Children's developing moral concern for animals

Heather Henseler Kozachenko, BA, MRes

Department of Psychology, Lancaster University

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Declaration

The research reported in this thesis is my own work, except where indicated otherwise, completed under the supervision of Jared Piazza and Charlie Lewis. None of the work in this thesis has been submitted elsewhere in support of application for another degree at this or any other institution.

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Name: Heather Henseler Kozachenko

Signature:

Date: 22/07/2022

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The contribution of each author is indicated by the order in which their name appears.

Study 1: How children and adults value different animal lives.

Conception and design of study: Heather Henseler Kozachenko, Jared Piazza

Data collection: Heather Henseler Kozachenko

Data analysis: Heather Henseler Kozachenko

Writing manuscript: Heather Henseler Kozachenko, Jared Piazza

Revision: Jared Piazza, Heather Henseler Kozachenko

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Writing manuscript: Heather Henseler Kozachenko

Comments: Jared Piazza

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Conception and design of study: Heather Henseler Kozachenko, Jared Piazza

Data collection: Heather Henseler Kozachenko, Lucy Taberner

Data analysis: Heather Henseler Kozachenko

Writing manuscript: Heather Henseler Kozachenko

Comments: Jared Piazza

Revision: Heather Henseler Kozachenko, Jared Piazza

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Data collection: Heather Henseler Kozachenko

Data analysis: Heather Henseler Kozachenko

Writing manuscript: Heather Henseler Kozachenko

Comments: Jared Piazza

Revision: Heather Henseler Kozachenko, Jared Piazza

Supervisor's name: Jared Piazza

Signature:

Date: 22/07/2022

Abstract

Adults tend to morally prioritise animals that share qualities with humans (e.g., intelligence), but they are also self-serving in their judgments of animals they consume. How children value animal life remains largely unexplored. Across four studies, this thesis examined how school-age children and adults evaluate the worth of animal life (Study 1) and judge the wrongness of harming animals (Studies 2-4). In Study 1, 241 children between 6 and 10, and 152 adults, were asked to rate a range of animals on seven different perceptual dimensions and rank order the animals within a moral-regard task. Structural equation modelling revealed several important developmental changes with younger children placing relatively more emphasis on animal aesthetics and benevolence than older children and adults who elevated the intelligence, sentience, and utility of animals as food for humans. Studies 2-3 explored the impact of categorisation and consumer motivations on children's and adults' judgments of harming animals. Perceptions of the intelligence of an animal were experimentally manipulated, as well as the animals' food status (chickens vs. kakapos, Study 2) and the perspective taken by the participant (self vs. other, Study 3). Compared to adults, children tended to hold more moralistic views of harm to animals, irrespective of their status as food (Study 2). Only adults exhibited motivated disregard for the animals' intelligence when it was an animal consumed (Study 2) or when personally judging its worth (Study 3); for example, adults believed that others would feel guilty about eating intelligent cows, but their own judgments were not affected by admitting cow intelligence. By contrast, children condemned eating cows as much as they believed others would. Study 4 isolated the personal relevance of the eaten animal. It also reduced the role of aesthetics within the materials. This conceptual replication with 223 adults produced very similar results to Study 2, but failed to replicate the motivated use of intelligence information for the non-food animal. This thesis substantially advances how we understand children's concern for animal life, in that, moral

valuations have their basis in childhood that (a) start with a focus on surface-level constructs that develop into more complex understandings of animals' minds and (b) lack the self-serving evaluative processes characteristic of adults.

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General Introduction

> "The future of all life on earth depends on how we behave towards one another and how we treat the plants and animals that share our world with us."
>
> (Queen Elizabeth II, *Platinum Party at the Palace* 4 June 2022)

Introduction

Humans are constantly influencing and affecting their environment, this includes the animals people interact with every day. Such interactions may not always impact on the lives of people, but they certainly affect the lives of the animals. The interactions are varied and depend on, not only the person, but the type of animal in any given situation. There is a spectrum of treatment that animals receive from humans. Some animals are kept as pets and kept warm and well fed in our homes. Wild animals are sometimes left alone, sometimes hunted to extinction, sometimes deemed endangered and actively protected. Animals considered "pests" are often actively destroyed. Other animals are raised to be slaughtered and eaten. In fact, arguably, the most common interaction people have with animals is at the dinner table when the animal is being consumed. The way a person interacts with and treats animals has its basis in childhood. Children have an intrinsic interest in animals (DeLoache et al., 2011). Children are encouraged to learn about animals and be considerate towards animals – some more than others. Research shows that certain aspects of animals influence adults' perceptions, understanding, and valuing of them. But how do children integrate animals into their lives and make judgments about their relative value? Recent research points to the emerging idea that children are more charitable in their concern for animal lives, particularly when the interests of animals and humans directly conflict (Wilks et al., 2020). However, we continue to know very little about how children integrate different aspects of

different kinds of animals into their own understanding. The present thesis considers how children's perception of animals and moral concern for their lives shifts across early to late childhood, in relation to (a) the attributes they presume animals to possess and (b) the uses animals offer them, particularly in the domain of food.

Research on moral standing has traditionally focused on human directed judgements and concern (Goodwin, 2015). Aspects of the person being considered make a difference in how that person will be regarded, for instance, it has been found that moral character is a central feature that factors into human interpersonal and intergroup judgments because of what it reveals about the person's social intentions (Brambilla et al., 2012; Goodwin et al., 2014; Leach et al., 2007). Another direction taken in moral concern research is based on how the person doing the regarding reacts more broadly. People have varying levels of moral expansiveness, meaning they hold different numbers of entities at different levels of moral regard (Crimston et al., 2016). There is also growing research that focuses on adults' moral concern for animals (Bastian, Loughnan, et al., 2012; Bratanova et al., 2011; Klebl et al., 2021). In addition, a deeper understanding of how adults' moral judgments form and are used could be integral to mitigating the effects of lower moral standing for some animals. However, there is little research that has been done regarding the moral standing of animals with children.

Understanding children's moral concern for animals is important because children are developing their moral attitudes throughout childhood, and this then carries with them into the future. Perhaps if we can educate children about why animals should be respected and treated better, then they will carry this learning forward into adulthood and continue to care about animals. The research looking at which perceptual dimensions adults prioritise when making moral decisions about animals has found adults value animals with higher intelligence, sentience (Gray et al., 2007), and animals that are phylogenetically similar to

humans (Batt, 2009). Understanding which animals are important to people is vital in order to protect certain animals and ecosystems.

There can be a range of animals that are vital to an ecosystem, however, some may be overlooked when people make decisions about that environment. An example is the wolves of Yellowstone National Park in the United States. Wolves are seen by people as dangerous predators (Treves et al., 2013) that kill livestock on which people depend. This made it easy for people to kill wolves when they came into contact with them. It is generally accepted that by 1926 wolves had been extirpated from Yellowstone (Boyce, 2018). However, in removing the wolves and other large predators this allowed the elk to become overpopulated and overgraze the young willow trees. When they reintroduced wolves in 1995 the landscape began to change. Over the years the population of elk decreased, the willows grew tall, the river became slower and wider, and the wildlife, such as beavers, moved back into the area (Beschta & Ripple, 2019). The ecosystem was all interconnected and the missing large carnivores had devastating effects on the landscape.

The story of the wolves of Yellowstone demonstrates how people's hatred of one animal can impact on the lives of so many others. Environmentalists may need to draw attention to overlooked animals in order to re-establish populations or assist in an ecosystem's recovery. People may only be thinking about a certain kind of animal, like charismatic megafauna (Petersen, 1999), when they deem animals worthy of their moral concern and act to protect them.

People place entities in an order in which they care for them (Crimston et al., 2016). This can be seen as a moral circle, the inner most entities are the ones that are most cared about while the outermost are least cared about (Neldner et al., 2018). This organising of entities constitutes someone's moral hierarchy. Organising in this fashion can be dangerous because people will not care about animals that are low in their moral hierarchy.

Unfortunately, animals that are unpopular, such as wood lice, snails, and mice (Randler et al., 2012), can be the most influential and important aspects of a food chain. For instance, krill, which are very small crustaceans, not only support whales and penguins but also play a pivotal role in the Southern Ocean carbon sink (Cavan et al., 2019).

Even given adults' preference for highly intelligent animals that are similar to humans, there are a few animals that stand out as not being valued or treated with respect. These are the animals used for food by humans (Bastian, Loughnan, et al., 2012). Adults' treatment of these animals is mired in conflict. Food animals, generally mammals, have traits people value yet are systematically slaughtered for the benefit of humans. Unlocking the mechanism which creates adults who carry on treating food animals as lesser beings would have huge implications for society at large.

This thesis aims to add to the growing body of literature around how children form moral judgements around animals and their treatment and usage by humans. The main overarching theme followed the line of: do children and adults differ in the way they prioritise, conceptualise, and think about animals?

In general, we found that, compared to adults, children's judgments are less affected by the instrumental value of animals, such as their edibility. Instead, children place more value on the animals' intrinsic properties, such as their aesthetic qualities. Though adults are often motivated to treat food animals differently than non-food animals, we observe that children's evaluations of animals are *less* instrumentally motivated than adults, particularly when it comes to animals that are eaten.

Moral development

Examining children's moral concern for animals begins with children's moral development as a whole. Piaget (1932) described three stages of moral development. He begins with amoral, meaning the child makes no moral decisions, followed by decisions that

follow a strict code dictated by an authority figure, and ends with decisions that follow an internal guide without being fixed by an external force. Kohlberg's (1976) stages of moral development expand on Piaget's work. He came up with six stages that children go through starting with a focus on not breaking rules because of a fear of punishment, ending with a focus on an internal set of ethical principles. These principles may or may not coincide with laws but rely on a person following their own internal principles. Further research has found it is not a requirement to cycle through stages in succession, thus people rarely reach stage six (the final stage) (Levine, 1976). People will use thinking that is characteristic of different stages simultaneously depending on the situation, they may even apply rules for more than one stage for a given situation (Levine, 1976). People use the rules for the most relevant moral stage, not necessarily the highest stage they have achieved. In the context of reasoning about animals, different situations may illicit different responses, such as when people consider the life of an animal weighed against the convenience of a person. Even decisions that are between animals may elicit different responses. Someone's pet may be given more consideration than the animals that were killed to feed it. These situations may not elicit people to engage in thinking that is characteristic of the highest stages thus the perceived category that the animal is placed into is relevant to the decision-making process. It is important to note Kohlberg's theory has been met with some opposition. Gilligan (1982) argued that Kohlberg's stages were not universally applicable because his subjects only consisted of boys. Gilligan claimed boys have a justice orientation to moral reasoning while girls have a care and welfare orientation.

Children's learning occurs in the context most relevant to the situation they find themselves in. Domain theory states that they learn the rules of the society as well as learning moral rules (Nucci, 2001). Societal rules are arbitrary and may or may not benefit the child, this includes things like 'no running around a pool.' This societal rule is meant to keep

children safe, but it is not wrong to do so if there is no rule against it, even if it may not be a good idea to do so. Moral rules are things that can complement societal rules but also have intrinsic value. Moral rules may include things like ‘don’t hit other children.’ Such rules are imposed by society but would still be wrong if there were no rules against them. Children develop more complex reasonings within these domains as they mature (Nucci et al., 2018). Adults usually spend more time reminding children of societal rules and children spend more time reminding each other of moral rules (Nucci, 2001). It seems that adults are content to let children work through those issues on their own as they mature. Sometimes there may be conflict between societal rules and moral rules. In the context of eating meat, it may be considered by society as acceptable to eat meat but, this is in conflict with the moral rule of not harming animals. Children have to navigate this tension with animal treatment in their own lives and how much control they have in a given situation, and often the societal rule wins out.

Starting at 4 years old, children begin to be able to shift their thinking from only relying on one domain to incorporating other domains (Smetana et al., 2018). Children below the age of 3 years old do not show a difference in how they judge moral transgressions versus conventional transgressions (Smetana et al., 2012), while children older than 4 years old are able to make distinctions between moral and conventional transgressions and they integrate societal rules into their judgements and decision making. Children’s ability to coordinate different aspects of a situation, such as situational factors and characteristics of the victim, increases with age (Yoo & Smetana, 2019). Children also become more able to distinguish between physical harm and psychological harm (Jambon & Smetana, 2014). Yoo and Smetana’s (2022) meta-analysis confirmed that over 46 studies, children from 3 to 12 years old have an increased distinction between moral and conventional rules/transgressions. According to other research, in the context of resource allocation, older children will

integrate societal norms into their division of resources, while younger children focus on equity (Cooley & Killen, 2015). For our purposes, concerning children's moral concern for animals, we might expect that younger children would be against harming animals because it is morally wrong and older children would take other factors and norms into account. Therefore, this thesis will focus on children within the range of 4 to 12 years old because the ability to process different kinds of transgressions and situations emerges and matures between these ages.

Society's perception of children's relationship with animals

Children are exposed to animals from a very young age. They have stuffed animals, they watch animals on television, they learn from anthropomorphised animals about how to behave (Kotaman & Balcı, 2017). They watch on repeat their favourite characters like Pingu the penguin and Peppa Pig (Godfrey & Holmes, 2016). One may think that children see these anthropomorphised animals and relate to them as human characters. This would be justified since the behaviours of these characters are more similar to humans than the animals they represent. Nonetheless, Russell and Cain (2020) found that children between 3 and 7 years old think of these anthropomorphised animals as animals and not as people. This means the children viewed the anthropomorphised animals as thinking and feeling more as real animals instead of the humanlike characters they were portraying. In addition to these abstract animals, children will encounter classroom pets and visit petting zoos on fieldtrips. All this exposure is meant to increase learning, love, and understanding of animals (Thompson & Gullone, 2003). It has been shown that children pay a lot of attention to animals, even toddlers will pay more attention to a living animal in a cage than to a stuffed animal they can interact with (LoBue et al., 2013). Animals have even been shown to aid in children's development. A review by Endenburg and van Lith (2011) found that companion animals

aided in the development of children's self-esteem, autonomy, empathy for others, social competence, and cognitive development, such as language acquisition.

Despite all this encouragement to engage with animals, children are often shielded from another role animals play in human society, as food. Parents (particularly parents living in urban and suburban environments) are sometimes hesitant to discuss the origins of meat with their children (Bray et al., 2016). They often want to shield children from the realities of the origins of meat or wish not to think about the topic themselves. This creates a disconnect between the happy, smiling, dancing animals children see every day and the dinner table. Even parents who tell their children where meat comes from may skip the process of how the animal gets from the farm to their tables (Bray et al., 2016).

Being shielded from the process of meat production may not be the only mechanism by which children can remain loving animals and eat meat at the same time. Rothgerber (2020) suggests that the ignorance of the origins of meat may be motivated, especially for children who love animals. Motivated thinking means the purposeful disregard of information in order to avoid a potential moral dilemma (Piazza & Loughnan, 2016). That is, for children who love animals, they avoid learning about the origins of meat in order to continue their practice of eating meat and continue being animal lovers. The knowledge that animals suffered in order for their meal to be created may be too much for children and they may wilfully ignore it.

Even Rothgerber admits it may be a combination of the sheltering from parents and wilful ignorance at different stages of a child's life. Children must be able to understand that meat comes from animals and have the ability to make critical connections between meat and slaughter in order to engage in motivated thinking. The children may also feel pressure to continue acting in a way society encourages (eating meat) thus, they may begin motivated thinking as a means to reduce their internal conflict.

Children's knowledge and interest in animals

Inagaki and Hatano (2006) define young children's knowledge of the animal kingdom as "naïve biology." One aspect of this is that children base what they know of animals or plants using what they know of themselves. Children as young as 5 years old are able to recognise and describe similarities between animals and plants. They also attribute human responses to living things in novel situations. Children tend to attribute human motives and explanations to many living things because they are most familiar with their own motives. Naïve biology would suggest that children have a better understanding of how other living things behave, interact and feel, than one may initially believe. Geerdts et al. (2015) conducted a study with 3 and 5 year old children who did and did not have pets. They first introduced a novel unobservable biological property about people or dogs and then asked whether the children thought that property could be found in other kinds of animals, plants, or objects. The children with pets were less likely to view things in an anthropocentric way. That is, children without pets generalised the novel property to more entities when they were first told the property could be found in humans than when they were first told the property could be found in dogs. The children with pets did not show this bias. The researchers next asked whether a pet (the child's pet, if they had one, or the researcher's pet) had biological properties (for example, internal organs, sleep, growth, food, contagion, parentage) and psychological properties (social interaction, emotions). The researchers found that the children who had pets attributed more of the biological properties to animals than the children who did not have pets. However, the children attributed psychological properties at lower levels than biological ones regardless of pet ownership. Even so, the children with pets had more knowledge about animals' physical states and needs than their peers.

Myers (2007) observed that aged children 3 to 5 years old showed empathy towards the animals in and around their classroom. The children were interested in the animals when

they moved about on their own. Myers observed that the children considered the needs of the animals similarly to their own. As an example, one boy, while playing, projected his desire for freedom to a pair of caged doves. He pretended to cut an imaginary hole in their cage and one in the exterior window of the classroom. Myers reasoned that this served no purpose other than an attempt to help the caged birds escape. The children were also able to think about what the animals wanted and why the animals were behaving in different ways. Some children gave the animals human motives, but others were able to reason that the animals had their own minds with their own motives. From these specific interactions, we can further see that children show a general interest in animals and that humans are orientated towards animals from a very young age.

Kellert (1997) looked at how people perceived and felt about the natural world. He conducted a series of studies in the 1980s which consisted of a large-scale survey comprised of mostly adults but also included some children. One of the things he found were the many prevailing attitudes that people hold toward nature. These included “interest and affection for wildlife and the outdoors” (termed ‘naturalistic’), “concern for the environment as a system or for interrelationships between wildlife species and natural habitats” (termed ‘ecologistic’), “interest and strong affection for individual animals—principally pets” (termed ‘humanistic’), “and concern for the right and wrong treatment of animals” (termed ‘moralistic’) (Kellert, 1985, p. 48). His findings revealed attitudes that pertained to human needs and fears but also an orientation towards nature itself. His attitude labels have made it possible for researchers to focus on specific aspects of people’s experiences with nature. Research has also focused on what these attitudes mean for interventions and educating the public (Bexell et al., 2013). When Kellert (1985) also applied these attitude categories with children he found a developmental difference in orientations between age groups. He observed that as children mature, they exhibited stronger moralistic attitudes (concern for the

ethical treatment of animals), and a surprising finding that teenagers showed stronger moralistic attitudes than the adults in his studies.

A view as to why children are interested and focused on animals can be seen in the biophilia hypothesis (Kellert & Wilson, 1993). This is the idea that people are naturally orientated towards animals. There is an innate desire to learn about animals and be involved in their lives (Melson, 2001). Humans also display aversive and fearful attitudes towards certain animals, such as spiders and snakes (LoBue & DeLoache, 2008). Some theorists have called this aversion *biophobia* (Ulrich, 1993), but that was not the intention when the word biophilia was first coined (Wilson, 1984). Aversion and love of nature are two sides of the same coin. The argument is that as human beings evolved, they had to be keen observers of their surroundings. To survive and flourish, humans had to know what was dangerous, what was benign, and what was edible—thus, humans have evolved to be attentive to animals, and features of animals, that are indicative of such meaningful events (Lee & Kang, 2012; Olivos-Jara et al., 2020). People who grow up in modern cities (without much interaction with nature) still can be found to have this orientation towards animals (Kahn, 1997).

Moral concern for animals

Levels of empathy (matching one's own feelings with the corresponding feelings of someone else) and moral development have been associated in past research (Eisenberg-Berg & Mussen, 1978). Gilligan (1982) theorised that girls' moral development is affected by their orientation towards caring behaviours, this bears out in a relationship with their moral concern and levels of empathy. One way that humans show moral concern for animals is by empathising with their experiences and suffering. Many studies have examined moral concern for animals in the context of how empathy affects pets and whether pet keeping affects empathy. Paul (2000) developed the first scale for assessing empathy towards animals and demonstrated that animal related empathy was increased when people had a pet at home.

Adults who had higher rates of pet keeping in childhood had increased empathy and more humane attitudes towards animals in young adulthood (Paul & Serpell, 1993) In addition, children who had both a cat and a dog and were more attached to their pets had increased levels of empathy (Daly & Morton, 2006). Children who kept pets had more favourable attitudes and better knowledge of unpopular animals than children who did not have pets (Prokop & Tunnicliffe, 2010). Childhood pet attachment increased empathy towards animals and that empathy mediated adulthood meat avoidance (Rothgerber & Mican, 2014). However, research has also shown that human orientated and animal orientated empathy were only moderately correlated, indicating they were separate constructs (Paul, 2000). From work on empathy, we can see forming an attachment to certain animals (pets) can promote wider concern for a variety of animals (see e.g., Possidonio et al., 2021; Rothgerber & Mican, 2014). However, while moral concern for animals involves empathy, it is a broader concept that also entails the consideration of what people value in animals.

In order to find what people value in animals we must first examine how they approach reasoning about animals. Kahn (1999) conducted several studies with children and adults, as well as some cross-cultural studies, in which he examined the biophilia hypothesis. He identified two moral reasonings that people use when thinking about environmental issues: anthropocentric and biocentric. Anthropocentric reasoning is focused on the ways the environment affects people. People who use this reasoning care about the environment only because it makes a difference to human lives. Biocentric reasoning focuses on the environment and creatures in it for their own sake. Contained within that is a focus on the intrinsic value of nature and the rights that apply to all living beings. Kahn (1999) found that children develop both of these reasoning styles as they mature. When asked about the environment, children were able to reason about it in similar ways as adults, however as they matured, they used more biocentric reasoning. Ruckert (2016) showed that in semi-structured

interviews with children 7 to 10 years old, their prevailing moral reasoning about humans harming the environment, specifically endangered grey wolves, was biocentric or centred around nature instead of how it affected humans.

In an examination of Kohlberg's stage theory, Dunlap (1989) saw that not only did eighth- and twelfth-grade boys use higher moral reasoning levels when considering dilemmas involving people, she found that they used lower stages of moral reasoning when considering three different animals: chimpanzees, dogs, and turkeys. In this example, the children engaged in a higher stage, postconventional reasoning, when their thinking made use of themes dependant on justice when considering dilemmas involving humans but relied on lower, conventional reasoning, that was characterised by their focus on pleasing others or law and order when considering dilemmas involving the animals. Children have also been found to reason about harm to others dependent on the personal characteristics of the entity, e.g., judging harmful actions harsher when the recipient of the action has a distinct vulnerability (Nucci et al., 2018).

Since children see it as wrong to harm entities that are vulnerable, we should point out that all animals are vulnerable to humans. Humans exert vast control over their environments and change the landscape to suit their needs. This comes at the detriment to the organisms that were already living in those environments. What is worse is that humans are not considered top predators because we do not even eat everything we kill. Humans exploit other animals in the domains of food, clothing, animal testing, hunting/wildlife management, and sports. In the United States, for example, in 2020, 32.9 million cattle and 132 million pigs were slaughtered (USDA, 2021b), in 2019, 49,422 animals were involved in painful experiments that received no pain medication (USDA, 2021a), and hunting is available at almost 400 national wildlife refuges (USFWS, 2022). Exploring how children (and adults) reason about these various "uses" of animals is an important aspect of moral concern for

animals. The moral judgments people are forced to make every day have to do with the ways in which humans treat and exploit animals. This leads to the question, which properties do children use in their moral judgments of animals?

