Bear in "Song of the South" (Jackson & Foster, 1946) -Banjo in "Banjo-Kazooie" (video game) (Rare, 1998)
Birds (general) "The dumb, simple-minded bird"	-Scuttle in "The Little Mermaid" (Clements & Musker, 1989) -HeiHei in "Moana" (Clements, Hall, Musker, & Williams, 2016) -Kevin in "Up" (Docter & Peterson, 2009) -Becky in "Finding Dory" (Stanton & MacLane, 2016) -Orville in "The Rescuers Down Under" (Butoy & Gabriel, 1990)
Cats (domestic) "The evil, apathetic cat"	-Garfield in "Garfield and Friends" (Davis, J., 1988-1994) -Lucifer in "Cinderella" (Geronimi, Jackson, & Luske, 1950) -Chloe in "The Secret Life of Pets" (Renaud & Cheney, 2016) -M.A.D. Cat in "Inspector Gadget" (Chalopin, Heyward, & Bianchi, 1983-1986) -Pete in "A Goofy Movie" (Lima, 1995) -Dragon in "The Secret of NIMH" (Bluth, 1982)
Crustaceans (general) "The mean, immoral crustacean"	-Lobster Mobster and Da Shrimp in "The Little Mermaid (TV Series)" (Mitchell & Mantta, 1992-1994) -Tamatoa in "Moana" (Clements, Hall, Musker, & Williams, 2016) -Bad Polly (Polly Lobster) in "Muppet Treasure Island" (Henson, B., 1996)
Donkey "The dumb, stubborn donkey"	-Donkey in "Shrek" (Adamson & Jenson, 2001) -Donkey Boys in "Pinocchio" (Ferguson, et al., 1940) -Jacchus in "Fantasia" (Beebe, 1940)
Foxes (red) "The cruel, cunning fox"	-Fox characters in "The Fox and the Stork" (Aesop, 2017); "The Fox and the Goat" (Aesop, 2017); "The Cock and the Fox" (Aesop, 2017); "The Fox and the Crow" (Aesop, 2017) -Reynard the Fox in various stories (Jacobs, 1895) -Honest John in "Pinocchio" (Ferguson, et al., 1940)

Table 1.2: Continued on next page...

Animal Trope	Example Characters
Insects (general) "The bad, revolting insects"	-Hopper in "A Bug's Life" (Lasseter & Stanton, 1998) -General Mandible in "Antz" (Darnell & Johnson, 1998) -Scroop in "Treasure Planet" (Clements & Musker, 2002)
Lemming "The dumb, suicidal lemming"	-Lemmings in "Norm of the North" (Wall, 2016) -Lemmings in "Lemmings" (video game) (DMA Design, 1991) -Lemmings (fictional portrayal) in "White Wilderness" (Algar, 1958)
Lizards (general) "The evil, sneaky lizard"	-Joanna the Goanna in "The Rescuers Down Under" (Butoy & Gabriel, 1990) -Randall Bogs in "Monster's, Inc." (Docter, Silverman, & Unkrich, 2001) -Bill the Lizard in "The Great Mouse Detective" (Clements, Mattinson, Michener, & Musker, 1986) -Wart in "Chip 'n Dale Rescue Rangers" (Stones & Zaslove, 1988-1990)
Octopus/Squid "The evil, monstrous octopus/squid"	-Kraken in "Pirates of the Caribbean: Dead Man's Chest" (Verbinski, 2006) -The "poulpes" in "Twenty Thousand Leagues Under the Sea" (Verne, 1870) -Ursula in "The Little Mermaid" (Clements & Musker, 1989)
Raccoon "The criminal, dishonest raccoon"	-Norvirus Raccoon in "The Nut Job" (Lepeniotis, 2014) -Bering in "Brother Bear 2" (Gluck, 2006) -Sly Cooper in "Sly Cooper and the Thievius Raccoonus" (video game) (Sucker Punch Productions, 2002)
Rat "The evil, greedy rat"	-Templeton in "Charlotte's Web" (White, 1952) -Professor Ratigan in "The Great Mouse Detective" (Clements, Mattinson, Michener, & Musker, 1986) -The Rat in "Lady and the Tramp" (Geronimi, Jackson, & Luske, 1955)
Snake "The evil, untrustworthy snake"	-The Serpent in "The Bible" (The Fall 3:1-24; Revelation 20:2; Proverbs 23:32; Matthew 23:33 and 7:10; Redding Brand, 2005) -Kaa in "The Jungle Book" (Kipling, 1894) -Jafar in "Aladdin" (Clements & Musker, 1992) -The Basilisk in "Harry Potter and the Chamber of Secrets" (Rowling, 1998)
Weasel "The sneaky, impetuous weasel"	-The Weasels in "Wind in the Willows" (Grahame, 1908) -Smart Ass, Greasy, Psycho, Wheezy, and Stupid in "Who Framed Roger Rabbit?" (Zemeckis, 1988) -Weasels in "Mickey's Christmas Carol" (Mattinson, 1983) - Professor Von Kriplespac from "Conker's Bad Fur Day" (video game) (Rare, 2001)
Wolf "The cruel, evil wolf"	-"Big Bad Wolf" characters in "Little Red Riding Hood" (Grimm & Grimm, 1903), "Boy Who Cried Wolf" (Aesop, 2017), "Peter and the Wolf" (Geronimi, 1946), "The Three Little Pigs" (Gillett, 1933) -Ralph Wolf in "Don't Give Up the Sheep" (Jones, C., 1953)

Table 1.2: Common examples of tropes in film, literature, and video games that rely on negative stereotypes of animal minds and morality. Examples were obtained through purposive sampling.

Animal Trope	Example Characters
Dog "The heroic, noble dog"	-Lassie in "Lassie Come-Home" (Knight, 1940) -Old Yeller in "Old Yeller" (Gipson, 1956) -Bolt in "Bolt" (Howard & Williams, 2008) -Pongo and Perdita in "101 Dalmatians" (Geronimi, Luske, & Reitherman, 1961) -Snowy in "The Adventures of Tintin" (Hergé, 2007)
Dolphin (bottlenose) "The playful, heroic dolphin"	-Flipper in "Flipper" (Clark, J., 1963) -Ecco in "Ecco the Dolphin" (video game) (Novotrade International, 1992) -Winter in "Dolphin Tale" (Smith, C., 2011)
Elephant "The wise, kind-hearted elephant"	-The Elephants in "The Jungle Book" (Favreau, 2016) -Horton in "Horton Hears a Who!" (Seuss, 1954) -Whispers in "Whispers: An Elephant's Tale" (Joubert, 2000)
Horse "The brave, noble horse"	-Black Beauty in "Black Beauty" (Sewell, 1877) -Maximus in "Tangled" (Greno & Howard, 2010) -Angus in "Brave" (Andrews, Chapman, & Purcell, 2012) -Pegasus in "Hercules" (Clements & Musker, 1997) -Khan in "Mulan" (Bancroft & Cook, 1998)
Lion "The brave, noble lion"	-Simba and Mufasa in "The Lion King" (Allers & Minkoff, 1994) -Aslan in "The Lion, the Witch and the Wardrobe" (Lewis, 1950) -King Richard in "Robin Hood" (Reitherman, 1973) -King Noble in various "Reynard the Fox" stories (Jacobs, 1895)
Owl "The wise owl"	-Owl in "The Complete Tales of Winnie-the-Pooh" (Milne, 1994) -Archimedes in "The Sword and the Stone" (Reitherman, 1963) -Owl in "Bambi" (Algar, et al., 1942) - Kaepora Gaebora in "The Legend of Zelda: Ocarina of Time" (video game) (Nintendo EAD, 1998)

Table 1.3: Common examples of tropes in film, literature, and video games that rely on positive stereotypes of animal minds and morality. Examples were obtained through purposive sampling.

While the tropes in table 1.2 are all based on negative stereotypes of animal minds and morality, tropes based on positive stereotypes also exist. Table 1.3 provides some examples of tropes based on positive stereotypes of animal minds and morality. Positive animal tropes often highlight virtues and moral characteristics. For example, the positive tropes listed in table 1.3, portray animals as heroic, brave, noble and wise. Often, positive tropes exist alongside or as alternatives to negative tropes. For example, the "wise owl" trope portrays owls as knowledgeable advisors, but the "evil owl" or "evil owl assistant" trope portrays owls as dark and immoral. The "elephant who never forgets" trope portrays elephants as intelligent and

having a vast capacity for memory, but the "elephant who is scared of a mouse" trope portrays

elephants as irrationally fearful. The "cunning fox" trope portrays foxes as intellectual and witty,

but the "sly fox" trope portrays foxes as deceitful and untrustworthy. While it may be tempting

to view these positive tropes as a sort of counter-balance to the negative tropes, we will see in the

next section that the positive tropes also play an important role in promoting and defining animal

prejudice.

1.4. The Harms of Stereotypes and Animal Prejudice

While typing can be a helpful form of categorization, stereotyping has negative cognitive

consequences, which result in animal prejudice. This prejudice in turn can lead to

epistemological, metaphysical, and ethical problems if left unchecked. In this section, I will

discuss the negative cognitive consequences of animal stereotypes and outline the resulting

animal prejudice. In section 1.5, I will lay the foundation for the argument that animal prejudice

can lead to epistemological, metaphysical, and ethical problems if left unchecked. While this

argument will begin in section 1.5, it will be continued throughout this entire thesis.

An important feature of categorization is the distinction between in-groups and out-

groups. In-groups are the groups to which one belongs and out-groups are the groups to which

one does not belong. The stereotypes that a person makes use of tend to favour their in-groups

and disfavour their out-groups. The negative cognitive consequences of stereotypes include

viewing members of in-groups as overly heterogeneous, viewing members of out-groups as

overly homogenous, viewing "good" members of an out-group more positively than is warranted

by evidence, and viewing "bad" members of an out-group as more negative than is warranted by

evidence (Tajfel & Turner, 1979; Fiske & Taylor, 1991). Furthermore, confirmation bias tends

to cause people to focus selectively on information that supports established stereotypes, while ignoring information that rejects them (Kenyon, 2008, pp. 195-206). Stereotypes about animal minds, like the ones identified in section 1.3, are not new. Their continued applications through pejoratives, tropes, and other expressions exhibit and promote a prejudice against animals that is widespread throughout many English-speaking Western cultures.

In discussing social-cognitive theories of stereotype formation, Ann Cudd (2006) argues that a combination of categorization theory, social identity theory, and economic theory explain why stereotypes are so prevalent and the roles they play. According to categorization theory, stereotypes allow individuals who hold them to more efficiently categorize perceptual data and relate that data to their own interests. The social categorization of individuals into in-groups and out-groups is a further attempt to categorize individuals in relation to one's interests. According to social identity theory, individuals are motivated to establish and develop positive social identities. Stereotypes and the distinctions between in-groups and out-groups serve as a way to define a positive social identity in accordance with one's interests and values. Cudd (and also Hall (2013)) further notes that stereotypes serve not only to group individuals within a social context, but also to establish a social order, wherein individuals of in-groups are ranked higher than individuals of out-groups. Finally, Cudd argues that there are economic motivations for using and maintain stereotypes. By maintaining stereotypes and reinforcing the distinctions between in-groups and out-groups, the economically dominant groups in society maintain their status and stand to reap the rewards of that status (Cudd, 2006, p. 76).

Animal tropes like the ones in tables 1.2 and 1.3 are metaphors, wherein animal trope serve as a vehicle for values or character traits. The problem is that rather than viewing the animals in these tropes as tokens for particular values or traits, the metaphors become naturalized

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(Hall, 2013; Adams, 2015) and animal tropes are adopted as stereotypes for the animal's species as a whole. That is, animal tropes result in stereotypes that reduce their subject animals to only simplified and exaggerated traits (regardless of whether the subject animals actually exhibits those traits). Importantly, both positive and negative stereotypes that become naturalized are harmful for our conceptions of animals in that they reduce animals to over simplified and over exaggerated traits. When stereotypes become the norm for conceiving of animal minds, we oversimply animal minds and overgeneralize individuals.

One of the most notable patterns in animal stereotypes is that there is a clear difference between stereotypes for mammalian animals and stereotypes for non-mammalian animals. First, there is a clear difference in the level of specificity with regard to scope between stereotypes of mammalian animals and stereotypes of non-mammalian animals. Stereotypes of animals can be made at various levels, including at the level of kingdom (of all animals, with the exception of humans), class (of all mammals, reptiles, birds, fish, etc.), and species (of all dogs, cats, donkeys, etc.). Figure 1.1 shows the basics levels of taxonomic rank within the animal kingdom. Figure 1.2 shows the distribution of animal stereotypes from tables 1.2 and 1.3 according to taxonomic rank and whether the animal subject of the stereotype is a bird, crustacean, insect, cephalopod, reptile, or mammal. Importantly, figure 1.2 shows that most stereotypes were of mammalian animals and that the scope in terms of taxonomic rank of stereotypes of mammalian animals was much narrower than the scope of stereotypes of non-mammalian animals. That is, stereotypes about mammals, tended to focus on narrower groups of animals (for example, at the level of species), whereas stereotypes about non-mammals tended to focus on broader groups of animals (for example, at the level of order).

A)

Kingdom

Phylum

Class

Order

Family

Tribe

Genus

Species
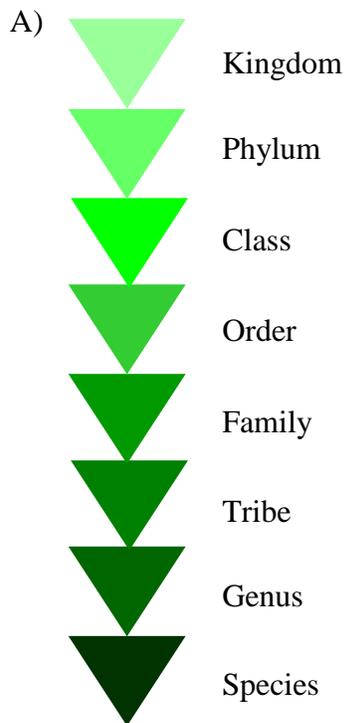
Figure 1.1: The basic levels of taxonomic rank within the Animalia kingdom, with the most general level at the top and the most specific level at the bottom.

B)

Number of Stereotypes

Class   Order   Family   Tribe   Genus   Species

● Birds
● Crustaceans
● Insects
● Cephalopods
● Reptiles
● Mammals
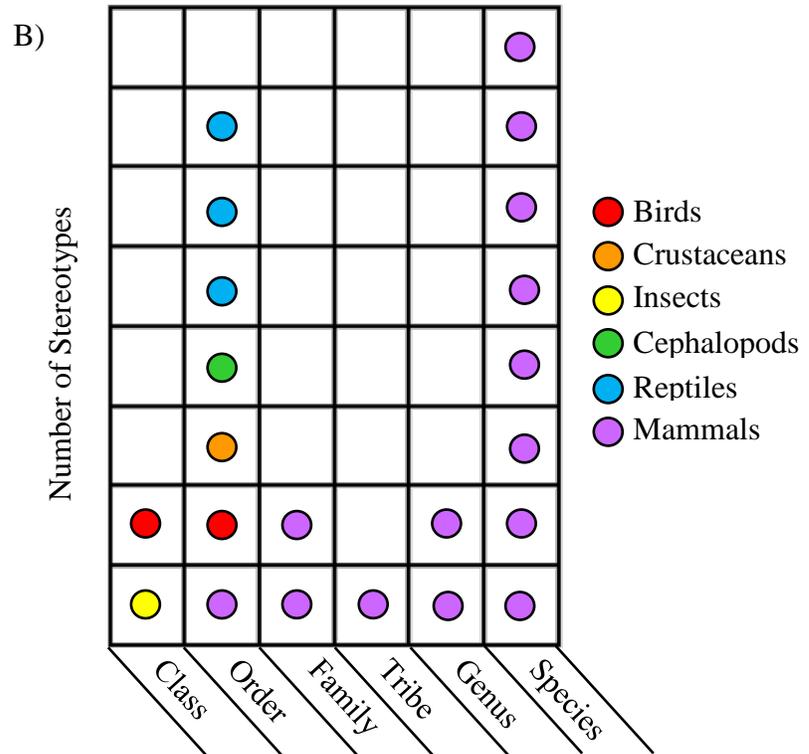
Figure 1.2: The distribution of animal stereotypes from tables 1.2 and 1.3 according to taxonomic rank. The x-axis represents the taxonomic level at which each stereotype was made and the y-axis represents how many stereotypes were made at each taxonomic level. Each circle represents one stereotype and the colour of the circle represents the type of animal.

Fine-grained stereotypes will be more often seen for the animals who we most often interact with. These animals are typically, though not always, mammalian and are domesticated or hunted. This makes sense on a common-sense level; the animals we interact with most, we know the most about and therefore, we are most easily able to stereotype them. For example, when asked to imagine the stereotypical characteristics of a cow, one has a much easier time than when asked to imagine the stereotypical features of an axolotl. Furthermore, for species we are very familiar with, such as dogs and horses, our stereotypes narrow even more in scope when we stereotype different breeds within a species. For example, if you are familiar with dogs, you can easily imagine the stark contrast between the stereotypical features of a golden retriever and the stereotypical features of an American pit bull terrier. Golden retrievers are stereotypically
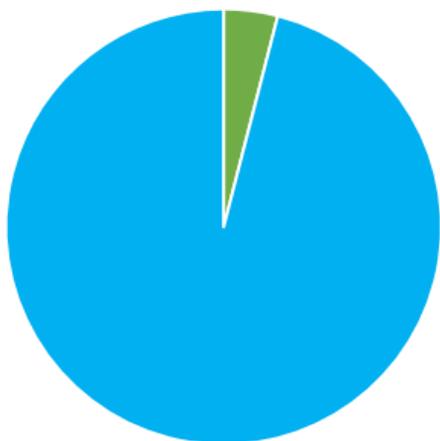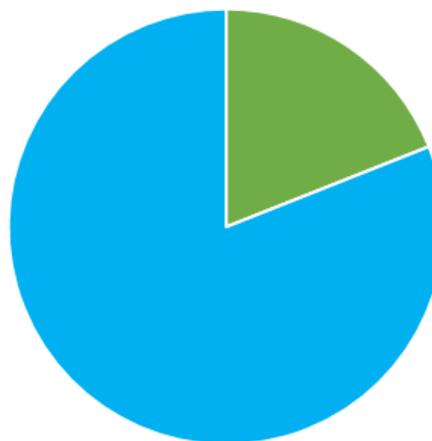
Figure 1.3: Percentages of non-mammalian stereotypes (left) and mammalian stereotypes (right) from tables 1.1, 1.2, and 1.3 that are positive and negative.

thought of as easy-going and friendly dogs, whereas American pit bull terriers are stereotypically

(and inaccurately) thought of as mean and aggressive dogs. For those familiar with horses, one

can do the same with Arabians and percherons. Arabians are stereotypically thought of as high-

strung and feisty horses, whereas percherons are stereotypically thought of as quiet and gentle

horses.

A second distinction between mammalian and non-mammalian stereotypes is that there

seem to be more negative stereotypes (relative to the number of positive stereotypes) for non-

mammalian animals than there are for mammalian animals. Figure 1.3 shows the percentages of

non-mammalian and mammalian stereotypes from section 1.3 that are positive and negative.

While there are more negative than positive stereotypes overall for both mammalian and non-

mammalian animals, a smaller proportion of non-mammalian stereotypes are positive as

compared to mammalian stereotypes. One potential explanation as to why non-mammalian

animals may be more often negatively stereotyped than non-human-mammalian animals is due to

the fact that humans are mammals and therefore belong to the same in-group as other

mammalian animals. Non-mammals therefore comprise a large out-group, which humans can

more readily conceive of negatively.

Not only do non-mammalian animals seem to be more often stereotyped negatively, they

also seem to be stereotyped in much broader strokes. For example, the entire class of birds have

been negatively stereotyped as unintelligent. Out of all of the bird stereotypes discussed in

section 1.3, only one is positive ("the wise owl") and only one does not directly focus on

intelligence ("the immoral vulture"). The rest are all negative stereotypes that directly focused

on intelligence. In fact, out of the thirty-one pejoratives listed in table 1.1, eleven of them are

bird names that serve as different ways to call a person unintelligent. Indeed, one of the

cognitive consequences of categorizing individuals into in-groups and out-groups is the tendency

to view out-group members as overly homogenous.

Similarly, the entire class of reptiles has been stereotyped as bad or immoral and reptilian

characters are often portrayed as villainous rather than heroic. It is easy to come up with

examples of villainous alligators, snakes, and lizards (see table 1.2), but there are far less heroic

reptilian characters (for example, Louis in "The Princess and the Frog" (Clements & Musker,

2009), and Leonardo, Donatello, Raphael and Michelangelo in "Teenage Mutant Ninja Turtles"

(Eastman & Laird, 1984). Even when heroic reptilian characters are introduced, they often

encounter stereotypical expectations of their species in other characters. Reptiles are further

demonized when humans represent hostile alien characters as reptilian or as reptilian humanoids.

The tradition of reptilian aliens in science fiction is long and widespread (for an extensive list of

examples, see (List of reptilian humanoids, 2017)).

Another characteristic of animal prejudice that may account for the disproportionate negative stereotyping and demonization of non-mammalian animals compared to mammalian animals is that animals who humans consider "cute" tend to be more positively stereotyped than animals who humans consider "ugly." The animals humans commonly recognize as cute tend to be mammals (in-group members), while the animals humans commonly recognize as ugly tend to be non-mammals (out-group members, such as reptiles and insects).

Another characteristic of animal prejudice that is worth noting is that predatory animals are more often portrayed as villainous characters than prey animals. For example, villainous wolves, snakes, and crocodiles are easily found (see table 1.2), but villainous rabbits, sheep, or mice are harder to find (for example, Boingo in "Hoodwinked!" (Edwards, Edwards, & Leech, 2005), Snowball in "The Secret Life of Pets" (Renaud & Cheney, 2016), Brain in "Pinky and the Brain" (Ruegger & Spielberg, 1995-1998)).

All of these characteristics of animal prejudice discussed here simply serve to show that animal prejudice is complex and it does not apply equally to all animals. Similar to human prejudice, animal prejudice targets different groups disproportionately. If we hope to understand how animal prejudice affects our conceptions of animals and how we make decisions about animals, then it is important to recognize how animal prejudice targets different animals.

1.5. The problem

As I mentioned at the beginning of this chapter, humans are animals, but this is not a label that we readily apply to ourselves. This is evident in the ordinary use of the term "animal" to refer specifically to non-human animals (just as I am doing for this thesis). This may not seem particularly harmful, but what it does is point to a perceived divide between humans and

"animals." Of course, there is a difference between human and non-human animals, just as there is a difference between sloth and non-sloth animals. Different species of animals are different in important and interesting ways, but they can also be similar in important and interesting ways. The problem is that animal prejudice leads us to exaggerate the differences between human and non-human animals, while also exaggerating the similarities between non-human animals. These exaggerations and oversimplifications lead to epistemological, metaphysical, and ethical problems related to the study of animal minds.

There is a common belief, referred to as "human uniqueness", that humans are different in kind rather than degree from other animals. That is, it is commonly believed that there are some cognitive capacities that humans have that other animals simply do not (not even to a lesser degree). Scholars have long touted human uniqueness on a number of grounds – emotion, tool use, mental state attribution, language, etc. The more we learn about animals, the fewer the claims of human uniqueness. Importantly, denying human uniqueness is not equivalent to denying that humans have impressive abilities that, in some cases, are far greater developed and more refined than any comparable abilities in animals. Denying human uniqueness instead means denying that there are cognitive capacities that only humans have and that animals do not have in any form. Despite our continuous discoveries of evidence in animals for the very capacities that we once thought separated us, the perceived divide between human and animal minds remains exaggerated.

In addition to these exaggerated differences, the similarities amongst out-group members is also exaggerated. This is evident when scholars make oversimplified claims about the abilities (or more often the inabilities) of "animal minds." It is further evident in scope of animal

stereotypes in terms of taxonomic rank, whereby mammals are more narrowly stereotyped and non-mammals are more broadly stereotyped.

We will never have perfect knowledge of animal physiology and psychology. Stereotypes of animal minds are common and widespread throughout popular cultures, and changing this is not an easy task. What is important is that we recognize this and that we carefully assess the knowledge we do have so as to avoid making further mistakes. In the remaining chapters of this thesis, I will identify epistemological, metaphysical, and ethical issues that are caused by animal prejudice and I will offer solutions for avoiding and mitigating the effects of these problems.

Chapter 2: The Effects of Animal Prejudice on Scientific Methodology

2.1. Introduction

When asked to think of the animal with the shortest memory-span, most people probably think of goldfish and their famous "three-second memory." Despite contrary evidence (Gee, Stephenson, & Wright, 1994), the myth that goldfish have a memory-span of only three seconds is still widespread and is used to justify housing goldfish in tiny aquariums. Even though goldfish memory has now been the subject of multiple studies (Agranoff, Davis, & Brink, 1965; Davis & Agranoff, 1966; Piront & Schmidt, 1988; Broglio, Rodríguez, Gómez, Arias, & Salas, 2010), the process of overturning the myth and changing people's beliefs is slow. Animal myths abound and it is imperative that we use science to sort fact from fiction. Humans need to understand animal minds not only for the sake of knowledge, but because we live with and amongst animals in our daily lives. We need to understand animal minds in order to make informed decisions about how we should interact with and treat animals, and so that we can properly understand the ethical consequences of those decisions.

Within the last fifty years, the cognitive abilities of animals has transitioned from a taboo research topic to a scientifically recognized important field of research. More and more studies on animal minds are being done and we are learning new things all the time. At a time when so many new discoveries are being made, it can be tempting to overestimate our understanding of animal minds, but it is crucial that we recognize the limitations in our understanding. In chapter 1, I argued that animal stereotypes in popular culture promote an animal prejudice that negatively affects how we conceive of and make decisions about animals. In this chapter, I will examine how this prejudice affects the study of animal minds and argue that it leads to

epistemological problems at three different stages in studying animal minds: when designing experiments (section 2.3), when selecting test subjects (section 2.4), and when interpreting results (section 2.5). The study of animal minds is an interdisciplinary pursuit. For an overview of the various disciplines involved in the study of animal minds and their specific methodological approaches to studying the cognitive capacities of animals, see chapter 2 of Kirstin Andrew's (2014) book, *The Animal Mind: An Introduction to the Philosophy of Animal Cognition*. The problems I identify here are with contemporary and common approaches to studying animal minds, but they are not intended to represent an exhaustive assessment of all of the methodologies employed in the study of animal minds.

There are two main epistemic concerns that arise from the problems I will identify in this chapter. First, current methodological practices in the study of animal minds are problematic and can lead to studies yielding empirically inaccurate conclusions. Second, current methodological practices in the study of animal minds have resulted in and are sustaining large gaps in our knowledge of animal minds. In section 2.6, I will consider three popular models of scientific values and argue that according to each of these models, ignoring the problems I outline in sections 2.3, 2.4, and 2.5 would be epistemically irresponsible and would continue to prevent researchers from doing good science. I will conclude in section 2.7, where I will outline six recommendations for addressing these problems.

2.2 Studying Animal Minds

That other humans have minds is a relatively uncontroversial belief. Whether animals have minds and to what extent they have them is more controversial. Perhaps the most famous denial of animal minds came from René Descartes, who wrote "after the error of those who deny

the existence of God… there is none at all that puts weak minds at a greater distance from the straight path of virtue than to imagine that the soul of beasts is the same nature as ours" (2000 [1637], p. 73). Descartes denied that animals can have complex minds on the grounds that animals lack thought (since they do not express thoughts through speech) and reason (since general rules do not drive their actions). More recently, Donald Davidson (1982, p. 324) denied that animals can have complex minds. Davidson argued that in order to have beliefs and rationality, one must have a concept of belief, which is only possible if one has language. Davidson denied that animals have language and therefore also denied that they have beliefs. Davidson's argument for the denial of animal beliefs has lost uptake over time, but when it was first introduced, it was influential in shaping discussions of animal minds in philosophy (Lurz, 2017).

In contemporary discussions of animal minds, arguments that deny animal minds outright are rare. More common are arguments for the existence of animal minds, though there are a number of different ways these arguments are made. Kristin Andrews (2016; 2014) reviews three types of arguments that are typically offered to establish the existence of animal minds: arguments from analogy, inference to the best explanation arguments, and arguments from evolutionary parsimony. Arguments from analogy rely on important similarities between humans and other animals. In an argument from analogy, one argues: that humans have a particular property x, that animals of species y have property x, that the property x is made possible in humans by their having minds, and that therefore animals of species y likely have minds. In inference to the best explanation arguments, one argues that animals of species y engage in behaviour x, that the best scientific explanation for animals of species y engaging in behaviour x is that they have minds, and therefore that animals of species y likely have minds.

In arguments for evolutionary parsimony, one argues that when humans and animals of species y who share a common ancestor also share some characteristic x, the most parsimonious (and therefore best) explanation is that characteristic x is made possible in the same way in both humans and animals of species y. These explanations sometimes include having minds, and therefore animals have minds.

Arguments for animal minds - whether they be arguments from analogy, inference to the best explanation arguments, or arguments for evolutionary parsimony – all rely on having good empirical evidence. That is, in order to make any of these arguments, one needs to have some evidence for the relevant property, behaviour, or characteristic of an animal. In the next three sections, I identify three areas where animal prejudice can have negative effects on empirical evidence of animal minds.

2.3. Designing Experiments

Two problems arise when designing experiments to test the cognitive abilities of animals. The first is an obstacle that results from the fact that researchers and test subjects are of different species. As researchers are humans, they will naturally have a bias toward test scenarios and experimental paradigms that favour human cognitive abilities. Difficulty in generating informative test scenarios for particular kinds of species can contribute to gaps in our knowledge of animal minds.

Second, using test scenarios and experimental paradigms that favour human physiology and behavioural motivations and fail to account for important physiological and motivation differences between species can lead to inaccurate conclusions about the cognitive abilities of animals. These two problems are discussed in detail here.

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2.3.1. Generating New Experiments

We are familiar with human physiology and psychology in a way that is unparalleled by our understanding of any other animal. This is unsurprising, but it is an important point to keep in mind when considering the differences between studying human and animal minds. This familiarity gives us a unique advantage when designing experiments to measure human cognitive abilities. Researchers are able to use themselves as hypothetical test subjects in order to generate test scenarios that they think will be informative. This is not to say that researchers are limited to using only test scenarios that would be informative if they themselves were the test subjects, but in general, it is helpful to have an idea of what kinds of tests *may* work before dedicating resources to carrying out an experiment. This is extremely important when resources are limited, and they usually are. For this, a researcher's own intuitions serve as a helpful and effective guide for generating new experimental designs.

When studying animal minds, it makes sense that researchers may also try to use this strategy by trying to imagine things from the animal's perspective. This can again be helpful - if we want to come up with new experimental paradigms, we have to start somewhere – but relying too heavily on this strategy can be harmful, since it is likely to produce experiments that favour human cognitive abilities. This strategy for designing experiments relies on the ability of human researchers to accurately imagine things from a non-human perspective: an ability that Thomas Nagel famously concluded was imperfect (Nagel, 1974). At best, researchers will be able to imagine an animal's physical experiences from a human mindset, though even this can be challenging. Depending on the physiological similarities between the researchers and the animals they are trying to imagine themselves as, this can be more or less difficult. For example, a human researcher trying to imagine how a chimpanzee (an animal with visual and auditory

senses that are similar to our own) may use visual or auditory information in a given situation would have a relatively easier time than a human researcher trying to imagine how a shark (an electroreceptive animal, unlike humans, who is able to perceive natural electrical stimuli) will use electrical information in a given situation.

Researchers may try their best to understand and be sympathetic to the differences between species, but it is still difficult to imagine things from the perspective of an animal, even one who is physiologically similar to us, and it is even more difficult to imagine things from the perspective of an animal who is physiologically very different from us. Due to greater physiological likenesses, we are more easily able to imagine things from a mammalian perspective, and especially from an ape perspective. It is important to note here that this does not mean that we are able to imagine anything from a mammalian or even an ape perspective with 100% accuracy. Indeed, the only perspective that we can take that could even be close to 100% accurate is a human perspective, and even then, there will still be important differences between individuals that will prevent us from knowing entirely what it is like to be someone else. The key here is that *relative* to non-mammalian animals, we are better able to take on the perspective of a mammalian animal due to the greater physiological likenesses between us. That is, we are more easily able to generate new, informative test scenarios for animals more "like us" than we are for animals less "like us." This relative ease in generating test scenarios for mammalian animals and increased difficulty in generating informative test scenarios for non-mammalian animals are likely contributing factors in the decisions of researchers regarding which animals they will study (a point to which I will return in section 2.4) and can contribute to gaps in our knowledge about animal minds.

2.3.2. Accounting for Important Differences

Failure to account for important physiological differences (even between mammals) has impeded our ability to study animal minds in the past. Frans de Waal, a world-leading primatologist and ethologist, recounts two striking examples of such failures and how they were corrected for (2016, pp. 14-17). The first involved gibbons, who have hands that look much like elongated versions of our own – they have a thumb and four longer fingers. Based on this apparent similarity, researchers designed experiments to test gibbon intelligence that required gibbons to solve a problem by choosing from a number of objects placed on a flat surface in front of them – an experimental design that works very well with human subjects. The gibbons performed poorly in these experiments and researchers concluded that they lacked the relevant intelligence to solve the problems. However, what researchers failed to account for was that a gibbon's thumb, unlike a human thumb, is not fully opposable. Unlike humans, gibbons are arboreal and have hands that are designed to more easily grab tree limbs than pick up objects from flat surfaces. When this important physiological difference was accounted for and a new experimental design – one where objects were hung rather than placed on a flat surface – was used, gibbons easily solved the problems they were presented with (Beck, A study of problem-solving by gibbons, 1967).

The second example involves elephants. Elephants use their trunks much like how humans use their hands; they can use their trunks to pick up and manipulate objects. Because of this, researchers designed an experiment to test problem-solving in elephants that required elephants to use a stick to retrieve an out-of-reach food reward. Elephants can easily pick up sticks, but what the researchers failed to account for is that elephants also use their trunk for smelling and that by picking up an object, an elephant's nasal passage (and therefore, their

excellent sense of smell) gets blocked. De Waal amusingly describes this experimental design as being analogous to "sending a blindfolded child out on an Easter egg hunt" (2016, p. 15). When researchers accounted for this, and adapted their experimental design so that elephants were provided with sticks as well as large moveable objects (for example, a box) on which they could stand, the elephants exhibited spontaneous problem solving by moving the box across their enclosure so that they could stand on it and use their trunks to retrieve the food reward. Furthermore, providing the elephants with elephant appropriate tools allowed the elephants to display further impressive problem-solving and tool use skills when they stacked multiple smaller objects in order to make a higher platform to stand on (Foerder, Galloway, Barthel, Moore III, & Reiss, 2011).

These examples highlight physiological differences that researchers initially failed to account for. Fortunately, in both cases, these differences were eventually recognized and alternative experimental designs were used. However, it is entirely possible that these differences could have gone unnoticed and it is important to recognize that there are likely other differences in other animal experiments that are currently going unnoticed. One example of an experimental paradigm that is being applied in experiments where significant physiological differences may be going unnoticed is the mirror test. Perhaps the most popular paradigm for testing self-recognition is the mirror test (also commonly known as the mark test). The mirror test is commonly used to gauge self-awareness in both humans and other animals. In the mirror test paradigm, researchers surreptitiously mark a subject (usually using an unscented dye or a sticker) on a part of the body that the subject cannot naturally see (usually somewhere on the head). The subject is then allowed access to a mirror and researchers observe the subject to see how they react to their reflection and the mark on their body (Bard, Todd, Bernier, Love, &

Leavens, 2006). Traditionally, if the subject uses the mirror to inspect the mark (for example moving their body to better view the mark), guide their behaviour in a way that allows them to investigate the mark (for example reaching to touch the mark), or identifies the image in the mirror as an image of the subject's self (for example pointing to the image and saying "that's me!"), then researchers conclude that the subject possesses self-recognition abilities, as the subject has recognized that the mark they saw on their reflection corresponds to the mark on their body.

Since the mirror test was devised in the early seventies, a number of animal species have been tested using this paradigm. In addition to humans, mirror self-recognition abilities have been well documented in chimpanzees (Gallup, 1970; De Veer, Gallup, Theall, Van den Bos, & Povinelli, 2003; Swartz, Sarauw, & Evans, 1999), bonobos (Hyatt & Hopkins, 1994), gorillas (Patterson & Cohn, 1994; Swartz & Evans, 1994; Posada & Colell, 2007), orangutans (Suárez & Gallup, 1981), bottlenose dolphins (Reiss & Marino, 2001), Asian elephants (Plotnik, De Waal, & Reiss, 2006), and European magpies (Prior, Schwarz, & Güntürkün, 2008). Mirror self-recognition abilities have also been documented to a lesser extent in orcas and pseudorca crassidens (a member of the dolphin family commonly known as "false killer whales") (Delfour & Marten, 2001). Though there is no well-established evidence for natural mirror self-recognition abilities in any monkey species, there is evidence that rhesus monkeys can be taught mirror self-recognition abilities (Liangtang, Fang, Zhang, Poo, & Gong, 2015), and capuchins have been found to differentiate their reflections from conspecifics (de Waal, Dindo, Freeman, & Hall, 2005). Domestic pigs (Broom, Sena, & Moynihan, 2009) and African grey parrots (Pepperberg, Garcia, Jackson, & Marconi, 1995) have demonstrated the ability to understand and use mirrors to obtain information, but otherwise there is no evidence to suggest that they use

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mirrors to self-recognize. While this list includes an impressive sample of species, only two of the species included are non-mammalian and neither are non-avian. Just recently, some promising preliminary research on mirror self-recognition in manta rays has been done (Ari & D'Agostino, 2016; Ari, 2012), but research like this is rare.

Importantly, the mirror test can only test for visual self-recognition and no other kind of self-recognition based on other senses. So while this test paradigm may work well for testing self-recognition in humans and animals with similar visual systems, it could be entirely uninformative for species that rely more heavily on non-visual senses. Some preliminary research has been done on olfactory self-recognition in cichlid fish (Thünken, Waltschyk, Bakker, & Kullmann, 2009), but again, research like this is rare. For many species, vision is not the dominant perceptual sense. Therefore, for these species, it makes perfect sense that a mirror self-recognition paradigm would likely not be appropriate for testing self-recognition abilities.

Designing olfactory self-recognition studies is challenging, as our sense of smell is very poor compared to other species. However, olfactory self-recognition tests are still more easily conceived of than self-recognition tests based on electroreception (the ability to perceive natural electrical stimuli). Electroreception is an ability found mostly in fish and amphibians, though also in insects and rarely in mammals (Electroreception in fish, amphibians and monotremes, 2010; Greggers, et al., 2013). Importantly, humans do not have this ability, making it extremely difficult for us to imagine how an animal would use this sense in a specific situation. This in turn makes it difficult for us design informative experiments based on this ability, whether they be tests for self-recognition or any other type of cognitive ability.

Just as it is important to recognize that there can be important physiological differences between animals, it is also important to recognize that there can be important motivational

differences between animals. For example, just because humans are motivated to be concerned about our physical appearance, this does not mean that all animals are necessarily motivated to be concerned about their physical appearance. Interestingly, female chimpanzees will use mirrors to examine their behinds, while male chimpanzees show no interest in using mirrors for this purpose (de Waal, 2016, p. 49). This shows that even within a particular species, there can be differences in motivations – something that is also perhaps noticeable when considering the differences in how various friends and family members use mirrors. Perhaps the reason why domestic pigs and African grey parrots "fail" the mirror test, despite understanding how mirrors work and being able to use them to obtain information, is not because they lack self-recognition abilities, but because they are just not motivated to be concerned about their physical appearance in a way that makes mirrors or marks on their foreheads relevant. While there may be no harm in testing different species with the mirror test paradigm, it is important to remember that this paradigm is likely inappropriate for many species. This is a point I will revisit in section 2.5, when I discuss problems with how results of animal mind studies are interpreted.

Of course, researchers do not always have to be able to imagine things from the test subject's perspective or share their motivations in order to generate new experiments; researchers can use their current knowledge of a test subject in order to generate what they think will be an informative new test scenario. In order to generate reasonable hypotheses and have appropriate justification for running an experiment, researchers need to have a basic understanding of the test subject's physiology and psychology. If, for example, researchers do not understand how a specific part of the test subject's body is used, what the test subject's motivations are, or how the test subject interacts socially with other members of their species, then they may have a hard time generating informative new test scenarios. This makes it difficult to learn more about

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species we currently know relatively little about, species which are primarily non-mammalian, and can contribute to gaps in our knowledge of animal minds. However, just because it may be more difficult, it does not mean that it is impossible. In order to better understand animals who are very different from us, we should start by making a greater effort to observe them in their natural environments. By gathering more information on under-studied animals, researchers will be in a better position to design ecologically valid experiments (i.e. experiments wherein the materials, methods, and settings approximate the subjects' natural experiences).

2.4. Selecting Test Subjects

Related to the problems with designing experiments are the problems with selecting test subjects. There seems to be less interest in studying the minds of non-mammalian animals compared to the minds of mammalian animals. Perhaps this is because it is difficult for researchers to come up with informative experiments to test non-mammalian minds - as we just discussed in the last section – or perhaps non-mammalian animals are just more elusive and live in environments that make them more difficult to study. This may certainly be true for some species, but it cannot account entirely for the obvious lack of studies on non-mammalian minds. Another likely factor contributing to which species get studied and which do not, is animal prejudice. Once a species gets labelled as "unintelligent," whether it be because of past study results or conceptions of that species based on stereotyped representations in popular culture, it can difficult to change that label. Birds provide a perfect example of this. The pejorative term "birdbrain" is still commonly used in popular culture despite the fact that there is lots of evidence that many bird species have impressive cognitive abilities that rival the cognitive abilities of the great apes (Emery & Clayton, 2004). As someone who has written on the cognitive abilities of

birds and discussed this topic with many different people, I can attest to the level of ignorance

regarding avian minds. Most people know that great apes are smart, even if they do not know

exactly how smart or in what ways. Contrastingly, most people are surprised to learn that birds

can be smart and they are shocked to learn that avian intelligence can match great ape

intelligence.

One only has to skim the literature on animal mind research to see that there is an

obvious gap between how much we know about mammalian minds and how much we know

about non-mammalian minds. Figure 2.1 illustrates this more explicitly by showing the

distribution of the classes of the animals used as study subjects in research articles published in

the well-known journal *Animal Cognition*. By examining this distribution, it is obvious that

there is a large gap between the number of studies being published on mammalian animals and

the number of studies being published on non-mammalian animals, and particularly on non-

mammalian-non-avian animals. Recently, the number of studies being done on avian minds has

increased and this trend is reflected in the rise of avian mind studies being published in *Animal

Cognition*. This increase is encouraging, but there are still many entire classes of animals that

are being under-studied. Also worth noting is that the ratio of primate to non-primate

mammalian animals has changed significantly. In less than twenty years, the journal has gone

from publishing mostly primate studies and hardly any non-primate mammalian studies, to

publishing more non-primate mammalian studies than primate studies. This trend is also

encouraging, but the distribution of animal subjects is still far from representative of the animal

kingdom.

Given our discussion in the last section, it seems that one of the probable causes of this

distribution is a lack of understanding of non-mammalian animals, which creates difficulties for

Animal Cognition Study Subjects by Class
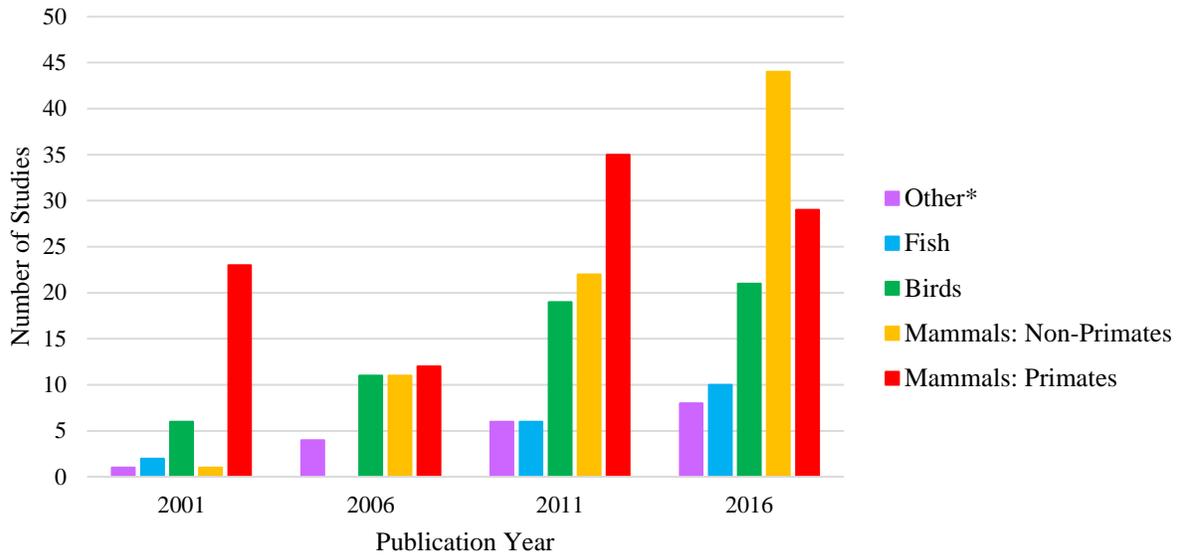
*Figure 2.1: The distribution of animal classes used as study subjects in research articles published in the journal Animal Cognition in the years 2001, 2006, 2011, and 2016. *Other includes: amphibians, arachnids, cephalopods, crustaceans, and insects.*

researchers wanting to study their minds. However, if this were the only reason for the gap

between mammalian and non-mammalian animals, then we should not expect to see this same

gap reflected in animal behaviour studies, since an animal's behaviour can be observed and

recorded regardless of whether the observing researcher understands it. Figure 2.2 illustrates that

this is not the only reason by showing the distribution of the classes of the animals used as study

subjects in research articles published in the well-known journal *Animal Behaviour*. By

examining this distribution, it is clear that it is more representative than the distribution observed

in figure 2.1, since in 2016, there were roughly as many bird and insect studies as there were

mammalian studies. However, there still remains a large overall gap between those animal

classes and other non-mammalian animal classes such as anthozoa, arachnids, asteroidea,

cephalopods, crustaceans, gastropods, polychaetes, and reptiles.

Looking at the distributions in figure 2.1 and figure 2.2, there seems to be a general bias

toward studying "smarter" species (that is, species commonly recognized and labeled as

Animal Behaviour Study Subjects by Class
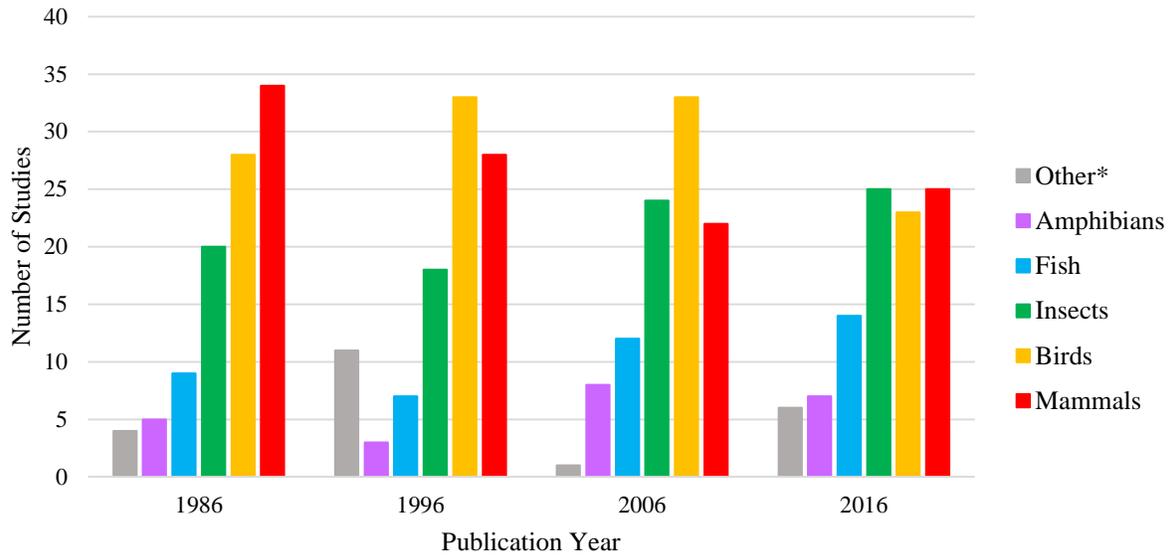
*Figure 2.2: The distribution of animal classes used as study subjects in research articles published in the journal Animal Behaviour in the years 1986, 1996, 2006, and 2016. The first 100 research articles of each year were surveyed. *Other includes: anthozoa, arachnids, asteroidea, cephalopods, crustaceans, gastropods, polychaetes, and reptiles.*

intelligent). After all, if researchers are interested in determining which animals have a

particular cognitive ability and resources are limited, it makes sense that they would focus their

investigation on the species that they believe to be the most intelligent and therefore have the

most promise of possessing the ability. Which species get labeled as more intelligent and which

species get labeled as less intelligent depends on both our current knowledge of their cognitive

abilities and also on the stereotypes that we have of them. For the most part, species with similar

neurological structures to ours and those that exhibit behaviours most like ours are the ones that

get deemed more intelligent. That is, the species that are most like humans, other mammalian

species, tend to be the ones that get labeled as more intelligent. In contrast, animals who we

know very little about, mostly non-mammalian animals, tend to be the ones that get labeled as

less intelligent. Even if we could avoid the problems of designing experiments for non-

mammalian animals, this bias towards studying more intelligent species or species like ours still contributes to the gap between research on mammalian and non-mammalian minds.

An alternative explanation as to why there may appear to be fewer studies on non-mammalian animal minds is that the studies are being done, but they are failing to produce interesting results and are therefore not being published. While this is possible, it seems unlikely that with so many non-mammalian species, so few would produce results that were interesting enough for publication. A more likely reason for their rarity is that the studies are just not being done.