Some moral attitudes and cognitions are slowly coming into focus due to the recent increase in interest in this area. Gray et al. (2007) describe two different aspects of mind perception. They separate it out into two components – experience, such as feeling pain or having emotions, and what they called agency, such as self-control and planning. People valued entities with high moral experience and agency. People felt it was more wrong to harm an entity that was high in experience but low in agency (Gray et al., 2007). This means that babies, who are able to experience the world but have no influence over it should be given more moral concern than a robot who can influence the world but does not experience it.

Faunalytics (2020), a non-profit organisation that researches animal-related issues, recommends an emphasis on teaching and reminding people that animals are intelligent and sentient. Furthermore, research on "mind perception" suggests that intelligence and sentience are two aspects of "mind" that people use to determine whether an entity has moral standing, i.e., it can be harmed and has interests that deserve consideration (Gray et al., 2007). Thus, it might be assumed that if an animal is perceived as intelligent, it will be given more moral concern. A way to test this is to see whether people who believe in the intelligence of the animal tend to also have greater concern for the treatment of animals. Knight et al. (2004) developed the Belief in Animal Mind (BAM) scale in order to examine how beliefs about animals related to attitudes towards animal use. They found that whether people believed in the mental worlds of animals made an impact on their acceptance of animal use. Morris et al. (2012) examined how people with a range of experience with animals attributed various emotions (fear, joy, love/affection, guilt, disgust, shame, jealousy, sadness, anger,

embarrassment, empathy, curiosity, pride, and grief) to a number of domestic species. They found that familiarity with animals can promote greater belief in animal minds; belief in a wider range of animal emotions and keeping an animal gives a greater understanding of that particular animal's emotions and intelligence (Morris et al., 2012). The researchers suggest that belief in animal emotions affects how the animal is treated, such as dismissing bad behaviour if the animal is seen to be jealous. This suggests that teaching people about animal intelligence and sentience would increase treatment of animals.

Hawkins and Williams (2016) used a paper and pencil self-report and got a measure of children's Belief in Animal Minds (Child-BAM). The ages ranged from 6 years old to 13 years old. They found that children rated dogs as the most sentient animal after humans in a range of species. The rest of the species followed in order of phylogenetic similarity to humans, except cows, which were rated on intelligence between frog and goldfish. Children who had higher Child-BAM scores also showed higher attachment to pets, compassion, humane, and caring behaviour towards animals as well as positive attitudes towards animals. This supports work with adults suggesting that belief in animal minds is an integral part of moral concern for animals. However, the Child-BAM measure is limited in several ways. Firstly, the scale used a limited set of animals (more than half were mammals, all were vertebrates) which does not accurately represent the animal kingdom as a whole. It also centred around emotional states that the children were likely to have experienced themselves which may have caused children to project human properties onto the animals in an attempt to understand animal minds. In addition, this scale required an understanding of complex concepts like "pain" which children seem to struggle with when applying it to other entities (Burich & Williams, 2020).

Children seem to take the level of experience and agency (Gray et al., 2007) of an animal into account when they make moral judgements. Hussar and Harris (2018) asked

children 7 to 12 years old to rate attacks (kicking, pulling a body part, throwing a rock) by children against pets (dog, cat, horse), food animals (cow, pig, lamb), wild animals (raccoon, monkey, opossum). and humans (classmate, brother, sister). The children more severely condemned attacks against animals than people. When asked why they rated the attacks in the way they did, the children cited the vulnerability of the animals most often to justify their decisions. The researchers coded vulnerability when the children made references to the strength and/or size disparity between the perpetrator and the victim, (e.g., ‘‘because an opossum is very little; it would go flying’’). Children also rated attacks against pets more severely than farm animals; while wild animals were placed in the middle (Hussar & Harris, 2018). This indicates aspects of the animals are being taken into account when moral decisions about harming animals are being made.

While the perceptual dimensions of an animal are the most important, framing those can make a large difference as well. When people were asked to think about how animals share characteristics with people, they gave animals more mental states and more moral standing (Bastian, Costello, et al., 2012). However, if people are asked to think of animals in the context of how people are like animals, they distance themselves and attribute lower mental states and lower moral standing. It is clear that though sentience is an important factor when making moral decisions about animals, humans do not always behave in accordance with that principle. There seem to be other characteristics at play when people make decisions about the moral standing of animals.

Colléony et al. (2017) conducted a study in which an example of an animal’s characteristics affecting its place in the world was made very clear. People’s choices about helping endangered species were examined. There was a long list of animals to choose from and people only donated to one or two from the list. When researchers looked at what could have affected people’s decisions, they found that the animal’s “charisma” was more

important, thus the amount of money that was donated to help them, than its place on the endangered species list and its amount of need. Charisma was defined by how popular the animal was in Google Search searches, but that shows a relative level of familiarity the general public have with the animal. Tisdell et al. (2006) found that when people were asked outright which endangered species they wanted to survive, in an 'Ark' situation, there was a large preference for mammals over birds or reptiles. When asked again, after people had the opportunity to digest new information they learned in a lecture and pamphlets they got to take home, knowledge and severity of endangerment affected rankings only slightly. These studies indicate humans have a preference for mammals to non-mammals indicating a bias towards animals that are phylogenetically similar to humans.

Piazza et al. (2014) demonstrated that people will consider how dangerous an animal is to humans when they make a moral judgement about it. The researchers manipulated a novel creature on harmfulness, intelligence, and patiency (similar to 'experience' discussed earlier). The participants were then asked to make judgments pertaining to the moral standing of the entity. After sentience has been taken into account, the harmfulness of the animal is added to the equation. This means that between two animals of equal intelligence, if one is a threat to humans, the benign animal will be given priority over the dangerous one.

If mental capacities are the most important aspects of moral concern, why do people continue to show low concern for animals that are objectively as intelligent as others but used for food? One reason may be the categorisation of the animal. The category the animal is placed in has a role in influencing moral judgments of it, for example if animal is categorised as "food" or "pest" it gets subordinated in people's hierarchy of concern (Bratanova et al., 2011; Prokop & Tunnicliffe, 2008). Thus, how we classify animals (as to be eaten vs. not eaten) can transform the concerns we have for their wellbeing. Bastian, Loughnan, et al. (2012) found people attribute less mental capacity to animals they consider to be food

animals especially when they were reminded of the production of meat. The researchers attributed this to motivated cognition in order to minimise discomfort with the knowledge they do not value that animal for its mental abilities. According to Rothgerber and Rosenfeld (2021) people may experience meat-related cognitive dissonance when they connect what is on the plate to the animal it once was or are reminded of meat production or animal welfare. They may avoid those triggers or remain wilfully ignorant on the topic in order to not experience discomfort. This is a wilful ignorance of food-animal minds and it has been shown that committed meat-eaters tend to be more avoidant of information that would "prove" animals used as food have sophisticated minds (Leach et al., 2022)

Methodological approaches to children's moral concern for animals

Moral concern research with children has been limited for several reasons, one of which is methodological concerns. Children may lose focus on the tasks or not understand the words that are being used to ask a question. Children may also not understand some of the technical terms or concepts used with adults, like "sentience," without the support of adults assisting them. Myers (2007) tackled this problem when he took a longitudinal approach to studying children's relationships and interest in animals. He spent a year with a class of preschool children and observed the things they said and took note of when they were exposed to animals that were in or brought into the classroom. He found that animals were an intimate part of how the children learned, not just about the animals but about themselves. The children connected with the animals and not only spoke to them but showed the animals empathy and compassion. The children allowed the animals to show them what the animals wanted and where they wanted to go. The children considered that the needs of the animals might be similar to their own. Children were also able to reason about what the animals wanted and why they were behaving in different ways. Some children gave the animals

human motives, but others were able to reason that the animals had their own minds and motives.

Some other ways to examine children's moral concern are to directly compare their actions with a real animal and an object or toy that has nearly all the same characteristics. Melson et al. (2009) showed that children were able to make different moral decisions when confronted with a robot dog that could move and respond to commands and a real dog. The children gave the real dog more moral consideration, showing they valued its experience. This method has real world validity in that it uses actual animals and behaviours. However, when attempting to examine children's moral concern for a range of animals, it is not practical to present all the animals which children may interact with or have an influence over in a sterile environment and observe their behaviour with each one.

Another research method that can be employed with very young children involves their drawings. Lee and Kang (2012) asked children to draw 'evil' animals to see if there was consistency in the schemas children used to identify dangerous animals, and to evaluate the realism of those schemas. What was produced were drawings that often had fangs, downward slanting eyes, and open mouths. These characteristics might suggest children and adults may have similar views towards animals with these features or perhaps that children associate certain traits with danger. This does not bode well for animals that resemble these drawings or have these characteristics. Animals like fruit bats fit many of these features and conservationists will have to work twice as hard to get people to realise they are not the monsters they may appear to be. Attention to big teeth may be of benefit to children (Kahn, 1997; LoBue & Rakison, 2013) since they are generally associated with predators, like crocodiles, which would be best avoided by children.

Borgi and Cirulli (2015) sought to include young children in the conversation about animal judgements. They used a forced choice paradigm to ascertain children's preferences

for a wide range of animals. They used pictures of animals and asked the preschool children "which one do you prefer?" The result of this gave a ranked order of which animals the children preferred. The resulting pattern indicated there was a high preference for mammals and beautiful creatures (attributed by the researchers). The researchers equated animal preference in these children to an indication about attitudes. This hierarchy gives a good indication that children may be using some of the same perceptual dimensions as adults who also showed a bias towards mammals (Miralles et al., 2019).

Neldner et al. (2018) found that children aged 4 to 10 years old preferred and cared more about pets versus farm animals and more about animals with higher sentience than lower sentience. This was obtained by asking the children to place pictures of a range of entities, including some animals, in circles on the ground in the categories of 'care a lot,' 'care a little,' or 'not care at all.' This was an adaption of the Moral Expansiveness Scale for use with children (Crimston et al., 2016). Even in the ages of 4 to 10 years old there was a difference in the priorities given to different kinds of animals (Neldner et al., 2018). As children got older, their patterns looked more like adult patterns. Their 'care a lot' category size did not change but they placed more entities in the middle more ambiguous category. This would seem to show that as children mature, they are less binary in their thinking and may be taking more factors into account when making their decisions.

Children's levels of speciesism and moral concern for animals has also been explored. Speciesism is "the unjustified disadvantageous consideration or treatment of those who are not classified as belonging to a certain species" (Horta, 2010, p. 243). Wilks et al. (2020) gave children and adults the choice between saving two entities, either human and dog or human and pig and varied the number of those entities. A singular entity could be paired against one, two, ten, or one hundred of the other. There could be one human versus one hundred dogs or one dog versus ten humans. Adults saved the humans all or most of the time,

even when the choice was one human versus one hundred dogs. The children, on the other hand, saved the dog when there was more than one dog and even when the choice was between one dog and two humans only 50% of children saved the human. The researchers argue that the children were less speciesist than the adults in their decision making. McGuire et al. (2022) also looked at speciesism and categorisation of animals in children. They compared children's and adults' categorisation of some animals as food versus pets. They found children were less likely than adults to class farm animals as food than pets when compared to adults. They also found children were less speciesist in their evaluations.

These studies span a range of methods and approaches to studying children's moral concern for animals. These findings range from children being more attentive towards animals to children being less speciesist in their moral judgements of animals. While these studies provide a good base for what children might be considering when making moral decisions, none of these studies touch on a wide range of animals while also exploring the characteristics that make animals worthy of moral concern. These studies also do not explore children's feelings towards meat and animals.

Overview of the following studies

The aims of this thesis relate to how children value animal lives and how this might differ from adults. Specifically, the studies investigate how children perceive and use various animal characteristics to guide their valuing of individual animals, relative to other animals (Study 1), and within the context of harming animals for human consumption (Studies 2-4). The research explores whether children are motivated to treat animals used for human consumption differently from those not used, in the way that parallels how adults are motivated to discriminate and differently treat "food" and non-"food" animals (e.g., Piazza & Loughnan, 2016). To this end, the thesis considers both categorisation (Bratanova et al., 2011) and motivational (i.e., self-serving; Piazza & Loughnan, 2016) aspects of this

differential treatment of food animals – extending these adult-derived perspectives, in a novel way, to child populations, with an eye towards developmental continuities and discontinuities. We broke this down into three more focused, guiding questions.

Research Questions (RQ) addressed in this thesis:

(1) What characteristics do children perceive and value in animals from early childhood to late childhood (RQ1a), and how do these childhood evaluations differ from adults (RQ1b)? (Study 1)

(2) Are children's moral valuations of animals less guided by animal categories (particularly, categorising an animal as "food") than adults? (Studies 2-4)

(3) Are children's judgments of animals motivated by instrumental uses of animals in the way that adults' judgments are instrumentally motivated? (Studies 2-4)

Regarding RQ1, we drew upon a range of studies that showed adults' moral concern for animals, in isolation, was dependent upon certain perceived characteristics the animals possessed. We explored how children rated a range of animals on those dimensions then how those would interplay when the children made a moral decision about those animals. With regards to RQ2, we drew upon the methods of Piazza and Loughnan (2016, Study 2) and examined whether the animal's status as a food animal caused children to exhibit strategic use of intelligence information in the way that adult meat-eaters do. Study 2 of this thesis looked specifically at children's and adults' judgments of two birds (a chicken, commonly used for consumption, and a kakapo, not used for consumption). For RQ3, we drew upon the methods of Piazza and Loughnan (2016, Study 3) and considered the instrumental use of animals as food and tested whether children are *motivated* to disregard information about food animals in the way that adults are.

Study 1

The first set of research questions (RQ1a-b) were focused on the attributional dimensions underlying child versus adult evaluations of animal lives. To address our RQ1a (what characteristics do children perceive and value in animals), we utilised a two-step procedure to, first, ascertain how children attribute qualities to different kinds of animals and then, second, assess how the appraised qualities influenced their valuing of different animals. Study 1 applied this two-step procedure to map the interaction between the perceptual dimensions appraised of animals and moral concern for them. This was done in a comparative way to address RQ1b, which contrasted children's judgments with those of adults. We also wanted to examine if there was a developmental trajectory to this patterning, thus, we recruited across a four-year developmental time window. Our choice of children from 6 to 10 years old was guided by several factors. First, we aimed for a period of development where children could respond to textual and verbal research materials. Second, this is the developmental period in which children's knowledge of animals and their abilities exhibits several advances. For instance, Hawkins and Williams (2016) found that children between 6 and 13 years of age form opinions of which animals have greater or fewer mental abilities specifically in regards to an animal's basic emotions and intelligence. We expected to find changes in and how children understood and valued animals in this time frame.

Our choice of perceptual dimensions was guided by previous research that has examined the trait dimensions adults commonly perceive to vary across different animal species. We settled on seven dimensions that we perceived to be representative of the literature: intelligence (Bastian, Costello, et al., 2012; Gray et al., 2007), capacity for pain (Morris et al., 2012), aesthetic quality (Borgi & Cirulli, 2015), dangerousness or harmfulness (Piazza et al., 2014), edibility (Bastian, Loughnan, et al., 2012), phylogenetic similarity to

humans (Borgi & Cirulli, 2015; Hawkins & Williams, 2016), and charisma or popularity (Colléony et al., 2017) (which we operationalised as possessing extraordinary abilities) were obtained in order to understand how these qualities work together to influence moral concern. Similar to Goodwin and Landy (2014), we used a medicine allocation task to represent real world situations in which the concerns of different entities are pitted against each other. Study 1 asked children to rank animals in order from most concern to least concern (which animal should receive the medicine first, and so on). British children were sampled from two age groups and compared to a sample of mostly British adults who completed the same task.

Study 2

Studies 2-4 turned to the latter set of research questions (RQ2 and 3) regarding the consumer-driven aspects of animal valuations. In Study 2, we examined how categorisation of an animal as food affects moral standing of that animal. Past research with adults suggests simply conceptualising an animal as food for people can alter judgments of their moral worth (Bratanova et al., 2011). We wanted to explore whether children engaged in motivated uses of morally-relevant information about food animals, as adults do. We loosely based our paradigm on Piazza and Loughnan (2016, Study 2) by manipulating the intelligence levels of an animal commonly used for meat (chicken) and a non-meat animal (kakapo). Our moral concern measure was based on a paradigm developed by Melson et al. (2009) which ascertains attitudes towards a range of different "harms" humans inflict on animals from displacing and caging them to slaughter. By comparing how children and adults consider the treatment of food vs. non-food animals we sought to assess judgments of animal moral standing in relation to their instrumental value for the perceiver. We predicted adults would show more concern for the non-food animal, particularly when high in intelligence, whereas children would show similar levels of concern for the animals irrespective of their food status.

Study 3

In Study 3, we addressed RQ3 with regards to the perspective someone takes when assessing the value of animal lives. Based on Piazza and Loughnan (2016, Study 3), we used a self-other paradigm, which had children (and adults) respond to high vs. low intelligence information about a food animal (e.g., cattle) either from their own perspective or another person's perspective. If children are aware of the moral conflict posed by eating animals, then information about cattle intelligence should only engage motivational processes when encountered from a first-person perspective, as exhibited by adults (see Piazza & Loughnan, 2016, Study 3). When considering what *others* think about food animals, one should be less motivated to ignore relevant information. We did not expect children to exhibit such self-serving motivations. Thus, in contrast with adults, we hypothesised that children's moral evaluations of animals should not differentiate as a function of perspective taking.

Study 4

Study 2 revealed that adults generally expressed more moral concern for kakapos (the non-food animal) than chicken (the food animal). Children's evaluations were much less affected by the food status of the animal. We were unable to determine whether adults' differential treatment of the birds was because of the chicken's classification as food (Bratanova et al., 2011), or specifically due to the *personal relevance* of the food animal as food for the participant (Piazza & Loughnan, 2016). We also had reason to believe the research materials from Study 2 introduced a few other, minor confounds between the two birds, beyond their food status. The kakapo has a colourful plumage and therefore may have been perceived as more physically attractive than the chicken. Further, our adult participants may have perceived the kakapo as a potentially rare and endangered species, if they were aware of its conservation status. In Study 4 we sought to replicate the findings of Study 2 with an adult sample while minimising the influence of such possible confounds. More

critically, we sought to isolate *personal relevance as food* as the principal independent variable, by describing both animals as food for people somewhere, thus, allowing both animals to be classified as "food," though chickens being the only animal participants themselves eat. For this study, we expected adults to condemn harm to kakapos more than chickens, and to be affected by the intelligence of kakapos, but not chickens, in their evaluations.

Discussion

The final section of the thesis constitutes an integrative discussion of all four studies, including their limitations and implications for theory and practice.

Open science throughout

Throughout this thesis we employed open science practices by preregistering studies, the analysis plan, and making data and research materials publicly available.

Study One: How children and adults value different animal lives

Introduction

Humans relate to animals in many different ways: for companionship, to produce and test products, satisfy our appetites, and entertain us (Herzog, 2010; Knight et al., 2009). But which animals do we have moral obligations towards, and which traits should guide our decisions about how different animals should be treated? These questions have occupied ethicists for centuries (e.g., Kant, 2001; Singer, 2015). Recently, psychologists have sought to better understand how the average person wrestles with these issues in their daily lives (e.g., Loughnan et al., 2014; Loughnan & Piazza, 2018).

Most ethical dilemmas involving animals entail situations where human and animal interests are in direct conflict, such as slaughtering animals for food. Such dilemmas are often resolved by people acting on a speciesist inclination to value human life over animal life (Caviola et al., 2019; Caviola et al., 2020; Wilks et al., 2020). Other dilemmas involve conflicts where humans must weigh the lives of one animal species against another, for example, killing wolves in the interest of protecting livestock. When approaching such dilemmas, individuals may be guided by anthropocentrism (e.g., preferring the animal with greater utility for humans). Yet, research suggests people also consider the kinds of properties they believe animals possess—e.g., how intelligent or benevolent an animal is perceived—when deciding which animals to protect and value (e.g., Knight et al., 2004; Piazza et al., 2014; Possidónio et al., 2019).

The aim of the present research was to model a wide range of attributions people draw upon when evaluating the lives of different animals and required to choose between them. There is a great need to build a better understanding of how human valuing of animal lives changes developmentally, from early school age to adulthood. Children's perception of animals and judgments of their worth may differ in important ways from that of adults, but

little work has considered how children's appraisals of animal characteristics might impact on their judgments of animal worth.

Children's Knowledge and Evaluations of Animals

From quite a young age, children exhibit a deep fascination with animals. Children between one and three years show more interest in a living animal than a comparable toy (LoBue et al., 2013). Young children are able to distinguish biological entities from inanimate objects in their need for nutrition, capacity for growth, and autonomous movements (Hatano & Inagaki, 1994; Inagaki & Hatano, 2006). By school age, children have quite a rich understanding of the unique capacities of animals—in some respects, a more accurate understanding than adults (see Kellert, 1985)—and can reasonably discriminate animal attributes from human attributes (Hatano & Inagaki, 1994).

Children as young as age six are already drawing important attributional distinctions regarding different animals. Some recent work using the Child-Belief in Animal Minds scale suggests that children ages six to thirteen form opinions of which animals have richer versus lesser "minds," with regards to basic emotions and intelligence. For instance, children rated animals such as dogs and chimpanzees as having richer minds than animals like cows and frogs (Hawkins & Williams, 2016). At the same time, young children have been found to struggle with the concept of animal sentience (see Burich & Williams, 2020)—a critical aspect of mind attribution that adults often use to guide their moral concern for animals (e.g., Gray et al., 2007; Sytsma & Machery, 2012). By age six, children form opinions about which animals are dangerous that can impact on their dislike for certain animals (e.g., snakes) (Ballouard et al., 2015; Lee & Kang, 2012). Other work has shown that both children and adults alike preferentially attend to both fear-inducing animals (LoBue & DeLoache, 2008) and animals with "cute" or aesthetically pleasing features (Borgi et al., 2014). How these

varied attributions relate to the kinds of moral attitudes children have towards different animals remains a largely underexplored area of developmental research.

One recent study by Wilks et al. (2020) compared the way children value animal lives—specifically, pigs and dogs—in relation to human lives. They found, using moral dilemmas where animal lives were pitted directly against human lives, that young children were less speciesist in their valuing of animals to humans. However, the focus of this study was on speciesism (i.e., the extent to which children prioritise human life relative to animal life). It does not directly address the question of how children value different animal lives. Two further studies to date have examined children's preferences for different animal lives. However, both studies are limited in terms of how they inform us about which traits children prioritise in their moral decisions.

Borgi and Cirulli (2015) presented preschool-age children with randomly paired pictures of animals and asked them to select the one they preferred ("liked most"). The authors interpreted the resulting rank order as indicating a high preference for mammals over non-mammals (i.e., a similarity bias). This method is limited in that it relies on the authors' own interpretation of which attributions guided children's preference judgments. Moreover, we must exercise caution in equating liking of animals with moral concern.

Neldner et al. (2018) moved beyond preferences and utilised a measure that more closely reflects a judgment of *moral standing*. The authors asked children ages ranging from four to ten how much they cared for an array of entities. The authors found that children tended to care more about mammals than non-mammals—for example, they cared more about dolphins than lizards—though there was variability across age groups. Overall, the results give weight to the claim that children's moral concerns, like their preferences, reflect a similarity bias—a bias that has also been observed in adults (e.g., Miralles et al., 2019). However, Neldner et al.'s own interpretation of the animal rankings was that children had

given priority to “high sentience” over “low sentience” animals. Currently, the data remain agnostic with regards to which interpretation best accounts for the pattern.

One straightforward method to help disentangle competing accounts would be to have children themselves make multi-dimensional ratings of animal targets, rather than relying on the experimenters’ own interpretation. Such a method would allow us to test whether other inferred characteristics—beyond sentience and biological relatedness to humans—might contribute to children’s moral concern for animals. Indeed, in the present study, we sought to apply such a method to arrive at a more systematic, bottom-up assessment of the factors impacting on children’s valuation judgments.

While little is known about the dimensions that factor into children’s value judgments of animals, a growing body of research has examined the features that impact on adults’ moral concerns (Loughnan & Piazza, 2018). Key dimensions include the degree of “mind” an animal is believed to possess (e.g., Knight et al., 2004; Leach et al., 2021), how harmful or dangerous an animal is perceived (e.g., Piazza et al., 2014; Sevillano & Fiske, 2016), an animal’s aesthetic qualities (e.g., how “cute” the animal appears; Piazza et al., 2018), an animal’s status as a food source for humans (e.g., Bastian, Loughnan, et al., 2012; Bratanova et al., 2011; Ruby & Heine, 2012), and the degree of similarity perceived between the animal and humans (e.g., Bastian, Costello, et al., 2012; Tisdell et al., 2006). These dimensions seem to reflect biases among adults related to a tendency to value traits in animals that define what it means to be human (e.g., being smart and sociable; Haslam et al., 2008); a biophiliac tendency to appreciate animals that induce positive emotions (e.g., joy, tenderness) or fail to elicit negative emotions, such as fear or disgust (Ulrich, 1993; Wilson, 1986), and an appetitive orientation towards seeing animals as objects for human consumption (Loughnan et al., 2014; Loughnan & Piazza, 2018). Here, we sought to explore whether these tendencies might be present as early as six years of age.

Overview of the Present Study

We investigated a wide range of factors that might contribute to children's developing moral concern for animals. Drawing on previous work—most of which has focused on adult participants—we utilised a multitude of appraisal dimensions that children completed with regards to a broad set of animal targets, including vertebrate and non-vertebrate. The appraised animals were then ordered by children in terms of the target's *relative* moral standing (i.e., their moral standing vis-à-vis the other animals in the set). To investigate the developmental trajectory of children's concern for animals, we sampled children from two different age groups—younger and older school-age children—and compared their judgments with those of adults.

Our selection of attributional dimensions was guided by past research that relates, either directly or indirectly, to the evaluation of animal lives. Although these studies have been predominantly focused on adult judgments, we thought that this literature would be a suitable launching point for our developmental investigation. Our survey of the literature identified four subtopics that touch upon the perception and valuation of animal lives, including studies of (a) mind attribution and moral standing; (b) appraisals of animals used for meat consumption; (c) wildlife conservation decisions; and (d) the treatment of companion animals. Our review led us to identify seven unique dimensions that have the potential to empirically serve as orthogonal predictors of moral standing. These dimensions included an animal's perceived level of (i-ii) "mind" including the aspects of *intelligence* and *sentience*, with "sentience" operationalised in terms of the capacity to experience pain—an aspect of sentience that features prominently in debates about animal treatment (e.g., the sentience of fish; see (Lund et al., 2007), (iii) *benevolence* or an animal's perceived lack of harmfulness, (iv) *edibility* or an animal's status as a source of food for humans, (v) *aesthetic*

quality or an animal's perceived physical attractiveness, (vi) special or charismatic *physical abilities*, such as the ability to fly or run fast, and (vii) degree of *similarity to humans*.

Although these seven dimensions have been studied in isolated strands of research, and primarily with adults, we are not aware of any research that has sought to systematically model the moral import of such a wide range of dimensions within samples of children. Obtaining ratings of these attributes among a diverse set of animals, along with moral-standing judgements, allowed us to model which attributions directly fed into children's moral evaluations, and to compare their judgments with those of adults.

Method

Preregistration and Open Science

We preregistered our research objectives, recruitment strategy, methods, and analysis plan on AsPredicted [see https://aspredicted.org/blind.php?x=ek6wr3]. An anonymised version of our data set and copies of our research materials are available on Open Science Framework [see https://osf.io/vn32g/?view_only=65d780793e474a49a4bd7a0f15ef53cb]. This research was conducted within the guidelines of the Faculty of Science and Technology Research Ethics Committee at Lancaster University.

Participants

Our pre-registered recruitment strategy was to recruit a minimum of 200 children (n = 100 per age group) and 150 adults to have a 90% power to detect moderate size effects (f = .25) when comparing across a three-level (age group) between-subjects design using G*power (Faul et al., 2009). Past studies have observed moderate to large relationships between, for instance, perceptions of mind, benevolence, and moral standing (Piazza et al., 2014). We did our best to recruit roughly equal numbers of younger and older children. Table 1.1 presents gender distributions of our sample by age group.

Adults. Adult participants were recruited from Prolific Academic. We used Prolific Academic because it caters to workers living in the UK (Peer et al., 2017), which made it a reasonable comparison group for our children samples. One-hundred and sixty-one adults started the survey and 152 completed it (M_{age} = 34.70 years, *SD* = 12.19). Participants received £3 for completing the survey, which lasted approximately 20 minutes. The majority of the sample was British (76.3%); the remaining participants had a variety of nationalities. Ninety-two individuals (60.5%) were pet owners.

Children. We recruited 243 children from four primary schools in Lancashire, England. Schools were approached by the experimenter and invited to participate. Schools that agreed to participate were given study information sheets and consent forms to be sent home to parents. The rate of return varied between schools. Most schools returned approximately 30% of the consent forms, but one school returned about half. Children with parents who signed the consent forms were asked for their verbal assent before starting the study. Two children were removed, because they only partially completed the second task even with repeated prompts from the researcher, leaving a total of 126 boys and 115 girls. Ages range from 6.17 to 10.33 years (*M* = 8.33). Children were split at the mean age into younger (*M* = 7.83, *SD* = 1.15) and older (*M* = 9.03, *SD* = 0.48) (Table 1.1). One hundred and seventy-three children (71.8%) had a pet at home.

Table 1.1

Distribution of gender and demographic location by age group.

	Younger Children (6 to 8 years)	Older Children (8 to 10 years)	Adults
Male	69	57	55
Female	70	45	96
Total	139	102	151 (1 missing)
City	56	35	64
Small town or village	69	55	72
Countryside	13	11	16
Total	138 (1 missing)	101 (1 missing)	152

Materials and Measures

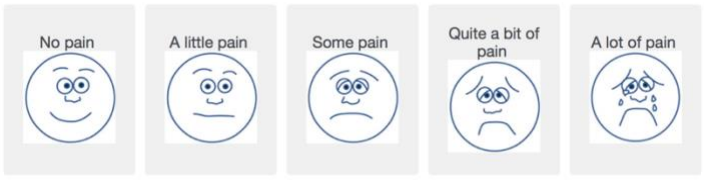
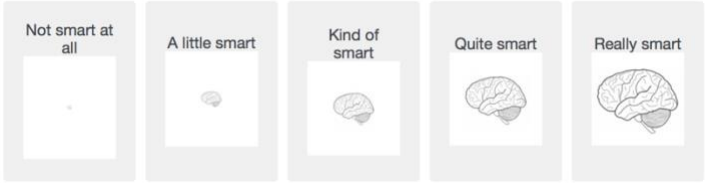
Animal images. Our set of animal targets was inspired by past stimuli used by Piazza et al. (2014, Study 1) and Borgi and Cirulli (2015). These two stimulus sets represented a range of animal types that appeared, at face validity, but also empirically, to differ in their degree of intelligence, sentience (capacity for pain), harmfulness, and similarity to humans. However, we had several ratings to collect for each target. Thus, to make the survey less onerous for children (we aimed for no more than 20 minutes per child), we sought to reduce

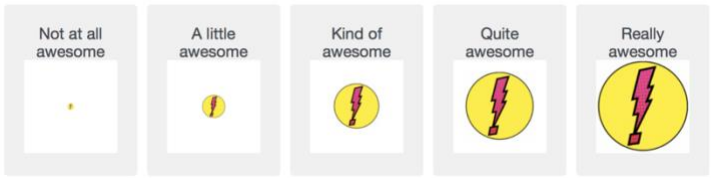
the number of animals in the set. We also sought to limit the number of mammals in the set out of concern for potential ceiling effects, such as judgments of pain and intelligence clustering at the upper bound of the scale. Our general aim was to provide sufficient coverage (low, medium, high) of each trait dimension across the entire stimulus set, while balancing these aforementioned concerns—a fuller description of our approach can be found in Supplementary Materials.

The final set included eight well-known mammals (dog, dolphin, elephant, monkey, pig, sheep, wolf, human), two birds (parrot, chicken), two herptiles (frog, lizard), two insects (bee, butterfly), a cephalopod (octopus), shark, arachnid (spider), jellyfish, and worm (19 total). We allowed our intuitions about each trait dimension to guide our selection (see Table S1 in Supplementary Materials for our expectations with regards to each animal target). Once the animal targets were set, we consulted the online, open-source image directory, Pixabay, to obtain a suitable image for each. In selecting the images, we applied a set of six criteria (see Supplements for details).

Table 1.2

Questions and scales used to measure each attributional dimension.

Variable	Question	Images used for Scales
Pain	If someone hit or kicked ANIMAL really hard, or stepped on ANIMAL, how much pain would it feel?	
Intelligence	How smart or clever do you think ANIMAL is?	

Harmfulness	How dangerous or harmful do you think ANIMAL is?	
Similarity	How much do you think ANIMAL is like you?	
Aesthetics	How ugly do you think ANIMAL is?	
Ability	Animals all have different abilities, horses can run fast, birds can fly, and some lizards can climb up walls. Let's think about ANIMAL's abilities. How awesome would you say those abilities are?	
Eat	Some animals we eat, like turkeys. Let's think about whether people eat ANIMAL. Do people eat ANIMALS?	Yes No
Edibility	How yummy (good) or yucky (bad) do you think ANIMAL would taste?	

Animal attributions. To make the materials more accessible to children, icons were used to correspond to each rung of a 5-point Likert scale to assist with comprehension (see Table 1.2). For ratings of pain capacity, emotion faces depicting gradations of pain were adapted from the Wong-Baker FACES scale (Wong & Baker, 1988). Faces depicting levels of disgust (at one end) to satisfaction (at the other end) were adapted from the DoctorYumProject (2018, March 14) to assess edibility. Ratings of harmfulness were communicated via faces ranging from happy to angry with green, amber, and red scaling. The other questions used pictures which increased in size to indicate the intensity of the answer. An image of a brain was used as the corresponding icon for the intelligence judgment; a cartoon image of two children was used for the similarity judgment; and a yellow circle with a pink lightning bolt (suggesting energy) was used for the ability judgment. A neutral, dark-brown circle was used for the aesthetic judgment to avoid biasing children's judgment in this domain towards a particular appearance or facial configuration.

Before answering the edibility question, children were asked whether people anywhere in the world eat the animal, to distinguish between their knowledge of the animal as a food source and their personal assessment of the edibility of the animal (which was the dimension of interest).

Background activities involving animals and meat. A series of questions were used to assess participants' background activities involving animals. The questions, adapted from Kellert (1985) and Daly and Morton (2006), related to activities in which participants might encounter animals or representations of animals in everyday life (see Supplements for details). Participants were also asked whether they had pets (yes/no) and, if so, they indicated which ones from a list of the following animals: dog(s), cat(s), bird(s), fish, small rodent (hamster, gerbil, mouse, etc.), reptile (turtle, lizard, etc.), amphibian (frog, newt, etc.), livestock (horse, sheep, goat, etc.), other type of pet. Finally, to give us some insights into

children's experiences with meat, we asked all participants (children and adults) how often they ate pork, chicken, beef, and lamb. Participants marked whether or not they ate these meat products, and, if so, they indicated how often (never, sometimes, often).

Procedure

Attribution task. Adult participants completed the entire study on the computer. For children, the rating task was completed on a tablet and the experimenter read the questions out loud to the child. They then selected the answer on their own by tapping the corresponding picture/point along the scale. If a child showed fear when rating the spider, the researcher used a white card to cover the image on the screen and, during the moral ranking task, the spider card was placed face down.

During the testing phase, participants were presented each animal target in a randomised order, with the human target always last, and they rated each target on a 5-point Likert scale for each dimension (Table 2). To reduce the length of the study for children, we created two subsets of ten targets, and randomly assigned children to one of the two subsets. The subsets consisted of nine animals and the human target. Half of the children completed each set (Set 1 [120], Set 2 [121]). Each page of the survey depicted a single question, with the image of the animal above the question prompt and Likert scale. The order of the questions was fixed, as presented in Table 2, and the procedure was repeated for all targets.

Moral ranking task. The moral ranking task required participants to value each animal life relative to the entire set of targets in the context of a life or death situation. In other words, the task forced participants to prioritise some animals' lives over others. The task was loosely inspired by the medicine allocation task used by Goodwin and Landy (2014) for different human targets.

Participants were presented with all 19 targets and given the following scenario:

Let's imagine for a minute that all the animals are sick. They all have a disease that is going to kill them unless we do something about it. Thankfully, we have some medicine that can help the animals get better. However, we can't help all the animals at the same time. We can only help one at a time. We are going to have to make some difficult decisions. Which animal should we help first?

Participants then placed all 19 targets in order from helping first to last. Adults completed this on the computer using a ranking procedure that required them to move each image of the animal, initially presented in a randomised order, into an order from the animal they wished to save first to the animal they wished to save last. Once they were satisfied with the order of targets, they submitted their response.

Children completed the task in person with the assistance of the experimenter. Children were presented laminated versions of the 19 targets. The cards were presented in a random display in front of the child (see Figure 1.1). Because participants were run back to back, a method was developed to shuffle the images from the preceding child. The cards were placed in a randomised fashion, so that there was no obvious pattern. This procedure sought to eliminate any instinctual reading of the cards from left to right.

The child was prompted by the experimenter to choose the target they would like to help first. The child either pointed, picked up the card, or voiced their selection. As cards were chosen, the researcher moved each selection to the top of the table. The cards were kept in sequence with each subsequent choice tucked partially under the last. This allowed children to review their answers at the end and make any unprompted changes they wished. At the end, the children were asked if they were happy with the order they selected. The experimenter avoided asking children if they would like to make changes, as children might infer by such a prompt that they should make changes.

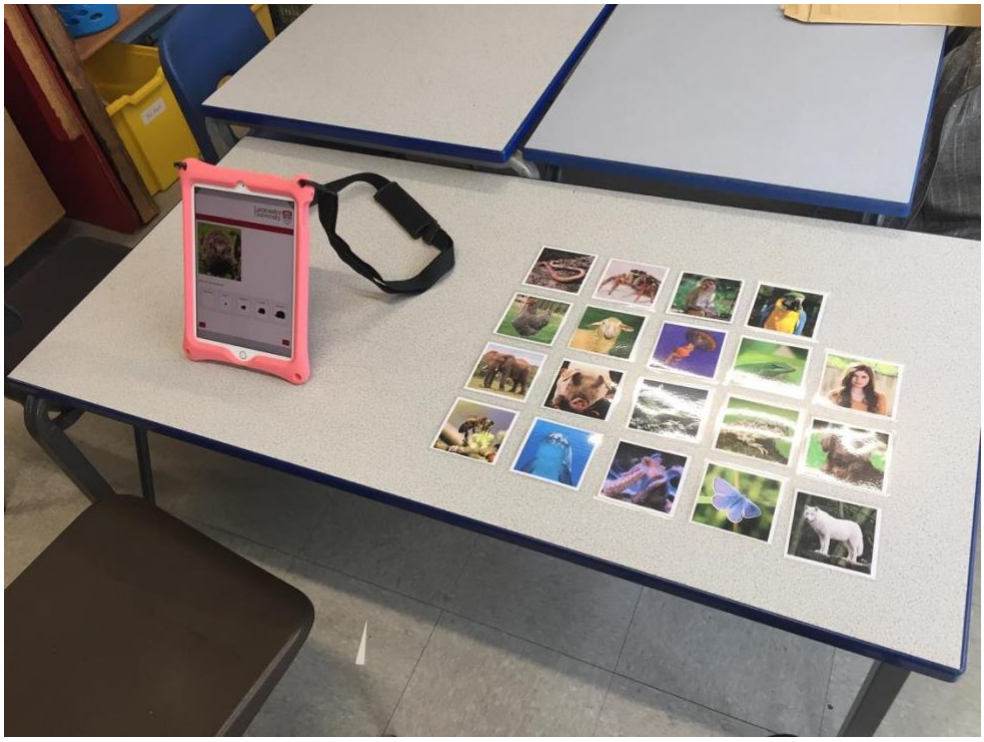


Figure 1.1. The experimental set up at a school. Cards were not displayed at the same time as the iPad during testing.

After completing the moral ranking task, participants completed the background animal activities questionnaire and demographic questions with regards to their gender, date of birth, and for adults nationality and ethnicity. Adults were debriefed, thanked and paid £3 for their participation. Children were debriefed, thanked and as gratitude to the participating schools, chocolates were placed in the break rooms for teachers to enjoy.

Results

Analysis Plan

Our main goal was to develop data-driven models of the attributional dimensions children and adults use to inform their moral valuations of animals. We used Structural Equation Modelling (SEM) to build structural models for each age group (e.g., Ullman & Bentler, 2003). These models could then be examined for commonalities and differences

across the three groups. Using SEM deviated from our preregistered analysis plan to use factor analysis and multiple regression, but it is in keeping with the intent of this plan.

To this end, we first established a set of criteria that could guide our model development (we elaborate the criteria below). As a first step in this process, we examined the raw correlations between the attribution dimensions and the moral concern rankings for each age group. We allowed these correlations to inform our decisions in the subsequent model-development phase. Throughout our analyses, we used the median ranking score for each animal target as our index of moral concern (for animal median-ranking scores by age group, see Figure 5). Because of the nature of the task (moving one animal up necessitated moving another down) the moral rankings for most of the animals across all ages were quite skewed, either positively or negatively. Thus, it could be argued that the median was a truer indicator of central tendency. Below we present the correlations first, followed by the model development, for each age group. The models were constructed using the lavaan package in R (R Core Team, 2020; Rosseel, 2012).

As a secondary analysis, in line with our preregistered exploratory aims and analysis, we contrasted the moral ranking structures and attribution patterns of each age group with Mann–Whitney *U* tests. We also conducted exploratory analyses of children's understanding of which animals are eaten, attribution patterns and moral rankings as a function of gender, and attribution patterns based on background activities involving animals. These latter analyses were conducted primarily for descriptive purposes, as we had no preregistered hypotheses regarding how gender or background experiences would impact on attributions made of different animals or the valuation of animal lives (see Supplementary Materials).

Step 1: Correlations between Attributions and Moral Rankings

Table 1.3 presents correlations between the mean animal attribute ratings and the median moral judgment ranking for each of our three age groups.

Table 1.3

Correlations of the animal attribute ratings and moral rankings by age group.

	Group	Pain	Intelligence	Ability	Similarity	Harmfulness	Aesthetic	Edibility
Intelligence	Children 6-8	-0.307						
	Children 8-10	-0.218						
	Adults	**0.432**						
Ability	Children 6-8	-0.093	**0.862**					
	Children 8-10	0.001	**0.868**					
	Adults	0.356	**0.879**					
Similarity	Children 6-8	0.015	**0.506**	**0.595**				
	Children 8-10	0.032	**0.653**	**0.587**				
	Adults	**0.692**	**0.825**	**0.616**				
Harmfulness	Children 6-8	**-0.482**	0.478	0.319	-0.319			
	Children 8-10	-0.385	0.420	0.267	-0.159			
	Adults	-0.205	**0.518**	**0.445**	0.193			
Aesthetic	Children 6-8	0.134	**0.560**	**0.618**	**0.797**	-0.260		
	Children 8-10	-0.062	**0.661**	**0.482**	**0.793**	-0.203		
	Adults	**0.532**	**0.486**	**0.473**	**0.646**	-0.121		
Edibility	Children 6-8	-0.381	-0.060	-0.209	0.207	-0.029	-0.029	
	Children 8-10	**-0.487**	0.025	-0.148	0.223	-0.106	0.232	
	Adults	0.436	0.115	-0.180	0.401	-0.021	0.042	
Moral rank	Children 6-8	-0.025	0.345	0.344	**0.763**	-0.419	**0.796**	0.019
	Children 8-10	-0.341	**0.523**	0.269	**0.757**	-0.041	**0.674**	**0.544**
	Adults	**0.690**	**0.717**	**0.477**	**0.944**	0.133	**0.597**	0.389

Note. Spearman's correlations are based on mean scores calculated for the seven variables for each of the 18 animal targets; that is, each target comprised a separate case (N = 18) for the seven measures. Bolded values are significant at $p < .05$.

Younger children. Younger children afforded *more* moral standing to animals when they were perceived as beautiful, benevolent, and seen as similar to humans. Pain capacity and edibility had nearly zero relationship with moral concern. Intelligence and ability were positively related to moral standing, but not statistically significant.

Older children. Older children afforded targets *more* moral standing when they were perceived as beautiful, intelligent, edible, and similar to humans. Attributions of benevolence, ability, and pain capacity did not significantly correlate with moral rankings.

Adults. Adults afforded *more* moral standing to animals that were perceived to be beautiful, similar to humans, intelligent, have the capacity to suffer, and have special abilities. Perceptions of benevolence and edibility had weaker associations with moral concern and did not reach levels of statistical significance.

Notably different from children, and something that informed our structural models, only adults perceived animal capacity for pain and intelligence to be positively associated. That is, for adults, the smarter the animal was perceived to be, the more it was deemed capable of suffering. Furthermore, only adults associated pain capacity with similarity to humans, whereas all three groups associated intelligence with human similarity. The relationship between intelligence and similarity was particularly strong for adults.

Attribution reduction. Ability was highly correlated with intelligence for all age groups (> .86). This created a potential issue of multicollinearity when trying to use both ability and intelligence in the structural equation models. Because intelligence had a larger and more consistent relationship with the moral ranking variable, across the three age groups, compared to ability, it was retained and ability was dropped from further analysis.

Step 2: Modelling the Development of Moral Concern

Our approach to model development was both theoretically and empirically driven. We considered insights from previous research on animal attribution, but drew also on the raw correlations we observed between our variables. Though the dimensions that we included in our study were guided by past findings, most of this literature has focused on adults, and thus we cannot assume *a priori* that they apply to younger participants.

A third criterion that we applied was, where possible, to treat similarity to humans as a 'higher order' (superordinate) variable that might be informed by 'lower-level' perceptual judgments. Our reasoning here was that similarity to humans is quite an abstract concept, not a feature that can be directly perceived in an animal, such as an animal's appearance, their physical abilities, etc. Thus, we sought where possible to model similarity as a dimension built upon other lower-level dimensions. For adults, intelligence had the strongest correlation with similarity judgments, whereas for children aesthetics had the strongest correlation with similarity judgments (see Table 1.3). Thus, intelligence may not be as relevant to children's concept of similarity as it is for adults—a finding which we sought to model more systematically via SEM.

Model fit statistics can be seen in Table 1.4. A detailed description of our modelling procedures for each group can be found in Supplementary Materials, and the best fit models are depicted in Figure 1.2 (adults), 3 (younger children) and 4 (older children).