It is also important to note that the criteria by which we determine which species are most intelligent (usually how similar their neurological structures and behaviours are to our own) are also human biased and therefore potentially problematic. We should be careful not to assume that the only way for a species to be intelligent is to be like our species (a point to which I will return in chapter 3). Crustaceans lack any of the visual systems found in humans, yet they are not blind and have well developed visual abilities (Elwood, Barr, & Patterson, 2009). Just because certain neurological structures make certain cognitive abilities possible in humans, it does not mean that these neurological structures are necessary in order for another species to have these cognitive abilities. The neocortex has long been thought to be a center for complex cognition in mammalian species. Recently, researchers discovered homologs of neocortical structures in a part of the avian brain known as the dorsal ventricular ridge (DVR), which is now thought to make complex cognition possible in birds (Dugas-Ford, Rowell, & Ragsdale, 2012). While non-mammalian animals may not have a neocortex as it is found in mammalian animals, this discovery in birds shows us that it is possible to have complex cognition without a neocortex.

Similarly, just because certain behaviours indicate a particular level of cognitive sophistication in humans, it does not mean that species that do not exhibit these behaviours are not cognitively sophisticated in other ways. Some species may exhibit impressive cognitive abilities at levels that humans are not capable of, yet we would not deny cognitive sophistication to humans simply because they do not exhibit these behaviours. For example, many animals outperform humans on memory tasks. While most driving adults can recall at least one instance (if not more) when they forgot where they parked their only vehicle, nutcrackers annually store hundreds of thousands of seeds in thousands of discrete locations over many square-kilometers and can recover those seeds up to eleven months later and with accuracy rates that are estimated to be between 60-86% (Kamil & Balda, 1985; Pravosudov & Roth II, 2013). If humans were to attempt the same spatial memory task, they would not be able to perform at the same level as the nutcrackers. Another example is found in working memory tasks, where chimpanzees outperform humans (BBC Earth, 2013).

These points have important implications for how results of animal mind studies should be interpreted, and I will return to them in the next section. For now, the point I want to make is that researchers should be careful not to restrict their pool of potential candidates to the same group of mammalian "all-stars" over and over again. For animals we know relatively little about, more emphasis should be put on observational studies so that we can improve our understanding of those species. For animals we know well enough to at least formulate probable and testable hypotheses, but who we are not currently paying much attention to in research, we should make an improved effort to study these animals. This is all not to say that the current research that is being done is not valuable or should not be done, it is simply to say that we should make a greater effort to study a greater variety of species and make animal mind research

more representative. Also note that my suggestion that animal mind research be more representative does also not imply that it should be exactly and proportionally representative to the animal kingdom. Insects make up an estimated 80% of animal species but this does not necessarily mean that 80% of all animal mind research should be dedicated to insects. Factors such as how similar one species is to another and how plausibly the minds of particular species can be tested will limit how representative research can be. What is important is that current representation in animal mind research is arbitrarily and extremely skewed toward mammalian animals (and even toward specific mammalian species).

If there is a case for focusing on any particular species more than others, animals on whom we have the greatest impact would likely be the ideal candidates for a greater focus. This includes animals who we keep as pets and share our living environments with, but also animals who humans consume and animals who humans use for testing and entertainment. A potential argument for narrowing the scope of animal mind studies and the ethical implications of such an argument will be discussed in chapter 5. For now, I will just make an observation about the distribution of the domesticated animal species that are being studied and identify a likely reason for this distribution. Figure 2.3 shows the distribution of the species of the domesticated animals used as study subjects in research articles published in the journal *Animal Cognition*. While the number of studies being done with animals humans typically keep as pets ("pet-animals") and animals humans typically consume ("consumed-animals") are both increasing over time, there is a consistent gap between the number of studies being done with pet-animals and the number of studies being done with consumed-animals. One likely contributing factor to this gap is animal prejudice.

Carol J. Adams (2015) argues that through the use of toxic metaphors, humans come to

Domesticated Animal Cognition Study Subjects by Species
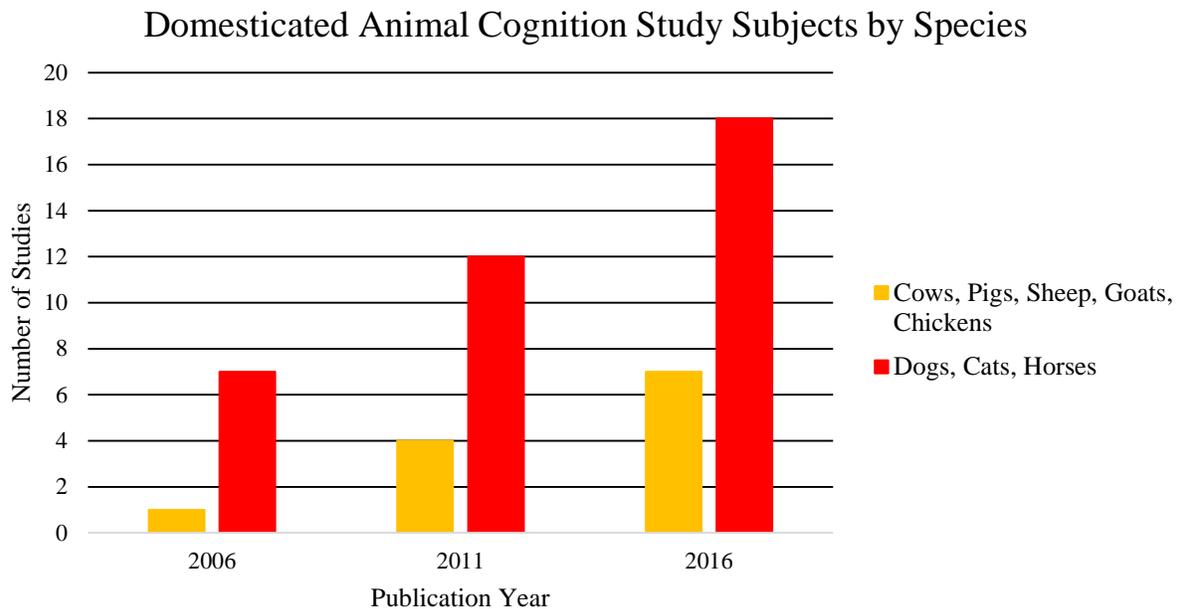
Figure 2.3: The distribution of the domesticated animal species used as study subjects in research articles published in the journal Animal Cognition in the years 2006, 2011, and 2016. Cows, pigs, sheep, goats, and chickens are animals commonly consumed in Western cultures, whereas dogs, cats, and horses are animals commonly kept as pets in Western cultures.

think of consumed-animals predominantly as objects as opposed to agents in order to make the

idea of consuming them more palatable (2015, pp. 64-91).

> After being butchered, fragmented body parts are often renamed to obscure the fact
> that these were once animals. After death, cows become roast beef, steak, hamburger;
> pigs become pork, bacon, sausage. Since objects are possessions they cannot have
> possessions; thus, we say "leg of lamb" not a "lamb's leg," "chicken wings" not a
> "chicken's wings. (Adams, 2015, p. 74)

Adams goes through an extensive set of examples in making her case and argues that for

most humans who consume animals, their conceptions of those animals who they consume

(typically cows, pigs, chickens, sheep, goats, etc.) are characterized largely by

objectification and cognitive dissonance.

While I will not be making an argument for or against the consumption of animals

here, I do maintain that this ethical discussion requires that those having it are properly

informed about the animals being discussed for possible consumption. One of the common reasons offered against the consumption of specific animals, such as great apes, elephants, and dolphins, is that those animals are highly intelligent. If an animal's intelligence (or cognitive abilities more generally) is an important factor for deciding whether that animal can be ethically consumed (assuming "ethical consumption" is possible), then appropriate research on the cognitive abilities of that animal ought to be done in order to properly inform discussions of consumption. I will also return to this point in chapter 5.

We know that cows, pigs, chickens, sheep, and goats are intelligent animals just like dogs, cats, and horses are (pigs (Mendl, Held, & Byrne, 2010); cows (Hagen & Broom, 2004); chickens (Nicol, 2004); sheep (Kendrick, 2008); goats (Kaminski, Call, & Tomasello, 2006)). So why is there such a large gap between the numbers of studies being done with them? Cows, pigs, sheep, goats, and chickens are all animals who are typically negatively stereotyped. A likely explanation for why they tend to be studied less (or at least to a lesser extent than animals like chimpanzees, dolphins, and elephants) is that animal prejudice affects how humans conceive of animals they typically consume. Furthermore, a lack of interest in challenging conceptions based on stereotypes or economic motivations for maintaining distinctions between in-groups and out-groups prevents many people from wanting to challenge their conceptions. However, if humans truly want to understand the animals they are consuming, and they should, then more studies need to be done on these animal minds, and the gaps in our knowledge need to be filled in.

2.5. Interpreting Results

Much of the research that has been done on animal minds has been plagued by an

obsession with human uniqueness (the view that humans possess some ability that make them different in kind rather than degree from other animals). This obsession, and other forms of animal prejudice, have negatively affected how results from animal mind studies have been interpreted. Like a strange judicial system, many human researchers studying cognitive capacities seem to operate under an assumption of "human until proven otherwise." That is, they operate under an assumption that humans possess all cognitive capacities and that unless we find evidence for cognitive capacities in other animals, we can assume they are unique to humans (Douglas, 2008; Akst, 2016). Reflecting on this obsession, Frans de Waal remarks:

> … [N]ow that animal cognition is an increasingly popular topic, we are still facing the mindset that animal cognition can only be a poor substitute of what we humans have. It can't be truly deep and amazing. Toward the end of a long career, many a scholar cannot resist shining a light on human talents by listing all the things we are capable of and animals not. From the human perspective, these conjectures may make a satisfactory read, but for anyone interested, as I am, in the full spectrum of cognitions on our planet, they come across as a colossal waste of time. What a bizarre animal we are that the only question we can ask in relation to our place in nature is "Mirror, mirror on the wall, who is the smartest of them all?" (2016, p. 157).

While focus on human uniqueness in animal mind studies has been changing over time, it is still pertinent that researchers be cautious not to over-interpret their results. Just because there is a lack evidence for particular kinds of cognitive capacities in other animals, it does not necessarily mean that other animals do not possess those capacities. It could be that a lack of interest has resulted in certain animal cognitive abilities having never been tested, and even if there is an interest, difficulties in designing experiments might be preventing researchers from carrying out informative studies. Both of these real problems could lead to a lack of evidence, but neither are sufficient reasons for assuming that an animal does not possess a particular cognitive ability.

When studies are conducted on animal minds, researchers must be cautious not to over-

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interpret their results. When an experiment fails to produce positive evidence for the hypothesis, there is a null result. In animal mind studies, the hypothesis typically states that the subject possess a specific cognitive ability. Given a hypothesis of the form "animal x possesses cognitive ability y", null results can be interpreted in a number of ways, including: as evidence for the lack of the cognitive ability in the species as a whole; as evidence for the lack of the cognitive ability in the tested individual; or as evidence that the experimental paradigm is ecologically invalid for the species tested (i.e. the materials, methods, and settings of the experiment do not approximate the subjects' natural experiences). Animal prejudice and confirmation bias may influence how researchers intuitively interpret a null result, so being careful of how null results are interpreted is important if we are to avoid making false conclusions and underestimating the cognitive abilities of animals.

A similar worry is outlined by Elliot Sober (2005). Sober's worries that strict interpretations of Morgan's canon (specifically the original presentation of Morgan's canon) have had negative effects on the study of animal minds. In *An Introduction to Comparative Psychology*, nineteenth century comparative psychologist C. L. Morgan outlined a methodological principle he called his "canon", which stated:

> In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale. (1894, p. 53)

Morgan later clarified his canon in the second edition of *An Introduction to Comparative Psychology*, adding:

> To this, however, it should be added, lest the range of the principle be misunderstood, that the canon by no means excludes the interpretation of a particular activity in terms of the higher processes if we already have independent evidence of the occurrence of these higher processes in the animal under observation. (1903, p. 59)

Despite this clarification, Sober argues that interpretations of Morgan's canon fostered a bias amongst researchers to favour type-2 errors (false negative: denying a cognitive ability to an animal when in fact the animal does possess the ability) over type-1 errors (false positive: attributing a cognitive ability to an animal when in fact the animal does not possess the ability). Sober argues that this bias is problematic and that type-1 errors should be treated as equally empirically harmful as type-2 errors. For further discussion on interpretations of Morgan's canon see section 2.2 and 2.4 in (Andrews, K., 2014, pp. 31-34, 39-44).

Kristin Andrews and Brian Huss (2014) further examine the bias that Sober identifies. Andrews & Huss agree that unjustifiably attributing and denying cognitive abilities to animals are equally troubling. They also agree that there is a greater and unjustified hesitation in attributing cognitive abilities to animals. However, they conclude that whether the bias for type-2 errors in animal mind studies is problematic depends on nuances in how type-2 errors have been defined. In either case, Andrews & Huss agree that the structure of hypotheses and how results are interpreted are areas in the study of animal minds where problems can occur and that careful attention needs to be paid here.

If a particular test is unsuccessful at identifying a cognitive ability in a species, we cannot conclude from those results alone that the species therefore lacks the ability. There are many reasons why a particular test may not work for identifying a cognitive ability like we think it should. Often, tests used for gauging cognitive abilities in animals are based on tests that were used successfully for gauging the ability in humans. Though tests that work for humans are good starting points when designing tests for other animals, we must acknowledge that there is no reason to assume that because a test works for humans, it must also work for another animal species. Similarly, there is no reason to conclude that because a test works well for identifying a

cognitive ability in one group of species, say mammals, that it must also work for identifying that cognitive ability in another group of species, say non-mammals. Recall the examples of gibbons and elephants discussed in section 2.3. To conclude that a species lacks a particular cognitive ability just because they failed a test that was used successfully to identify that cognitive ability in another species is like concluding that a person could not have entered a shopping mall just because they did not enter through the same door that you did. Given that there can be multiple ways in which to demonstrate a particular cognitive ability, just as there are (typically) multiple entrances to a shopping mall, both conclusions are unreasonable. To be clear, I am not saying that we should never conclude that a species lacks a particular cognitive ability; I am only saying that the null results based on one experimental paradigm are not enough to make this conclusion. Converging lines of evidence that include studies that have high ecological validity could very well support a reasonable conclusion that a species likely lacks a particular cognitive ability, especially if they come from different disciplines.

Let us return to self-recognition studies for another example. While there may be no harm in testing different species with the mirror test paradigm, it is important to remember that this paradigm is likely inappropriate for many species. Based on limited studies, researches have made claims that they have "used mirrors to assess animals' ability to recognize themselves and based on such tests, most vertebrates do not have self-recognition" (Desjardins & Fernald, 2010, p. 744). Even with a modest approximation, more than 50,000 vertebrate species have been described. To conclude that most vertebrates do not have self-recognition based on the results of one particular type of test, even if it had been done with a few hundred species (though it is more likely that far fewer have been tested) is to make a gross oversimplification. Similar oversimplifications such as "fish cannot self-recognize" have also been made based on an

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extremely limited number of mirror test studies done with some fish species (Desjardins &

Fernald, 2010, p. 744). There are approximately 30,000 different fish species that have been

described. Concluding that no fish species can self-recognize because a small handful of them

do not pass the mirror test is unreasonable. This is especially unreasonable given recent

promising evidence that manta rays could pass the mirror test (Ari & D'Agostino, 2016) and

evidence that cichlids can self-recognize based on olfactory information (Thünken, Waltschyk,

Bakker, & Kullmann, 2009). Importantly though, even if every fish species were tested and

none passed the mirror test, we could still not reasonably conclude that no fish species can self-

recognize since the mirror test could easily be ecologically invalid for fish.

Similarly, researchers must be aware of the possibility of individual differences within a

species. Researchers studying animal minds are typically interested in the general capacities of a

species as a whole rather than the particular capacities of individuals within a species.

Therefore, inter-individual variations are often largely ignored (for exceptions, see (Matzel, et

al., 2003; Anderson, 2000; Cole, Cram, & Quinn, 2011)). Researchers generally take evidence

for an ability in an individual as evidence for the capacity in the species. Consider for example

the human ability to solve highly theoretical and mathematical problems of quantum physics.

We generally agree that the human species is able to solve problems of quantum physics despite

the fact that if we were to give a random group of people a series of quantum physics problems,

the vast majority of them would not be able to solve them. In attributing this ability to the

human species, we care only that our species possesses the capability to solve problems of

quantum physics and that some individuals in fact can solve these problems. This is because we

recognize that there are differences between the cognitive abilities of individuals. Just as there

are differences between the cognitive abilities of individual humans, there are also sure to be

differences between the cognitive abilities of individuals within other species. Positive results from a particular experimental paradigm may be enough to conclude that the tested species has the capacity for the tested cognitive ability and that the specific individual tested may have that cognitive ability. However, negative results from just a few individuals are not enough to conclude that the tested species lacks the capacity altogether, since it may be that the tested individuals happen to lack the ability, while other members of the same species may not.

The phrasing of conclusions can also have an important impact on our conceptions of animals. Article titles such as "Is your toddler really smarter than a chimpanzee?" (Gregg, 2014), "Are you smarter than a chimpanzee?" (Ambridge, 2015), "Babies Vs. Chimps: Who's Smarter?" (Lemonick, 2007), and many more similarly themed titles illustrate just how interested humans seem to be with establishing our cognitive superiority over other animals. Many animal mind studies include in their conclusions a statement about the subject animal's cognitive abilities relative to human cognitive abilities. More specifically, animal cognitive abilities are often characterized by relative comparisons with the abilities of human children. While comparing the cognitive abilities of animals to human children can be useful for drawing insights on how particular cognitive abilities evolved or develop, it can also be infantilizing and can arbitrarily limit our conceptions of animal minds to being "stunted" or "lesser" versions of human minds. For example, concluding that chimpanzees are as intelligent as human toddlers simply because on one particular task, they performed similarly, fails to account for the different ways in which a cognitive capacity may be applied. Just as standardized tests are not able to accurately and completely measure every individual's intelligence, experimental paradigms are not able to accurately and completely measure every individual's intelligence.

Finally, researchers should be aware of differences between human and animal versions

of the same test. For example, when human children are tested, they typically arrive at the testing facility happy, well-fed and well-rested. Children, particularly infants and toddlers, are often accompanied by a parent throughout the experiment and they are able to self-select out of the experiment at any time without consequence. Alternatively, animals are rarely afforded the same luxuries and are often tested under duress (for example, deprived of food, under the threat of physical pain, or in generally stressful environments) (de Waal, 2016, pp. 141-146). Researchers must be careful not to ignore important confounding factors when comparing the results of human children and animals when the conditions under which they are tested are so different.

2.6 Scientific Values and Studying Animal Minds

In sections 2.3, 2.4 and 2.5, I identified epistemological problems that arise at three different stages in studying animal minds: when designing experiments, when selecting test subjects, and when interpreting results. There are two main epistemic concerns that arise from these problems. First, current methodological practices in the study of animal minds are yielding empirically inaccurate conclusions. Second, current methodological practices in the study of animal minds have resulted in and are sustaining large gaps in our knowledge of animal minds. There is much debate regarding scientific values. Though I will not be arguing for any particular view in this thesis, I will consider three popular models of scientific values and argue that according to each of these models, ignoring the problems I have outlined in this chapter would be epistemically irresponsible and would continue to prevent researchers from doing good science.

Scientific Values		Designing Experiments	Selecting Test Subjects	Interpreting Results
Thagard (Goldman)	Reliability	x		x
	Power	x	x	x
	Fecundity		x	
	Speed			
	Efficiency			
	Explanatory Efficacy		x	x
Kitcher	Truth	x		x
	Significance		?	
Longino	Empirical Adequacy	x		x
	Biases Mitigation	x	x	x

Table 2.1: A simplified representation of the conflicts between scientific values and the problems identified in sections 2.3, 2.4, and 2.5.

The first model I will consider is Paul Thagard's (Thagard, 1997), which is based on Alvin Goldman's standards for assessing epistemic practises (Goldman, 1992). Thagard offers an improved version of Goldman's standards, and argues that epistemic practices can be evaluated on the following criteria: reliability (measured by the ratio of results to total number of results and errors fostered by the practice); power (measured by the practice's ability to help cognizers find results that answer the questions that interest them); fecundity (measured by the practice's ability to lead to large numbers of results for many practitioners; speed (measured by how quickly the practice leads to results); efficiency (measured by how well the practice limits the cost of getting results); and explanatory efficacy (measured by how well the practice contributes to the development of theoretical and experimental results that increase explanatory coherence) (1997, pp. 247,255).

On this model, practices that lead to empirically inaccurate conclusions, such as failing to recognize important physiological and motivational differences between humans and other animals or over-interpreting null results, are epistemically irresponsible according to the reliability, power, and explanatory efficacy standards (see table 2.1 for a simplified

representation of these conflicts). Practices that lead to empirically inaccurate results: are unreliable because they will produce a high ratio of errors to results; are not powerful because they will not provide accurate answers to the questions researchers are asking; and do not effectively contribute to the development of theoretical and experimental results that increase explanatory coherence because they do not provide accurate explanations. Thus, the current methodological practices in the study of animal minds that make drawing empirically inaccurate conclusions more likely should be addressed according to Thagard's model.

Similarly, practices that lead to gaps in our knowledge of animal minds should also be addressed according to Thagard's model, since these practices are epistemically irresponsible according to the power, fecundity, and explanatory efficacy standards. Practices that contribute to large gaps in our knowledge of animal minds are: not powerful because they will not give researchers enough evidence to answer the bigger questions about animal minds that interest them; have limited fecundity as they will only produce results about a select few species; and do not contribute to the development of theoretical and experimental results that increase explanatory coherence as effectively as practices that generate more diverse results.

The second model that I will consider here is Philip Kitcher's, which promotes epistemic practices that yield significant truths. Kitcher argues that epistemic practices need to yield not just truths, but important truths that are based on human interests, and that "the sciences ultimately obtain their epistemic significance from broad questions that express natural human curiosity" (2003, p. 81). On this model, current methodological practices in the study of animal minds that make drawing empirically inaccurate conclusions more likely must be addressed since in order for science to yield significant truths, it must first yield truths. Whether practices that contribute to large gaps in our knowledge of animal minds ought to be addressed according to

this model depends on where the gaps are forming. If the gaps in our knowledge lie outside of human curiosity, then perhaps the gaps are not problematic. However, to the extent that the gaps fall within the broad questions of human curiosity (for example, questions concerning whether a particular cognitive ability is limited to humans), the practices that promote them should be addressed. Note that the extent to which understanding animal minds falls within this curiosity depends on how curiosity is defined. While some may limit curiosity to human interests, others expand curiosity to include animal interests (Haraway, 2008).

The final model I will consider here is Helen Longino's, which focuses on uncovering the values and assumptions that influence science and having an appropriate system for evaluating those values and assumptions. Longino argues that a knowledge-productive community must be empirically adequate and will ideally: have public venues where criticism can be raised; ensure that criticism is given uptake; have public standards for evaluating theories, hypotheses, and observation practices; and have members with tempered equality of intellectual authority (2002, pp. 128-135). Again, on this model, current methodological practices in the study of animal minds that make drawing empirically inaccurate conclusions more likely need to be addressed as they are not empirically adequate.

As for the issue of practices that contribute to large gaps in our knowledge of animal minds, the solution here is more complicated. Current methodological practices that are largely affected by bias and prejudice should be addressed. Longino argues that objectivity in science requires diverse communities, wherein members with a particular set of biases and prejudices can be challenged by members without those biases and prejudices (1990). She argues that scientists are embedded in a network of relationships and that this network provides a "rich pool of varied resources, constraints, and incentives" (2002, p. 128). A good example of diversity

improving objectivity within science is the addition of women to many scientific fields (Fehr, 2011). The challenge for the science of animal minds is that the biases and prejudices that are present are largely tied to the difference in species between the researchers and the test subjects. A. Breeze Harper has argued that some human groups who are targets of prejudice may be better able to identify prejudice against animals (Harper, 2012). While increasing epistemic diversity is always a good thing, increasing human diversity alone in the epistemic community of animal mind research will not be enough to rid animal mind research of its prejudice since ultimately researchers are affected by human biases and animal prejudice as a result of their being human. In this case, the scientific community must focus not only on adding diversity but on identifying and acknowledging these biases and prejudices so that they can make efforts to mitigate their effects.

2.7. Suggestions

In sections 2.3, 2.4, and 2.5, I identified problems with current methodological practices in the study of animal minds that are leading to empirically inaccurate conclusions and creating gaps in our knowledge of animal minds. These problems need to be addressed. Though there are no simple solutions for addressing these problems, there are a number of suggestions that I will make here that should help to improve the empirical accuracy of the conclusions that are drawn in animal mind studies and close the gaps in our knowledge of animal minds.

First, and perhaps most important, is that we should be aware of these problems and take them into consideration when studying and drawing conclusions about animal minds. The epistemological problems outlined in this chapter are significant and they can lead to metaphysical and ethical (chapter 5) problems, if left unchecked. If arguments for animal minds

rely on empirical evidence for particular properties, behaviours, or characteristics in animals, then problems with the empirical accuracy of the available evidence can directly affect these arguments. For example, if an argument for the existence of minds in animals of species y relies on animals of species y engaging in a behaviour x, but methodological problems caused by animal prejudice prevent researchers from attaining evidence for behaviour x in species y, then this can lead to an unfair denial of the existence of minds in species y. On a large scale, problems with available empirical evidence could lead to the unfair denial of the existence of animal minds entirely. On a smaller, and more likely, scale, problems with available empirical evidence could lead to the unfair denial of the existence of minds in particular kinds of animals.