Table 1.4

Model fit statistics of the Structural Equation Models by age group.

Model Description	χ^2 *(df)*	Comparative Fit Index	Root Mean Square Error of Approximation	Standardized Root Mean Square Residual	Moral R^2
Younger children					
Model 1 (Intel, Harm, and Aesthetic into Moral)	0 (0)	1.000	0.000	0.000	0.744
Model 2 (Sim assimilates Intel Harm and Aes)	7.87 (3)	0.886	0.300	0.065	0.635
Final Model (Aes direct to Moral; see Figure 1.3)	2.68 (2)	0.984	0.138	0.039	0.747
Older children					
Model 1 (Intel, Ed, and Aesthetic into Moral)	0 (0)	1.000	0.000	0.000	0.684
Final Model (Sim assimilates Intel and Aes; see Figure 1.4)	1.23 (2)	1.000	0.000	0.020	0.797
Adults					
Model 1 (Pain, Intel, Aesthetic, Ed Harm into Moral)	0 (5)	1.000	0.000	0.000	0.801
Model 2 (Harm dropped)	0 (4)	1.000	0.000	0.000	0.800
Model 3 (Sim assimilates Intel Pain and Aes)	6.38 (4)	0.957	0.182	0.042	0.826
Final Model (Aes direct to Moral; see Figure 1.2)	1.76 (4)	1.000	0.000	0.028	0.869

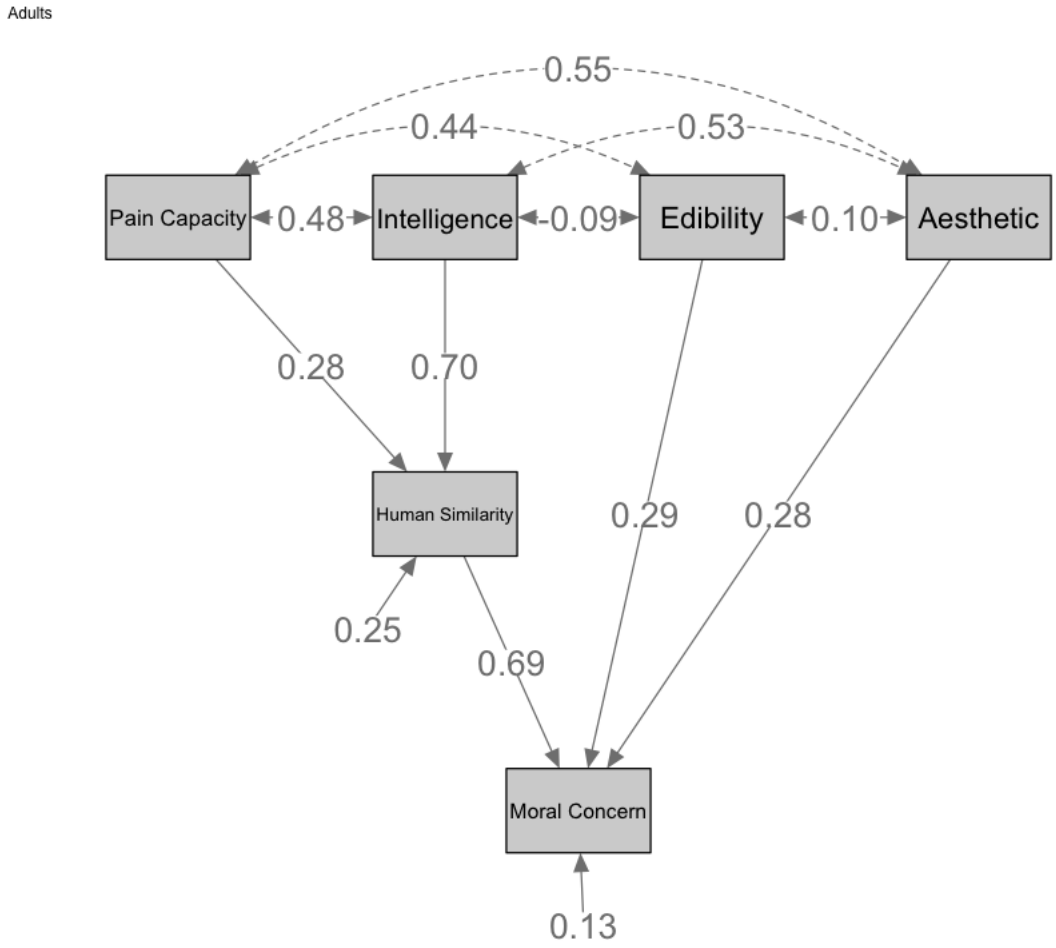


Figure 1.2. The best fit model of the attributional dimensions predicting adults' valuing of animal lives.

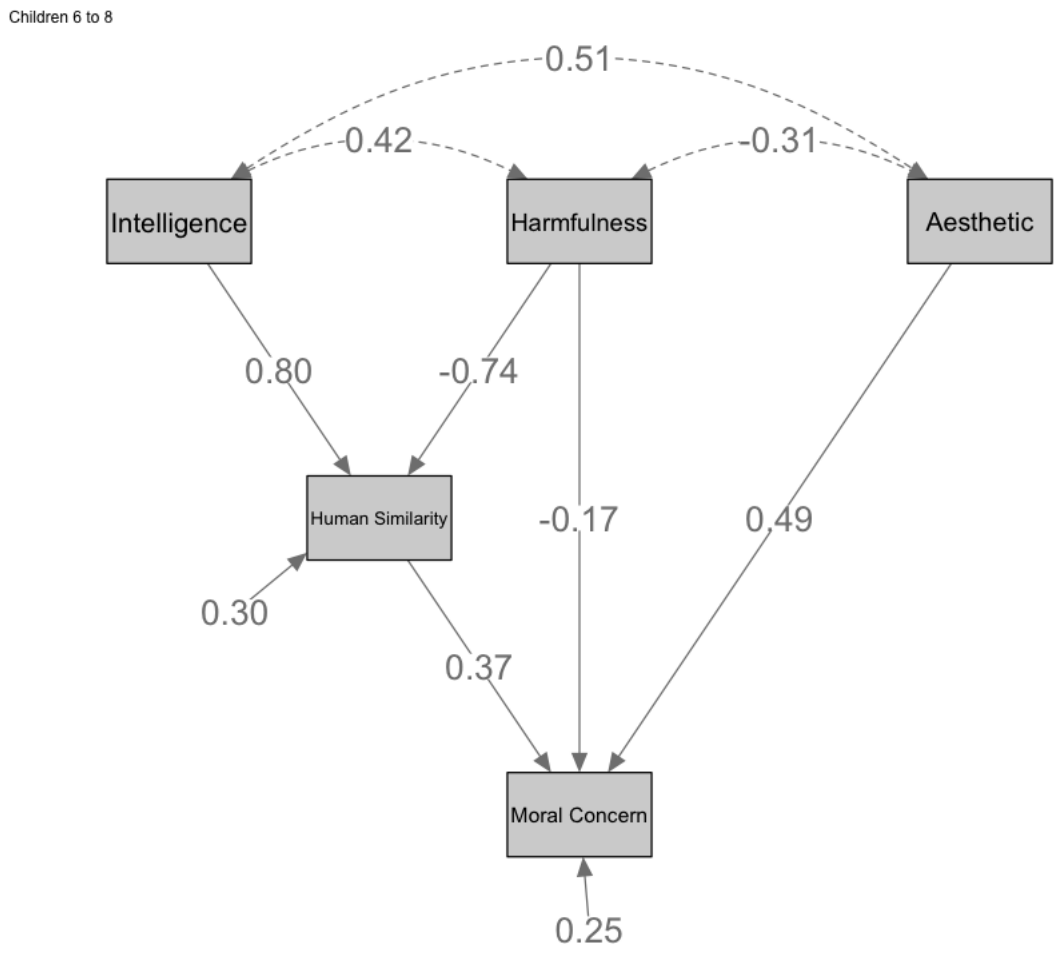


Figure 1.3. The best fit model of the attributional dimensions predicting younger children's valuing of animal lives.

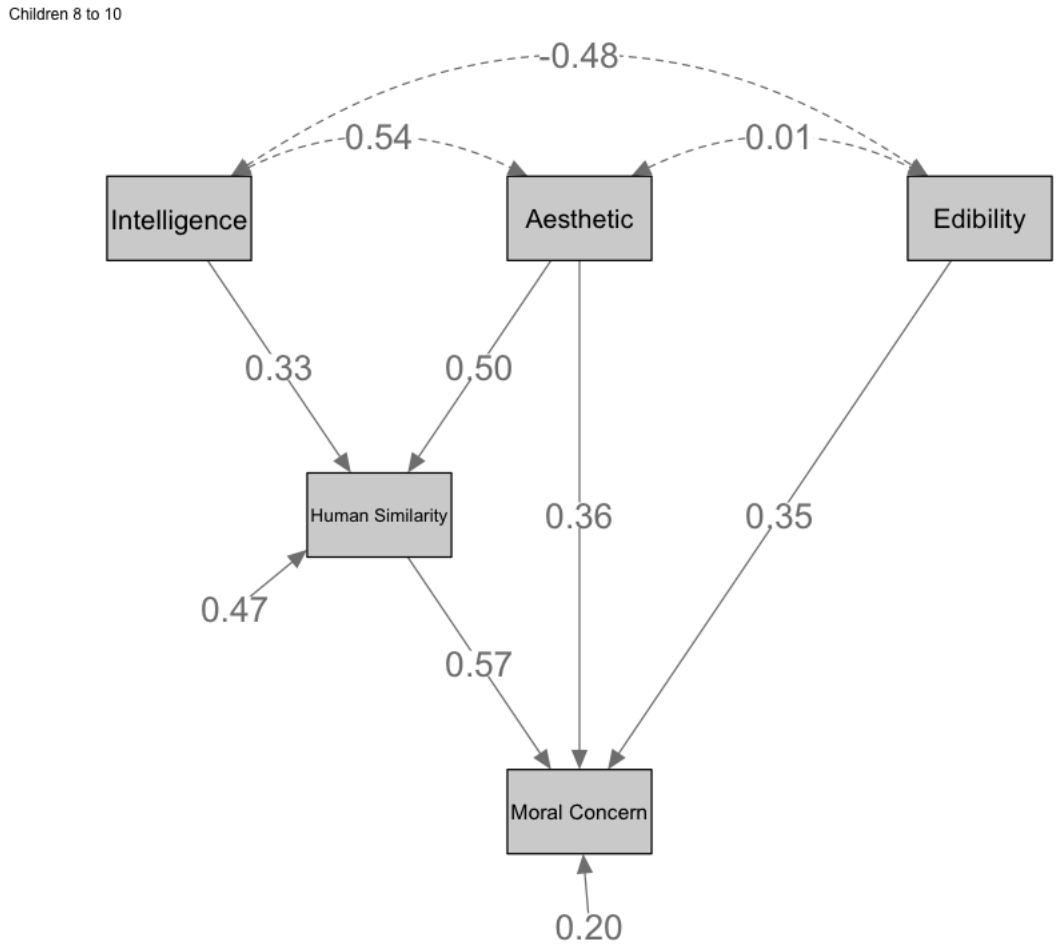


Figure 1.4. The best fit model of the attributional dimensions predicting older children's valuing of animal lives.

Summary of Modelling Results

Table 1.5 presents a summary of our SEM results by age group. In sum, younger children exhibited an attribution model that relied heavily on aesthetic judgments and an animal's similarity to humans. Young children's concept of human similarity entailed being intelligent and benevolent. Older children also valued animals high in aesthetics and human similarity. However, older children also factored in an animal's edibility and gave little weight to harmfulness, compared to younger children. Somewhat different from younger

children, older children conceptualised an animal's similarity to humans in terms of intelligence and aesthetics. Lastly, adults' moral concern for animals, like older children, was guided by human similarity, aesthetics, and edibility. However, for adults, human similarity was conceived mainly in mentalistic terms, i.e., the possession of intelligence and sentience. Neither younger nor older children factored sentience into their moral judgments or concept of human-animal similarity.

Table 1.5

Summary of results: Attributions predicting moral concern for animal lives by age group.

	Younger Children	**Older Children**	**Adults**
Predictive attributions:	Aesthetics Similarity -Benevolence -Intelligence Benevolence	Similarity -Aesthetics -Intelligence Aesthetics Edibility	Similarity -Intelligence -Pain Edibility Aesthetics

Animal Size and Capacity for Pain

Patterns in the children's ratings of the pain capacity of animals suggested that children may have used the size of the animal as a heuristic for guiding their judgments of capacity for pain. To explore this further, the first author ranked the animals by body size from 1 to 19, bees being the smallest and receiving that smallest number and elephants being the largest. This allowed us to correlate the size of the animal with the pain capacity ratings. The size and pain correlation for all children was r_s= -0.78, $p < 0.001$, with larger animals being rated as *less* capable of experiencing pain, while adults' pain judgments exhibited a small, positive, though non-significant, correlation with size, r_s= 0.32, $p = 0.18$.

Children's Meat Consumption, Understanding of Animal Products and Which Animals Are Eaten

Ninety-seven percent of our child participants ate at least one meat group at least sometimes (78% ate beef, 84% ate chicken, 78% ate pork, 36% ate lamb). Because almost all of the children in our sample consumed at least some meat, we did not explore the data in terms of children who do and do not eat meat.

Table 1.6 depicts children's understanding of which animals are eaten, relative to adults' understanding—the table is limited to animals that received at least 50% agreement by adults. As can be seen, relative to adults and older children, younger children had the lowest understanding of which animals are consumed by people. Chickens were the only animal that younger children understood were eaten at rates comparable to adults. Older children's responses more closely aligned with those of adults, though this was mainly the case for traditional farmed animals (chickens, pigs, and sheep) and octopus. Even older children struggled with the notion that other animals, such as sharks, frogs, and dogs, are eaten by people somewhere in the world.

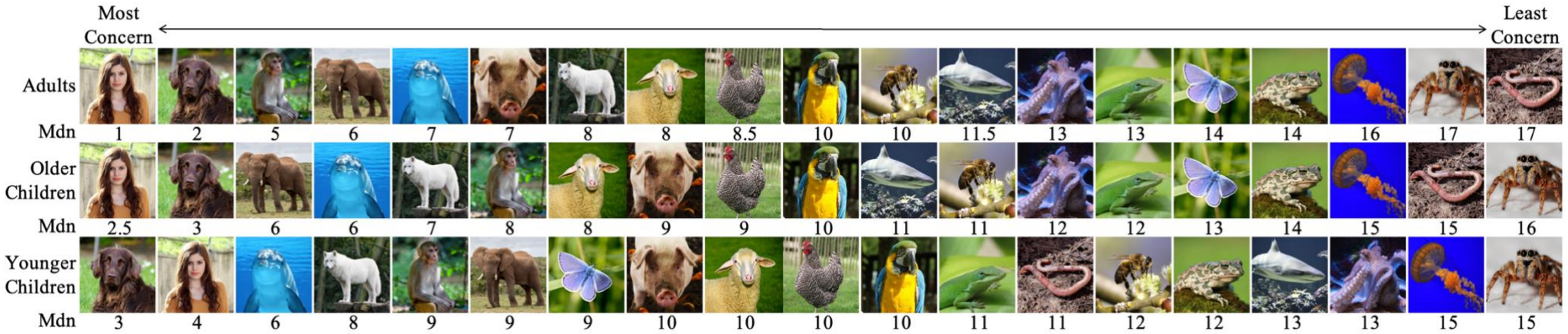
Spearman's correlations revealed that adults rated animals they identified as being eaten as more edible ("yummy") than animals perceived not to be eaten, $r_s = 0.73$, $p = 0.001$. This was also true for older children, though the association between edibility and food identification was weaker, $r_s = 0.56$, $p = 0.015$. Younger children exhibited a strong association between their edibility judgments and their identification of food animals, $r_s = 0.79$, $p < 0.001$. This may be because many younger children failed to identify animals eaten outside of their culture as food and their edibility judgments were mainly restricted to the animals they eat, whereas older children were more aware of animals that are eaten outside of their culture, though they do not personally consider such animals tasty.

Table 1.6

Knowledge of animals being eaten and edibility scores by age group. Targets include those animals that at least 50% of adults said are eaten by people.

	Adults			**Older Children**			**Younger Children**		
	Eaten	Edibility		Eaten	Edibility		Eaten	Edibility	
		Mean	*SD*		*Mean*	*SD*		*Mean*	*SD*
Chickens	100%	4.52	0.86	91%	4.13	1.21	91%	3.97	1.38
Dogs	61%	1.78	1.05	36%	1.71	0.90	14%	1.35	0.67
Frogs	86%	2.18	1.17	49%	1.53	0.83	41%	1.84	1.10
Octopuses	98%	2.78	1.37	85%	2.75	1.35	63%	2.58	1.49
Pigs	100%	4.38	1.03	96%	3.82	1.28	80%	3.48	1.61
Sharks	82%	2.44	1.18	58%	2.35	1.06	48%	2.00	1.05
Sheep	97%	3.78	1.31	85%	3.06	1.41	73%	2.96	1.57

Figure 1.5. Animal target median rankings by age group.



Developmental Comparisons of Moral Rankings by Animal Target

The median rank that each animal target received by age group is presented in Figure 1.5. Overall, the order between the age groups looks remarkably similar with mammals at the top and invertebrates at the bottom and birds, fish, reptiles, and amphibians in between, though with some notable exceptions (e.g., bees were ranked in the mid-range for most groups). A few developmental differences stand out. Younger children placed the dog first on the list whereas adults and older children have humans ranked first. Additionally, younger children valued worms and butterflies much higher than older children or adults. Another important distinction is the shape of the ranking distributions. The rankings of adults and, to some extent, older children were fairly spread apart suggesting clear demarcations in the valuing of some animals over others. However, the rankings of younger children were bunched more closely together suggesting greater overlap in how younger children valued the animals.

A scatterplot of the animal targets depicting the strength of the relationship between the relevant dimensions from our structural models and the moral ranking task can be viewed in Figure 1.6, presented as a function of age group. Several developmental trends can be observed. First, in terms of discontinuity, harmfulness factored negatively into younger children's moral judgments of animals but the impact of harmfulness reduced, with older children, and nearly reversed, with adults. Edibility emerged as a relevant correlate of moral concern in older children and continued into adulthood. In terms of continuity, aesthetics and similarity to humans emerged as strong predictors of moral concern in younger children and remained strong predictors into adulthood.

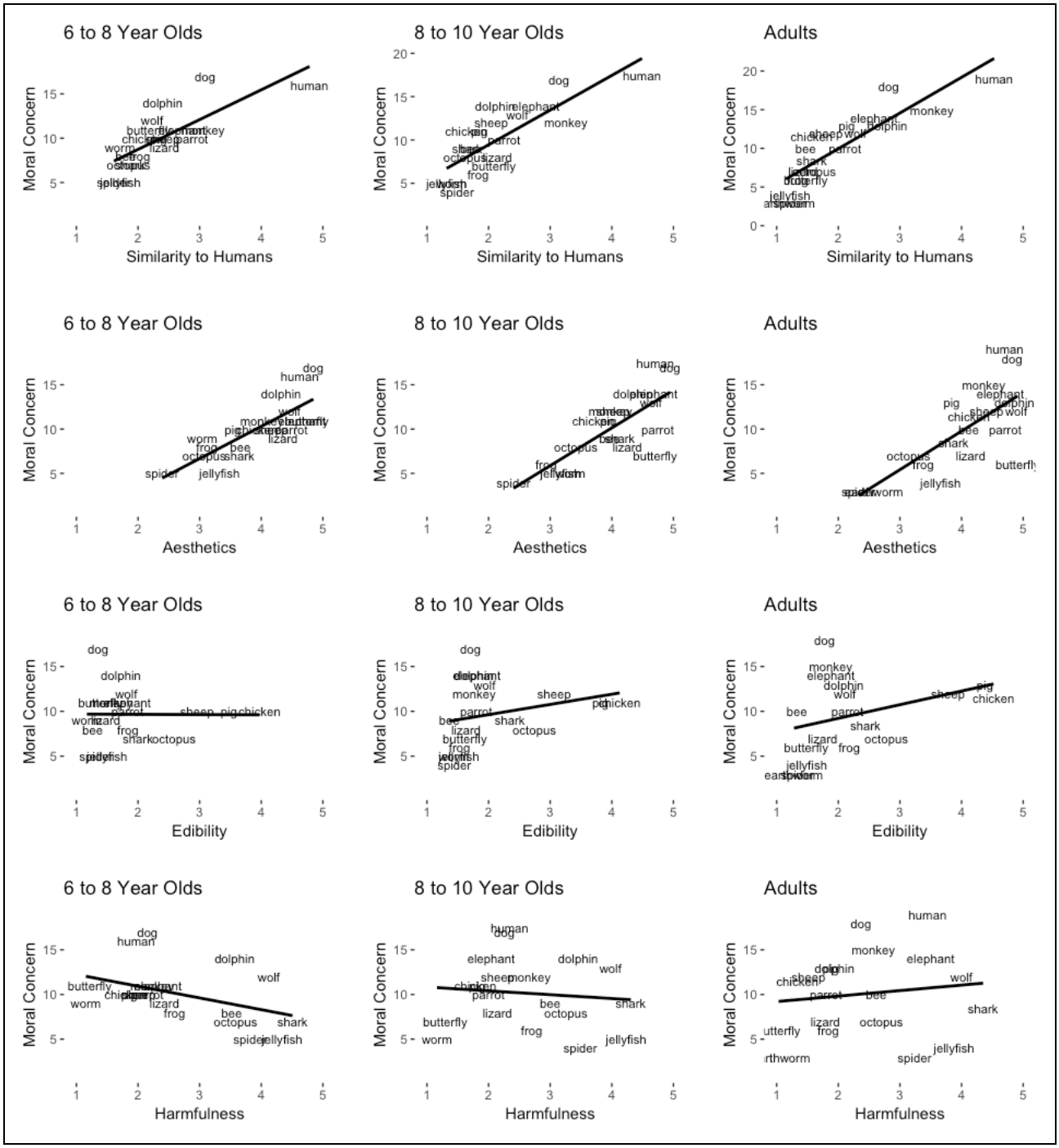


Figure 1.6. Scatter plots of the animal targets based on the relationship between moral concern and the relevant dimensions from the final structural models, by age group. Regression lines added.

Supplemental Information on Gender and Background Activities Involving Animals

See Supplemental Materials for details. In general, gender had little effect on animal attributions and rankings. Participating in benign activities with animals tended to promote positive attributions of animals' abilities, intelligence, and aesthetics, for older children and adults, but had little impact on younger children's attribution tendencies. Owning a pet also impacted positively on ability judgments, but only for adults.

Discussion

The present study investigated the factors that enter into children's moral concern for animal lives, and developmentally modelled this concern from school age into adulthood. Though children tended to organise the animals in a similar structure to adults when creating their moral hierarchy, they used somewhat different criteria to reach those conclusions. First, though participants of all ages elevated aesthetically pleasing animals and those that have similarities with humans, this emphasis on the aesthetic qualities of animals was especially pronounced among young children (ages 6-8). Furthermore, the manner in which children (younger and older) construed human-animal similarity differed from adults. Adults tended to view human-animal similarity strictly in mentalistic terms, that is, as a matter of possessing intelligence and sentience. By contrast, children of all ages failed to relate sentience (measured as the capacity to experience pain) as a human feature. Moreover, sentience factored little into children's moral valuations of animals, and, if anything, the relationship between sentience and moral standing was negative among children. When we explored children's attribution of pain capacity more deeply, we observed that it was guided by a simple body-size heuristic: children intuited that larger animals experience less pain than smaller animals. This might reflect an intuition among children that smaller animals are more physically vulnerable than larger animals. The way we phrased the sentience measure (how much the animal would be hurt if someone hit, kicked, or stepped on it) may have contributed

to this intuition. By contrast, adults associated body size to some extent with *higher* levels of sentience, and they tended to view sentience as a concomitant of intelligence: smarter animals were perceived as having a greater capacity to experience pain. This positive relationship between intelligence and sentience has been consistently found among adult participants (e.g., Bastian et al., 2012; Piazza et al., 2014). The absence of this relationship among children is intriguing, and it seems to be consistent with a recent study which found that children under age 7 tend to struggle with the concept of animal sentience (Burich & Williams, 2020). Yet, further research is needed to clarify whether alternative assessments of sentience might yield different results (see Limitations below).

Participants of all ages showed greater concern for beautiful animals. This is consistent with past perspectives on biophilia and biophobia (Ulrich, 1993; Wilson, 1986), which considers how humans connect to and avoid aspects of the natural world that facilitate human flourishing. Research in this area has shown that both children and adults place great emphasis on certain physical attributes of animals indicative of safety, such as perceiving a baby-like appearance (Borgi et al., 2014), or that induce positive emotions, such as perceiving warm colours in penguins (Stokes, 2007). Children as young as five experience a range of emotions towards animals, with aesthetically positive animals (e.g., penguins) eliciting joy and interest, and threatening and aesthetically negative animals (e.g., snakes, insects) tending to elicit fear and disgust (Olivos-Jara et al., 2020). Like adults, children as young as 3-years of age have been shown to preferentially attend to dogs and cats that have been enhanced to exhibit “cute” features (Borgi et al., 2014). In turn, the perception of baby-like or “cute” features in animals has been associated with positive outcomes related to caretaking of companion animals (Thorn et al., 2015), rejection of farm animal slaughter (Piazza et al., 2018), and protective feelings towards a broad range of animals (Possidónio et al., 2019).

Here we observed a developmental trend whereby younger children highly prioritised aesthetics when forming moral decisions about which animals should be valued and protected. This emphasis on aesthetics was stable with age, yet older children and adults shifted their focus to include more appetitive and mentalistic features, i.e., edibility and intelligence. This seems to be a developmental shift in emphasis as opposed to qualitative shift—older children still value animal aesthetics, however, their moral evaluations begin to take on board additional concerns, such as the utility humans derive from domesticated animals. They also tended to construe beauty as a feature that certain animals share in common with humans. Thus, their appreciation of aesthetics in animals begins to take on an increasingly human-centric quality.

Related to the notion of biophobia, younger children also tended to value animals that they perceived to be benevolent, whereas older children and adults did not put as much weight on this feature. It is generally within early to middle childhood (e.g., 5-10 years) that children's phobias for particular animals (e.g., snakes, spiders) emerge and heighten (Askew & Field, 2007), though attentional biases in detecting threatening animals are present even earlier (LoBue & DeLoache, 2008). Consistent with this developmental timing, Lee and Kang (2012) found that children at the age of 6 exhibit an orientation towards features in animals indicative of threat (e.g., the presence of claws or sharp teeth), and they associate these features with valenced judgments of animals as "bad." Thus, our younger children may be exhibiting a heightened sensitivity to potentially threatening aspects of animals and allowing these attributions to influence their moral considerations about which animals are deserving of their concern.

That participants of all ages valued animals that shared qualities with humans aligns in some ways with the studies by Borgi and Cirulli (2015) and Miralles et al. (2019), which found that animals phylogenetically similar to humans (mammals) were liked over animals

more biologically distal (birds, reptiles, insects) among toddlers and adults (respectively). It also aligns with developmental perspectives suggesting that a preference for similarity in human-human affiliations emerges quite early in development (Fawcett & Markson, 2010) and can bias attitudes regarding how individuals are treated (Hamlin et al., 2013). However, we found that the moral judgments of younger children placed *relatively* less emphasis on animals' similarity with humans, compared to older children and adults. This reduced emphasis on similarity may be reflective of a lesser degree of speciesism among our younger children. Wilks et al. (2020) found that children ages 6-10 valued animal life *in its own right,* relative to human life, more so than adults did. Wilks et al. speculated that the speciesist tendency to value human life over non-human animal life, appears to have a fairly late developmental origin.

Our findings add to this perspective by showing that younger children seem to value animals less through a human-centric lens compared to older children and adults. In fact, younger children tended to value dogs over humans, somewhat, in our medical intervention task, while this was not the case for older children and adults. Furthermore, we found that children's concept of what it means to be humanlike, differs from that of adults, which focuses more exclusively on the mentalistic properties of animals. By contrast, children seem to consider a wider range of properties, such as benevolence and physical appearance, as qualities that animals and humans share, and their moral judgments of animals seem to encompass these broader, non-mentalistic properties to a much greater extent. This increasing emphasis on an animal's mind with age may be an extension of children's maturing ability to reason about the minds of others (see e.g., McAlister & Peterson, 2007; Wellman et al., 2001), but it also likely reflects their increasing tendency to value qualities they associate with the dominion or supremacy of humans, which, for many adults, involves

traits related to humans' superior ingenuity and cognitive capacities (e.g., Haslam et al., 2005; Haslam et al., 2008).

Finally, different from the younger children, older children (ages 8-10) appreciated that some animals provide a utility to humans as food—a factor that entered into adults' evaluations. This pattern among our older children may reflect older children's growing awareness and appreciation of the use of animals as food. Compared to our younger children, who struggled with identifying which animals are eaten, our older children exhibited a richer understanding of which animals are used for human consumption. Years 5-10 appears to be the period that many children come to associate animal products with their animal origins, to have conversations with their parents about meat (Bray et al., 2016), and make decisions for themselves to avoid meat (Hussar & Harris, 2010). Thus, the emerging moral use of edibility information among the older children may be partly attributed to their greater awareness of the origins of meat. Yet, this result might also be indicative of a budding speciesism among older children. Consistent with a speciesist perspective, older children appear to consider not only the ways in which animals are *like* humans, but how they *benefit* humans when making judgments about their moral worth. Thus, our findings seem to reflect both a greater awareness of the animal origins of meat among older children and their greater valuing of the role meat plays in their life and wider society.

Strengths, Limitations and Future Directions

Two strengths of our study are that we utilised a naturalistic animal valuation task and had our participants form multiple ratings of each animal target, which could then be correlated with valuation judgments. Using this method, we were able to move beyond experimenter interpretations of participants' moral decisions. In this manner, our findings both align with and help elucidate past findings (e.g., Neldner et al., 2018). Our findings help clarify that children's evaluations of animal lives do indeed take into account the perceived

richness of animal minds—though children's attribution of mind appears to focus on animals' abilities rather than their sentience. Moreover, children's moral evaluations were not limited to mind attributions. They were also affected by appraisals of animal benevolence, physical attractiveness, and (for older children) edibility. Thus, our methodology helped to clarify the multi-dimensional nature of children's valuations.

A methodological limitation of our study concerns the number of animal targets employed and the use of single items to assess each attribution dimension. This was done to keep the study to a reasonable length for children. Our preliminary search for suitable targets began with fifty-five animals (see Supplementary Materials), but for practical purposes, we limited the set of animals to nineteen (ten per child) and the set of attributions to seven (70 total ratings). This inevitably led to a reduction in the diversity of animal species that could be sampled and modelled. The decision to use one item per attribution dimension may have presented a particular limitation for our assessment of sentience and intelligence. While our measure of sentience in terms of the experience of pain in response to bodily insults has face validity and is in keeping with philosophical definitions of sentience (e.g., Walters, 2018), alternative or wider assessments of sentience that expand the set of bodily insults (e.g., cutting part of the body; Villar et al., 2018) or the quality of experiences (e.g., to include emotions beyond pain), might return different results than observed here. Having children focus on the emotional capacities of animals, for instance, might redirect children to focus more on the mentalistic qualities of sentience, as opposed to concentrating on the animal's body size as a moderator of pain experiences. Furthermore, expanding the assessment of animal intelligence to include a variety of cognitive, behavioural, and social abilities (e.g., see Leach et al., 2021) would provide a more fine-grained assessment of children's ability to reason about the minds of animals and the role such attributions play in their valuing of different animals.

Another limitation was that we allowed past research to guide our methodological decisions about which attribution dimensions to include as appraisals, rather than developing a purely bottom-up procedure to guide our decisions. Future research should consider potentially expanding the set of attributions considered, for example, by first gathering participant-generated characteristic judgments prior to modelling their relevance for moral evaluations. Familiarity with an animal is an attribution dimension we did not include but might be considered. At least one study with adults (Possidónio et al., 2019) found a weak, albeit significant, tendency for familiar animals, across 120 targets, to be judged acceptable to kill for human consumption. Thus, future studies should consider how familiarity with an animal might impact on children's concern for animal lives.

Finally, our findings are limited by the focus on Western populations, which poses constraints on how widely we can generalise the results (Simons et al., 2017). Cultures of course vary in terms of which animals are categorised as food and non-food, and which animals are ascribed an elevated status (e.g., the sacred status of cows and elephants for Hindus; Manokara et al., 2021). These cultural differences would inevitably impact on how children value different animal lives, via the edibility ratings they make and possibly additional attributions not captured in the present investigation (e.g., sacredness). Future research should continue to explore the factors guiding children's judgments of animal lives in different cultures, as attitudes towards animals, their use and capacities, can vary between countries as much as within (e.g., Phillips & McCulloch, 2005).

Conclusion

Our findings highlight a number of ways in which children's concern for animal life differs from that of adults. When deciding which animals deserve protection, young children ages 6-8 appear to prioritise several non-mentalistic properties, including the aesthetic qualities of animals and the potential threat they pose to personal safety. By contrast, older

children ages 8-10 begin to place greater emphasis on the mental capabilities of animals and the potential utility of animals as food for humans. This emphasis on the mental life of animals and their utility appears to strengthen further in adulthood. At the same time, there was great continuity in the way children and adults prioritised animal life, as adults' moral evaluations were still affected by their aesthetic appraisals, and even younger children factored animal intelligence into their decisions to some degree—though children's understanding of sentience was notably different from that of adults. Finally, all ages displayed a human-centric concern for animals, as animals sharing qualities with humans were highly valued. Yet, this speciesist bias was least pronounced among younger children, and children's notion of human similarity differed from adults in its non-mentalistic focus. Overall, our findings suggest that the manner in which adults approach the valuation of animal life has its origins in early childhood, yet there is a gradual shift towards greater appreciation of animal minds, a mentalistic notion of sentience, and the utility that animals offer humans.

Study Two: A tale of two birds: Children's and adults' motivated use of intelligence information when valuing animals we eat vs. do not eat

Overview

From Study 1, we found that between the ages of 6 and 10 years old children are developing an understanding of which animals are eaten. We wanted to further explore the connection between children's understanding of meat and how they understand and value an animal's intelligence. We were also interested in how children's awareness (or lack of awareness) of the status of an animal as food they eat (e.g., chicken) might impact on their moral attitudes towards how an animal is treated. By devising a scenario in which children learn about an animal that is understood to be a food source and an animal that is not, we could see how this factor impacted the children's moral concern for the animal and whether the personal use of the animal as food affects their judgments in the way it is known to affect adults.

Introduction

Children's animal directed mind attribution.

Children are able to discern that others have minds from the age of 4 years old (Astington & Hughes, 2013). Children can also generalise their own understanding of minds on to the animals they interact with. They can attribute active imagination and desires to animals and determine that even animals have needs of their own (Myers, 2007). Children also are able to distinguish a difference between animals and inanimate objects and differentiate belief those entities mental states (Sommer et al., 2019)

Children's perceptions of animals and how they perceive different animal attributes has been under researched. What research exists shows that children are ingrained to see different characteristics between different animals, starting with obvious ones, such as the

sound of a hissing snake, which are animals that might be a threat to children (Erlich et al., 2013). Children as young as 3 years old will focus on a living animal more than a robot that is moving around (LoBue et al., 2013) because they pay attention naturally to animals in the world around them. Their understanding of distinctions between animals develops further when they make differentiations between other humans and non-human animals (Hatano & Inagaki, 1994). Children also have shown empathy and concern towards animals (Myers, 2007).

Differences in children's and adults' mind attribution.

Adults have a complex structure they use when determining animal intelligence and sentience, such as the ability to become distressed and feel pain (Duncan, 2006). Children, however, struggle with the concept of sentience and seem to use a heuristic based on size, in which, the smallest animals feel the most pain (discussed in Study 1). Children between the ages of 9 and 11 years old have been shown to increase their reliance on an entity's mental capacities to perceive, suffer, and think when assigning moral status to them (Olthof et al., 2008). While 9-year-olds focus on the entity's ability to suffer, 11-year-olds use the entity's ability to suffer but also focus on the entity's ability to perceive. By introducing a novel creature, Olthof et al. (2008) were able to control whether the entity could perceive, suffer, and think. The children were asked how wrong, guilty, and ashamed the person in the story who bumped, hit, or kicked the entity would feel. Eleven-year-olds judged it wrong to injure the entity that could only see and hear while the 9-year-olds only judged it wrong if the entity could, in addition to seeing and hearing, could also feel pain. The researchers also compared this to adults and found that the adults only felt it was wrong when the entity could not only suffer but also think.

Animal attributes, mind perception, and moral judgment

As we observed in Study 1, there is a whole host of attributes that affect adults' perceptions and moral judgments regarding animals. These include, among a number of other factors, intelligence, sentience, aesthetic qualities, similarity to humans, and edibility. When people are making moral decisions about animals they may choose to highlight or ignore a number of these factors. They may place greater value on a select few attributes. In Study 1, we found that while all ages used intelligence information when valuing animals, adults prioritised this information most, followed by older children. While the youngest children based their value judgments on animal intelligence, their judgments were also guided by less abstract things like appearance and how threatening an animal might be to them. We also found that the youngest children did not use an animals' category as a food animal in their judgments of moral status. The older children started to shift their reliance on the edibility status of the animals more similarly to the way it was used by adults.

Comparing how children interacted with a real animal compared to a robot that looked like an animal, Melson et al. (2009) showed that children were able to differentiate and gave more moral consideration to the real dog. They found that the children made different moral decisions when confronted with a robot dog that could move and respond to commands and a real dog. The children placed value on the sentience of the real dog. Children can also show moral concern for animals when they choose between alternatives within the context of a moral dilemma. Wilks et al. (2020) systematically varied the ratio of humans one could save relative to dogs or pigs and found that children were more willing to save the animals compared to adults. The children tended to value human and animal lives equally. They were torn when the ratio of lives one could save was 1:1. When the ratio increased, e.g., 1:2, they tended to save the greater number of lives irrespective of the species (person vs. animal). By contrast, the adults tended to value the life of people more than

animals, and only deviated from saving human lives when the ratios were dramatically in favour of the animal (e.g., 1 human: 100 dogs). This reveals that children are less speciesist in their moral judgements as their decisions, relative to adults, were more influenced by the number of lives one could save, as opposed to species membership.

Categorising animals

Children almost immediately start to organise their world into categories (Murphy & Lassaline, 1997). Categories expand and differentiate and narrow with understanding as children develop. An easy description of this is a superordinate category such as the moving animal with four legs category, this category has been called dog and when the child sees a cat they say, “look, dog.” This of course is a very simplified version. After being corrected, the child can expand this into subordinate categories of dog or cat, but they will both be under the category of animal or mammal or fluffy cuddly thing. This differentiation and combining will continue until children fully understand their world. At the end of childhood, children hold very complex categories about the world around them.

Speaking to the complexities of some categories, McGuire et al. (2022) found that children are more likely to categorise food animals as pets than adults. However, at some point children will have to combine their understanding of animals and their understanding of meat, and research shows even adults struggle with integrating meat and animals (Bray et al., 2016). Habituation to meat products as food and not animals, and the removal of animal reminders within modern consumer environments (e.g., packaged and highly processed meat at supermarkets) serve to psychologically diminish the connection between meat and its animal origins (Kunst & Hohle, 2016; Piazza et al., 2021). However, adults may at times experience cognitive dissonance when they think about animals in the context of meat and the potential harm inflicted on animals to produce it (Dowsett et al., 2018; Rothgerber, 2014).

Dissonance is an uncomfortable state of awareness about one's role in causing a negative event (Cooper, 2007). Most people show concern for animal welfare and even believe that farmed animals should be treated humanely, but their actions of consuming meat are counter to their sentiments (Rothgerber & Rosenfeld, 2021). When people experience meat-related dissonance, they often engage in efforts to reduce it. One dissonance-reducing mechanism studied by researchers is the motivation to deny the animals we eat "mind," i.e., to question the sophistication or trivialise the importance of animal minds (Bastian, Loughnan, et al., 2012). Mind denial appears to be one consequence of categorising animals as "food" (Bratanova et al., 2011). According to Rothgerber (2020) children may use categorisation, separating animals into different groups, in order to deal with cognitive dissonance, as adults do. Children may be encouraged to dichotomise animals they encounter as pets or farmed animals and attach more value to those not used for food. In doing this, Rothgerber says, children may develop less affection toward farmed animals and thus be less traumatised upon learning the origins of meat. Rothgerber put forward that children need to have four qualities in order to have cognitive dissonance. They have to eat meat, understand that meat comes from animals, they have to love animals, and they have to be able to experience dissonance in general. With regards to the experience of dissonance, children's experiences with and knowledge of meat have to be sophisticated enough for them to realise their actions (of eating meat) are in conflict with their ideals of not harming animals. One of the themes running through the present research is to consider whether school-age children have a sophisticated enough understanding of meat to be motivated to engage in self-serving efforts to treat food animals differently than non-food animals.

Children's understanding of animal meat consumption

Children's understanding of animal and meat consumption has been under researched because of the sensitive nature of the topic. Studies have been conducted that rely on parents

recall on the *way* they teach their children, *when* they teach their children, and *what* they teach their children (e.g., Bettany & Kerrane, 2018; Bray et al., 2016). Some parents—for example, rural, farming communities—are comfortable having conversations with their children about where meat comes from by the age of 5 years old, while other parents will not approach the topic until the child has already learned about the origins of meat somewhere else, perhaps around age of 7 or 8 years old (Bray et al., 2016). Thus, there is likely a great deal of individual variability in terms of developmental timing of learning that the animal and the food are the same.

Evidence that children do understand that animals are slaughtered for their meat is the existence of vegetarian children that chose to be vegetarian without influence of parents or other family members (Hussar & Harris, 2010). Bray et al. (2016) notes that children who discover the origins of meat sometimes will refuse to eat meat for a time. Vegan adults often reported having a "meat epiphany"—a moment when they realised that meat involved animal slaughter—that began their journey towards veganism (Pallotta, 2008). In Study 1, even young children understood that chickens are consumed by people at rates comparable to adults. Older children understood other animals like pigs, sheep, and octopuses were consumed at rates similar to adults. However, older children had less understanding than adults about consumption of animals that were not consumed in their culture. Rothgerber (2020) argues that children may learn that animals in general are used for meat, but children may not fully understand which animals relate to specific types of meat. From our own research (Study 1), we see that children are progressively learning which animals are used for meat at different rates—for example, with young children identifying certain animals (e.g., chicken) as "food" earlier than other animals. By earlier adolescence (older children), their knowledge of which animals are eaten was richer, more accurate and extended beyond their own cultural boundaries. Indeed, Burich and Williams (2020) found that while children

empathised with animals and understood the sentience of farm animals, the younger children in the study lacked the knowledge of the treatment of the animals on the farm. They also found that children over 10 years old engaged in discussions about the ethical treatment and slaughter of animals for food. This is similar to the way adults take steps to mitigate the harm being caused (improving living conditions of animals while they are alive) while still engaging in practises that hurt animals (eating meat) (Bastian & Loughnan, 2017).

The emergence of children's understanding of where meat comes from appears to begin around 6 years old. Hahn et al. (2021) found that children from 4 to 7 years old had little understanding of animal-based foods and animals that are used for food, however this knowledge progressively increased within their sample with age. The researchers wanted to look at how children were categorising the items that they were given into plant/animal and food/not food. In order to ensure that even the youngest children could understand the task, the researchers made an effort to simplify the tasks. The children sorted pictures of food items into boxes covered in animal hair or plants and also sort the pictures of items that were edible or not into receptacles in the shape of a mouth or a garbage can. When examining the results, the researchers noted that their younger group of children had made more categorisation errors in sorting the animal-based foods and animals that are eaten into the mouth, while the older children had significantly fewer errors. The researchers suggest that the reason for the younger children making these errors was a combination several factors. These consist of American parents' lack of willingness to discuss where food comes from, children's lack of understanding the food chain process, and food being highly processed and separated from its original source. The older children would be more exposed to where their food is coming from but are still developing an understanding of what that process actually entails.

From these studies it is clear that younger children are capable of understanding where meat comes from when educated about it. They can process that animals are used for food. Their lack of understanding at this age, thus, seems to be largely a matter of adults in their lives choosing to avoid this sensitive topic, as a matter of sparing them the potentially traumatic emotions such a discovery might evoke.

Animal category and mind denial

Adults treat animals differently as a function of how they categorise them. Meaning that perceiving an animal as "food" seems to have the psychological consequence of reducing perceptions of animals as sentient beings (Bratanova et al., 2011). Bratanova et al. (2011) found that simply categorising an animal as food was enough for adults to reduce their attributions of mind and moral concern for an animal. Further, adults are less likely to take an animal's intelligence into account when the animal is classed as a food animal; for example, Piazza and Loughnan (2016) looked at adults' motivated use of information about an animal when forming judgments of the animal's moral standing. They showed that when an animal is personally used as food (e.g., pork eaters reasoning about pigs), information that would otherwise impact on their moral concern for the animal is disregarded, arguably, in the service of maintaining that use of the animal. In their Study 2, they described three animals, one which was eaten by the participants themselves (pigs) and the other two animal that were not eaten in the participants culture but were described as being eaten in another culture (tapirs in South America and "trablan" aliens in a future world). The researchers described the animals as either intelligent or not intelligent. They found that when the animal was eaten by the participant the perceived intelligence (i.e., high intelligence) of the animal failed to impact on their judgment of how the animal should be treated, whereas this morally relevant information promoted concern for the animals used as food in another culture. This happened despite participants rating the three animals as equally intelligent when given information

about the animals' high intelligence. This study demonstrates how adults can be motivated to discard information about an animal that they personally use as food. Arguably, this behaviour is a useful strategy that serves to reduce any conflict a person might otherwise experience when considering the morality of animal slaughter (see Rothgerber & Rosenfeld, 2021).

Ang et al. (2019) found people who ate meat devalued mental capacity ratings of animals consumed by humans compared to pets, while people who did not eat meat showed no difference in the mental capacity ratings for those two sets of animals. This is further evidence that people will selectively ignore information when it is of benefit to themselves. McGuire et al. (2022) looked at categorisation of animals by children and adults. Children were less likely to categorise farm animals as food than adults, instead they categorised them as pets. This could mean that children are less rigid about the categories than adults or possibly that their knowledge of which animals serve as food for humans is imperfect and still developing. Finally, Wilks et al. (2021) found that school-age children place more value on animal life, compared to adults, when making decisions about whose life to save within sacrificial dilemmas. This valuing of animal life did not seem to be influenced by the classification of animals as food vs. non-food, as pigs were treated very similarly as dogs in these scenarios.