Not only could problems with available empirical evidence negatively affect arguments for the existence of animal minds, they could also negatively affect arguments about the nature of animal minds. Arguments for human uniqueness rely on humans possessing some cognitive ability that other animals do not. Therefore, in order to support or dismiss arguments for human uniqueness, empirical evidence for the relevant cognitive ability is needed. Methodological problems that affect the empirical accuracy of available evidence therefore have the potential to affect arguments for human uniqueness. Acknowledging the epistemological problems created by animal prejudice is important if we are to avoid further metaphysical and ethical (chapter 5) problems. If we do not acknowledge that these problems exist, then we cannot hope to address them.

Second, though there may be little we can do to improve our natural ability to imagine things from the perspective of animals who are physiologically very different from us, we can improve our basic knowledge and understanding of those animals and therefore put ourselves in a better position to generate new informative experiments to test their cognitive abilities. If we

are unable to generate informative tests for a particular species because our lack of understanding of that species is too great, then the most reasonable thing to do is to increase our understanding of that species. We can do this through observational studies. Observing animals in their natural environments and recording their behaviours over time can teach us many things about a species. Highly structured, artificial laboratory settings and quantitative data are importantly informative, but natural and field observation and qualitative data are also importantly informative, especially when the former is unavailable. In order to put ourselves in a better position to test the cognitive abilities of non-mammalian animals, we should first try to learn more about them by putting greater emphasis on observational studies. Once we learn more about an animal's natural behaviour, we may be better able to generate more ecologically valid experimental paradigms. Alternatively, this knowledge may allow us to run a computer simulation of the animal's behaviour, providing an easier way to test different experimental designs before committing greater resources to a study with animal subjects.

Third, we should try to keep an open mind when selecting candidates for cognitive studies and we should increase diversity in the range of species being studied. This is perhaps easier said than done, given that in a publish-or-perish environment, many researchers do not have the luxury of dedicating time and resources to experiments with "riskier" payoffs. Still, researchers should try to expand their pool of potential test subjects to include species beyond the typical "all-star" mammalian species that are commonly studied. Manta rays display a range of intelligent behaviours and should not be overlooked as candidates for cognitive studies. Other non-mammalian-non-avian species like octopuses, squid, and cuttlefish (members of the Cephalopod sub-class Coleoidea), are also highly intelligent and are capable of much more than was previously expected. They should also be considered as prime candidates for studies on

cognitive abilities (Ikeda, 2009; Mather, 2008; Hochner, 2008).

Fourth, we should be cautious of how we interpret results. Many of the experiments we use to test the cognitive abilities of animals are based on experiments that we have used successfully to test the cognitive abilities of humans. This is a useful technique for generating experiments to test animal cognition, but we have to be careful in how we interpret these results. In general, null results should only be interpreted as evidence for the lack of an ability when that particular test has already been used to successfully document the ability in the relevant species, and therefore the lack of ability is being attributed to the individual and not to the species to which the individual belongs (though note that even here we should be careful to consider individual differences when interpreting null results since a test can work better for some individuals than for others). This is necessary in order to avoid drawing empirically inaccurate conclusions and vastly underestimating non-human animals.

Fifth, we should be cautious of overgeneralizations when comparing the cognitive abilities of animals to human children. Keeping in mind the important differences in experimental conditions between human and animal versions of the same experiment and differences between the appropriateness of particular paradigms for particular species is essential if we are to avoid drawing empirically inaccurate conclusions and making hasty generalizations.

Finally, it is important to recognize that we are different from other animals and that we do have an impressive collection of sophisticated cognitive abilities, but the strong focus on marking human mental territory is unhelpful. Analogies between humans and other animals can be very beneficial to many aspects of our understanding of ourselves and other animals. Human-animal analogies are used all the time in biological sciences and similarities between humans and other animals are the reasons why we study other species in order to make medical advances for

our own species. The similarities we use to justify studies in biology and neuroscience are not only physiological but psychological as well. Many researchers seem to have no problem in admitting that other animals are similar enough to humans to warrant subjecting them to experimentation for the benefit of human wellbeing. Yet when it comes time to admit psychological similarities, a new hesitancy is encountered. Reflecting on this phenomena, Frans de Waal writes:

> This is not to deny that humans are special – in some ways we evidently are – but if this becomes the a priori assumption for every cognitive capacity under the sun, we are leaving the realm of science and entering that of belief…In biology, neuroscience, and the medical sciences, continuity is the default assumption. It couldn't be otherwise, because why would anyone study fear in the rat amygdala in order to treat human phobias if not for the premise that all mammalian brains are similar? Continuity across life-forms is taken for granted in these disciplines, and however important humans may be, they are a mere speck of dust in the larger picture of nature. Increasingly, psychology is moving in the same direction, but in the other social sciences and the humanities discontinuity remains the typical assumption (2016, p. 124).

The default assumption that only humans command cognitive abilities can be harmful. It is possible that we share all of our cognitive capacities with other animals, even if it is not to the same degree.

2.8. Conclusion

In this chapter, I examined how human bias and animal prejudice affect the study of animal minds and argued that they lead to epistemological problems at three different stages in studying animal minds: when designing experiments, when selecting test subjects, and when interpreting results. When designing experiments to test the cognitive abilities of animals, it is easier to design experiments that favour human physiology and it can be difficult to conceive of new, informative experiments to test the cognitive abilities of animals who are physiologically

different from us. When selecting test subjects, the focus tends to be on species that are physiologically most similar to us. When interpreting results of animal minds studies, it can be easy to make overgeneralizations and underestimate species' cognitive abilities.

Two main epistemic concerns that arise from the problems I identified in this chapter. First, current methodological practices in the study of animal minds are problematic and can lead to studies yielding empirically inaccurate conclusions. Second, current methodological practices in the study of animal minds have resulted in and are sustaining large gaps in our knowledge of animal minds. In considering three different popular models of scientific values, it is clear that these problems should (to different extents) be addressed and I outlined six recommendations for addressing these problems. We should be aware of these problems and identify the reasons for these problems. Efforts should be made to increase our knowledge and understanding of under-studied animals and researchers should be more open to studying a greater variety of species. Researchers should be careful when interpreting results, especially null results, and comparisons between the cognitive abilities of human children and other animals should be made cautiously. Finally, default assumptions about the inconsistency (and consistency) between humans and other animals should be considered carefully and not taken for granted.

Humans live with and amongst animals in our daily lives, and many of the things we do have an effect on the environment and the animals who live in it. As will be discussed in chapter 5, our knowledge and understanding of animals is the basis on which ethical decisions about how we should treat and interact with animals are made. Epistemic problems in this foundation need to be addressed if we are to avoid further metaphysical and ethical problems. Similarly, epistemic problems in this foundation may be masking further ethical problems, which we are unaware of. Being in a position to not only address the ethical issues that concern us but to

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identify the ethical issues that concern us requires that we first address epistemological and

metaphysical issues that are interfering with our understanding of animal minds. With such

important consequences riding on our understanding of animal minds, it is important that we

make our best effort to ensure our understanding is accurate. The suggestions that I have made

in this chapter will contribute to this goal by increasing the empirical accuracy of the conclusions

we draw about animal minds and helping to close the gaps in our knowledge of animal minds.

Chapter 3: The Effects of Animal Prejudice on the Study of Animal Problem Solving, Learning, Tool Use, and Language

"All species display areas of intelligence (and ignorance), and human beings are no exception."
– Howard Gardner, 2011

3.1. Introduction to Intelligence

Intelligence is highly valued in our society; the more intelligent someone (or something) is, the more respect we tend to give them. But what does it really mean to be intelligent? For many people, the stereotypical markers of intelligence are things like IQ scores and academic achievements, but these things represent only a limited view of intelligence. Howard Gardner (2006) argues that traditional views of intelligence that focus too heavily on what can be measured with standardized IQ tests fail to account for the full range of intelligent behaviours that humans display. In place of traditional accounts, Gardner offers a pluralistic view of intelligence that recognizes that there are multiple facets of cognition and that individuals have different cognitive strengths. On this view, the chess Grandmaster, the world-class violinist, and the champion athlete are all recognized as intelligent in their pursuits, even though standard "intelligence" tests may fail to identify them.

Gardner characterizes intelligence as a biological and psychological capacity to process a certain kind of information in order to solve a problem or create a "cultural product" that functions to capture and transmit knowledge or to express beliefs and feelings (2006, p. 6). While Gardner provides a list of nine kinds of intelligences that he argues characterizes human intellect (musical, bodily-kinesthetic, logical-mathematical, linguistic, spatial, interpersonal, intrapersonal, naturalist, and existential), he also maintains that his list is not intended to be an exhaustive inventory of all kinds of intelligences. Indeed, Gardner writes that "Perhaps some

species – like bats and dolphins – exhibit intelligences that are unknown or not developed in human beings" (2006, p. 81). Gardner further cautions that some computational abilities may operate in isolation in some species but have become coupled together in other species. For example, discrete aspects of musical intelligence may appear in isolation in a variety of species and only be joined in humans (2011).

Gardner's view of multiple intelligences makes important progress in removing arbitrary limitations placed on intelligence. Rather than restricting intelligence to a set of computational capacities exhibited in a specific way by some humans, it allows for the possibility of many intelligences displayed in a variety of ways. Still, the debate over animal intelligence remains contentious. Determining which species have which intelligences and the extent to which they have them is difficult. The issue is further complicated by the fact that an animal's level of intelligence (or lack thereof) is commonly used to justify the standards according to which humans interact with them (a point to which I will return in chapter 5). With important ethical decisions riding on conclusions of animal intelligence, it is crucial that researchers do everything they can in order to ensure that their results are as accurate as possible.

As discussed in chapter 2, animal prejudice can have negative effects on the scientific study of animal minds generally. In chapters 3 and 4, I will review some specific areas of animal mind research and examine how animal prejudice could and does negatively affect empirical accuracy if left unchecked. In chapter 3, I will examine problem solving, learning, tool use, and language, and in chapter 4, I will continue this examination with emotion and empathy. While this list does not cover all of the cognitive capacities of animals, it does cover some of the most common capacities currently being studied in animals.

3.2. Problem Solving

Thinking about problem solving may conjure up memories of sitting at a kitchen table and doing math homework, but it is not just students who need to solve problems. All animals are required to solve problems in their daily lives in order to survive and thrive. Finding reliable food sources, avoiding predators, and navigating environments are just a few examples of the basic problems that animals are faced with. Not only do animals solve problems that arise naturally, some animals have also taken to solving problems presented by humans. The adeptness with which some animals can solve human-presented problems is impressive; it is this adeptness which explains why it can be so difficult to keep squirrels away from birdfeeders and raccoons out of trash cans.

It is clear that animals solve problems, but it is less clear at what point their problem solving begins to be recognized as intelligent behaviour. One of the motivations for studying the problem solving abilities of animals is to compare them to human problem solving abilities. While these cross-species comparisons are interesting, especially when examined developmentally, it is important that this motivation for studying animal problem solving (or any cognitive capacity) does not negatively bias the research being done. In this section, I will briefly review the common approaches to problem solving that are studied in animals and identify areas where animal prejudice may be problematic.

Problem solving is at the core of studying animal intelligence because animals often rely on a variety of different cognitive capacities when solving problems. Researchers are interested in finding out not only whether an animal can solve a particular problem, but also how they solve a particular problem. A problem can often be solved through multiple different approaches, which may require different degrees of cognitive sophistication. Table 3.1 provides examples of

Approaches to Problem Solving	
Trial-and-Error	-Spiders (Jackson & Wilcox, 1998; Jackson, Cross, & Carter, 2006) -Spotted Hyenas (Benson-Amram, Weldele, & Holekamp, 2013) -Meerkats (Thornton & Samson, 2012) -Domestic Cats (Thorndike, 1911) -Rhesus Macaques (Swartz, Chen, & Terrace, 2000) -Mice (Smart, 1970) -Octopuses (Fiorito, von Planta, & Scotto, 1990)
Observation (Demonstration)	-Dingoes (Smith & Litchfield, 2010) -Goats (Nawroth, Baciadonna, & McElligott, 2016) -Pigeons (Palameta & Lefebvre, 1985) -Cotton-top Tamarins (Snowdon & Boe, 2003) -Domestic Dogs (Pongrácz, Miklósi, Vida, & Csányi, 2005) -Common Marmoset (Caldwell & Whiten, 2003) -Bees (Loukola, Perry, Coscos, & Chittka, 2017) -Humming Birds (Altshuler & Nunn, 2001)
Planning (Reflection)	-Great Apes (Manrique, Völter, & Call, 2013; Girndt & Call, 2008; Premack & Woodruff, 1978) -Squirrels (Beynon & Walton, 1991) -New Caledonian Crows (Hunt, 1996; Jelbert, Taylor, Cheke, Clayton, & Gray, 2014) -African Grey Parrots (Pepperberg, 2004) -Common Ravens (Heinrich, 1995) -Asian Elephants (Foerder, Galloway, Barthel, Moore III, & Reiss, 2011) -Rooks (Bird & Emery, 2009) -Bottlenose Dolphins (Kuczaj & Walker, 2006)

Table 3.1: Examples of different approaches to problem solving in a variety of different animals.

three common approaches to problem solving (trial-and-error, observation, and planning) in a

variety of different animals. While the precise distinctions between these three approaches to

problem solving may be blurred, they generally appear to fall on a kind of spectrum in terms of

the level of cognitive sophistication that they require (Kuczaj & Walker, 2006, pp. 580-581).

Generally, problem solving through trial-and-error requires less cognitive sophistication than

problem solving through observation, which in turn requires less cognitive sophistication than

problem solving through planning. This is true in both humans and other animals.

Consider for example, three different approaches to solving a Rubik's cube. You could

grab hold of the puzzle and "without thinking" begin furiously twisting the puzzle in an attempt

to make some sort of progress. This approach requires little mental preparation, but as the

number of degrees of freedom in a problem increases, the less efficient pure trial-and-error problem solving becomes. A second approach to solving a Rubik's cube is to watch someone else demonstrate how to solve the puzzle and copy their actions. This approach requires more cognitive sophistication than pure trial-and-error problem solving, as the observer needs to watch the demonstration carefully and copy the relevant actions in the right way if they are to successfully solve the problem. This approach to problem solving can be extremely useful when one wishes to avoid the inefficiency of trial-and-error, but lacks the cognitive sophistication (or the motivation to use that sophistication) to solve the problem through planning. Planning is a third approach that could be used to solve a Rubik's cube. This approach is generally the most cognitively sophisticated and requires an individual to reflect on the current state of a problem and consider possible outcomes in order to determine the appropriate solution. This approach requires the most mental preparation, but for some difficult problems, it can be the only plausible approach. While trial-and-error, observation, and planning are all different approaches to problem solving, they can also be used in combination.

After reviewing studies on animal problem solving abilities and considering the possible effects of animal prejudice on the study of animal problem solving, I have identified three areas where animal prejudice can increase the likelihood that empirically inaccurate conclusions may be drawn. Accordingly, the following three factors should be given more consideration in order to reduce the risk of empirical inaccuracy: the presentation of the problem, the motivation of the problem-solver, and the differences between individuals.

When a problem is presented to an animal in an ecologically invalid way, there is opportunity for confounding factors to interfere with the accurate assessment of an animal's problem solving abilities. Recall the example of studies done with gibbons and elephants

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discussed in section 2.3.2. In these studies, problems with ecological validity in the form of species inappropriate tools (tools that were appropriate for human subjects, but not for the animal subjects being tested) presented to the animals for problem solving interfered with the accurate assessment of the animals' problem solving abilities. When presented with species inappropriate tools, the animals were unable to solve the problems using the tools they had been presented with. However, this result did not reflect poor problem solving abilities. Instead, these results reflected that the experimental paradigms were designed for animals with a particular anatomy. That is, the original experimental paradigm used to test the problem solving abilities of gibbons was designed for animals with fully opposable thumbs, which gibbons do not have. The original experimental paradigm used to test the problem solving abilities of elephants was designed for animals who could simultaneously grasp a tool and locate a food reward, which the elephants could not due to the fact that they grasped the tools with their trunks, which in turn prevented them from being able to smell and thus locate the reward.

When the animals were presented with species appropriate tools, they were able to successfully solve the same problems. Researchers must be careful to consider the presentation of the problem and whether it is appropriate for the species being tested and not just humans. Experimental paradigms that favour one particular kind of anatomy over another should not be used to measure the problem solving abilities of animals' whose anatomies do not suit the experimental setup. Therefore, the presentation of a problem, especially in terms of ecological validity, should be considered when studying the problem solving abilities of animals.

Animals naturally encounter problems in their environments. These problems provide a good opportunity for observational studies and to learn more about the problem solving abilities of animals on ecologically valid tasks. The impressive problem solving that squirrels and

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raccoons do in an attempt to cash in on opportunities for food provide excellent examples of

problem solving that can easily be tested outside of an artificial, laboratory setting. Yet, these

kinds of problem solving tend to increase human frustration rather than pique human interests.

Natural presentations of problems can serve as excellent guides when constructing artificial

problem solving scenarios for captive animals.

The second factor that needs to be given more consideration when studying the problem

solving abilities of animals is the subject's motivation for solving the problem. Depending on

the consequences of solving the problem they are presented with, some animals may lack the

appropriate motivation required to solve the problem. Similarly, problems often have multiple

solutions and despite a researcher's effort to control for the number of available solutions,

animals can still sometimes identify alternative solutions to the ones intended by the researcher.

When multiple solutions are available, an animal's motivations can influence the approach they

take to solving the problem and this may or may not reflect the animal's actual problem solving

abilities.

For example, Irene Pepperberg tested the problem solving abilities of African grey

parrots using an experimental paradigm that had previously been used successfully in common

ravens (Heinrich, 1995). The experiment was designed so that the birds could attain a target item

(ex. a food reward, such as a nut) that was hanging on a string by using their beaks and feet

together to pull up the string. Four birds were tested: Kyaaro, Arthur, Griffin, and Alex. At the

time of most trials, Kyaaro and Arthur were 4.75 and 4.5 years old respectively, and had

relatively limited vocabularies and little training in referential English requests (e.g. "I want X").

Griffin was 8 years old and Alex was 27 years old and both had more developed vocabularies

with considerably more training in referential English requests. Pepperberg found that Kyarro

and Arthur immediately solved the problem in the way intended (by using their beaks and feet). Griffin and Alex responded differently.

> Neither Alex nor Griffin made any attempts at recovering the nuts. In Alex's only trial in 1995 and in his subsequent trials in 2003, he, like Griffin in 2003, looked at the nuts, looked at the trainer, and said "Want nut". To the trainer's command "Go pick up nut", they both replied "Want nut"; this verbal interplay was repeated several times during each trial…In Alex's case, the volume and intensity of the request increased in one trial with the trainer's failure to comply. After their first failure in 2003, they observed one of Arthur's successful trials, but their behavior did not change. The session was ended for both Alex and Griffin without their having succeeded. (Pepperberg, 2004, p. 264)

Pepperberg concluded that the reasoning behind Griffin and Alex's failure to retrieve the nut themselves physically, despite failed verbal requests, is unclear. She hypothesizes that perhaps the communication areas of the brain had developed to the detriment of the areas used for completing sequential physical tasks using both beaks and feet. Alternatively, it is also possible that the birds lacked the motivation to complete the task themselves physically. This happens in human problem solving all the time. Having worked as a mathematics tutor in an elementary school with many different students, I can personally attest to the difference good motivation can make in a student's eagerness and willingness to apply their problem solving abilities. Of course, if an individual lacks the ability to solve a particular problem, then regardless of their motivation, they will not be able to solve it. Still, for individuals who do possess the ability, different motivations can invoke different responses to a problem.

Just as it would be unreasonable to conclude that a human math student lacks the ability to solve a particular homework problem simply because they lack motivation, it would also be unreasonable to make the same conclusion about an animal's problem solving abilities. This is especially true when the particular problem has been solved by conspecifics and when the problem has not been thoroughly tested in different conditions. While a failed attempt at

problem solving may reflect an inability, thorough examination and careful consideration are required before this conclusion can be made. It is important to consider possible variations in an animal's motivation when studying their problem solving abilities.

Finally, it is important to consider the individual differences that animals may exhibit in their problem solving abilities. As was discussed in section 2.5, acknowledging the variation of individual cognitive abilities is important for avoiding sweeping generalizations. Not only do individual animals within a species differ in their problem solving abilities, but groups of individuals with different backgrounds can vary in their problem solving abilities as well. For example, some researchers have noted differences in the problem solving abilities (or at least how these abilities are exhibited) of wild versus captive populations (Benson-Amram, Weldele, & Holekamp, 2013). Most notably, it has been observed that captive populations tend to be less neophobic than wild populations. Thus, studies examining the problem solving abilities of wild animals should be careful to consider the effects of neophobia on the performance of animal subjects.

It has also been documented that wild populations that are raised in different geographical locations and in different environments can also develop different problem solving abilities or exhibit their abilities differently. For example, wild bullfinches from urban areas were found to be better at problem solving than wild bullfinches from rural areas (Audet, Ducatez, & Lefebvre, 2015) and some primates have also adapted to thrive in urban areas (Sinha & Vijayakrishnan, 2017). Crows in Japan have been thoroughly documented to use vehicles to crack open (run over) nuts that are otherwise too hard for the crows to crack open (Nihei & Higuchi, 2002; BBC Wildlife, 2007). When this behaviour was first recorded anecdotally (Maple, 1974; Grobecker & Pietsch, 1978), researchers wanted to test the anecdotes, so they

observed crows in two of the locations from the anecdotal accounts. These locations were in California. The researchers conducted their observations without witnessing this behaviour and concluded that crows do not use vehicles to crack open nuts (Cristol, Switzer, Johnson, & Walke, 1997). While the authors are careful to note that they cannot conclude definitively that crows never use cars intentionally to crack open nuts, their unfortunate title choice ("Crows Do Not Use Automobiles as Nutcrackers") does not appropriately reflect their findings. This is especially problematic as this behaviour had already been well-documented in crows in Japan in 1995 (Nihei, 1995), two years before Cristol, Switzer, Johnson, & Walke published their article (1997). This example demonstrates the importance of recognizing that animals from different geographical locations can develop different problem solving abilities, even if they are members of the same species.

Furthermore, some animals solve problems cooperatively. It is possible that individuals on their own may not be able to successfully solve a problem, yet when that individual is a member of a larger group, the group can successfully solve the problem (Drea & Carter, 2009; Cronin, Kurian, & Snowdon, 2005; Eskelinen, Winship, Jones, Ames, & Kuczaj II, 2016). This is also important to keep in mind when making conclusions about the problem solving abilities of animals.

Differences between individuals can affect animal problem solving abilities in a variety of different ways. Just as researchers should be careful to avoid using experimental paradigms that favour a particular anatomy on an animal who does not have that anatomy, researchers should also be careful to consider other ways in which differences between individuals may be affecting the results of problem solving studies. For example, differences in how and where an animal is raised can easily affect the problem solving abilities of individual members within a

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species. Considering this before drawing conclusions about a species as a whole is important for minimizing the risk of drawing empirical inaccurate conclusions.

The presentation of a problem, the problem-solver's motivation, and differences between the problem solving abilities of individuals are all important factors that should be given more consideration if researchers are to maximize the empirical accuracy of their conclusions and reduce the effects of animal prejudice in the study of animal problem solving abilities.

3.3. Learning

For many animals, learning is a necessary for survival. Whether it is learning how to find food, how to avoid predators, or how to coexist within a large social group, there are many different things that animals have to learn. For those who have had pets, it is easy to come up with examples of animal learning. For example, dogs regularly learn whether particular behaviours are or are not acceptable, they learn to associate particular stimuli (such as the sound of a doorbell) with a particular event (such as the arrival of guests), and they can learn how to solve problems in order to attain rewards (a quick YouTube search for "sneaky pets" should return some impressive and entertaining examples). That animals are capable of learning is relatively uncontroversial. What is more controversial is which kinds of learning which animals are capable of.

While there is no universally accepted, all-encompassing account of learning, there are common types of learning that are studied in animals (see Mackintosh (2017) for a detailed overview of the different types of animal learning). Put simply, there are five general types of learning: non-associative, associative, spatial, perceptual, and complex problem solving. See

table 3.2 for some examples of different types of learning in a variety of different kinds of animals.

Non-associative learning happens when an animal's response to a particular stimuli changes in absence of any other associated stimulus or event. An example of non-associative learning is habituation, which refers to a decline in a particular response to a particular stimulus. For example, the pigeons in Chicago (and other similarly large cities) regularly walk on sidewalks full of human pedestrians and will allow humans to get much closer to them before moving away than pigeons living in more rural areas. This is because the pigeons living in dense urban areas are habituated to close proximity with humans.

Associative learning, famously studied by Edward Thorndike and Ivan Pavlov occurs when a temporal relation between a particular stimulus and a specific event creates an association such that when the stimulus is presented, the associated event is anticipated. One of the most well-known examples of associative learning is Pavlov's dog experiment (Pavlov & Thompson, 1902). In Pavlov's study, he discovered that dogs could learn to associate being fed with a variety of arbitrary stimuli (for example, the sound of a metronome or a bell). Dogs who had learned to associate the sound of a metronome with being fed, would start to salivate when the metronome was started, despite not being able to see or smell any food (the typical cause for salivating).

Spatial learning occurs when an animal learns the spatial relations between objects in their environment, whether it be natural or artificial. In the wild, animals must learn how to navigate their environments in order to venture out from their shelters to seek food and successfully return home. Many animals are also capable of learning how to navigate in artificial environments. For example, many animals have successfully navigated mazes in order to

Types of Learning	
Non-associative	-Larval Lepidoptera (Papaj & Prokopy, 1989) -Nematodes (round worms) (Rose & Rankin, 2001) -Yellow-eyed Penguins (Ellenberg, Mattern, & Seddon, 2009) -Sea Slugs (Cohen, Kaplan, Kandel, & Hawkins, 1997) - Iberian Wall Lizards (Rodríguez-Prieto, Martín, & Fernández-Juricic, 2011) -Rats (Davis & Sheard, 1974; Deshmukh & Bhalla, 2003)
Associative Conditioning	-Snails (Lukowiak, Ringseis, Spencer, Wildering, & Syed, 1996; Alkon, 1983) -Bees (Muth, Papaj, & Leonard, 2015; Menzel & Muller, 1996) -European Starlings (Bateson & Matheson, 2007) -Leopard Slug (Sahley, Rudy, & Gelperin, 1981) -Domestic Cows (Lee, et al., 2009)
Spatial	-Cuttlefish (Karson, Boal, & Hanlon, 2003) -Turtles (Lopez, et al., 2001) -Rats (Gage, Dunnett, & Björklund, 1984) -Corn Snakes (Holtzman, Harris, Aranguren, & Bostock, 1999) -North American Least Shrew (Punzo & Chavez, 2003) -Guinea Pigs (Dringenberg, Richardson, Brien, & Reynolds, 2001)
Perceptual	-Bees (Loukola, Perry, Coscos, & Chittka, 2017) -Goats (Nawroth, Baciadonna, & McElligott, 2016) -Great Apes (Byrne & Russon, 1998; Hayes & Hayes, 1952) -Pigeons (Zentall, Sutton, & Sherburne, 1996; Palameta & Lefebvre, 1985) -Cotton-top Tamarins (Snowdon & Boe, 2003) -Common Marmoset (Caldwell & Whiten, 2003) -White-crowned Sparrow (Soha & Marler, 2000)
Complex Problem Solving	-Keas (Werdenich & Huber, 2006) -Great Tits (Cole, Cram, & Quinn, 2011) -African Grey Parrots (Pepperberg, 2004; Schloegl, Schmidt, Boeckle, Weiß, & Kotrschal, 2012) -Squirrels (Beynon & Walton, 1991) -Great Apes (Girndt & Call, 2008) -New Caledonian Crows (Hunt, 1996; Jelbert, Taylor, Cheke, Clayton, & Gray, 2014) -Cichlid Fish (Grosenick, Clement, & Fernald, 2007) -Domestic Horses (Hanggi, 2003)

Table 3.2: Examples of types of learning in a variety of different animals.

retrieve a positive reward or to escape a negative stimulus.

Perceptual learning occurs when an animal perceives a set of stimuli that can be subsequently used to guide its behaviour. One of the most commonly studied types of perceptual learning is observational learning. In observation learning, an animal perceives another animal

(typically through visual or auditory observation) performing a task and copies that animal's relevant actions in order to gain a new behaviour or technique. Other examples of perceptual learning include imprinting and song learning. For example, when young songbirds are learning birdsong, they listen to the songs of older members of their species and develop songs that are similar to the ones they have heard (Catchpole & Slater, 2003).

Finally, complex problem solving is perhaps the most "impressive" type of learning and includes things like discriminating between relational and/or abstract stimuli, learning generalized rules, insight, and reasoning. Recall the example discussed in the previous section of African grey parrots who were presented with a novel problem, wherein they had to attain a food reward that was hanging from a piece of string and was out of reach. When the parrots used their beaks and feet to pull up the string and retrieve the food reward (a behaviour they had not previously been trained on), they exhibited that they had learned how to solve the problem (Pepperberg, 2004).

After reviewing studies on animal learning and considering the possible effects of animal prejudice on the study of animal learning, I have identified two areas where animal prejudice can increase the likelihood that empirically inaccurate conclusions may be drawn. Accordingly, the conditions in which learning is expected and the differences between individuals should be given more consideration in order to reduce the risk of empirical inaccuracy.

It is well-known that human learning is greatly affected by the conditions in which an individual is expected to learn. Consider for example, a typical university setting. There are many common environmental factors that can interfere with individual learning that are shared by the majority of the population. This is why classrooms tend to be relatively quiet, why we have limits on how long classes last, and why individuals are typically allowed to leave the

classroom in order to eat or go to the washroom as they please. In addition to common

environmental factors that are shared by the majority of the population, we also recognize that

individuals may also have their own unique environmental stressors that impair their learning.

This is why universities also make special accommodations for students on an individual basis.

That human learning can be so sensitive to the conditions in which it happens makes it relatively

unsurprising that animal learning can also be sensitive to the conditions in which it happens.

In 1981, Richard G. Morris introduced a new experimental paradigm for studying the

spatial learning abilities of animals. This paradigm is now famously referred to as the Morris

water maze (Morris, 1984). In a typical Morris water maze, animals (usually rats) are placed in a

round pool of water, with a platform somewhere in the tank. Initially the platform is raised, just

barely, out of the water so that the rats can see it. During training trials, the rats are expected to

learn that if they swim to the platform and wait a certain amount of time, they will be rescued.

Once the rats have been trained with a visible platform, the water level is raised and the water is

made opaque so that the platform is submerged just below the murky water (i.e. the rat can still

sit on the platform without having to swim or tread water, but the platform is not visible above

the water). These experimental trials are designed to test the rat's spatial learning abilities by

tracking the path the rat takes and the amount of time it takes the rat to reach the platform over

multiple trials.

The Morris water maze has become a widely used paradigm in animal learning research

and many claims about the spatial learning abilities of animals are made based on their

performance in Morris water mazes. The problem is that Morris water mazes can be a very

stressful environment for animal subjects and it has been documented that stress can impair

learning (Maier & Seligman, 1976). Furthermore, it has also been documented that stress from

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Morris water mazes specifically can impair learning (Francis, Zaharia, Shanks, & Anisman, 1995; Hölscher, 1999).

Christian Hölscher conducted a review of the effects of stress on animal learning in Morris water mazes and made the following conclusion:

> I conclude that stress-induced learning impairments can impair performance in spatial water maze tasks, independent of the actual spatial learning abilities of the animals. Previous publications that interpret poor performance of animals in spatial water mazes as an impairment in spatial learning abilities will have to be re-analysed. (1999, p. 234)

Despite reaching this conclusion after thorough examination of the Morris water maze, the paradigm continues to be widely used and conclusions about subjects' spatial learning abilities continue to be made based on their performance without appropriate consideration for the effects of stress. Importantly, if this experimental paradigm is to be used, it must be recognized that the paradigm does induce stress in its subjects and that this stress does affect the subject's spatial learning abilities. Failing to make this acknowledgment will negatively affect how results of studies using the Morris water maze are interpreted and can lead to empirically inaccurate conclusions.

Imagine that a Morris water maze experiment was run with human subjects, wherein the experience of the humans was designed to match, as closely as possible, the experience of rats in a typical Morris water maze. That is, human subjects were placed in a proportionally larger pool of water, they likely did not understand that an experimenter would intervene in the event of extreme struggling, and they were given no options to opt-out of the study. Conclusions about the general learning abilities of humans based on the performance of the subjects from this study would understandably be met with objections. Putting any ethical objections to the side, these conclusions would still be met with objections on the grounds that these conclusions over-

interpret the evidence. That is, conclusions that human learning abilities are limited to those exhibited by humans in highly stressful environments would be unacceptable given that we know that stress can negatively affect a human's learning abilities. Failing to make this same acknowledgement when animal subjects are tested using the Morris water maze is an instance of animal prejudice.

Conclusions based on an animal's performance in a Morris water maze experiment should appropriately acknowledge that the results reflect the animal's learning abilities in a highly stressful environment, and that these abilities do not necessarily reflect the animal's learning abilities outside of highly stressful environments.

The effects of stress on learning are an important consideration to keep in mind for any animal learning study, and not just studies that use Morris water mazes. Similarly, other forms of duress that can affect the learning abilities of animals should also be considered. Reflecting on the current standards and practices in the study of animal learning (and of other animal cognitive abilities as well), Frans de Waal remarks:

> If we test animals under duress, what can we expect? Would anyone test the memory of human children by throwing them into a swimming pool to see if they remember where to get out? Yet the Morris Water Maze is a standard memory test used every day in hundreds of laboratories that make rats frantically swim in a water tank with high walls until they come upon a submerged platform that saves them. In subsequent trials, the rats need to remember the platform's location. There is also the Columbia Obstruction Method, in which animals have to cross an electrified grid after varying periods of deprivation, so researchers can see if their drive to reach food or a mate (or for mother rats, their pups) exceeds the fear of a painful shock. Stress is, in fact, a major testing tool. Many labs keep their animals at 85 percent of typical body weight to ensure food motivation. We have woefully little data on how hunger affects their cognition. (2016, p. 35)

The little data that does exist on the effects of hunger on cognition shows that hunger can negatively impair the learning ability of animals (Buckley, et al., 2011).

In addition to stress, other forms of duress, such as food and water deprivation, should also be appropriately accounted for when making conclusions about an animal's cognitive abilities. Note that the ethical question of whether these experimental paradigms should be used at all is one that I will put aside for now and return to in chapter 5. For now, my concern is that conclusions based on evidence from experimental paradigms that place animals under duress in order to test their cognitive function, like the Morris water maze, should appropriately reflect that the learning abilities exhibited are learning abilities under duress. Importantly, how an animal performs cognitively when under duress should not be used to limit our understanding of that animal's cognitive abilities. The conditions in which learning is expected should be considered when studying animal learning in order to avoid drawing empirically inaccurate conclusions.

The second factor that should be given more consideration when studying the learning abilities of animals is the possibility of differences between the learning abilities of individuals. Just as individual differences in problem solving abilities are possible (as was discussed in section 3.2), individual differences in learning abilities are also possible. For example, it has been documented that age (Gage, Dunnett, & Björklund, 1984; Punzo & Chavez, 2003), diet (Jones & Agrawal, 2017), sex (Perrot-Sinal, Kostenuik, Ossenkopp, & Kavaliers, 1996; Rodríguez-Prieto, Martín, & Fernández-Juricic, 2011; Ellenberg, Mattern, & Seddon, 2009), and whether an animal is wild or captive (Desforges & Wood-Gush, 1975) can all affect the learning abilities of animals.

It has also been documented that individual animals learn differently from different teachers (Nelson, 2000). Perhaps the best examples of the effect different teachers can have on an animal's learning abilities are the highly enculturated apes at the center of long,

dedicated research projects. Individuals like Washoe the chimpanzee (Fouts, 1983), Koko the gorilla (Patterson & Gordon, 2002), Kanzi the bonobo (Savage-Rumbaugh & Lewin, 1994), and Chantek the orangutan (Miles, 1994) are pioneers for language studies in their respective species. The communication skills exhibited by Washoe, Koko, Kanzi, and Chantek greatly exceeded previous conceptions of language abilities in great apes and as individuals, their abilities surpassed those of their conspecifics. What makes Washoe's, Koko's, Kanzi's, and Chantek's cases unique is that they were raised much more like human children than as young apes of their own species and had dedicated human teachers to learn from. Highly enculturated animals provide unique insights into animal minds and the effects that nature and nurture have on their development. I will return to examples of enculturated animals in chapter 4, where I will discuss the unique insight into animal emotion that enculturated animals provide, and in chapter 5, where I will discuss the ethical implications of raising enculturated animals.

There are so many factors that can potentially affect the learning abilities of individuals and it is crucial that researchers take this into consideration when making conclusions about the learning abilities of animals. Just as researchers would never make a conclusion about the learning abilities of all humans based on a study conducted with fifty 12 year olds from Toronto, researchers should avoid making conclusions about the learning abilities of an entire species based on a small group of relatively homogenous individuals.

The conditions in which learning is expected and the differences between the learning abilities of individuals are all important factors that should be given more considerations if researchers are to maximize the empirical accuracy of their conclusions and reduce the effects of animal prejudice in the study of animal learning abilities.

3.4. Tool Use

Making and using tools has allowed humans to survive in many different kinds of environments. Humans are excellent at innovating tools that allow them to adapt to their environment in ways they otherwise would not be able to. Humans are able to survive and thrive in almost any climate in the world because of the advanced tools we have created. What makes tool innovation extremely valuable to a group is the opportunity for non-innovators to learn from the innovator. This results in the advancement of the group as a whole, without requiring every member of the group to be an innovator. For example, all humans are able to use and benefit from the creation of computers, despite the fact that only a small portion of us are actually able to build them.

The extent to which humans make and use tools is far greater than anything seen in the rest of the animal kingdom. That being said, humans are not the only animals to make and use tools. Tool use and tool manufacturing have been documented across three phyla (anthropods, mollusks, and chordates) and seven classes (insects, malacostracans, gastropods, cephalopods, actinopterygii, birds, and mammals) of the animal kingdom (Bentley-Condit & Smith, 2010, p. 193). What is perhaps even more interesting, is that tool use is not always present across a species as a whole. Rather, there can be groups within a species that demonstrate tool use in a way that other groups within the same species do not. Some researchers suggest that this is evidence of animal culture.

In a recent and comprehensive review of animal tool use research, Vicki K. Bentley-Condit and E.O. Smith begin by remarking that, "The definition of 'tool use' is problematic, often arbitrary or subjective, sometimes anthropocentric, and open to interpretation" (Bentley-Condit & Smith, 2010). Despite what may seem like a relatively pessimistic start, Bentley-

Definitions of Tool Use	
Definition	Author
"use of an external object as a functional extension of mouth or beak, hand or claw, in the attainment of an immediate goal"	Jane Goodall (Van Lawick-Goodall, 1971, p. 195)
". . . the manipulation of an inanimate object, not internally manufactured, with the effect of improving the animal's efficiency in altering the position or form of some separate object"	John Alcock (1972, p. 464)
Summarized by Bentley-Condit & Smith as "…made the important distinction between 'true' and 'borderline' tool use; true tools were objects not a part of the substrate that were manipulated by the users while borderline tools remained a part of the substrate. For example, a thorn broken from a tree and used by an individual would be a true tool while a thorn that remained a part of the tree would be a borderline tool." (2010, p. 187)	Jeffery Boswall (1977a; 1977b; 1978) (1982; 1983)
". . . the external employment of an unattached environmental object to alter more efficiently the form, position, or condition of another object, another organism, or the user itself when the user holds or carries the tool during or just prior to use and is responsible for the proper and effective orientation of the tool"	Benjamin B. Beck (1980, p. 10)
". . . the exertion of control over a freely manipulable external object (the tool) with the goal of (1) altering the physical properties of another object, substance, surface or medium (the target, which may be the tool user or another organism) via a dynamic mechanical interaction, or (2) mediating the flow of information between the tool user and the environment or other organisms in the environment".	Robert St. Amant & Thomas E. Horton (2008, p. 1203)
"…our tool-use definition is very similar to that of St. Amant & Horton (St. Amant & Horton, 2008) with somewhat more leeway in what constitutes 'dynamic' behaviour."	Vicki K. Bentley-Condit & E.O. Smith (2010, p. 189)

Table 3.3: Examples of common definitions of tool use, based on summary by Vicki K. Bentley-Condit and E.O. Smith (2010).

Condit and Smith go on to outline common definitions of animal tool use and also offer their own definition. While arguing for a specific definition of animal tool use is not the goal of this section, identifying which definitions may be problematic and which definitions best fit the scientific values associated with studying animal minds is.

Table 3.3 provides a summary of common definitions of tool use (based on Bentley-Condit & Smith's (2010) review). For an extensive catalogue of documented tool use and tool manufacture in a wide variety of species, see Appendix A ("Animal Tool Use Catalogue") in Bentley-Condit & Smith's (2010) paper.

Goodall's (1971) definition of tool use is simple, but it is overly simplistic and arbitrarily restrictive to only species who use their mouths, beaks, hands, or claws to use tools. Many animals use tools without using (or without having) mouths, beaks, hands, or claws. For example, sea snails have been documented to use small stones as counterweights to upright themselves when they are inverted. When a snail becomes inverted, its initial response is to search for a nearby surface on which it can anchor itself in order to upright itself. However, sometimes snails find themselves inverted on the sea floor in a location where there are no sufficiently heavy objects nearby. In these cases, the snails have been observed to use the prehensile anterior tip of the propodium (the foremost division of the snail's ventral foot) to pick up small stones (that are individually too light for the snail to anchor themselves on) and move the stones along their body to their postpodium (the posterior end of the foot) until the snail has been documented that do not involve mouths, beaks, hands, or claws. Thus, a definition of tool use should not arbitrarily restrict tool use to only species with particular anatomies.

Alcock's (1972) definition of tool use is also simple and again arbitrarily restrictive. In this case, the restriction has been placed not on the anatomy of the tool user, but on the way in which a tool can be used. Requiring that a tool be used to alter the position or form of a separate object, denies that tools can be used in other ways. For example, elephants have been documented to use boxes to reach an out-of-reach food reward by stacking and standing on the boxes (Foerder, Galloway, Barthel, Moore III, & Reiss, 2011). In this example, the elephants (who are also not using mouths, beaks, hands, or claws), are using the boxes as tools, but they are not altering the position or the form of the food reward they are trying to reach. Thus, a definition of tool use should not arbitrarily restrict the ways in which tools can be used.

Boswall's (1977a; 1977b; 1978; 1982; 1983) definition of tool use avoids the problem faced by Alcock's definition, but seems to suffer from a similar problem to Goodall's definition. Boswall distinguishes between true and borderline tool use, with the distinction being made based on whether the tool is attached to a substrate. The example given is of a thorn used as a tool. A thorn used while attached to a tree is an example of borderline tool use while a thorn free from a tree is an example of true tool use. As separate categories of tool use, this distinction seems harmless. However, using the words "true" and "borderline" to label these two categories gives a higher status to tools that are not attached to a substrate. The problem is that this again favours a specific type of anatomy. For animals who have prehensile appendages (typically mammals), freeing a tool (like a thorn) from a substrate (like a tree) may work well for their particular needs. Alternatively, for animals who do not have prehensile appendages, using tools that are attached to substrates may be more functional (perhaps because the substrate acts as an anchor for the tool and therefore as a sort of artificial prehensile appendage). For example, yellowhead wrasse fish have been documented to use large stones as anvils against which to break open scallops (Coyer, 1995). The fish hold the scallops in their mouths and strike the scallops against a large stone. In this case, because the fish lack prehensile appendages, they are limited to using only their mouths to hold objects. Holding the stones in their mouths in order to strike the scallops is impractical since the stones are much heavier than the scallops and the scallops, without being anchored to anything, would move when struck.

Again, the problem is not with separating tools attached to substrates from tools free from substrates into two categories; the problem is with arbitrarily giving higher status to one category of tool use that typically requires a certain kind of anatomy. Beck's (1980) definition of tool use not only identifies tools that are "unattached", but it requires that the tool be unattached in order

for the behaviour to even count as tool use. An animal's tool use skills should be judged on their cognitive abilities and not on which appendages they happen to have. So again, a definition of tool use should not arbitrarily discount or deny tool use abilities based on anatomy.

St. Amant & Horton's (2008) and Bentley-Condit & Smith's (2010) definitions of tool use are better than previous definitions in the sense that they avoid restricting tool use to species with particular anatomies, and they are also more flexible in terms of the ways in which a tool can be used, but their definitions still contain a noteworthy restriction. According to these definitions, the tool user must have control over a freely manipulable object. The problem here is that some animals use tools by appropriately placing the object on which the tool is to be used in the right place at the right time, and by predicting the movement of the tool (over which they actually have no control). Recall the example of the crows from Japan discussed in section 3.2. These crows have been well documented to use vehicles to crack open nuts that they could otherwise not open. The crows carefully place the nuts on busy streets and wait for vehicles to come by and run over the nut, and therefore crack it open so that the crow can eat the meaty inside of the nut. Not only do the crows choose their roads carefully, they also carefully choose the locations on the road where they leave the nuts. Busy traffic is good for cracking open nuts (the more vehicles that pass by, the sooner the nut will likely be run over), but busy traffic also makes retrieving the cracked nuts more difficult. In order to make retrieving cracked nuts easier, the crows will place their nuts on roads in locations that are near pedestrian crossings and wait for the traffic to stop before going on to the road to retrieve the cracked nuts (Nihei & Higuchi, 2002; BBC Wildlife, 2007). In this example, the crows are clearly using the vehicles as nutcrackers, despite not actually having any control over the vehicles. Thus, again, a definition of tool use should not arbitrarily restrict the ways in which tools can be used.

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After reviewing common definitions of tool use in light of evidence for animal tool use, I have identified two ways in which definitions tend to be arbitrarily restrictive: by arbitrarily restricting tool use to animals with particular anatomies and by arbitrarily restricting the ways in which tools can be used. Definitions that are arbitrarily restrictive in these ways will negatively affect conclusions about animal tool use abilities, such that the tool using abilities of certain species may be denied for non-cognitive reasons, thus reducing the empirical accuracy of the conclusions. In order to increase empirical accuracy and avoid conflicting with a commonly agreed on value in science, definitions of animal tool use should avoid these restrictions and be appropriately flexible.

3.5. Language

Perhaps one of the most controversial debates about the cognitive abilities of animals is whether animals have language. As evidence for other abilities previously considered to be "uniquely human" mounts, the focus on language as the defining difference between humans and other animals grows. Language is certainly one of the cognitive abilities humans pride ourselves most for having. Indeed, language facilitates communication and the transferral of information in a way that has allowed our species to thrive in ways that others seemingly do not. Many animal species have complex forms of communication (see table 3.4 for some examples), but the threshold between these forms of "mere" (for lack of a better word) communication and what we identify as language is unclear.

Evidence of Complex Communication	
Animal	Evidence
African Grey Parrots	-acquisition and use of English speech, including ability to combine known words in novel referential vocalizations (Pepperberg, 2006, 2007)
Ants	-encoded information about the presence or absence of a food source in pheromone trails (Hölldobler, 1999; Robinson, Jackson, Holcombe, & Ratnieks, 2005)
Bees	-encoded information about distance and direction of food sources in waggle dance (Von Frisch, 1967; Gould, 1974; Riley, Greggers, Smith, Reynolds, & Menzel, 2005)
Bonobo	-acquisition and use of artificial language, including interspecific communication, and the ability to understand spoken English (Savage-Rumbaugh & Lewin, 1994)
Bottlenose Dolphins	-acquisition and use of artificial language, including referential comprehension and word combination and recombination according to a set of syntactic rules (Herman, 1986, pp. 221-252; Herman, 2010); communication during cooperative problem solving (Eskelinen, Winship, Jones, Ames, & Kuczaj II, 2016)
Chimpanzees	-acquisition and use of artificial language, including interspecific communication, the ability to combine known signs to create novel referential descriptors and sentences, and the ability to understand spoken English (Rumbaugh, 2014); acquisition and use of American sign language, including interspecific communication and the ability to combine signs to create novel referential descriptors (Gardner & Gardner, 2013); encoded information about food reward type and location in grunts, vocalizations unique to individuals (Slocombe & Zuberbühler, 2005)
Cuttlefish	-intraspecific communication, including recognition and deception (Shashar, Rutledge, & Cronin, 1996; Brown, Garwood, & Williamson, 2012)
Domestic Dogs	-interspecific communication, including the interpretation of verbal (spoken language) and non-verbal cues (Rossi, Smedema, Parada, & Allen, 2014; Ades, Ramos, Rossi, & Suenaga, 2004; Pilley & Hinzmann, 2013)
Elephants	-encoded information about the individual caller and emotional state in rumbles (Soltis, Leong, & Savage, 2005); imitation of human speech (Stoeger, et al., 2012)
Gorilla	-acquisition and use of American sign language, including interspecific communication, the ability to understand spoken English and the ability to combine known signs to create novel referential descriptors (Patterson & Gordon, 2002)
Humpback Whales	-interindividual difference and structural syntax in whale songs (Suzuki, Buck, & Tyack, 2006)
Japanese Great Tits	-encoded information about predator type in alarm calls (Suzuki, T., 2014)
Meerkats	-encoded information about predator type in alarm calls, vocalizations unique to individuals (Townsend, Charlton, & Manser, 2014; Manser, 2001)
Orangutans	-interspecific and intraspecific communication through gestures, including compositionality, systematicity and productivity (Russon & Andrews, 2011); acquisition and use of American sign language, including interspecific communication and the ability to combine known signs to create novel referential descriptors (Miles, 1994)
Putty-nosed Monkeys	-encoded information about predator type in alarm calls, individual caller specific responses (Arnold & Zuberbühler, 2008)
Vervet Monkeys	-encoded information about predator type in alarm calls, social grunting (Cheney & Seyfarth, 1990, pp. 98-138)

Table 3.4: Examples of evidence for complex communication in a variety of different animals.

In reflecting on the debate over whether animals have language, Stephen R. L. Clark writes:

> …we remain doubtful that animals could be said to have a language. In part this doubt is a mere device of philosophy: it is not that we have discovered them to lack a language but rather that we define, and redefine, what language is by discovering what beasts do not have. If they should turn out to have the very sort of thing we have hitherto supposed language to be, we will simply conclude that language is something else again. (1997, p. 96)

Similar views on how language is and has been defined are shared by others doing research on animal language (Pepperberg, 2016; Fouts, 1974). Clark's view may seem rather pessimistic about the study of language and philosophy, but it does highlight a rather important point. A language is a complex form of communication, but not all complex forms of communication are considered languages. The threshold between a language and a non-language form of complex communication is unclear, despite many scholars' attempts at clarification.