Several empirical questions about children's concern for the treatment of food animals remain untested or in need of further investigation. One such question is whether children are likely to reduce their moral concern for animals commonly understood to be used as food, much as adults do, or whether children's moral judgments are less influenced by this instrumental use of animals. Furthermore, it remains unclear whether school-age children would exhibit the typical, self-serving behaviours adults exhibit when considering the moral worth of food animals relative to non-food animals with comparable properties.

Overview of the Present Study and Hypotheses

The present study considers whether children might, similar to adults, engage in motivated uses of morally-relevant information about food animals. Specifically, the research focuses on information about an animal's perceived intelligence and considers whether children might differ from adults when confronted with such information, particularly when it is presented about an animal typically used as food. We drew upon research, and our own findings from Study 1, that suggests children are less likely than adults to categorise animals as "food" and to devalue food animals (e.g., McGuire et al., 2022; Wilks et al., 2021). We hypothesised that children would not show the same motivated process evinced by adults, particularly, in ignoring relevant information when forming judgments about animals used as food (e.g., Piazza & Loughnan, 2016). Based on our findings from Study 1, and in line with the theorising of Rothgerber (2020), we suspected that children would not readily differentiate, in their moral judgments, animals eaten and animals not eaten, as adults do, since children likely lack the sophisticated processes needed to appreciate their role in meat production (e.g., the understanding that meat consumers perpetuate the slaughter of animals with their food choices).

Our age range expanded on the range we sampled for Study 1 by including children as young as 4 years old and up to 11 years old. This was done because we expected to see a focus on an animal's intrinsic worth in the younger children and a more utility focus in the older children, however due to some practical limitations this age was collapsed into one group. We still expected the older children to be less norm driven than adults so this grouping of the children into one group to be compared to adults remains useful.

We also expected that children's judgments of animal treatment would, more generally, be less influenced than adults by an animal's status as food. As we have seen,

adults tend to reduce their moral concern for animals when viewing them as food (Bastian et al., 2012; Bratanova et al., 2011; Piazza & Loughnan, 2016). Arguably, this may be a direct result of objectifying animals as food—i.e., a consequence of categorisation (Bratanova et al., 2011), or, additionally, a result of motivated cognition—i.e., a consequence of efforts to avoid the moral implications of eating animals (Piazza & Loughnan, 2016). Since children are less likely than adults to categorise farmed animals as "food" (McGuire et al., 2022) and have less knowledge of how meat is produced, and consequences of this for animals (Bray et al., 2016; Hahn et al., 2021; Rothgerber, 2020), we hypothesised that their moral evaluations of animals would be less influenced by the animal's "status" as food for humans.

To test these theoretical aims, we manipulated the intelligence levels of a food and non-food animals loosely modelled on the methods of Piazza and Loughnan (2016, Study 2). Since children in our previous study had the greatest level of understanding about chickens being used as food (and in English chicken is the same word for the bird and the meat consumed), we used a chicken as the animal that was recognisable as a food animal and a similar sized but unfamiliar bird (kakapo) as the non-food animal. This was a departure from the animals used by Piazza and Loughnan (2016). Participants included a new sample of school-age children, ranging from 4 to 11 years of age, and a new sample of adults. All participants evaluated the acceptability of harming one of the two birds after reading information about its intellectual abilities or lack of ability.

Our specific predictions were as follows:

Hypothesis 1: Compared to adults, children will show more concern for all animals in their judgment of harmful actions.

This developmental difference will be especially visible for the food animal (chickens) where adults are expected to show little moral concern for the animal. In other

words, relative to adults, children were expected to be overall less accepting of harm to animals.

Hypothesis 2a: Adults will utilise intelligence information in their moral judgment more for non-food animals than for food animals.

This was an attempt to replicate the findings of Piazza and Loughnan (2016) which would be manifested by an interaction of animal category and intelligence.

Hypothesis 2b: Relative to adults, children will exhibit fewer differences in their treatment of food and non-food animals. That is, children are expected to be less *food category* driven in their treatment of animals.

We expected this to be the case on the basis of children being less rigid and discerning when it comes to categorising animals as food (McGuire et al., 2022).

Preregistration and Open Science

We preregistered our research objectives, recruitment strategy, methods, and analysis plan on AsPredicted [see https://aspredicted.org/XTP_M1P]. An anonymised version of our data set and copies of our research materials are available on Open Science Framework [see https://osf.io/p94cu/?view_only=19ad241f33bd4bf4a03b45d707a668fb. This research was conducted within the guidelines of the Faculty of Science and Technology Research Ethics Committee at Lancaster University.

Method

Participants

For our pre-registered recruitment strategy[1], we calculated a power analysis for a 2x2x2 between-subjects design using G*power (Faul et al., 2009). We needed between 327

[1] This preregistration was amended to reflect changes made as a result of the COVID-19 pandemic. A preregistration had been submitted prior to the pandemic, this amended version was submitted after data collection resumed, but prior to analysis of the children's data.

to 418 participants to have 80% - 90% power of detecting a medium size effect (f = .20). We estimated the size of the effect using Piazza and Loughnan's (2016) reported effect sizes for the interaction of animal intelligence and perspective (Study 3). To achieve this level of power, we aimed to recruit a minimum of 200 adults and 140 children, the lower value for the children was based on realistic recruitment expectations surrounding child participants.

Adults. Adult participants were recruited from Prolific Academic. Two-hundred and seven adults started the survey and 202 completed it (females n = 83, M_{age} = 29.85 years, *SD* = 10.88). The sample was varied with the three most frequent nationalities being British (28%), Polish (22%), and Portuguese (13%); the remaining participants had a variety of nationalities.

We collected another set of adult participants that were all residents in the United Kingdom. The participants from the first set were not eligible to participate in the second round of data collection. This second run consisted of 253 adults starting the survey and 250 completing it (females n = 140, M_{age} = 32.52 years, *SD* = 12.07). This sample was mostly British (68%) and all UK residents. For adults we used Prolific Academic's built-in pre-screens to exclude vegans, vegetarians, and pescatarians. For the second collection of adult data, we also asked in the survey what their diet was in case they got through the pre-screen. We found that there were minor differences between the two sets when we ran the analyses, such as, for the question about cages there were no significant results for the second set while the first set had a main effect of intelligence and bird. The question about food had another difference between the sets, the second set showed an interaction between intelligence and bird while the first set did not show the interaction. When we combined the two samples after exclusions (n = 42, detailed later) the total sample included 410 adults (females n = 218, M_{age} = 31.13 years, *SD* = 11.42).

Participants in both sets received £1.50 for completing the set of studies which included this one, the entire survey lasted approximately 10 minutes.

Children. We recruited children in two sets: the first batch was collected in person in a school, the second occurred at the children's home and was overseen by the parental guardian. We initially recruited 98 children from a primary school in South Lancashire, England. The school was approached by the experimenter and invited to participate. The school was given study information sheets and consent forms to be sent home to parents. The rate of return was approximately 60% of the consent forms. Children with signed consent forms were asked for their verbal assent before starting the study. Due to school closures caused by the COVID-19 pandemic the recruitment strategy had to be adapted to parents overseeing the completion of the studies at home with their children. The recruitment for this phase was conducted through schools: the advertisements about the study were either sent home with the children or advertised in the school newsletters. Parental consent was obtained online and children's verbal assent was required prior to participation.

Two children were removed from the first set, because they did not understand or failed to complete the questions: a third child, in the second set, was excluded for failing the attention check criteria we set out in the preregistration for children. This left us with a total of 82 boys and 66 girls (n = 148). Ages range from 4.21 to 11.98 years (M_{age} = 8.47 years, *SD* = 1.75).

Exclusions

For adult participants, we excluded (Table 2.1) extreme outliers on the manipulation check which were defined as extreme scores (> 2 SD) in the direction opposite to the manipulation. We also excluded vegans, vegetarians, and pescatarians that made it through the pre-screen, as well as those that indicated they did not eat chicken.

For children, we excluded if they incorrectly answered 2/2 attention checks.

Table 2.1

Numbers of exclusions within each category

Reason for exclusion	Children excluded	Adults excluded
Failed attention checks	1	
Outlier with regards to the intelligence manipulation		25
Pescatarian, Vegetarian or Vegan diet		12
Does not eat chicken		5
Total	1	42

Materials and Measures

Animal images. Participants received information about a bird, either a chicken or a kakapo, and a raven (Figure 2.1).

Figure 2.1. Images of (left to right) the kakapo, chicken, and raven.

Animal category. We used chickens as the animal that most participants, even children, would recognise as a food animal, since Study 1 showed 91% of our younger children knew chickens were eaten by people. The bird we used as a comparison to the chicken was the kakapo since they are similarly sized, flight limited, and unfamiliar to most people since they are an endangered bird native to New Zealand. Depending on condition,

kakapos or chickens (the target animals) were described as either lacking or possessing great intelligence. We adopted a similar procedure as Piazza and Loughnan (2016, Study 3) and used ravens as the reference animal in the descriptions, such that kakapos or chickens were described in terms of being of similar intelligence as or less intelligent than ravens (Piazza and Loughnan used "dogs" as the reference animals and "pigs" as the target). Care was placed into providing participants in each condition with the same amount of content (i.e., number of claims), such that each attribution made about kakapos or chickens in the high-intelligence condition had a parallel statement in the low-intelligence condition, though the argumentation was framed in terms of kakapos or chickens lacking, rather than possessing, the trait (e.g., "kakapos have amazing memories" vs. "kakapos have awful memories"). The full descriptions by condition were as follows:

High intelligence condition

- *Kakapos (chickens) can't fly like other birds, like ravens, can, their bodies are too heavy. They can get up to high places by jumping and flapping their wings for a few feet. Then they can glide down.*
- *Kakapos (chickens) can learn new behaviours similar to the way dogs can. For example, kakapos (chickens) can be taught to go up to your arm when you stick it out for them, and then glide back down on command.*
- *Kakapos (chickens) have amazing memories. Just like ravens, they can hide food in places for months and remember where they have hidden it, only to return to it later when they're hungry.*
- *Both kakapos (chickens) and ravens need to keep their brains active and stimulated, otherwise they get bored. They are quite interested in exploring the world around them and discovering new things. They will easily get bored if they can't explore.*
- *Kakapos (chickens) make a variety of sounds that they use to communicate to other kakapos (chickens). The kakapos (chickens) can recognise the meaning of these sounds within a specific context. For example, kakapos (chickens) have a specific call they use to greet one another and say hello. Mother kakapos (chickens) use a specific call to calm their young when they're nervous. Kakapos (chickens) use a separate call to warn one another when there is a danger, such as a snake in the grass. They use a different sound to warn each other when they spot a hawk flying above them*

- *People have given kakapos (chickens) and ravens puzzles to solve, and both species are really good at solving them. When they watch other kakapos (chickens) or ravens completing the puzzles, they can copy them and solve it.*

Low intelligence condition

- *Kakapos (chickens) can't fly like other birds, like ravens, can, their bodies are too heavy. They can get up to high places by jumping and flapping their wings for a few feet. Then they can glide down.*
- *Kakapos (chickens) are not good at learning things. Ravens, for example, can be taught to go up to your arm when you stick it out for them, and then fly back down on command. Kakapos (chickens) cannot do this.*
- *Compared to ravens, kakapos (chickens) have awful memories. They sometimes will hide food in places and forget where they put it. In contrast, ravens can remember locations of food months afterwards.*
- *Kakapos (chickens) are quite simple animals. They don't really get bored because they are not that interested in exploring the world around them. They prefer to do the same activities, which are comfortable to them, rather than learn new things.*
- *Kakapos (chickens) make a variety of sounds, but these sounds do not have any meaning. They are just sounds. This is different from some other birds that are quite intelligent, like ravens. Ravens have a specific call they use to greet one another and say hello. Mother ravens use a specific call to calm their young when they're nervous. Ravens use a separate call to warn one another when there is a danger, such as a snake in the grass. They use a different sound to warn each other when they spot a hawk flying above them.*
- *People have given kakapos (chickens) puzzles to solve, and they are really bad at solving them. When they watch someone complete the puzzle, they cannot even copy them to solve it. Ravens can solve the puzzles easily.*

Attention and manipulation checks. We had two attention checks at the end of the description in order to a) check they read or listened to the description and b) to reinforce the manipulation. We asked, "do kakapos (chickens) have amazing (awful) memories" based on whether it was the high or low intelligence condition. This was taken verbatim out of the description and should always be answered "yes." The second question was "can kakapos (chickens) solve puzzles?" This was taken from the last bullet point in the description and would be either yes or no depending on the condition. We had the manipulation check on the

next page. We asked, “how smart do kakapos (chickens) seem to you?” This was answered with a sliding scale from 0 to 5 that went to the second decimal place. Guides above the slider went from ‘not smart at all’ to ‘really smart.’

Moral concern for birds. The dependant variable was measured by using the formatting of Melson et al. (2009) which ascertained the harms that children accepted about a real dog and a robot dog. They first asked is it ‘OK’ or ‘not OK’ to do certain actions, like hitting, and then follow up a ‘not OK’ answer with ‘how bad would it be…’ to do the action. The first question allows the child to choose whether an action is ‘OK’ or ‘not OK’ without prompting a more severe condemnation based on the question itself. Only after the first question do they choose the severity of wrongness of the action. We combined the first and second questions for all four harms resulting in a five-point Likert scale that increases from not bad to very, very bad. Our four questions start broad (is it ‘OK’ or ‘not OK’ to harm a kakapo (chicken) and get more specific (is it ‘OK’ or ‘not OK’ to take a kakapo (chicken) away from its home, keep a kakapo (chicken) locked in a cage, and finally to kill a kakapo (chicken) to be eaten for food). These actions that ranged from general harm to displacement and deprivation, to killing varied in their specificity, their potential to justify, and, we surmised as a consequence, degree of wrongness.

Demographics. We asked basic demographic questions, these were age and gender and for adults we asked nationality.

Procedure for children

The data was collected in two parts for the children, the first in person, the second at home with their parents. For the first round of data collection (pre-pandemic), the children had the researcher, or a trained undergraduate research assistant, sit with the child individually in a quiet room. The researcher provided a short description of the study and asked if the child was happy to participate. All children assented prior to commencing the

study. The child was shown both the laminated pictures of the animals and the identical images on the iPad. The researcher read off the iPad the description of the bird in either the low intelligence or high intelligence condition. There were then two attention checks. The first asked if the bird had an awesome (or awful) memory, depending on the condition. The second asked whether they could solve puzzles. The next question was the intelligence manipulation check. Following this the moral questions were asked. Following that the children completed a filler task and continued another study. Then two demographic questions, age, and gender.

Procedure for adults

The adults completed the study online via Qualtrics. They were required to consent before participating in the study. They followed the same procedure as the children with the description of the bird followed by the attention checks, the manipulation check, and the moral questions. Just like the children they completed the filler task and proceeded to the next study. The adults had an additional demographic question about nationality to enable comparison with the child samples.

COVID-19 changes for child participants

Due to COVID-19 restrictions we were not able to continue collecting data in person. However, we needed an adult to be present due to considerations about children reading the descriptions in full and comprehending the study. This meant adapting protocols to ask parents or guardians to complete the study with their child. Prompts were put in place and reminders were repeated for parents/guardians to have their children answer the question by themselves rather than having the adults help. The parents/guardians were reminded that they could discuss the questions after the study was completed but that they needed to allow the child to answer the questions with their first intuitions. The study was conducted online in the same format as for adults. The parent first presented the child the picture of the target animal

(kakapo/chicken) and the reference animal (raven) and then read the description of the animal's intellectual abilities. Next, they asked the attention and manipulation checks followed by the four moral concern questions. They next completed the filler task, followed but the next study. They then asked the demographic questions. Parents were finally asked whether they let the child answer for themselves and if they helped the child. This was meant to ascertain whether the parents were answering the questions for the child or only accepting certain answers they deemed desirable instead of letting the child answer for themselves.

Results

Analysis plan

We first tested whether our four moral judgment items would correlate reliably. If so, they would have been aggregated into a single index of animal treatment. We used a 2x2x2 ANOVA to assess participants' ratings of animal treatment, with follow-up simple effects upon the event of a significant two-way interaction and three-way interactions. We were particularly interested in the interactions of edibility, intelligence, and age. All analyses were completed in R using stats, rstatix, and tidyverse (Kassambara, 2021; R Core Team, 2020; Wickham et al., 2019). The tables in this study were created using apaTables (Stanley, 2021) and the graphs were created using ggplot2 and ggpubr (Kassambara, 2020; Wickham, 2016).

Manipulation check – Intelligence

The manipulation of intelligence was successful. The adults reported higher intelligence scores in high intelligence condition (see Table 2.2). The children also reported higher intelligence scores in the high intelligence condition than the low intelligence condition. The adults and children did not differ in their ratings of intelligence between the high and low intelligence conditions. However, both groups rated kakapos as more intelligent

than chickens overall (Table 2.3). We preregistered that among adults, extreme outliers on intelligence rating would be excluded because it could be inferred that the manipulation had failed to convince them of the animal's intelligence (i.e., that participants rejected the validity of the information). For children, extreme outliers were not excluded but we instead compared the results with outliers included and removed (Giner-Sorolla et al., 2020). The full sample analyses appear here and the alternative analyses (with outliers removed) appears in Appendix B. The alternative analyses show the same findings.

Table 2.2

Means and standard deviations for Intelligence Rating as a function of a 2(Intelligence) X 2(Relevance) X 2(Age)

		Bird			
		Chicken		Kakapo	
	Intelligence	*M*	*SD*	*M*	*SD*
Adults	High	4.12	0.51	4.32	0.64
	Low	0.22	0.34	0.40	0.46
Children	High	4.18	1.02	4.44	0.85
	Low	0.55	0.93	0.83	0.97

Note. M and *SD* represent mean and standard deviation, respectively.

Table 2.3

Fixed-Effects ANOVA results using Intelligence Rating as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1547.14	1	1547.14	3686.70	.000		
Intelligence	746.19	1	746.19	1778.10	.000	.76	[.74, .78]
Bird	1.94	1	1.94	4.62	.032	.01	[.00, .03]
Age	0.07	1	0.07	0.17	.679	.00	[.00, .01]
Intelligence x Bird	0.01	1	0.01	0.02	.900	.00	[.00, .00]
Intelligence x Age	0.96	1	0.96	2.28	.131	.00	[.00, .02]
Bird x Age	0.05	1	0.05	0.13	.718	.00	[.00, .01]
Intelligence x Bird x Age	0.01	1	0.01	0.03	.870	.00	[.00, .00]
Error	230.81	550	0.42				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

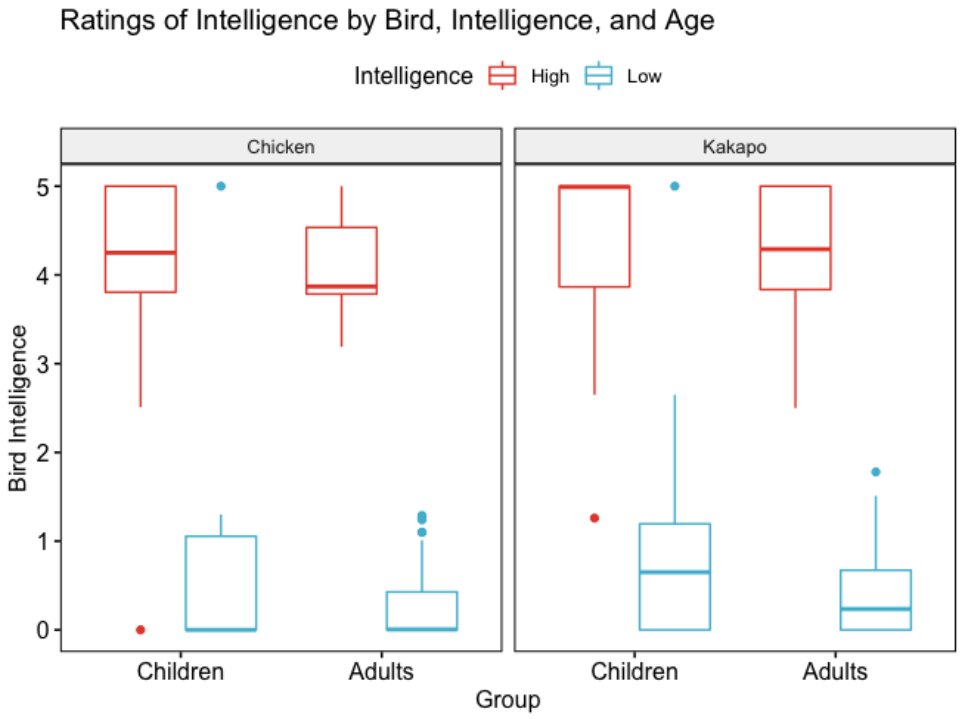


Figure 2.2. Box plot of intelligence ratings by bird, intelligence category, and age group

Moral concern scale

As per the preregistration, the four questions were checked to see if they correlated and could be combined into one measure of moral concern. With the exception of the displacement measure and killing animals for food, the ratings were not correlated (see Table 2.4). Thus, the four measures were analysed separately.

Table 2.4

Means, standard deviations, and correlations with confidence intervals for adults

Variable	*M*	*SD*	1	2	3
1. Harming	2.89	1.71			
2. Displacement	4.16	1.24	.10 [-.21, .38]		
3. Caging	3.82	1.53	-.05 [-.34, .25]	-.03 [-.33, .27]	
4. Killing for food	4.39	1.20	-.02 [-.32, .28]	.30* [.00, .55]	.05 [-.25, .34]

Note. Values marked with * are significant at $p < .05$.

Table 2.5

Means and standard deviations for Harming, Displacement, Caging, Kill for food as a function of a 2(Intelligence) X 2(Bird) X 2(Age)

		Harming				Displacement				Caging				Kill for food			
		Chicken		Kakapo		Chicken		Kakapo		Chicken		Kakapo		Chicken		Kakapo	
	Intelligence	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Adults	High	3.34	1.39	4.42	0.77	2.74	1.46	3.97	0.98	3.85	1.19	4.09	1.07	1.30	0.90	3.87	1.37
	Low	3.56	1.35	4.48	0.82	2.42	1.50	4.15	1.13	3.27	1.52	3.85	1.40	1.34	0.99	2.99	1.58
Children	High	3.74	1.38	3.77	1.42	3.83	1.36	4.23	1.14	3.80	1.26	3.86	1.22	2.94	1.75	4.51	1.04
	Low	3.49	1.52	3.14	1.57	4.06	1.11	4.02	0.96	3.40	1.56	3.40	1.48	3.03	1.71	4.33	1.02

Note. M and *SD* represent mean and standard deviation, respectively.

Harming

There was no main effect of age group on how participants judged condemnation of harming the birds (Table 2.6). Thus, with regards to harming, H1 (that children will show more concern for animals in their judgment of the harmful actions when compared to adults) was not supported. Both age groups were highly condemning of the harm in general (i.e., in the absence of any mitigating circumstances or justifications).