Like with all cognitive abilities, how an ability is defined will determine whether the empirical evidence of an animal's behaviour counts as evidence for that ability. For example, in the previous three sections, I argued that conceptions of problem solving, learning, and tool use should be sufficiently flexible so as to appropriately account for empirical evidence of these abilities in animals. While I could make a similar argument about language here, it strikes me that the debate over animal language is importantly different from the debate over the other animal cognitive abilities that I have discussed. While problem solving, learning, and tool use often overlap, they all appear to be distinct cognitive abilities as opposed to a subset of or a specific kind of a more general cognitive ability. In comparison, language seems to be a specific kind of complex communication. That is, the more general cognitive ability is communication and the more specific kind of that cognitive ability is language. Instead of focusing on where the

line between language and other forms of complex communication is drawn, I will focus on the nature and implications of this distinction.

First, whether we define language in such a way that we end up with only evidence for language in humans or in such a way that we end up with evidence for language in humans and other animals is a matter of semantics. I do not mean to suggest that this is not a worthwhile academic pursuit or that there is no value in characterizing language; I only mean to point out that the actual communication abilities humans and other animals are unchanged regardless of whether we classify them as "language." It may very well be that what scholars whom deny language abilities to other animals are trying to characterize is actually a human form of complex communication. If one was to try to characterize what language was based on intricate knowledge of whale communication and very little knowledge of human communication, it would be unsurprising if the resulting characterization was more appropriately suited to describe whale communication. In this same way, scholars working to characterize what language is, are doing so based on intricate knowledge of human communication and relatively little knowledge of animal communication. It should therefore not be surprising that current characterizations of language tend to be more appropriately suited for human communication and also less appropriately suited for animal communication.

The reason why animal prejudice in characterizations of language strikes me as less of an issue than animal prejudice in characterizations of other cognitive abilities is precisely because of what I said earlier: language is just one form of complex communication and not an entirely unique cognitive ability full stop. Whereas characterizing problem solving, learning, or tool use too narrowly could result in the complete denial of these abilities in animals, too narrowly characterizing language may just result in denying animals a specific form of complex

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communication (likely a human form of complex communication). Of course, it is still important that researchers be aware of empirical evidence for complex communication abilities in animals and that they be careful to recognize that although what they may think they are characterizing is a human form of communication, it does not mean that their characterizations could not also describe complex communication in other species. That is, if what scholars are trying to do through characterizing language is distinguish between human communication and animal communication, that is fine so long as they keep in mind that their characterizations could be wrong.

Secondly, it is critical that conclusions drawn about the language abilities of animals and the implications of those abilities be appropriately justified, particularly if language is characterized up front as a human form of communication. Most importantly, it needs to be recognized that the denial of language in a species should not entail the denial of complex communication or other cognitive abilities in that species (de Waal, 2016). For example, Raymond G. Frey (1980) has argued that in order to have desires, one must have beliefs, which require language. Frey argues that since animals lack language, they lack beliefs and therefore lack desires. José Bermúdez (2011) has argued that mental state attribution is not possible without language. Similarly, Donald Davidson has argued that animals are not capable of having beliefs as he believes that language is necessary for having beliefs and that animals do not have language (1982, p. 324). However, there is substantive empirical evidence that suggests that animals do have beliefs. Many scholars, such as Elisabeth Camp (2009), have argued that for some animals, beliefs may be based on imagistic representational systems. Camp, specifically, argues that these imagistic systems can account for the social knowledge that baboons have without requiring a language of thought.

There are many different ways in which animals can communicate. Furthermore, there are many different levels of complexity at which a form of communication may sit. Humans have developed very complex systems of communication, including what is characterized as language. Depending on how language is characterized, we may or may not think that it is an exclusively human ability. If language is characterized in a way that makes it appear to be exclusively human, it should be recognized that this does not mean that other animals do not have complex forms of communication. There is no denying that the communication abilities of humans is extremely sophisticated, but the fact that we have developed these sophisticated abilities does not mean that animals lack communication abilities or that the communication abilities of animals cannot also be complex (even if not to the same degree). Remembering this and the fact that not all cognitive abilities have to function the same way or be made possible by the same mechanisms across species is crucial in order to avoid drawing problematic and empirically inaccurate conclusions.

3.6. Conclusion

In this chapter, I have reviewed four specific areas of animal mind research: problem solving, learning, tool use, and language. Through examining how these cognitive capacities are studied in animals, I have identified areas where animal prejudice threatens the empirical accuracy, a commonly agreed on value in science, of claims about animal minds.

When studying the problem solving abilities of animals, researchers should be careful to give appropriate consideration to the presentation of a problem, the problem-solver's motivation, and differences between the problem solving abilities of individuals. When studying the learning abilities of animals, the conditions in which learning is

expected and the differences between the learning abilities of individuals should be given adequate consideration. In studying the tool use abilities of animals, researchers must be cautious of definitions of tool use that arbitrarily restrict tool use to animals with particular anatomies and that arbitrarily restrict the ways in which tools can be used. Finally, researchers must remember that conclusions about an animal's language abilities are dependent on the characterization of language being considered and that the denial of language abilities should not entail the denial of complex communication or other cognitive abilities.

In the next chapter, I will continue my examination of how animal prejudice negatively affects empirical accuracy in the study of animal minds, by looking specifically at the study of animal emotion and empathy.

Chapter 4: The Effects of Animal Prejudice on Animal Emotion and Empathy

4.1. Introduction

Humans experience a vast range of emotions, which have been both lauded as being what makes life interesting and beautiful, and condemned for interfering with our ability to think clearly and make good decisions. Regardless of whether one believes emotions help or hinder us, it is uncontroversial that we experience them and that they play an integral part in our lives. We experience emotions like happiness, sadness, surprise, fear, anger, and disgust, as well as more socially complex emotions, such as guilt, betrayal, pride, and many more. Furthermore, we can experience simultaneous combinations of different emotions.

Darwin proposed that many species share similar emotions and that they may express these emotions in similar ways (Darwin, 1872 [Republished 2002]). It is now widely accepted that some animals are capable of feeling some emotions (de Waal, 2011; Fraser, 2009; Panksepp, 1998), but determining which animals experience which emotions and to what extent they experience them is still difficult. Answering these questions relies on having good general (as opposed to species-specific) accounts of the nature of emotion and having access to good empirical evidence. It is important that we try to answer these questions, as understanding animal emotion has important implications not only for our understanding of the origins of human emotion, but also for governing how we interact with animals.

In the vast majority of cases, animals are not able to provide subjective reports of their emotions in the same way that humans are able to. For this reason, researchers who make claims about animal emotion must rely heavily on alternative methods for testing emotion. Researchers currently use a variety of experimental techniques to test animal emotion, but many questions

remain unanswered, which in turn limits discussions about how we should interact with and treat animals. In this chapter, I will examine how judgments about animal emotions are made and how animal prejudice can affect various aspects of the making of these judgments. I will begin by reviewing some common accounts of emotion in section 4.2 and outlining what kinds of evidence are currently being used to justify claims about animal emotion in section 4.3. In section 4.4, I will evaluate the consistency of these general accounts of emotion with scientific values, and I will offer recommendations for increasing the empirical accuracy of judgments made about animal emotion. In sections 4.5, I will repeat this process and apply my recommendations to the study of animal empathy.

4.2. The Nature of Emotion

Traditionally, there have been three approaches to characterizing the nature of emotions. The first approach explains emotions in terms of judgements (or cognitive appraisals) made about one's current situation in relation to their goals (Nussbaum, Upheavals of thought: The intelligence of emotions, 2003). On this approach, an individual's emotions are the result of cognitive appraisals about how their situation affects their goals. Situations that conflict with an individual's goals will lead to negative emotions for that individual, and situations that support the individual's goals will lead to positive emotions for that individual. The second approach explains emotions in terms of physiological perceptions of the changes in one's body (Prinz, 2004). On this approach, an individual's situation causes physiological changes in their body, which when perceived, lead to emotions. Situations that result in similar emotions do so because the situations result in similar physiological changes. The third approach explains emotions as social constructions (Harré, 1986). On this approach, the emotions that an individual

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experiences are the result of the situation the individual is in and the individual's social expectations for that situation.

More recently, these three approaches to explaining emotions have been combined to produce a unified theory that better captures the nature of emotion. Paul Thagard and Tobias *Schröder* argue that emotions are best understood as an integrative process that combines physiological perceptions with cognitive appraisals and social interpretations (Thagard & Schröder, 2014; Schröder, Kajić, Stewart, & Thagard, 2017). This integrative process is made possible by a neural mechanism using semantic pointers, a class of mental representation introduced by Chris Eliasmith (Eliasmith, 2013). Though it is likely that a theory of human emotion would be very similar to a theory of animal emotion, it is not necessary that they be identical. For instance, it may be the case that cognitive appraisals and social interpretations play larger roles in emotion in humans than they do in emotion in animals. Furthermore, cognitive appraisals and social interpretations may play larger roles in explaining the emotions of one animal species versus another animal species.

Recall the scientific values discussed in section 2.6. When considered in light of the scientific values outlined by Thagard (1997) /Goldman (1992), Kitcher (2003), and Longino (2002; 1990), adopting a hybrid theory of emotion better supports scientific values on all three theories. See table 4.1 for a simplified account of the consistency between scientific values and adopting a hybrid versus a traditional theory of emotion.

On Thagard's model, adopting a hybrid theory of emption is better than adopting a traditional theory of emotion because it is more reliable, more powerful, has greater fecundity, and better contributes to the development of theoretical and experimental results that increase

Scientific Values		Hybrid Theory	Traditional Theory
Thagard (Goldman)	Reliability	✓	
	Power	✓	?
	Fecundity	✓	
	Speed		
	Efficiency		✓
	Explanatory Efficacy	✓	
Kitcher	Truth	✓	
	Significance	?	?
Longino	Empirical Adequacy	✓	
	Biases Mitigation	✓	

Table 4.1: A simplified representation of the consistency between scientific values and hybrid theories of emotion.

explanatory coherence. Adopting a hybrid theory of emotion: is more reliable because it is better able to account for more kinds of emotion than a traditional theory, thus reducing the number of empirically inaccurate conclusions that animals lack emotion; is more powerful because a hybrid theory will better help cognizers answer questions about animal emotion (even when that emotion is different from our own); has greater fecundity because it can identify more kinds of emotion; and better contributes to the development of theoretical and experimental results that increase explanatory coherence among a greater number of species. Alternatively, adopting a traditional theory of emotion can be considered more efficient and powerful, but only if the answers we care about are limited to identifying which animals have emotion like ours. That is, if we are only interested in determining which animals have human-like emotion and not which animals have emotion generally (even if they are not human-like), then adopting a traditional theory of emotion would limit the expenses of attaining those results (because there would be fewer kinds of evidence to look for and therefore fewer experiments to run) and could be considered powerful (because it will help cognizers find answers to the limited question they are

asking). However, even in this case, adopting a hybrid theory of emotion is still more consistent with a greater number of scientific values.

On Kitcher's model, adopting a hybrid theory of emotion is better than adopting a traditional theory of emotion because it will lead to a great number of truths. Whether these truths are considered significant depends on what kinds of emotion humans are interested in identifying. Similar to the consideration of power on Thagard's model, if researchers are only interested in identifying which animals have human-like emotion, then both a hybrid theory and a traditional theory will both yield significant truths. However, if researchers are interested in identifying which animals have emotion more generally (even if that emotion is not human-like) then adopting a hybrid theory of emotion will yield more significant truths.

Finally, on Longino's model, adopting a hybrid theory of emotion is better than adopting a traditional theory of emotion because a hybrid theory increases empirical accuracy and is better at mitigating biases. Since a hybrid theory can better account for the different kinds of emotion, it will more accurately identify emotion in animals. Similarly, because it is more flexible in explaining different kinds of emotion, it will better mitigate the biases of individual explanations for emotion because it will not restrict emotion to any one particular explanation.

According to all three popular accounts of scientific values, adopting a hybrid theory of emotion is better than adopting a traditional theory of emotion, because a hybrid theory is more flexibly and accurately able to account for emotion in a greater number of species. I will return to my discussion of these accounts of emotion in section 4.4, after I have reviewed the kinds of evidence used to justify claims about animal emotion.

4.3. Evidence for Emotion

Despite advances in interspecies communication, asking animals to self-report their emotions, as we do with humans, is not a viable method for assessing animal emotions – at least in the vast majority of cases. A few highly enculturated great apes who have been taught sign language are seemingly able to self-report some of their emotions (The Gorilla Foundation, 2015; Cole, M., 2014), but this method of assessing animal emotion is extremely limited and only viable for a small population of animals. So, what kinds of evidence do researchers rely on when making claims about animal emotion? Evidence used to support claims about animal emotion can be organized into three main types: behavioural, physiological, and neural.

4.3.1. Behavioural Evidence

Behavioural evidence for animal emotion tracks the physical actions and reactions of an animal when experiencing a particular emotion. These physical reactions are often characterized in terms of the environment they are made in and the stimulus they are made in response to. For example, purring in a cat may be considered to be behavioural evidence of happiness in the form of a vocalization that is exhibited in response to being gently petted. Other examples of the kinds of behaviours used as evidence for animal emotion include physical actions, movement, facial expressions, and body language. Note that there may be some overlap among the different types of evidence. For example, facial expressions could also be considered physiological types of evidence. See table 4.2 for some examples of different types of behavioural evidence for animal emotion.

Due to the nature of behavioural evidence, it is the most readily observed type of evidence for animal emotion. Though the specific parameters under which behavioural evidence

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Behavioural Types of Evidence		
Emotion	Animal	Behavioural Indicator
Consolation	-ravens (Fraser & Bugnyar, 2010) -bonobos (Clay & De Waal, 2013)	-affiliation with conspecifics -body-contact with conspecifics
Grief	-various species, including cats, dogs, horses, rabbits, and elephants (King, B., 2013)	-various behaviours
Negative Emotions	-European starlings (Bateson & Matheson, 2007)	-ambiguous signal interpretation based on taste aversion
Positive and negative emotions	-domestic sheep (Reefmann, Kaszàs, Wechsler, & Gygax, 2009)	-ear posture
Stress	-rats (Van der Harst, Baars, & Spruijt, 2003)	-reward anticipation
Positive and negative emotions	-rats (Knutson, Burgdorf, & Panksepp, 2002)	-vocalizations
Negative emotions	-honeybees (Bateson, Desire, Gartside, & Wright, 2011)	-ambiguous signal interpretation based on odour aversion
Positive and negative emotions	-domestic pigs (Reimert, Bolhuis, Kemp, & Rodenburg, 2013)	-various behaviours including vocalizations, tail posture, defecation
Anxiety	-mice (Sherwin & Olsson, 2004)	-self-medication
Various emotions	-extensive examples of different emotions in different animals (Bekoff & Goodall, 2007; Masson & McCarthy, 2009; Bekoff, 2000)	-various behaviours
Anxiety	-crayfish (Fossat, Bacqué-Cazenave, De Deurwaerdère, Delbecque, & Cattaert, 2014)	-location avoidance
Pleasure	-iguanas (Cabanac, 1999)	-comparing sensory modalities
Positive and negative emotions	-chimpanzees (Parr, 2001)	-matching facial expressions to video clip content

Table 4.2: Examples of behavioural types of evidence for animal emotion.

for animal emotion may be observed can be manipulated with controls in laboratory settings,

behavioural evidence does not require a laboratory setting in order to be observed. That is,

behavioural evidence can also be observed in an animal's natural environment with little human

interference.

4.3.2. Physiological Evidence

Physiological evidence for animal emotion ascribes emotions to an animal on the basis of psychological changes, which are often characterized in terms of the environment they are produced in and the stimulus they are produced in response to. For example, an accelerated heart rate in a cat may be considered to be physiological evidence of fear that is exhibited in response to being confronted by a cat-aggressive dog. Other examples of the kinds of physiological changes used as evidence for animal emotion include changes in body temperature, skin and/or fur, and body chemistry. Physiological types of evidence include internal physiological changes and external physiological changes. See table 4.3 for examples of different types of physiological evidence for animal emotion.

Physiological evidence for animal emotion is less readily observed than behavioural evidence for animal emotion, though depending on the type of physiological change being observed, it is still sometimes observable outside of a laboratory setting and without human interference. For example, physiological evidence for animal emotion in the form of fur or skin colour changes may be observed in an animal's natural environment. In contrast, physiological evidence for animal emotion in the form of heart rate or body temperature changes are not readily observable without human interference. Though it is in theory possible to study these kinds of physiological changes in an animal's natural environment with human interferences, it is impractical and so these types of physiological changes are typically measured in laboratory settings.

Physiological Types of Evidence		
Emotion	Animal	Physiological Indicator
Positive emotions	-domestic cows (Hagen & Broom, 2004)	-heart rate
Anxiety	-mice (Sherwin & Olsson, 2004)	-drug level in body
Anxiety	-rhesus macaques (Aureli, Preston, & de Waal, 1999)	-heart rate
Positive and negative emotions	-iguanas (Cabanac, 1999)	-heart rate, body temperature
Positive and negative emotions	-rats (Thompson, Brannon, & Heck, 2003)	-body temperature
Negative emotions	-chimpanzees (Parr, 2001)	-peripheral skin temperature
Anxiety	-crayfish (Fossat, Bacqué-Cazenave, De Deurwaerdère, Delbecque, & Cattaert, 2014)	-chemical levels in body

Table 4.3: Examples of physiological types of evidence for animal emotion.

4.3.3. Neural Evidence

Neural evidence for animal emotion tracks the characteristics of an animal's brain as they relate to emotion. Examples of the kinds of neural characteristics used as evidence for animal emotion include changes in brain activity, changes in brain chemistry, and the presence of the same or homologous brain structures that are related to emotion in humans. For example, a change in brain activity in a cat may be considered to be neural evidence of a particular emotion that is exhibited in response to being presented with positive or negative stimuli. See table 4.4 for examples of different types of neural evidence for animal emotion.

Due to the nature of neural evidence, it is the least readily observed type of evidence for animal emotion. Measuring neural evidence requires extensive human interference and is not easily done in an animal's natural environment. Therefore, neural evidence for animal emotion is gathered in laboratory settings and requires the most human interference of all the different types of evidence.

Neural Types of Evidence		
Emotion	Animal	Neural Indicator
Positive and negative emotions	-domestic sheep (Doyle, et al., 2011)	-serotonergic system
Social emotions	-whales (Coghlan, 2006)	-spindle neurons
Anxiety and fear	-rats (Davis, Rainnie, & Cassell, 1994)	-amygdala
Social emotions	-elephants (Hakeem, et al., 2009)	-spindle neurons
Anxiety and pain	-rats (Seminowicz, et al., 2009)	-anatomical changes in brain
Anxiety	-bees (Bateson, Desire, Gartside, & Wright, 2011)	-neurochemical changes
Positive emotions	-domestic dogs (Berns, 2013)	-caudate nucleus activity
Anxiety and fear	-crows (Marzluff, 2012)	-brain activity

Table 4.4: Examples of neural types of evidence for animal emotion.

4.4. Making Judgments about Emotion

Currently, claims about animal emotion rely on behavioural, physiological, and neural types of evidence, but are these kinds of evidence appropriate for making such claims? The benefit of having these three different types of evidence is that it allows for converging lines of evidence from different disciplines. Rather than being restricted to one field, animal emotion is being examined in a number of fields and using a number of different approaches. This is important for the study of animal emotion as, unlike with humans, we are unable to ask animals to self-report their emotions. The more distinct lines of evidence supporting a claim about animal emotion there are, the more confident we can be in that claim.

Despite the benefit of diversity in the different kinds of evidence for animal emotion, animal prejudice can still compromise the empirical accuracy, a commonly agreed on value in science, of the conclusions made about animal emotion. In addition to the recommendations I made in chapter 2 (which apply generally to the study of animal minds), I have four further suggestions for improving the empirical accuracy of judgments made about animal emotion.

4.4.1. Be Cautious of Anthropodenial not just Anthropomorphism

Anthropocentrism, anthropomorphism, and anthropodenial are all important concepts for understanding how humans think about animals. Anthropocentrism is the view that humans are the central or most important thing in existence, especially in comparison to animals or gods (Boslaugh, 2017). Anthropomorphism can be defined as "the attribution of a human psychological, social, or normative property to a non-human animal, usually with the suggestion that the attribution isn't justified" (Andrews, K., 2014, p. 186). Anthropodenial (de Waal, 2016) – also sometimes called "anthropectomy" - can be defined as "the denial of human properties to non-human animals, usually with the suggestion that the denial isn't justified (Andrews, K., 2014, p. 186).

Many discussions of animal emotion include warnings for anthropomorphism (Wynne, 2004; Povinelli & Vonk, 2003; Penn, 2011). While being careful not to overestimate an animal's cognitive abilities based on the evidence available is important, it is just as important to be careful not to underestimate an animal's cognitive abilities. Empirical accuracy is a commonly agreed on value in science, and in terms of the epistemic motivations for studying animal minds, there is no reason to treat overestimations any differently than underestimations (Andrews & Huss, 2014; Sober, 2005). Whether this is also true in terms of the ethical motivations for studying animal minds will be discussed in chapter 5.

Attributing emotions to animals merely because we are used to talking about humans in terms of their emotions can be problematic. However, not attributing emotions to animals in the presence of good evidence merely because emotions have traditionally been characterized as unique to humans is also problematic. Warnings of anthropodenial have historically been less common in animal mind research, though more recently, they have started to appear (de Waal,

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2016; Andrews & Huss, 2014; Sober, 2005). My first suggestion is that researchers should be just as cautious of anthropodenial as they are of anthropomorphism.

As we discussed in section 2.3.2, paradigms used for testing animal minds are often based on paradigms that were used successfully for testing human minds. Though paradigms that are successful at gauging emotion in humans are good starting points when designing experiments for animals, there is no reason to assume that because a particular paradigm is successful with humans (or any other species for that matter), it must be successful for another animal species.

Researchers should avoid assuming that particular brain structures that are related to emotion in humans are necessary for emotion in animals. Just because a species lacks the brain structures that are thought to be responsible for emotion in humans, it does not mean that they are not capable of emotion. Robert Elwood, Stuart Barr, and Lynsey Patterson (2009) argue that the fact that crustaceans lack the brain structures that are thought to be responsible for emotion in humans is not sufficient for concluding that crustaceans do not have emotion. Elwood, Barr, & Patterson offer alternative evidence for suspecting that crustaceans have emotion, but they also provide an argument as to why the lack of particular brain structures is not good reason for rejecting the possibility of emotion in crustaceans. They argue that this rationale for the dismissal of emotion in crustaceans would also allow one to argue that crustaceans do not have vision, since they lack any of the visual systems found in humans. They go on to point out that crustaceans are in fact not blind and have well developed visual abilities. This kind of argument supports what is known in philosophy of mind literature as the multiple realizability thesis. Put simply, this thesis states that the same mental property, state, or event can be implemented (realized) by different physical properties, states, or events (Bickle, 2013).

Similarly, it is important to be aware of the way in which research on animal emotion is framed in an effort to reduce animal prejudice. Animal emotion is still a relatively controversial topic, and it is easy to find examples of animal prejudice in discussions of animal emotion research. For example, a summary of empathy research done with mice published in "Science" reads, "…scientists argue that even lowly mice have a rudimentary form of [empathy]" (Miller, 2006, p. 1860). Prejudiced framing like this is common among discussions of animal empathy, and animal minds generally, in both academic and non-academic settings. As was discussed in chapter 1, if we are to remove animal prejudice from the study of animal minds, we must be aware of the framing in our discussions of animal minds.

Avoiding anthropodenial is not something that should only be done at the experimental level; it should also be done at the metaphysical level. The possibility of emotion in animals should not be denied merely because a theory of emotion is defined in an anthropocentric way. The cognitive appraisal (Nussbaum, Upheavals of thought: The intelligence of emotions, 2003) and social construction (Harré, 1986) theories of emotion are more cognitively sophisticated theories of emotion, whereas the physiological perception theory (Prinz, 2004) of emotion is a less cognitively sophisticated theory. Focusing too heavily on cognitively sophisticated theories of emotion can lead to anthropocentric biases because the theories are based on what we know about human cognitive appraisals and human social constructions. That is, if we adopt a theory of emotion that relies too heavily on how we know humans think and reason, we run the risk of adopting more anthropocentric biases. Alternatively, focusing too heavily on less cognitively sophisticated theories of emotion can lead to a failure in accounting for the significant complexities of human emotion. Though there may be many cases where the same mechanisms are responsible for the same abilities in humans and other animals, we should avoid making this

a default assumption. Therefore, adopting a hybrid theory of emotion (Thagard & Schröder, 2014; Schröder, Kajić, Stewart, & Thagard, 2017) that allows for many different kinds of evidence is less likely to have anthropocentric biases.

It is important that researchers recognize that emotion in animals may be made possible by means other than those that make emotion possible in humans. Avoiding the temptation of overestimating an animal's abilities as a result of anthropomorphism is important for maintaining objectivity and accuracy in the study of animal emotion. Avoiding the temptation to underestimate an animal's abilities as the result of anthropodenial is also important for maintaining objectivity and accuracy in the study of animal emotion.

4.4.2. Favour Studies with High Ecological Validity

Recently, more focus in animal mind research has been put on designing experiments that are ecologically valid. An experiment is ecologically valid when its materials, methods, and setting approximate the subjects' natural experiences. My second suggestion is that researchers should focus on studies with high ecological validity.

Designing ecologically valid experiments is important if we are to avoid underestimating an animal's abilities. This is true not just of animal emotion studies, but for all animal studies. If the goal is to determine an animal's natural abilities, it is best to test them in a natural setting. Highly artificial and abstract experimental paradigms can be useful, especially when trying to tease out subtle details, but they can also be harmful in that they can set arbitrary limitations on an animal's abilities. Recall the example of studies done with gibbons and elephants discussed in section 2.3.2. Just as paradigms with low ecological validity can set arbitrary limitations on the problem solving abilities of gibbons and elephants, paradigms with low ecological validity

can also potentially set arbitrary limitations on animal emotions. Therefore, in order to reduce the risk of drawing empirically inaccurate conclusions, we should favour evidence produced by experiments with higher ecological validity and be cautious of evidence produced by experiments with low ecological validity.

4.4.3. Respect Field Observations and Qualitative Data

My third suggestion falls in line with my second; researchers should respect field observations and qualitative data, not just laboratory studies and quantitative data. It should be recognized that field studies that include observations of animals in their natural environments with minimal human interference can be importantly informative. Not only are worries of ecological validity significantly reduced in field studies that focus on observation with minimal human interference (though the presence of humans in observational studies can still have an effect on the animals being observed (Bekoff, 2002)), but the variety of activities that animals can engage in are not limited by artificial constraints as they are in laboratory studies. Despite the efforts of creative researchers, there are many situations that arise in the wild that would be very difficult (and sometimes unethical) to recreate in captivity.

Field observation and laboratory studies can also be mutually informative. In cases where the evidence for animal emotion is consistent between field observations and laboratory studies, we can be more confident in that evidence, as we have converging lines of evidence. In these cases where evidence is not convergent (i.e. is inconsistent), further investigation is warranted to determine which, if either, of the two methodologies is producing the accurate results. It may be the case that the study done in the laboratory setting lacks a particular factor that is present in the study done in the natural setting. In this case, it may be necessary to adjust

the laboratory study so that it better matches the natural setting. Alternatively, it may not be possible to replicate the necessary factors that are present in the natural setting in the laboratory setting.

Marc Beckoff and Colin Allen (1997) argue that opinions of cognitive ethology, which emphasizes observing animals in their natural environments and questions the use of highly artificial settings in experimental psychology, can be sorted into three categories: slayers, skeptics, and proponents. Beckoff and Allen argue that slayers, and to a lesser extent skeptics, often confuse the difficulty of doing rigorous cognitive ethology with the impossibility of doing rigorous cognitive ethology. Beckoff and Allen highlight a pattern of facile arguments against cognitive ethology as a scientific field and suggest that the views against mentalistic concepts, anthropomorphism, and parsimony that slayers and skeptics often display are likely to be just as influenced by socialization as they are by rational deliberation. Importantly, this pattern seems to reflect a larger pattern in animal mind research whereby field observations and studies of animals done in naturalistic settings are unfairly dismissed as unscientific.

It should also be recognized that qualitative data, particularly in the form of narratives, can also be informative. Though working with quantitative data may be more familiar for some researchers, the value of qualitative data should not be underestimated. Not all observations are easily translated into numerically represented quantitative data, but omitting qualitative data from observations that are not easily quantified leaves a critical gap in scientific research. Some of the best examples of the value added by qualitative data come from the research done by Anne Innis Dagg (Innis Dagg, 2016), and later by Jane Goodall (Goodall, 2000). Both Innis Dagg's and Goodall's research is filled with quantitative data, but it also included crucial qualitative data, often in the form of narratives. It is important to note that while Innis Dagg's and

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Goodall's narratives made important scientific contributions, not all narratives are equal. That is, the individual doing the observation and the methodologies they employ are key factors in determining the scientific merit of their narratives. For a detailed discussion of some of the problems with anecdotal evidence see Andrews (2014, pp. 25-31).

Just as studies done in natural settings and studies done in laboratory settings can be mutually informative, qualitative data and quantitative data can also be mutually informative. Consistency between quantitative and qualitative data provides reassurance that the data is more likely to be accurate. Alternatively, inconsistency between quantitative and qualitative data provides an indication that further investigation is warranted to determine which data, if any, is accurate. Respecting that field observations and qualitative data are importantly informative is important for increasing empirical accuracy in the study of animal minds.

4.4.4. Respect Individual Differences

Typically, researchers seek to test the emotional abilities of a species as a whole rather than examining the differences between individuals (recall the discussion in section 2.5). When differences are paid attention to, it is typically in the form of differences in social dominance and not differences in individual cognitive ability. Test subjects in studies are viewed as exemplars of their species. However, ignoring individual differences can lead to inaccurate conclusions about the capabilities of a species. For example, the performance of animal subjects who have been raised in captivity is often used to make claims about the abilities of a wild species as a whole, despite the fact that the test subjects were raised in a very different environment in comparison to their wild conspecifics. My fourth suggestion is that individual differences should not be ignored, but rather examined.

Some of the most interesting research on animal minds comes from researchers working closely with individuals. Individuals such as Alex the African grey parrot (Pepperberg, 2009), Koko the gorilla (Patterson & Linden, 1981), and Kanzi the bonobo (Savage-Rumbaugh & Lewin, 1994) have demonstrated abilities that other individuals within their species have not. Just as humans show individual differences in their cognitive abilities, animals show individual differences in their cognitive abilities. Humans show differences in their emotional abilities across basic differences like age and gender, but also across more specific differences in mental health (for example, psychopaths versus non-psychopaths). If such drastic differences are present among individuals within the human species, it is reasonable to assume that differences in emotional ability are possible among individuals within other species. This becomes even more apparent in light of recent research being done on animal mental health issues (Lilienfeld, Gershon, Duke, Marino, & de Waal, 1999; Braitman, 2014; Ferdowsian, et al., 2011; Bradshaw, Capaldo, Lindner, & Grow, 2008).

Chantek the orangutan is an excellent example of how different members of the same species can have different cognitive abilities, including emotional abilities. I will discuss Chantek's case in more detail in chapter 5, but for now I want to highlight one specific encounter between Chantek and Lyn Miles, who led the research project in which Chantek was taught sign language. After eight years of being raised by a small number of devoted caretakers on campus at the University of Tennessee at Chattanooga, Chantek was moved to the Yerkes National Primate Research Centre. During his quarantine period, Miles visited Chantek and noted an obvious decline in his mood and mental health. In an interview about her work with Chantek, Miles reflects, "I would say [sign] 'how are you?' and he would say 'hurt.' And I would say 'Where?' - thinking it was some kind of an injury - and he would say 'feelings'" (Cole, M.,

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2014). Regardless of whether this example demonstrates that Chantek was able to reflect on his emotions to a greater extent than other orangutans or that Chantek's sign language abilities allowed him to express his emotions in ways that other orangutans are not able to, what is most important is that Chantek's abilities are different from the abilities of other orangutans. Researchers should be careful not to overlook important differences between individuals when making claims about animal emotion (or any cognitive ability) as doing so could lead to drawing empirically inaccurate conclusions.

4.5. Animal Empathy

I now want to focus on a more specific discussion related to animal emotion: the discussion of animal empathy and mental state attribution. Being able to attribute mental states to others allows humans to predict, understand, and manipulate the behaviour of others with great success. Attributing emotional states to others is just one form of mental state attribution. Importantly, not all emotional state attribution is empathic. Empathy is the ability to experience the emotions of another being as if they were your own. Not to be confused with sympathy, empathy involves not just an understanding of why an individual feels a particular way but also an understanding of how that individual feels. This empathic understanding of how an individual feels results from a first person experience of that individual's emotions. Whereas sympathy is the ability to recognize that another individual feels a particular way and to have secondary feelings about that individual's feelings, empathy is the ability to understand and feel for oneself (to a certain extent) the emotions of the other individual.

It is clear that humans have strong empathic abilities. Not only can humans be empathic toward other humans, either living or fictional, but humans can also be empathic toward other

animals and anthropomorphized objects (for example, the incinerator scene in "Toy Story 3" (Unkrich, 2010) and the end scene in "Wall-E" (Stanton, Wall-E, 2008)). Having empathy for others provides a great advantage to those living within complex social groups. Humans display a great deal of empathy in their day to day to lives. When watching a sad movie or reading a sad book, many will often find their eyes welling up and a lump in their throat in reaction to the hardships of a character within the plot. A few years ago, I was at the theatre seeing a movie in which a family was faced with the difficult decision to euthanize their pet dog when, at an old age, he became very ill. Looking around the movie theatre, there were many teary-eyed faces and sniffling noses. This reaction goes beyond sympathy. The physical response that the audience had, whether it was fighting back tears or just feeling sad, was triggered by an experience of the emotions felt by the characters in the movie. Having this sort of understanding of how others are feeling is important evolutionarily for humans because it allows us to manipulate and predict the behaviours of others. However, empathy has also been described as what makes possible the many acts of kindness and compassion that appear to set humans apart from other species. But is empathy really a uniquely human ability?

Answering questions about the empathic abilities of animals relies on having good general accounts of the nature of empathy and having access to good empirical evidence. In section 4.4, I made four recommendations for increasing the empirical accuracy of conclusions drawn about animal emotion. For the remainder of this chapter, I will apply these recommendations to the discussion of animal empathy in an effort strengthen the position from which judgments about animal empathy are made. I will begin in section 4.5.1, by reviewing the nature of empathy and three approaches to explaining mental state attribution. In sections 4.5.2, I will review a hybrid theory of empathy (empathy as analogy) and argue that its flexibility

makes it more appropriate for accounting for empathy in animals. In section 4.5.3, I will review

the kinds of evidence typically used to justify claims about animal empathy in light of the

recommendations I made in section 4.4.

4.5.1. The Nature of Empathy

A range of behavioural, physiological, and neural evidence has been offered as

suggestive of animal empathy. See table 4.5 for some examples of different kinds of evidence

that have been used to suggest animal empathy. Kirstin Andrews and Lori Gruen (2014) have

argued that one of the reasons why identifying empathy in animals is so difficult is because even

in humans, our understanding of what empathy is and how it functions lacks clarity. Andrews &

Gruen add clarity to our understanding of empathy, by distinguishing between different kinds of

empathy. Empathy, they argue, can be more or less complex depending on the mechanisms

involved. For example, there are more basic kinds of empathy (such as emotional contagion)

that rely on more basic mechanisms, but there are also more complex kinds of empathy (such as

emotional state attribution) that rely on complex cognitive capacities. Andrews & Gruen refer to

complex kinds of empathy as entangled empathy, as it involves both affective and cognitive

states.

Empathy then, in at least some forms, can include mental state attribution, wherein the attributer

shares in (to some extent) the emotional state being attributed to the target. Since empathy can

sometimes include mental state attribution, I will briefly review different approaches to

explaining mental state attribution here before I move on to discussing a hybrid of empathy.

The term "theory of mind," first introduced by David Premack and Guy Woodruff

(1978), is typically associated with the ability to attribute mental states to others. Despite its

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Suggested Types of Evidence for Empathy		
Type	Animal	Indicator
Behavioural	-Various species, including elephants, dolphins, baboons, chimpanzees, and hyenas (de Waal, 2010; Pruetz, 2011)	-targeted helping
Physiological	-chimpanzees (Campbell & de Waal, 2014; Campbell & de Waal, 2011)	-contagious yawning
Behavioural	-rats (Bartal, Decety, & Mason, 2011)	-targeted helping, prosocial behaviour
Behavioural	-mice (Langford, et al., 2006)	-social modulation of pain
Behavioural	-elephants (Byrne, et al., 2008)	-various behaviours
Behavioural	-domestic dogs (Custance & Mayer, 2012)	-consolation, emotional contagion
Behavioural	-dolphins (Connor & Norris, 1982)	-altruism
Neural	-macaques (Iacoboni, 2009)	-mirror neurons
Behavioural	-Eurasian jays (Ostoji, Shaw, Cheke, & Clayton, 2013)	-food sharing

Table 4.5: Examples of behavioural, physiological, and neural types of evidence that suggest empathy in animals.

wide use, there is much ambiguity associated with the term. While psychologists tend to associate the term with the mere ability to represent the mental states of others, some philosophers associate the term with particular approaches to explaining this ability. As a result of the ambiguity surrounding "theory of mind," the terms "mindreading" (Nichols & Stich, 2003) and "mentalizing" (Goldman, 2006) have been used to replace the term "theory of mind" to refer to the ability to represent the mental states of others. Though these terms have been widely used in philosophy, they may not be so widely used across disciplines. For simplicity and clarity, I will call the ability what it is, the ability to attribute mental states to others, and avoid the use of these terms.

Alvin Goldman (2006) distinguishes between three unique approaches to mental state attribution: Theory Theory (TT), Rational Theory (RT), and Simulation Theory (ST). TT says that people use their naïve psychological theory to guide them in representing the mental states of others (Stich & Nichols, 1992). RT says that ordinary people are rational and thus represent the mental states of others by assuming, in accordance with some rationality postulate, that their

target is rational as well (Davidson, 1984; Dennett, 1987). ST says that people represent the

mental states of others by simulating their experiences (Goldman, 2006). In his own account of

mental state attribution, Goldman argues that in order to fully explain mental state attribution in

humans, a hybrid view that draws on both TT and ST is needed, but he notes that all three of

these types of theories have been offered in explanation of human mental state attribution.

Hybrid theories of empathy (like with hybrid theories of emotion) are more flexibly able

to account for the different kinds of empathy in animals, because it does not limit the ways in

which empathy can be explained. Paul Thagard (2010; 2017) offers a hybrid account of empathy

that puts researchers in a stronger position to make empirically accurate claims about the

empathic abilities of animals, precisely because it is more flexible. I will briefly outline

Thagard's theory next.

4.5.2. A Hybrid Theory of Empathy: Empathy as Analogy

Paul Thagard argues that empathy is best viewed as a kind of analogical thinking.

Thagard argues that empathy, though always simulation and always involving some kind of

analogical thinking, sometimes (though not always) includes theory application in the form of

processes of rule based reasoning. Thagard identifies three modes of empathy: conscious

analogical thinking, unconscious non-verbal rules, and mirror neurons (2017, pp. 192-196).

Holyoak & Thagard (1995) argue that in order to think analogically, knowledge must be

represented in an explicit form in order to allow for systematic comparisons between the source

(the representer) and the target to be carried out (Holyoak & Thagard, 1995, p. 37). In Barnes &

Thagard's (1997) account of empathy as analogy, they focus on verbal mapping between the

source and the target domains. However, in later work Thagard (2010) notes that recent

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neuroscientific evidence suggests that representations need not be linguistic in order for analogical thinking to be possible.

The first mode of empathy requires a conscious, deliberate consideration of the represeter's and the target's emotional states and the analogous relationship between them. Empathy in this case, is a kind of analogical mapping of emotional states between individuals. The second mode of empathy is an unconscious process wherein the represeter uses a chain of embodied non-verbal rules to make inferences about the target's emotional states, while also feeling something like the emotional state of the target. The third mode of empathy is more neurologically direct. Through this third mode of empathy, mirror neurons allow for perception detection of a relation between a target's situation and your own. Put briefly, mirror neurons, first discovered in macaques (Keysers, 2011), are classes of neurons that discharge both when a particular action is performed and when that particular action is observed. For a more detailed, yet still general overview of mirror neurons see Thagard (2010, pp. 188-190).

In light of the recent research on mirror neurons, Thagard suggests the following structure for a more direct kind of empathy as analogical thinking:

> *Visual tactile representation of my stimulation* →
> *Sensory/affective representation of my pain*
>
> *Visual representation of your stimulation* →
> *Sensory/affective representation of my AND your pain*
>
> This mental operation is still a sort of analogical inference, in that it involves grasping a relational similarity between two situations, but it is much more direct than the verbal sort performed by computer programs for reasoning with analogy. The arrows indicate a sequence of sensory-motor neural representations, not a verbal description. Thus my feeling your pain can sometimes be a direct reaction based on observation, not an intellectual exercise I perform in seeing systematic mappings between two people's situations and goals. (Thagard, 2010, p. 191).

In the same way that theories of human and animal emotion need not be identical, theories of human and animal empathy need not be identical, though they are likely to be similar. While these three modes of empathy may be required for accounting for human empathy, they may not all be required for accounting for animal empathy. For example, it may be the case that conscious analogical thinking plays a large role in human empathy, but does not play a role in animal empathy.

If empathy is analogy of the kind described by Thagard (2017), animals must at least be able to make analogical inferences about the representations made by mirror neurons in order to qualify for having empathic abilities. While the ability of animals to make analogical inferences has been denied by some (Penn, Holyoak, & Povinelli, 2008), this is still a controversial argument. What is important here is that Thagard's account of empathy offers important flexibility and does not exclude animals up-front from having empathic abilities. This is important if researchers looking to make claims about animal empathy are to avoid anthropodenial.

4.5.3. Evidence for Animal Empathy

Since empathy is so closely related to emotion, it is unsurprising that the evidence for empathy looks very similar to the evidence for emotion more generally. As with evidence for emotion, evidence for empathy can be separated into three kinds: behavioural, physiological, and neural. What's different between evidence for emotion and evidence for empathy is the context in which the behavioural, physiological, or neural evidence is gathered. Rather than simply recording an individual's reaction to specific stimuli, researchers testing the empathic abilities of animals are recording an individual's reaction to another individual's reaction to specific stimuli.

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These empathic reactions include things like targeted helping, contagious yawning, and consolation. Since it can be difficult to assess the difference between an emotional reaction to stimuli and an empathic reaction to stimuli with physiological and neurological evidence, behavioural evidence is more often used to justify claims of animal empathy.

My second, third, and fourth recommendations from section 4.4 also apply to discussions of animal empathy; studies with high ecological validity should be favoured, field observations should be respected, and researchers should be aware of the possibility for individual differences. Like other cognitive abilities, empathic mental state attribution abilities are likely to be affected by a number of factors, including ecological validity. For example, studies on the ability to represent the mental states of conspecifics in chimpanzees originally used a food begging paradigm, which produced little evidence for the ability. More recent studies that use a food competition paradigm, a paradigm with higher ecological validity for chimpanzees, have been much more successful at producing evidence for the ability (Hare, 2001). Just as paradigms with low ecological validity can set arbitrary limitations on an animal's problem solving abilities (as was discussed in section 2.3.2), paradigms with low ecological validity can also potentially set arbitrary limitations on animal empathy. Therefore, we should favour evidence produced by experiments with higher ecological validity, and be cautious of evidence produced by experiments with low ecological validity.

Much of the justification for running laboratory experiments on animal empathy comes from anecdotal accounts of remarkable actions of animals in the wild. Frans de Waal remarks that empathy is a "biological imperative" and that there is lots of evidence for animal empathy, but that the subject is not given the respect it is due in scientific research because it has been deemed taboo (de Waal, 2016, p. 132). Though the acceptance of animal empathy research is

growing, it is still in early stages. Furthermore, there are challenges to studying animal empathy in laboratory settings as laboratory environments by design limit the possible situations that an animal is exposed to. This is not necessarily a bad thing; many of the observations made on wild populations that are offered as evidence for animal empathy involve sad circumstances (for example, the death of a group member) that would be unethical to recreate in captivity. Field observations can thus be beneficial in a way that laboratory experiments cannot because they allow us to observe animals in a greater range of circumstances.

For example, in 1954 a boat was working just off the coast of Florida in the United States, and a stick of dynamite was detonated in the water near to a school of dolphins. One of the dolphins was severely stunned by the explosion and was unable to swim normally. Dolphins are mammals and therefore need to breathe air at regular intervals (typically every few minutes). Recognizing that a member of their pod was injured, a pair of dolphins swam over to the injured dolphin and oriented themselves in order to buoy the injured dolphin and allow it to breathe. Due to their position, the pair of dolphins were not able to breathe themselves while buoying their pod-mate. The dolphins buoyed the stunned dolphin for several minutes, while the rest of the pod remained close by, until the stunned dolphin recovered enough to swim independently. At that point, the pod fled the area as a group (Siebenaler & Caldwell, 1956). This is just one of many remarkable examples of animal behaviour from the wild that serves as evidence for animal empathy (for more examples, see (de Waal, 2010; Bekoff & Goodall, 2007)).

Anecdotal accounts of evidence for animal empathy provide good insight into animal minds and can offer important "tips" to researchers wanting to conduct more controlled studies. Since it is often unclear what situations will inspire empathic responses from animals and because there are important ethical limitations on what situations researchers can subject animal

subjects to, field observations offer an important advantage to studying animal empathy. By observing animals in their natural environments and with as little human interference as possible, artificial limitations on the situations animals can find themselves in and problems of ecological validity are removed.

Finally, the possibility of individual differences should be paid attention to. Research on emotional and mental health issues in animals is growing, and there is good evidence to suggest that animals experience emotional and other mental disorders in similar ways to humans (Lilienfeld, Gershon, Duke, Marino, & de Waal, 1999; Braitman, 2014; Ferdowsian, et al., 2011; Bradshaw, Capaldo, Lindner, & Grow, 2008). Just as these emotional disorders can affect the empathic abilities of humans, they likely also affect the empathic abilities of animals. Further research suggests that housing environments that are sterile and lack enrichment (as many laboratory housing environments do) negatively affect the mental health of the animals living in them (Sherwin & Olsson, 2004). If a test subject is experiencing stressors on their mental health, it is entirely possible that it will affect their cognitive abilities, including empathy.

4.6. Conclusion

Understanding animal emotion, including which animals experience which emotions and to what extent they experience them, is important for animal welfare. Many animal welfare arguments refer to animal suffering when determining acceptable standards of practice, and part of this suffering can be psychological. Being in a good position to address issues of animal welfare and have debates on what standards of practice should be, requires having good general accounts of the nature of emotion and having access to good empirical evidence. Thus, it is important that problems with general accounts and evidence be avoided.

In this chapter, I examined how judgments about animal emotions are made and how animal prejudice affects various aspects of the making of these judgments. I reviewed common accounts of animal emotion and animal empathy and argued that hybrid accounts with greater flexibility are more appropriately able to account for animal abilities and are more consistent with commonly held scientific values. I argued that there is great benefit to having different types of evidence, as it allows for claims about animal emotion to be supported by converging lines of evidence. I also made four recommendations for improving the process of making judgments about animal emotion and applied those recommendations to the discussion of animal empathy.

First, I suggested that researchers should be just as cautious of anthropodenial as they are of anthropomorphism. Studies that are designed for humans are great starting points when beginning an investigation into animal emotion, but we must be cautious not to assume that just because something works for humans, it should also work for a non-human species. Not only should we be cautious of anthropomorphism and anthropodenial at the experimental level, but we should also be cautious of anthropomorphism and anthropodenial at the metaphysical level. Traditional theories of emotion and empathy lend themselves to adopting more anthropocentric biases, but hybrid approaches that offer greater flexibility are more appropriately suited to accounting for animal abilities.

Second, I suggested that researchers should focus on studies with high ecological validity in order to avoid setting arbitrary limitations on an animal's abilities. If we want to accurately gauge an animal's abilities, then we must be careful to avoid confounding factors, which can arbitrarily limit or interfere with our ability to measure an animal's abilities. Increasing an experiment's ecological validity is one way to reduce the potential for confounding factors.

Third, I suggested that researchers should respect field observations and qualitative data, as they can capture important events and information that laboratory studies and quantitative data cannot. Not only do field observations avoid the problems of ecological invalidity, they allow for situations and circumstances that are not able to be replicated in a laboratory setting. Qualitative data and field observation are just as informative as quantitative data and laboratory studies and are also mutually informative. By using a variety of strategies to test for the same ability, we increase the reliability of our results.

Finally, I suggested that individual differences should not be ignored, since animals, like humans, are subject to individual differences in cognitive ability. To assume that one individual shares the identical emotional abilities as another is an assumption that risks leading to unwarranted sweeping generalizations about a species.

Which animals experience emotions and to what extent they experience them is still largely controversial. Whether animals have empathic abilities is even more controversial. Studying animal emotion and empathy, like studying any animal cognitive ability, is difficult. Animal prejudice, if left unchecked, can negatively affect the empirical accuracy of conclusions. The recommendations I have made here serve to mitigate the effects of animal prejudice and increase the empirical accuracy of conclusions drawn about animal emotion and empathy.

Chapter 5: The Ethical Implications of Animal Prejudice

5.1. Introduction

As I said at the beginning of this thesis, there are estimated to be roughly 8 million animal species, of which humans are just one. Inter-species interactions are unavoidable, and in many cases, this is a good thing. Many species, including humans, have symbiotic relationships with other species. For many humans, their relationships and interactions with other animals enrich their lives and are integral to their happiness. However, not all inter-species interactions are pleasant. Of specific concern are human-animal interactions in which humans negatively affect (directly or indirectly) the well-being of other animals.

Determining how we should and should not interact with animals is crucial and incredibly difficult. Despite recent advances in our understanding of other animals, debates over issues of animal welfare remain controversial and complex. Many arguments about animal welfare and the moral status of animals are based on claims about what animals are and are not capable of. With important ethical decisions riding on our understanding of animal minds, it is imperative that we strive to understand animal minds as accurately as possible.

In this thesis, I identified and outlined animal prejudice and ways in which it can create epistemological, methodological, and ethical problems if left unchecked. In chapters 2, 3, and 4, I addressed the epistemological and metaphysical problems that can result from animal prejudice. A few times throughout those chapters, I made note of ethical considerations that I said I would return to. I will address these and other ethical concerns relative to animal prejudice and our understanding of animal minds here.