There was a main effect of bird type. Participants rated it more wrong to harm kakapos than chickens (see Table 2.6). There was also a significant interaction between bird type and age group. Follow-up tests showed there was a simple effect of bird type only for adults, with adults judging it worse to harm kakapos than chickens, $F(1, 549) = 67.90$, $p < 0.0001$, $\eta^2 = 0.11$. However, children did not judge it worse to harm kakapos than chickens, $F(1, 549) = 0.912$, $p = 0.34$, $\eta^2 = 0.002$. Children and adults did not differ in their condemnation of harming the chicken, $F(1, 549) = 0.866$, $p = 0.35$, $\eta^2 = 0.002$, but adults condemned harming the kakapo more than the children did, $F(1, 549) = 40.50$, $p < 0.0001$, $\eta^2 = 0.069$. This supports H2b, that adults' moral judgments will be influenced by the food status of the animal more so than children's moral judgments.

When considering general harm to animals, the wrongness ratings of both age groups were uninfluenced by the manipulated intelligence of the bird.

Table 2.6

Fixed-Effects ANOVA results using Harm as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1015.56	1	1015.56	686.94	.000		
Intelligence	2.28	1	2.28	1.54	.214	.00	[.00, .01]
Bird	57.35	1	57.35	38.79	.000	.07	[.04, .10]
Age	4.09	1	4.09	2.77	.097	.01	[.00, .02]
Intelligence x Bird	0.65	1	0.65	0.44	.506	.00	[.00, .01]
Intelligence x Age	2.89	1	2.89	1.95	.163	.00	[.00, .02]
Bird x Age	14.27	1	14.27	9.65	.002	.02	[.00, .04]
Intelligence x Bird x Age	0.31	1	0.31	0.21	.647	.00	[.00, .01]
Error	811.63	549	1.48				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

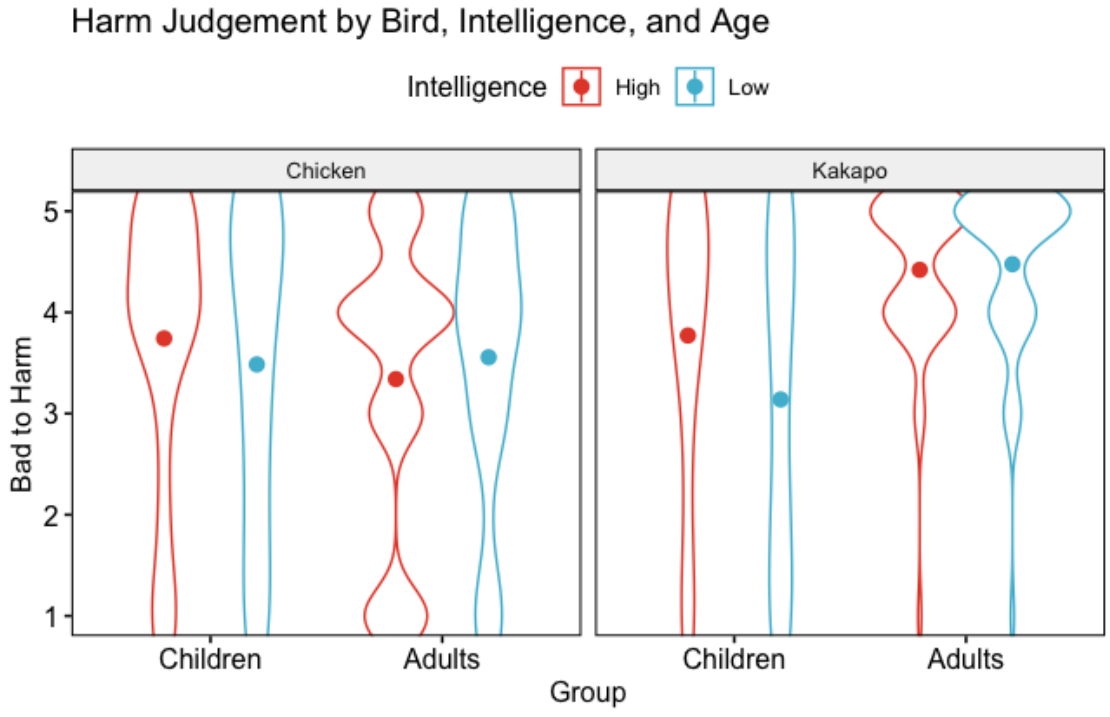


Figure 2.3. Violin plot of condemnation of harm by bird, intelligence category, and age group

Displacement

Overall, it was perceived as more wrong to displace kakapos from their home than chickens (Table 2.7), though this main effect was driven primarily by adults treating chickens and kakapos differently (i.e., a Bird Type x Age Group interaction; supporting H2b). Simple-effects tests confirmed that adults judged it more wrong to displace kakapos than chickens, $F(1, 550) = 149$, $p < 0.0001$, $\eta^2 = 0.213$. However, children condemn this form of harm equally for the two birds, $F(1, 550) = 0.711$, $p = 0.40$, $\eta^2 = 0.001$. Children and adults both condemned displacing kakapos at the same level, $F(1, 550) = 0.109$, $p = 0.74$, $\eta^2 < 0.001$. However, children condemned the displacement of chickens at greater levels than adults, $F(1, 550) = 63.6$, $p < 0.0001$, $\eta^2 = 0.104$.

In support of H1, children tended to show equally high levels of condemnation towards displacing the two birds, at levels significantly higher than adults.

Though there was no main effect of intelligence on evaluations of displacement, intelligence level interacted with bird type (see Table 2.7). Examining the simple effects of bird type on intelligence showed that at both high and low intelligence the bird type had significant effects on displacement evaluations (high intelligence, $F(1, 550) = 42.8$, $p < 0.0001$, $\eta^2 = 0.072$, low intelligence $F(1, 550) = 78.2$, $p < 0.0001$, $\eta^2 = 0.124$) with displacement of kakapos being rated worse than displacement of chickens at both levels. However, focusing on kakapos, there was no effect of intelligence on displacement judgments, $F(1, 550) = 0.293$, $p = 0.589$, $\eta^2 = 0.001$, nor was there an effect of intelligence on judgments of chicken displacement, $F(1, 550) = 2.03$, $p = 0.155$, $\eta^2 = 0.004$.

Table 2.7

Fixed-Effects ANOVA results using Displacement as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	681.33	1	681.33	440.91	.000		
Intelligence	5.05	1	5.05	3.27	.071	.01	[.00, .02]
Bird	75.09	1	75.09	48.59	.000	.08	[.05, .12]
Age	30.16	1	30.16	19.52	.000	.03	[.01, .06]
Intelligence x Bird	6.38	1	6.38	4.13	.043	.01	[.00, .02]
Intelligence x Age	3.90	1	3.90	2.52	.113	.00	[.00, .02]
Bird x Age	9.01	1	9.01	5.83	.016	.01	[.00, .03]
Intelligence x Bird x Age	5.89	1	5.89	3.81	.051	.01	[.00, .02]
Error	849.91	550	1.55				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

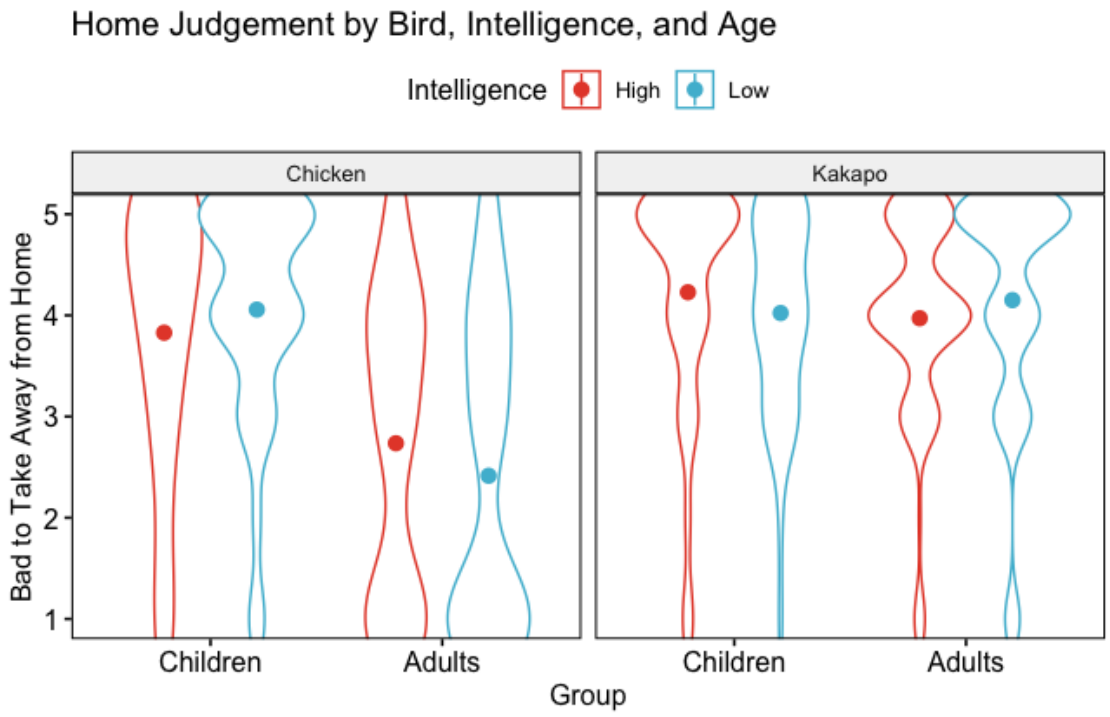


Figure 2.4. Violin plot of condemnation of displacement by bird, intelligence category, and age group

Caging

With regards to the judged wrongness of caging the animal, there was very little variation in the means for this measure, with near ceiling ratings observed for both age groups across bird type. There was a main effect of intelligence, such that it was perceived as more wrong to cage the highly intelligent animal (bird) than low intelligent animal (Table 2.8). Both children and adults rated it worse to cage highly intelligent birds relative to less intelligent birds. Intelligence did not interact with bird type, thus, H2a was not supported for this measure. There were no differences in how adults and children rated the wrongness of caging animals; thus, H1 is not supported for this judgment.

Thus, with regards to caging judgments, only the perceived intelligence of the animal informed participants' ratings, and this was true for both age groups.

Table 2.8

Fixed-Effects ANOVA results using Cage as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	$_{\text{partial}}\ \eta^2$	$_{\text{partial}}\ \eta^2$ 90% CI [LL, UL]
(Intercept)	1346.15	1	1346.15	758.49	.000		
Intelligence	16.05	1	16.05	9.04	.003	.02	[.00, .04]
Bird	3.01	1	3.01	1.69	.194	.00	[.00, .02]
Age	0.05	1	0.05	0.03	.862	.00	[.00, .00]
Intelligence x Bird	2.75	1	2.75	1.55	.214	.00	[.00, .01]
Intelligence x Age	0.38	1	0.38	0.22	.642	.00	[.00, .01]
Bird x Age	0.47	1	0.47	0.26	.608	.00	[.00, .01]
Intelligence x Bird x Age	1.03	1	1.03	0.58	.447	.00	[.00, .01]
Error	976.13	550	1.77				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

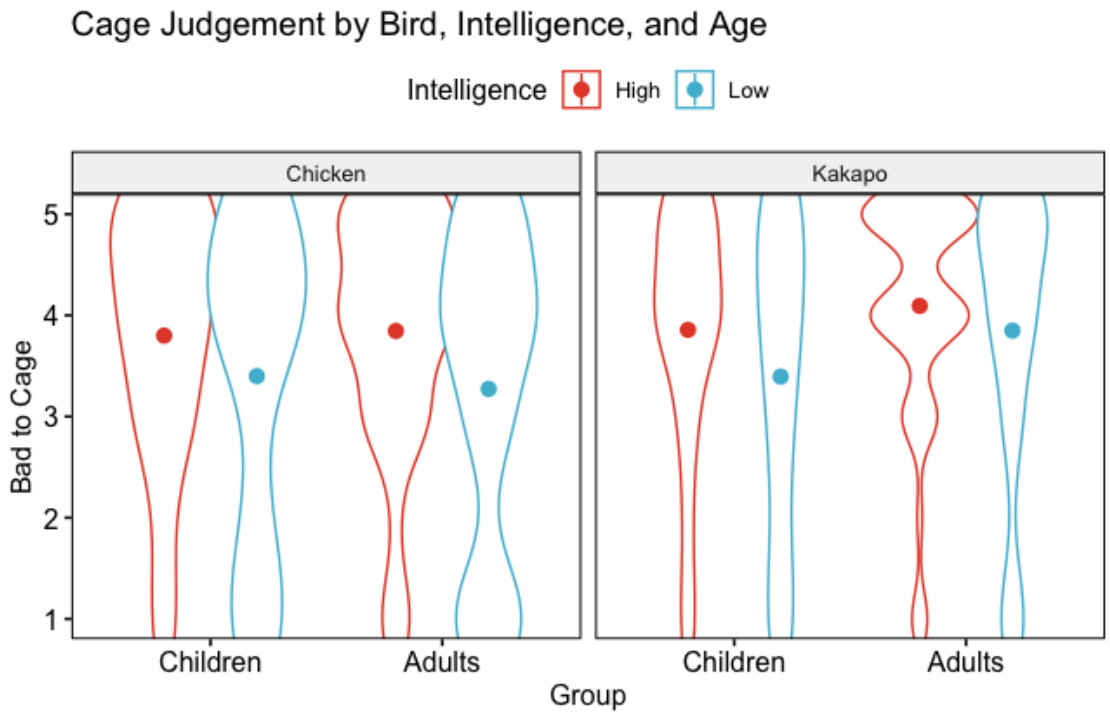


Figure 2.5. Violin plot of condemnation of caging by bird, intelligence category, and age group

Killing for food

With regards to the judged wrongness of killing the birds for food, it was perceived as more wrong to kill and eat kakapos than chickens (Table 2.9). This difference was observed within both age groups. Simple-effects confirmed the acceptance to kill the birds for food among both age groups was affected by bird type; meaning for adults it was more acceptable to kill chickens than kakapos $F(1, 550) = 273.00$, $p < 0.0001$, $\eta^2 = 0.331$, and children also viewed it as more acceptable to kill chickens than kakapos $F(1, 550) = 44.70$, $p < 0.0001$, $\eta^2 = 0.075$. Adults judged it more acceptable than children to kill both chickens, $F(1, 550) = 85.60$, $p < 0.0001$, $\eta^2 = 0.135$, and kakapos, $F(1, 550) = 32.60$, $p < 0.0001$, $\eta^2 = 0.056$. In support of H1, children judged killing to eat the animals as worse, overall, relative to adults. This pattern was visible for both animals, but especially for chickens where adult ratings were at floor on wrongness indicating the adults in the study are highly category driven (consistent with H2b).

To further explore the interaction effects and to test the two parts of Hypothesis 2 (a) that adults would have an effect of intelligence on the acceptance to kill the birds for food and b) that the children would not) the significant Intelligence x Bird interaction was explored separately for adults and children despite the lack of an Age x Intelligence interaction. For kakapos, but not chickens, adults judged it worse to kill and eat the more intelligent than less intelligent animal (H2a supported). Simple-effects confirmed that adults judged it more wrong to kill and eat kakapos that are intelligent than kakapos that are unintelligent, $F(1, 550) = 24.50$, $p < 0.001$, $\eta^2 = 0.043$. However, there was no difference in judged wrongdoing towards high vs. low intelligent chickens, $F(1, 550) = 0.054$, $p = 0.817$, $\eta^2 < 0.001$. This is a full replication of Piazza and Loughnan's (2016) finding with regards to pigs vs. tapirs/trablans (their Study 2).

Children showed this pattern to a lesser extent than adults, which supports H2b that children are less influenced by the animal's status as food. Simple-effects confirmed that children judged it similarly wrong to kill and eat high vs. low intelligent kakapos $F(1, 550) = 0.41$, $p = 0.522$, $\eta^2 < 0.001$, just as they judged it comparably wrong to kill and eat chickens high vs. low in intelligence, $F(1, 550) = 0.077$, $p = 0.782$, $\eta^2 = 0.001$.

Table 2.9

Fixed-Effects ANOVA results using Food as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	153.01	1	153.01	91.38	.000		
Intelligence	0.09	1	0.09	0.05	.817	.00	[.00, .00]
Bird	325.43	1	325.43	194.35	.000	.26	[.21, .31]
Age	68.50	1	68.50	40.91	.000	.07	[.04, .11]
Intelligence x Bird	21.66	1	21.66	12.94	.000	.02	[.01, .05]
Intelligence x Age	0.02	1	0.02	0.01	.906	.00	[.00, .00]
Bird x Age	12.93	1	12.93	7.72	.006	.01	[.00, .03]
Intelligence x Bird x Age	2.83	1	2.83	1.69	.194	.00	[.00, .02]
Error	920.96	550	1.67				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

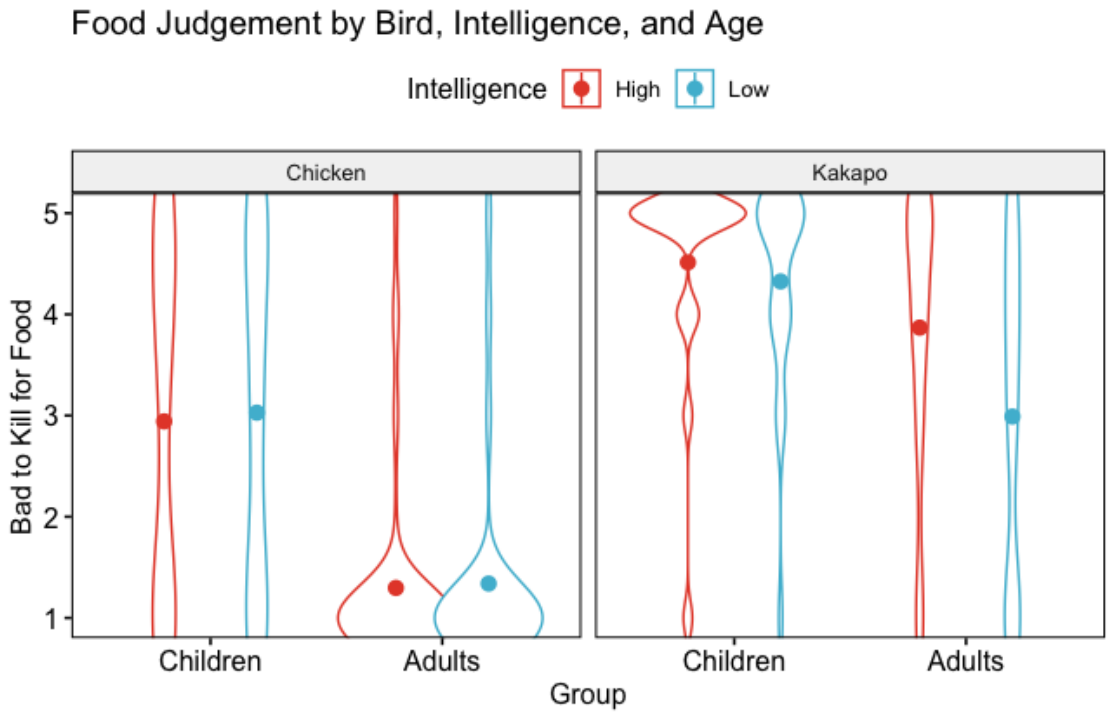


Figure 2.6. Violin plot of condemnation of killing for food by bird, intelligence category, and age group

Discussion

In this study we wanted to explore whether children might engage in motivated uses of morally-relevant information about food animals, as adults do, or whether they would not engage in such self-serving valuations. We looked at how children and adults judged the wrongness of harming animals that varied in their (a) degree of intelligence and (b) status as a food eaten by the participant. We observed some key differences in how children and adults utilised these attributes when judging the morality of animal harm. In general, our hypotheses were largely supported, children showed less acceptance of harm to animals than adults did. Children also did not rely heavily on the animal's status as an animal used for food when making their moral judgements indicating they were not showing motivated use of intelligence information.

We hypothesised that children would be less accepting of harm to animals (Hypothesis 1). This was generally born out, especially towards the chickens. The children overall condemned all types of harm to both birds while the adults placed more value on the kakapo than chicken. Children's understanding of the nuances between different kinds of harms develops as they mature (Smetana et al., 2013). Their condemnation of all harms reflects their rigid adherence to the norms of how one ought to treat others. In other words, it would be wrong to harm, cage, displace, or kill an entity, thus it is wrong in this case as well.

We hypothesised that adults would disregard intelligence information for the chicken (food animals) but not the kakapo (non-food animal) (Hypothesis 2a). This question was focused on investigating whether we could replicate the findings of Piazza and Loughnan (2016, Study 2) in the novel context of birds used for food. We would have expected to find that adults ignored the intelligence of food animals, but factored in the intelligence of non-food animals, when deciding about the morality of harming them. However, we did not replicate this finding for the measures of general harm, caging or displacing the animals.

Instead, we found that, for questions not related to killing for food, intelligence information *was* factored into the judgements of generally harming, displacing, and caging for both the food and non-food birds. Intelligence information was only ignored (i.e., not used) for the food animal in the specific context of being killed to eat for food. This is the specific context that Piazza and Loughnan focused on in their work. Thus, motivated non-use of intelligence information may be restricted to animal harms that occur specifically in the domain of slaughter for food.

It may be that the harms inflicted upon the birds outside of a consumer context did not require participants to deeply consider or place much weight on the intelligence of the animals. Instead, they may have been relying on the types of harms being inflicted. In fact, for the question about generally harming the birds, the participants strongly condemned harming both the high and low intelligence birds. We also found that participants varied in condemnation of harm to the same bird between questions. This indicates there is value in assessing different sorts of harms. Intelligence information may be more relevant when judging certain harms (e.g., imprisonment, killing) than others (direct harm). In contrast to generally harming the birds, when it comes to the results for caging birds, participants found it worse to cage intelligent birds. This is likely because caging would deprive them of their natural interest in exploring. It is interesting to note this finding given that chickens are often caged in the meat industry. However, there has been an increase in awareness of the conditions chickens are kept in and a general consumer push to obtain cage free eggs and free range chicken (Rondoni et al., 2020). Participants may have had this in mind when they were directly asked about caging chickens. It is also encouraging for chicken welfare to note that perceiving chickens as intelligent pushes the judgment of condemning the caging of them even further.

We also hypothesised that children would use the “food” status of the animal less than adults did in their moral judgments (Hypothesis 2b). This was supported with all harm items, with the slight exception of the food-related question. The children tended to condemn the harm of the chicken and the kakapo equally for harming, caging and displacing the animals. When children were asked whether it was acceptable to kill to eat the birds, however, they accepted the killing of chickens more than kakapos. That being said, the children were more condemning of killing the chicken than the adults. This indicates that children’s moral judgments are less affected by an animal’s status as food.

Hahn et al. (2021) showed children between 4 and 7 years old had trouble identifying which animals were used by people as food. The researchers argue that children are not taught about the origins of meat thus children know little about the production of meat. Children also rely more on an animals' similarity to humans (Miralles et al., 2019) as opposed to their edibility to determine moral concern. Which is consistent with what we found in Study 1, which saw that younger children did not rely on edibility at all, and the older children relied more heavily on the animals’ similarity to humans and aesthetics over the animals’ perceived edibility. McGuire also found that children were more likely to label farmed animals “pets” than “food” and children believed farm animals should be treated better than adults believed they should be treated. While children were able to integrate intelligence information and understand categories, they do not rely on those categories to make moral judgments in regards to animals. Children place much more value on life itself than adults who were very category driven. This study further supports that children are less speciesist in their moral judgements than adults (McGuire et al., 2022; Wilks et al., 2020).