5.2. Why Animal Prejudice Matters for Animal Ethics

The moral status of animals is typically identified in one of two ways: either animals are identified as having direct moral status or they are identified as having indirect moral status. Ethical theories that identify animals as having direct moral status maintain that we ought to treat animals ethically for their own sake. Ethical theories that identify animals as having indirect moral status maintain that we ought to treat animals ethically for our own sake. That is, they maintain that failing to treat animals ethically would result in some negative consequence for humans, to whom we do have ethical obligations. Of the ethical theories that identify animals as having direct moral status, different theories identify the status of animals to varying degrees. Some theories maintain that animals have equal moral status to humans and others maintain that animals have a lower (though still direct) moral status than humans. See table 5.1 for examples of these three approaches to identifying the moral status of animals. For a more detailed review of these approaches, see (Wilson, 2017).

Most people take for granted that animals are importantly different from objects. Animals have particular capacities that allow them to experience the world in ways in which objects do not. These capacities are often what theories of animal ethics focus on when defining the moral status of animals. See table 5.2 for examples of cognitive capacities that have been described as defining an animal's moral status. Note that just because an author is listed in table 5.2 as identifying a particular cognitive capacity as relevant for moral status, it does not mean that the author attributes that cognitive capacity to animals; it simply means that the author has identified the cognitive capacity as one that marks moral status. Similarly, the ethical theories of authors listed in table 5.2 may not solely rely on their respectively listed cognitive capacities as markers of moral status. Importantly though, they do identify these listed capacities as markers

Approaches to Defining the Moral Status of Animals		
Indirect Theories	Animals have no direct moral status themselves. Ethical treatment of animals is only required in so far as doing so promotes human morality.	- Immanuel Kant (1956 [1785]; 1993 [1788]) -René Descartes (Descartes, 2000 [1637]; Harrison, 1992; Regan & Singer, 1989) -St. Thomas Aquinas (Regan & Singer, 1989) -Peter Carruthers (1992)
Direct Unequal Theories	Animals have moral status for their own sake, but this moral status is not equal to the moral status of humans. Ethical treatment of animals is required, but not to the same extent as ethical treatment of humans.	-Leslie Pickering Francis and Richard Norman (1978) -Bonnie Steinbock (1978) -Joel Feinberg (1974)
Direct Equal Theories	Animals have moral status for their own sake and this moral status is equal to the moral status of humans. Ethical treatment of animals is required to the same extent as ethical treatment of humans.	- Peter Singer (1995; 2011) -Tom Regan (2004; 2001) -Martha C. Nussbaum (equal moral consideration) (2006)

Table 5.1: Three approaches to defining the moral status of animals.

Morally Relevant Cognitive Capacity	Author
Consciousness	-René Descartes (Descartes, 2000 [1637]; Regan & Singer, 1989)
Suffering (physical and psychological)	-Peter Singer (1995; 2011) - Jeremy Bentham (Bentham, 1996) - Bonnie Steinbock (1978)
Experiencing "unpleasant sensations"	-Richard G. Frey (1980)
Emotion (in addition to other cognitive capacities)	-Thomas G. Kelch (2007) -Martha C. Nussbaum (2006)
Having beliefs, desires, and a psychophysical identity over time (being a "subject-of-a-life"	-Tom Regan (2004; 2001, pp. 42-43)
Having Interests	-Joel Feinberg (1974)
Autonomy (will to determine actions), Rationality	-Immanuel Kant (1956 [1785]; 1993 [1788])
Being able to "experience and pursue what is naturally good or bad for [the animal]"	-Christine M. Korsgaard (2004, p. 102)
Rationality	-Peter Carruthers (1992) -St. Thomas Aquinas (Regan & Singer, 1989)
Sense, thought, imagination; practical reason; play; control over one's environment	-Marth C. Nussbaum (2006, pp. 392-401)

Table 5.2: Examples of cognitive capacities that have been described as markers of moral status.

of moral status. There are, of course, many different theories of animal ethics that describe an animal's moral status in relation to a number of different capacities. Determining which capacities are relevant to moral status and how is an important task that many scholars have taken up, but it is not one that I will take on in this thesis. What is important for my purpose here is that cognitive capacities are consistently identified as relevant, and indeed fundamental, to defining an animal's moral status.

It is also worth noting that some theories of animal ethics describe non-cognitive factors as relevant to the ethical treatment of animals. See table 5.3 for examples of such factors. Note, these factors are often identified in conjunction with cognitive capacities that serve as markers for moral status. For example, Immanuel Kant (1956 [1785]; 1993 [1788]) identifies moral obligations to an animal's owner as a marker of indirect moral status, but he also identifies rationality and autonomy as markers of direct moral status. Similarly, Bonnie Steinbock (1978) identifies feelings of sympathy and protectiveness toward our own species as morally relevant for granting humans a higher moral status (this is cognitive in the sense that human emotions are cognitive, but it is not related to the cognition of the animals whose moral status it affects), but she also identifies the capacity to suffer physically and psychologically as a marker of direct moral status. In many cases, when a theory relies on a non-cognitive factor for determining the moral status of animals, it is because animals seemingly do not meet the requirements of the cognitive capacities that mark the moral status of humans. Thus, for many theories of animal ethics that describe an animal's moral status in terms of non-cognitive factors, scientific conclusions about that animal's cognitive capacities are still relevant.

Many decisions of animal welfare are being made in accordance with theories of animal ethics that identify particular cognitive capacities as indicative of moral status. Indeed, Andrew

Morally Relevant Non-Cognitive Factors	Author
Relations to members of our own species (other humans)	Leslie Pickering Francis and Richard Norman (1978)
Feelings of sympathy and protectiveness toward our own species (humans)	Bonnie Steinbock (1978)
Cruelty toward animals leading to cruelty toward humans or monetary damage to animal owners	St. Thomas Aquinas (Regan & Singer, 1989)
Duties to animal owners (humans)	Immanuel Kant (1956 [1785]; 1993 [1788])
Good and bad qualities of character that treatment of animals evince	Peter Carruthers (1992)

Table 5.3: Examples of non-cognitive factors that have been described as relevant to the ethical treatment of animals.

Fenton argues that in order to determine the moral status of animals in a non-arbitrary manner, we must rely on "our best scientific knowledge of animal cognitive and affective capacities" (2012, p. 75). Therefore, the conclusions that are drawn about an animal's cognitive abilities can ultimately have a direct effect on that animal's moral status. With conclusions about the cognitive abilities of animals at the centre of important ethical decisions, it is imperative that these conclusions be empirically accurate. Throughout this thesis, I have identified ways in which animal prejudice can and does negatively affect the empirical accuracy of the conclusions being drawn about animal minds. If scholars debating issues of animal ethics are not aware of their own animal prejudice and of the problems animal prejudice creates for the study of animal minds, then they may be missing important empirical inaccuracies in the claims about animal minds that they rely on for justifying animal welfare arguments. Therefore, identifying and addressing animal prejudice is important not only for epistemological and metaphysical reasons, but also for ethical reasons. While it may not be possible to eliminate animal prejudice entirely, in this thesis, I have identified important ways in which its effects can be mitigated or avoided.

5.3. A Possible Argument for Narrowing the Scope in Animal Mind Studies

In section 2.4, I argued that the scope of animal mind studies is overly narrow and far from representative of the animal kingdom. There are a number of potential factors that contribute to the selective focus of animal mind studies when it comes to selecting test subjects. A likely influential factor is animal prejudice. In order to increase our knowledge and understanding of under-studied animals and thus close the gaps in our knowledge, I recommended that researchers be more open to studying a greater variety of species. However, I also noted that an argument for putting special focus on the animals on whom we have the greatest impact was possible. I will consider what such an argument could look like here.

Animals who are typically consumed by humans (cows, pigs, goats, sheep, chickens, fish, etc.) are greatly underrepresented in animal mind studies as compared to the great apes and other animals typically labeled as "smart", including corvids and dolphins. In section 2.4, I argued that one explanation for this gap is that animal prejudice affects how humans conceive of animals they typically consume and a lack of interest prevents many people from wanting to challenge their conceptions.

Another, related, reason for this gap is the motivation behind studying specific species. There is a great focus on studying the cognitive abilities of "human-like" animals because these are the animals who exhibit cognitive abilities in ways we can most readily identify and because learning about their abilities and how they develop seems most likely to offer insight into our own abilities and how they develop. However, if our understanding of an animal's cognitive abilities is what allows us to make decisions about how to ethically interact with that animal, then, assuming we want to interact with animals ethically (an assumption which I will take for

granted here), we should want to understand the cognitive abilities of all animals with whom we are interacting.

As humans are living in many different places all around the world, and as we are making decisions that are fundamentally impacting our environment and climate (to our own detriment as well as that of other animals), it is likely that we are affecting (either directly or indirectly) most animals on the planet in some way. Still, it seems clear that there are some species that are more directly and severely affected by our interactions with them than others. For example, animals in the farming, fashion, and entertainment industries appear to be affected by interactions with humans to a far greater extent than animals living in remote environments, where they have little interaction with humans. Of course, there are examples where animals living in remote environments are being severely affected by human interactions, but overall it seems that animals in the above-mentioned industries experience more regular and consistently more severe effects from their interactions with humans.

Theories of animal ethics are typically constructed with the goal of reducing unnecessary harm and suffering. As we discussed in section 5.2, many of these theories identify cognitive capacities as indicators of an animal's moral status. If the animals on whom humans have the greatest effect are animals in industries like farming, fashion, and entertainment, then it seems plausible to conclude that our obligation to understanding these animals is the greatest. That is, assuming we have an obligation to reduce unnecessary harm and suffering and to treat animals ethically, one could plausibly argue that our greatest obligation is to the animals to whom we stand to cause the greatest harm and suffering. As theories of animal ethics identify cognitive capacities as indicators for an animal's moral status, this means that our obligation to treat animals ethically would entail an obligation to understand the cognitive abilities of animals.

Importantly though, the effectiveness of this approach to determining which animals should be focused on in animal mind studies relies on our ability to appropriately identify those animals on whom we have the greatest impact. In opposition to the argument outlined above, one could argue that existing gaps in our knowledge of the cognitive abilities of animals may be interfering with our ability to appropriately gauge the level of impact human interaction has on understudied species. Therefore, the scope of animal mind studies should not be narrowed and all species should be given equal consideration (at least in terms of the ethical motivations for studying animal minds).

Whether special focus should be placed on studying the cognitive capacities of specific animals is an issue that requires further discussion. However, the distribution of animals selected as test subjects for animal mind studies remains extremely unrepresentative and heavily focused on a small number of species. Failing to study a greater variety of species will broaden the gaps in our knowledge of animal minds. Accordingly, even if an argument for narrowing the scope of animal mind studies, like the one outlined above, were accepted, the existence of large gaps in our understanding of animal minds would interfere with our knowing how to appropriately narrow the scope. For this reason, regardless of whether an argument for special focus can be made, I maintain my original recommendation that a greater variety of species should be studied.

5.4. Justifying Experimental Paradigms

The ethical motivation for studying animal minds is to understand the cognitive abilities of animals so that we can appropriately determine an animal's moral status and ultimately reduce unnecessary harm and suffering. With this motivation in mind, it seems reasonable to conclude that efforts to study animal minds should not inflict unnecessary harm and suffering.

Importantly, the distinction between what counts as necessary and unnecessary harm and suffering is critical, yet difficult to determine. Determining how this distinction should be made is an important goal for scholars working on issues of animal welfare in research, but the debate is still very much controversial (in defense of animal experimentation see (Fox, 2007); in opposition to animal experimentation see (Regan, 2005)).

In response to worries of animal welfare, most research institutions have adopted codes of ethics for experiments that involve animal subjects. One common method for reducing harm and suffering in animal experimentation (particularly in medical experimentation) is the "Three Rs" approach, which was first introduced by William Russell and Rex Burch (1959). According to the Three Rs approach, researchers using animal subjects are required to *reduce* the number of animals used in their experiments, *refine* the experimental procedures in order to minimize the pain and suffering of animal subjects, and *replace* animal subjects with non-animal alternatives when scientifically feasible. The Three Rs are still commonly referred to in animal research regulations today, despite arguments that the approach is insufficient for regulating animal research. Darian M. Ibrahim (2006) argues that the Three Rs approach is insufficient partly because it does not allow for challenges to the purpose of the experiment. That is, the Three Rs approach serves as a guide for reducing animal suffering in experimentation, but it does not offer criteria for evaluating whether the purpose of the experiment justifies carrying the experiment out. This leaves an important gap in the regulations of animal research as not all experiments may be justifiable.

Typically, scholars have argued that what justifies the harm and suffering of animal subjects in research is the potential to gain knowledge that will prevent a greater amount of future harm and suffering or that will prevent the harm and suffering of animals with a higher

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moral status (specifically humans). That is, an experimental paradigm that will inflict harm and suffering on animal subjects is only justifiable if the paradigm has the likely potential to produce knowledge that will prevent greater, future harm and suffering. Debating the relative moral worth of humans and other animals is not something I will do here. Instead, I want to focus on cases where animal experiments are being run for the purpose of gaining knowledge and understanding of the animals subjects themselves.

The point I want to make here is that it is possible that in certain cases, the purpose of an experiment may not justify the harm and suffering inflicted by that experimental paradigm. In section 3.3, I discussed the Morris water maze and Columbia obstruction methods of studying animal minds and noted that whether these experimental paradigms were justifiable was controversial. I will focus on an experiment that made use of the Columbia obstruction method here as an example of a case in which the purpose of the experiment does not obviously justify the harm and suffering inflicted on the animal subjects.

The Columbia obstruction method has been used by many researchers to study the motivations of various animals (most often rats). In a series of studies (Warden, 1931), rats are deprived of things (such as water, food, sex, and their pups) for various periods of time and then placed in an environment in which they can only access those things that they have been deprived of if they cross an electrified grid that delivers a painful electric shock. The point of these studies is to measure the level of motivation the rats have to attain these things. Results from these studies allow researchers to make conclusions like: for male rats, thirst is a bigger motivator than hunger; and for female rats, the maternal drive is the strongest motivator. While researchers did come to some conclusions about the animal subjects they were studying, it is very much unclear whether these conclusions justify the suffering of the animal subjects. Also,

it is not clear whether these motivators needed to be studied at all. If researchers were to assume that water, food, sex, and pups are all equal motivating factors for rats, what would the consequences have been? On one hand, researchers may not have known which motivating factor is the strongest for rats, but on the other hand, rats would not have been subjected to the suffering inflicted by these studies. Which of these two alternatives is best is a discussion that must be had.

Electric shock, along with stress, fear, and various types of deprivation (food, water, social) are still widely used in animal behaviour experiments. While research institutions generally have codes of ethics for animal research, there is great variation among these codes. Experimental paradigms should be regulated not only in an effort to reduce the pain and suffering inflicted on animal subjects but also in an effort to ensure that the experiments that are run are justifiable in the first place.

5.5. Underestimations vs. Overestimations

In section 4.4.1, I argued that researchers should be just as cautious of anthropodenial as they are of anthropomorphism. In doing so, I noted that the epistemic motivations for studying animal minds yielded no reason to favour underestimations of the cognitive abilities of animals over overestimations (Andrews & Huss, 2014). I also noted that the same may not be true when considering the ethical motivations for studying the cognitive abilities of animals. There is a recognizable pattern in animal mind research whereby researchers conclude that a particular cognitive ability is unique to humans only to have evidence for that ability in animals be found later on. As we discussed in section 2.5 and in chapters 3 and 4, there are a number of ways in

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which animal prejudice threatens the empirical accuracy of the conclusions of animal mind studies. For all of the reasons discussed in this thesis, these problems need to be addressed.

Ideally, conclusions drawn about the cognitive abilities of animals will be clear and specific enough that overgeneralizations and false conclusions are avoided. However, in cases where conclusions are not clear or in cases where the purpose of an experiment cannot justify the experimental paradigm that would be needed to study a particular animal cognitive ability, decisions will sometimes need to be made that could effectively result in overestimating or underestimating an animal's cognitive abilities. Similarly, there are some aspects of animal minds that researchers simply do not understand and do not have effective methods for testing, yet we still interact with these animals and therefore need to make decisions about how to do so ethically to the best of our abilities. When these educated decisions need to be made, the ethical consequences of potentially underestimating the animal's cognitive abilities and the ethical consequences of potentially overestimating the animal's cognitive abilities must both be considered.

Table 5.4 lists examples of potential ethical consequences for overestimating and underestimating the cognitive abilities of animals in various contexts. Note that the ethical consequences listed in this table generally represent the extreme ends of the spectrum of potential consequences. Furthermore, I have only listed a few potential consequences for each case; they are by no means meant to represent an exhaustive list of all potential consequences for the various contexts.

Epistemically, there is no reason to prefer underestimating an animal's cognitive abilities to overestimating an animal's cognitive abilities (Sober, 2005; Andrews & Huss, 2014). But is this true ethically? Perhaps in some cases, the ethical implications of overestimating an animal's

Context	Dangers of Overestimation	Dangers of Underestimation
"Pest" Animals	-humans are no longer able to exterminate bothersome animals	-animals are unnecessarily harmed or killed during the extermination process
Pet Animals	-animals are denied the pleasure of being kept as pets -humans can no longer enjoy the pleasure of keeping animals as pets	-psychological needs of pets are not met -psychologically stressful training methods or environmental factors are ignored
Service Animals	-animals are denied the satisfaction of working -humans who would rely on service animals will have a reduced quality of life	-animals are sent into unnecessarily stressful situations -animals are not provided with the appropriate means to recover psychologically from traumatic events
Competition Animals	-animal are denied the satisfaction of competing -animals are denied the satisfaction of forming working partnerships with humans -humans are denied the satisfaction of training and/or competing with animals	-animals are forced to compete against their will -animals are placed in unnecessarily stressful environments
Animals in Zoos	-animals whose species are threatened will not benefit from human assistance -humans are denied an opportunity to learn about wild animals and how to protect them	-wild animals are held in captive conditions that do not meet their psychological needs -family/social groups are broken up unnecessarily
Animals in Entertainment	-animals are denied the satisfaction of forming working partnerships with humans -humans are denied the satisfaction of training and/or working with animals	-animals are forced to work against their will -animals are placed in unnecessarily stressful environments
Animals in Medical Research	-animals do not benefit from medical knowledge and advances gained through research on animal subjects -humans do not benefit from medical knowledge and advances gained through research on animal subjects	-animals suffer physical and psychological harm -appropriate measures are not taken to reduce the harm caused to animals -animals are not given the appropriate means to recover from the trauma of their experiences
Animals in Agriculture	-humans can no longer consume animals for pleasure	-animals are unnecessarily killed -animals are subjected to immense physical and psychological pain and suffering

Table 5.4: Examples of potential ethical consequences of overestimating and underestimating the cognitive abilities of animals in various contexts.

abilities will be less severe than the ethical implications of underestimating that animal's abilities. Alternatively, there may be cases where the reverse is true. My point is not that there necessarily are cases in which either overestimations or underestimations are preferable; there may not be. Importantly though, this is not obvious. The point I want to make here is that there *may* be cases in which the ethical consequences of one kind of estimation outweigh the ethical consequences of the other. These cases will likely be complicated and will require evaluation on an individual basis. Still, if one of the motivations for drawing conclusions about the cognitive abilities of animals is to provide a basis for making decisions about how to treat animals ethically, it is important that when we must rely on estimations of cognitive abilities, we consider the ethical implications of these estimations.

5.6. The Cognitive Welfare of Animals

As we learn more about the minds of animals, we have a responsibility to use that knowledge to promote the welfare of the animals (Fenton, 2012; Fenton, 2014; Dawkins, 2006; Beaver, 1989). For some studies, animal welfare may already be an underlying motivation for conducting the study (Lee, et al., 2009), and in other studies, researchers may unexpectedly arrive at conclusions that have relevant implications for animal welfare. For example, researchers have consistently documented that captive animals living in enriched environments are physically and psychologically healthier than conspecifics living in more sterile environments (Baumans, 2005; Lutz & Novak, 2005). Increasing knowledge of the physical and psychological effects of enrichment serve as motivation for arguments to enhance the welfare of captive animals (Bayne, 2002; King & Rowan, 2005). For example, based on research about the problem solving abilities of animals, Cheryl L. Meehan and Joy A. Mench (2007) argue that

opportunities to solve complex problems (provided that animals have the appropriate skills and resources available to solve the problems) are an important and necessary part of enrichment programs for captive animals.

Better understanding the minds of animal research subjects can also have important implications for ethical standards in animal research and experimentation. For example, Andrew Fenton (2014) has argued that our current understanding of the minds of chimpanzees requires a reappraisal of the ethical standards for research with chimpanzee subjects. Fenton argues that chimpanzee possess the cognitive capacities required for dissenting from participating in research and draws an analogy between dissent in research with chimpanzee subjects and dissent in research with human children subjects. Fenton concludes that just as the sustained dissent of human children is considered in ethical assessments of research, the sustained dissent of chimpanzees should also be considered in ethical assessments of research.

Researchers must also be aware of the ways in which specific studies can affect and change the cognitive welfare of their subjects, even after the studies are complete. Lyn Miles's work with Chantek the orangutan provides an excellent example of how studies on the cognitive abilities of animals can have unintended consequences (Cole, M., 2014). Miles picked up Chantek from the Yerkes National Primate Research Centre when he was just 9 months old. As the sole subject of a long-term research project on the sign language abilities of orangutans, Chantek was primarily raised by Miles and Ann Southcombe on the campus of the University of Tennessee at Chattanooga. During his time with Miles and Southcombe, Chantek became accustomed to his nontraditional lifestyle, living with his human caretakers, and a number of conventions. One of these conventions included using metal washers to "pay" (trade) for

rewards. Chantek's most prized reward was to go for a car ride off campus (which he asked for

by signing "car-ride-out"), usually to a nearby restaurant for an ice cream or a cheeseburger.

As Chantek got older, he became adept at escaping from his enclosure and on one

occasion, jumped on a student, catching her unaware and frightening her, though not injuring

her. The university decided that Chantek was too great a liability and the decision was made to

send Chantek back to the Yerkes Centre after being raised on campus for eight years by Miles

and Southcombe. Miles's and Southcombe's descriptions of Chantek after he was moved back

to the Yerkes Centre are striking. In an interview while reflecting on the first time she went to

visit Chantek after he had been moved back to Yerkes, Southcombe said "He was used to such a

wonderful life, and [now] he was in a 5x5 cage…The first thing he said to me was 'car-ride-out'"

(Cole, M., 2014). In her own interview, Miles recounts that Chantek seemed depressed and

repeatedly asked to leave and "in sign language, said 'mother Lyn get the car go home'" (Cole,

M., 2014).

Clearly Chantek's cognitive welfare was directly affected when the life he had become

accustomed to while participating in Miles's study was taken away. Not only did Chantek

become accustomed to conventions of his life on campus, being raised by Miles and Southcombe

in isolation from other orangutans also affected the way in which he interacted with other

orangutans. In Miles's same interview, she reflects on the time when Chantek was integrated

into a colony of other orangutans, saying:

> As he joined the orangutan colony there, Chantek looked over and I just suddenly
> thought "I've taken for granted that he will recognize that that is his species" and I
> just said "who are they?" or "what are they?" or "what do you think?" and Chantek
> looked, and he said "orange-dogs." (Cole, M., 2014)

Stories like Chantek's may seem extreme, but what the story highlights is that there can

be unintended consequences for taking an animal out of their natural environment in order to

study their cognitive abilities, especially when their environments are drastically changed. Irene Pepperberg (2010) also reflects on the unintended consequences of "engineering" more intelligent animals, and other scholars (Davis & Balfour, 1992; Bayne, 2002) have reflected on the unintended consequences of the bonds that are formed between researchers and their animal subjects. These consequences on the cognitive welfare of animals must be considered when studying the minds of animals.

Ensuring our understanding of animal minds is as empirically accurate as possible is crucial for addressing concerns of animal welfare. Not only does our understanding of animal minds allow us to answer existing ethical questions, but growing our understanding of animal minds has the potential to uncover new and important ethical questions that we would not have otherwise known to ask.

5.7. Conclusion and Going Forward

In chapter 1, I reviewed conceptions of animal minds in popular culture and argued that they promote a problematic animal prejudice. This prejudice is complex and can lead to epistemological, metaphysical, and ethical problems if left unchecked. In chapter 2, I reviewed the effects of animal prejudice on the scientific study of animal minds generally and argued that animal prejudice leads to problems at three stages of studying animal minds: when designing experiments, when selecting test subjects, and when interpreting results. I argued that these epistemological problems conflict with common accounts of values in science and I made recommendations for avoiding and mitigating the effects of these problems. In chapters 3 and 4, I examined the scientific study of some specific cognitive abilities in animals. In chapter 3, I examined problem solving, learning, tool use, and language, and in chapter 4, I examined

emotion and empathy. I identified areas where animal prejudice creates epistemological and metaphysical problems in the study of these cognitive abilities and again made recommendations for avoiding and mitigating the effects of these problems. In this last chapter, I reviewed the ethical implications of animal prejudice and examined a few specific areas in which animal prejudice interacts with animal ethics.

Even if our understanding of other animals was perfect, it would still be very difficult (if not impossible) to make perfectly ethical decisions about how we should and should not interact with animals. Unfortunately, our understanding of other animals is far from perfect, but there are important ways in which we can improve it. The recommendations made in this thesis represent steps that can be taken toward avoiding and mitigating the harmful effects of animal prejudice and improving the empirical accuracy of the conclusions we draw about animal minds.

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