The most notable difference between the children and adults in this study was their judgements on whether it was bad to kill the birds for food. Both adults and children had originally said it was very bad to harm the birds, but when it came to killing them, the adults

said it was more acceptable to kill the chickens and only somewhat bad to kill the less intelligent kakapos. The children condemned the killing of the chickens more often than the adults, however, children indicated it was somewhat bad to kill the chickens and very bad to kill the kakapos. This reiterates the motivated nature of the judgements that adults make, since they eat chicken, they deemed it more acceptable to kill them. They were able to find this harm more justifiable.

The use of birds might explain any differences we see between this study and Piazza and Loughnan (2016). Their use of mammals made it easier for participants to attribute mental capacities to the animals. It also would have elevated the base level of moral concern for the animals since people rely heavily on an animal's similarity to humans for moral concern judgements (Miralles et al., 2019). Since pigs are already more elevated than chickens, it is possible in their study participants would have been motivated to disregard intelligence information in order to alleviate cognitive dissonance.

Limitations and Future Directions

A limitation of this study is that we were unable to determine if our finding of kakapos being given more moral concern than chickens was based on their categorisation as non-food and food animals or whether this finding was based on participants own personal use of the animal. Both are possible to explain main effect so further research is warranted to examine participants own personal use of the birds. Another limitation was the focus on school-age children. Important advances in children's understanding of meat production may occur during adolescence—for example, an increased awareness of one's own responsibility as a consumer. Thus, future work on this topic would benefit from augmenting the age range of the children to help pin-point important developmental shifts in motivated cognitive processes.

Possible confounds. We found that the kakapo was always rated as more intelligent than the chicken. This may be because of the aesthetic qualities in the pictures that we did not measure. In Study 1, we discussed how the perceived aesthetic qualities of the animals influenced participants' moral rankings of those animals. The two birds that we used have different colouring which may have played a part in the participants' judgements of harm. Another possible confound we did not measure was how familiar the participants were with the birds. It was assumed that they would all be familiar with chickens and understand that they are used as a food source. We did not collect information on whether participants were familiar with the kakapo. Familiarity has been shown to have a positive effect on concern for animals (Possidonio et al., 2019), which would work against our hypothesis, however, some adults might have known that kakapos are an endangered species. Another possible issue was that if participants were unfamiliar with the kakapo, they may have assumed it was quite rare and exotic and placed higher value on its life. In either case, rarity could be a potential confound.

Conclusion

The findings here further emphasise the way children and adults process information about animals and then utilise it in their moral decisions. Children were highly condemning of all harms and they were less reliant on animal categories to make moral decisions about animals. Adults were more accepting of doing harm to an animal when presented with meat consumption as the justification. Adults were motivated to disregard intelligence information, but it was unclear from this study whether this was personal use or category driven. Thus, further research is warranted to investigate this further.

Study Three: Does it matter to me?: Children's and adults' use of food-animal intelligence from their own vs. another's perspective

Overview

In this study we further explored the connection between children's understanding of meat and how they understand and use an animal's intelligence to determine how they value the animal. We adapted another method from Piazza and Loughnan (2016, Study 3) for testing whether children utilise information about animals they eat in a *strategic* manner, as adults do, or whether they fail to engage these motivational processes. We accomplished this using a self-other paradigm, which has children (and adults) respond to high vs. low intelligence information about a food animal (e.g., cattle) either from their own perspective or another person's perspective. If children at this age are aware of the moral conflict posed by eating animals, then information about cattle intelligence should only engage motivational processes (i.e., a failure to *apply* the information) when encountered from a first-person perspective.

Introduction

Piazza and Loughnan (2016) showed that adults perceive that intelligent animals deserve protections not owed unintelligent animals, at least not at the same rate (Piazza & Loughnan, 2016, Study 1). However, when the animal was known to be a source of food for the participant (e.g., a pig), learning about the animal's intelligence failed to impact on their moral concern for how the animal is treated (Piazza & Loughnan, 2016, Study 2). This motivated disregard for intelligence information appears to only occur when participants take a first-person perspective when encountering the information and acting upon it (e.g., feeling guilty about one's meat consumption). When participants considered the intelligence of pigs from another person's perspective ("John"), the participants concluded that the other person would act upon the information and feel guilty about their own meat consumption (Piazza &

Loughnan, 2016, Study 3). This self-other distinction demonstrates how the disregard for food animals' intelligence may be a self-protective measure, arguably, aimed at preserving the behaviour of eating meat for meat consumers.

Children within the ages of 4 to 12 years old are still developing their ability to navigate the complex system of moral and social conventional rules/transgressions (Yoo & Smetana, 2022). In the context of meat consumption, we are exploring whether children in this age range utilise a decision-making process that concludes in them feeling that they need to protect themselves. Children are more likely to rely on moral rules (Cooley & Killen, 2015) and start their thinking in a place that says 'killing is wrong' without considering the reality that social norms deem it acceptable to kill for food and what that would mean for themselves.

Self-relevance versus other

Piazza and Loughnan (2016) found that when people are given intelligence information, specifically high intelligence, of an animal that they personally eat, they disregard that information when making judgements about the animal. However, when participants are given the same information and asked to judge how another person would feel based on the information, they judge the other person would likely regard the information. Piazza and Loughnan (2016, Study 3) presented adults a story about pigs, creating high intelligence and low intelligence conditions in which to examine how people would regard the information. They accomplished this by comparing the pigs' level of intelligence to dogs in that the pigs were either as smart as or not as smart as dogs. In order to create the other person's perspective condition, the researchers presented the information as either "John" had found out this information or the information was just presented to the participants. When participants were asked to judge how bad they feel about eating meat from pigs, or how bad "John" would feel, the participants consistently said that in the high

intelligence condition John would feel worse than they would about eating the animal. However, participants showed no significant increase in moral concern when they learned this information about pigs without reference to "John." This shows that people simply fail to morally act on the information when it has personal implications for themselves. When it has implications for another person, it is less threatening and so a person is free to believe the information will be acted upon.

Intelligence as requirement for moral concern

It is well established that adults use the intelligence of an animal as their basis for moral concern (e.g., Bastian et al., 2012; Leach et al., 2021; Piazza et al., 2014), and as we have seen, in Study 1, this is also true of children as young as 5 to 6 years old. The more cognitively aware and able to reason and understand their environment an animal is, the more people care for the animal's wellbeing. This however does not hold true for animals that are considered food animals. Animals in a food category are seen as less intelligent even if they have the same demonstrable intelligence as people's favourite animals, dogs and cats (Bratanova et al., 2011). Pigs have high levels of intelligence (Marino & Colvin, 2015) but they are viewed as not intelligent because of their status as a food animal.

Children's perspective taking and experience of guilt

Children develop the ability to understand that other people do not always think like themselves or even know the same things that they do with the development of perspective taking. This continues to improve across development, but at 4 years of age children can conceive of others' conceptual points of view (Marvin et al., 1976). Younger than this, children will assume someone else has the same knowledge they do and will make the same decisions they would make based on the information they themselves have. These children do not yet have the comprehension to know that these people do not have the same knowledge they have and thus would make a different decision (Birch & Bloom, 2007). These studies

may involve such procedures as placing a ball under a box then asking another person to leave the room. The ball will be moved to a different box and the child will be asked where the person will think the ball currently is (Song et al., 2008). When children are allowed to track a person's perspective during a sequence of events, children can pass false belief tasks at the age of 3 and a half years old but more commonly children readily pass verbal false belief tasks at the age of 4 or 5 years old (Rubio-Fernández & Geurts, 2013). In order to pass false belief tasks children must possess abilities in working memory abilities, executive functioning (inhibitory control), as well as theory of mind.

As children develop, they are able to understand that others may think differently than they do. They are able to think like someone else or how another person may feel if something happened. When given the same information about the ball they will say the person will think the ball is in the same place the other person last saw it. Children are also capable of understanding the needs of others even if they do not have the need themselves. It is likely that the children we tested (age 4-11 years old) in the current study very likely have sufficient perspective taking abilities. Thus, if children do not differentiate between how they feel about cattle slaughter and how another person might feel, this is unlikely to be a result of a failure to perspective take.

Children at the age of 5 years old are able to understand the emotion of guilt (Berti et al., 2000). They will feel bad if they do something wrong and are developing consciences. There is also a relationship between empathy and guilt, Thompson and Hoffman (1980) showed children who empathised with the victim of an act exhibited more intense guilt than those who had not empathised with them. Children can self-regulate their behaviour when they think they have harmed another person (Kochanska & Aksan, 2006). High levels of understanding of guilt were associated with high levels of performance on Theory of Mind

tests (Misailidi, 2018). Children we tested will have a developed understanding of guilt and may be empathising with the cow when we ask about how they would feel to eat cow-meat.

Children's understanding of the origins of meat

Children in Study 1 had varying levels of knowledge when it came to whether an animal was eaten by people. Children may not fully recognise where meat comes from until 7 or 8 years old. There has been work indicating parents tell children when they feel like they are ready (Bray et al., 2016). Some parents avoid the subject while others will tell their children when the children ask. Some parents wait until the child finds out on their own. Other parents will wait until the last moment and may avoid the topic themselves, so instead they lie to their children about where meat comes from. Children also lack the level of insight that adults possess regarding the nature of animal slaughter, thus, often fail to connect the meat on their plate with animal slaughter.

There are societal mechanisms in place designed to shield, not only children but adults as well, from the uncomfortable realities of slaughtering animals. The locations of slaughterhouses are hidden in the countryside and people use distancing language when discussing the slaughter of animals (Mazhary, 2021). The way that people talk about meat allows us to keep mental distance between the living animals and their meat that is consumed. We do not use the same name for certain types of meat and animals. We use pork or ham when we mean pig-meat, we use beef when we mean cow-meat (Serpell, 1996), we use mutton when we mean sheep-meat. One animal that we use the same name for is chicken, but even then, children do not quite equate chicken, the cute bird, with the chicken nuggets on their plate. Hahn et al. (2021) suggests that the reason for this is a combination of American parents' lack of willingness to discuss where food comes from, children's lack of understanding the food chain process, and food being highly processed and separated from its

original source. Of course, these are all things that can even prevent some adults from reflecting on the origins of meat as well (e.g., Hoogland et al., 2005; Kunst & Hohle, 2016).

Children may not equate eating meat with something that is bad because they do not understand that meat is the product of killing an animal. When young children are given the information that beef comes from a cow, they may respond that all killing is wrong (Nucci et al., 2018) and not be able to reflect that they are part of a cycle of killing. Older children may respond in a less condemning way since they are more aware that meat is a product of killing and may be able to reflect on their involvement in the cycle (Pnevmatikos, 2018). They may start to enable the same mechanisms as adults to dissipate their cognitive discomfort (Rothgerber, 2020). If this happens, they may begin to minimise morally-relevant information they received about the animal to make themselves feel better about eating it.

Motivated use/non-use of animal attributes

Cognitive dissonance occurs when people hold two or more cognitions that are opposed to each other (Cooper, 2019). People generally like animals and also like to eat animals (Piazza, 2020). The act of eating meat causes people to become uncomfortable with the knowledge that the meat that they are eating came from an animal which causes meat-related cognitive dissonance. According to Rothgerber and Rosenfeld (2021), people employ various tactics to reduce dissonance such as avoidance, willful ignorance, and disassociation. People avoid the animal welfare, environmental, and health concerns associated with eating meat. They also lack knowledge about typical farming practices which the researchers suggest is motivated to prevent the arousal of meat-related cognitive dissonance. People can also disassociate the meat they eat with an animal by pretending that no animal was involved in the meat production process.

Piazza and Loughnan's (2016) Study 3 was designed to look at whether people are motivated to disregard information about an animal that they eat. This was accomplished by

presenting people with intelligence information and seeing whether they would take the information they learned about a pig and apply it to their moral evaluation of pig slaughter vis-à-vis how they think other people would apply the same information in their evaluation. By asking what another person would do the researchers were able to isolate the motivated use of intelligence information in participants' own moral thinking.

Rothgerber (2020) suggests that in order for children to experience cognitive dissonance they must love animals, they must understand meat comes from animals, and they must understand that meat involves hurting animals. While Study 1 suggests that children at the age we were testing generally understand that meat comes from the animals, it remains unclear whether children grasp their responsibility as meat consumers. If children are fully aware of their role in the meat process, then they might display a disregard of intelligence information when judging on behalf of themselves, as we see in adults.

Overview of the Present Study and Hypotheses

In the present study, we sought to *developmentally* extend Piazza and Loughnan's (2016) investigation of motivated non-use of information about food animals, and test whether children between the ages of 4 and 11 years of age may or may not exhibit similar strategic responses to information about food animals. Children in this age range are developing their abilities to apply moral and conventional rules to their decisions. Based on the findings from Study 1, and convergent findings from other, emerging studies (e.g., McGuire et al., 2022), we had reason to believe that children at this age would not exhibit self-other distinctions exhibited by adults. Although children's understanding of which animals are eaten is emerging during this period, it is not as accurate and fully formed as adults; furthermore, their knowledge of which animals are eaten impacts less on children's moral valuation of animals (Study 1). Children also lack the level of insight that adults possess regarding the nature of animal slaughter and, thus, often fail to connect the meat on

their plate with animal slaughter (Bray et al., 2016; Hahn et al., 2021). Though many parental guardians begin to have difficult conversations with their children about the origins of meat during this time (Bray et al., 2016), food-categorisation judgments do not impact on children's moral valuation of animals to the degree they do for adults. As we have observed in Study 2, relative to adults, children were generally more condemning of harms to food animals, including slaughtering animals for food (see also McGuire et al., 2022).

Taken together, these findings suggest that children at this age lack a sophisticated understanding of animal slaughter that would elicit conflicted feelings about meat consumption, and, therefore, children should be less motivated to redress this conflict. Thus, we hypothesised that children at this age would not exhibit self-protective responses to food-animal intelligence in the way that adults do. Rather, we expect that children would report feeling as bad about cattle slaughter as they think another person ("John") would feel.

Hypothesis 1: Consistent to our Hypothesis 1 in Study 2, we expected that, compared to adults, children will show more concern for cattle used for food. In other words, relative to adults, children will be overall less accepting of harm to food animals.

Hypothesis 2a: We expected that the animal's perceived intelligence would be utilised by adults in their moral evaluation of meat eating when taking the perspective of another person but less so when providing their own judgment.

This is an attempt to conceptually replicate the findings of Piazza and Loughnan (2016) regarding adults' motivated use of animal intelligence.

Hypothesis 2b: Children will exhibit little difference in their moral evaluation of meat consumption independent of whose perspective they take.[2]

[2] Due to experimenter error, we forgot to include Hypothesis 2b in the preregistration. Thus, the tests regarding Hypothesis 2b should be viewed as exploratory.

In other words, compared to adults, children would not exhibit a self-other distinction or use intelligence information about food animals in a self-protective (i.e., *strategic*) manner.

Preregistration and Open Science

We preregistered our research objectives, recruitment strategy, methods, and analysis plan on AsPredicted [see https://aspredicted.org/XTP_M1P]. An anonymised version of our data set and copies of our research materials are available on Open Science Framework [see https://osf.io/p94cu/?view_only=19ad241f33bd4bf4a03b45d707a668fb. This research was conducted within the guidelines of the Faculty of Science and Technology Research Ethics Committee at Lancaster University.

Method

The current study and Study 2 were collected in a single session as part of a two-part study. This study followed Study 2 after a filler task. The participants are the same with a few different exclusion criteria between the studies. Details of participants and recruitment can be found in the Methods section of Study 2.

Participants

Adults. Adult participants were recruited from Prolific Academic. When we combined the two samples (detailed in Study 2) after exclusions (n = 63, detailed later) we were left with 389 participants (females n = 206, M_{age} = 31.46 years, *SD* = 11.74).

Participants received £1.50 for completing the set of studies which included this one, the entire survey lasted approximately 10 minutes.

Children. Two children were removed from the first set, because they did not understand or failed to complete the questions; two more children in the second set were

excluded (details given below), This left us with a total of 81 boys and 66 girls (n = 147). Ages ranged from 4.21 to 11.98 years (M_{age} = 8.48 years, *SD* = 1.75).

Exclusions

For adult participants, we excluded (Table 3.1) extreme outliers on the manipulation check which were defined as extreme scores in the direction opposite to the manipulation. Those that indicated John did not eat beef, and those that indicated they themselves did not eat beef were also excluded. In addition, we also excluded vegans, vegetarians, and pescatarians that made it through the pre-screen.

For children, we excluded if they incorrectly answered 2/2 attention checks. One parent volunteered that their child had autism. Since we had no further details about their diagnosis, and this study requires children to consider how someone else would think and feel, to avoid adding noise to the study, the child was excluded from the analysis.

Filler Task. There was a filler task between Study 2 and Study 3. The filler task consisted of three drawings created by the primary researcher that were of a creature that had been made up of different animals. An example of one picture was a creature that had the body and head of a green tree viper, wings of a bat, legs and talons of a hawk, and the mane of a lion. The children and adults were told that children had drawn these pictures and we wanted them to identify which animals they had used to create the hybrid animals. The three pictures were presented one at a time and the participants could enter as many animals as they saw in the drawing. This task was intended to get the participants thinking about something else and not focus on the moral questions that they had just asked in Study 2. The images we used can be seen in Appendix C.

Table 3.1

Numbers of exclusions within each category

Reason for exclusion	Children excluded	Adults excluded

Outlier with regards to the intelligence manipulation		5
Failed attention checks	1	
Child with autism	1	
Pescatarian, Vegetarian or Vegan diet		12
Does not eat beef		29
Stated John did not eat beef		17
Total	2	63

Materials and Measures

Animal images. Illustrations of an elephant and a cow (Figure 3.1) were used to highlight the animals and keep the children's attention.

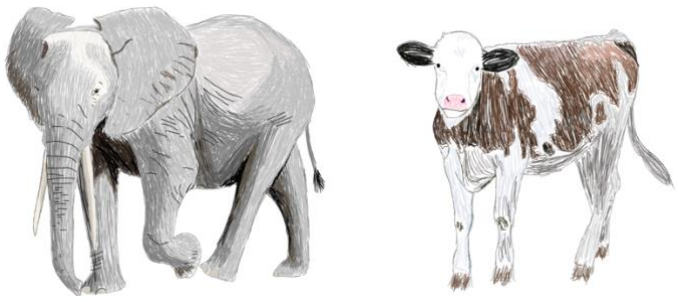


Figure 3.1. Images of the elephant and cow.

Animal category. Depending on condition, cows (the target animals) were described as either lacking or possessing great intelligence. As with Study 2, we used similar procedures as Piazza and Loughnan (2016, Study 3) and used an elephant as a reference to compare to the cow. We either made claims of how and the cow's intelligence was equal to the elephant or less than that of the elephant. Again, we created the same number of statements for each of the conditions (high and low intelligence). The argumentation was

framed in terms of cows lacking, rather than possessing, the trait (e.g., “cows have great memories” vs. “cows have poor memories”). The full descriptions by condition were as follows:

High intelligence condition

- *Cows are connected to their family. A mother cow escaped and tracked down her calf through unknown fields after being sold to another farm. After losing her calf, a mother cow sought out the comfort of her own mother to help her cope with the loss.*
- *Cows often choose the most intelligent member of their herd as the herd leader, rather than simply the biggest or strongest. Among cows the leaders are usually the most intelligent, confident and often the oldest cows. This is also true for elephants.*
- *Cows ‘baby-sit’ for other members of the herd. To protect their babies from danger, a few cows will stay back with a group of calves while the rest of the herd grazes or visits the water.*
- *Cows have great memories. They remember where they've been and they don’t return to fields until they know the grass has grown back.*
- *Cows watch over and comfort their ill or injured friends. They will stay by their injured friends until they are better.*
- *Cows hold grudges against people who are cruel to them or who took away their calves. They can do this because they have good memories. Cows have been known to remember people years after they first met them.*

Low intelligence condition

- *Cows are not connected to their family in the way that elephants are. A mother elephant escaped and tracked down her calf through unknown fields after being separated. After losing her calf, a mother elephant sought out the comfort of her own mother to help her cope with the loss. Such behaviours have never been observed in cows.*
- *Among cows, the leaders of the herds are usually the biggest or strongest cows in the herd. Elephants on the other hand choose the most intelligent member as their leader. Among elephants the leaders are usually the most intelligent, confident and often the oldest elephant.*
- *Elephants ‘baby-sit’ for other members of the herd. To protect the babies from danger, a few elephants will stay back with a group of calves while the rest of the herd grazes or visits the water. Cows only watch over their own calf.*
- *Cows have poor memories. They don't remember where they've been and so they often return to fields before the grass has grown back.*

- *Cows don't watch over or comfort their ill or injured friends, they just keep moving and looking for food, abandoning the injured member of their herd. Elephants will stay by their injured friends until they are better.*
- *Cows don't hold grudges against people who are cruel to them. They greet everyone the same because they can't remember who they've met before. On the other hand, elephants have been known to remember people years after they first met them.*

Personal perspective. We were interested in whether participants will use intelligence information less when evaluating cattle treatment from their own perspective versus from another person's point of view. The description was either presented to the participant as information about cows or they were given a story about another person, a student named "John," who had discovered this information while he was doing a school report:

> John is working on a school project about cows and elephants. John's favourite food is hamburgers, so he was curious to see what he might learn about cows. He discovered the following information in a book on animals:

Attention and manipulation checks. We had two attention checks at the end of the description in order to a) check they read or listened to the description and b) to reinforce the manipulation. We asked "do cows have great (poor) memories" based on whether it was the high or low intelligence condition. This was taken verbatim out of the description and should always be answered "yes." The second question was "do cows stay with their injured friends?" This was taken from the second to last bullet point in the description and would be either yes or no depending on the condition. We then had the manipulation check on the next page. We asked. "how smart do cows seem to you?" This was answered with a sliding scale

from 1 to 5 that went to the second decimal place. Guides above the slider went from ‘not smart at all’ to ‘really smart.’

Beef eating check. We asked the participants “do you eat hamburgers, beef or steak” in order to exclude adult participants who would not find it relevant for themselves and also to remind them that they eat beef. "Do you know which animal hamburgers, beef or steak come from” was used to ascertain whether the children knew that the meat that they eat comes from a cow. “Does John eat hamburgers, beef or steak” was used to check that the participants read the description and as a reminder that John is the one who found out the information about the cows and that his favourite food was hamburgers. If they did not remember that John ate beef they were excluded because it would be assumed that they would not think John would find the information he found out relevant to himself if he did not eat beef.

Moral concern for cows. Our measure of moral concern was based on Piazza and Loughnan (2016, Study 3) and was ascertained by asking two questions. “How bad do you (think John) feel(s) about eating hamburgers (meat from cows)?,” and “How wrong do you (would John) think it is to eat hamburgers?” Both these questions were on a slider from 0 to 5 that went to two decimal places and the guides went from not at all (bad, wrong) to extremely (bad, wrong). The two moral-standing items were internally reliable ($r = 0.82$, $p < .001$) and thus were averaged together to form an index.

Demographics. We asked basic demographic questions, these were age and gender and for adults we asked nationality.

Procedure for children

The procedure to start was the same as described in Study 2. The data was collected in two parts for the children, the first in person, the second at home with their parents. For the first round of data collection (pre-pandemic), the children had the researcher, or a trained undergraduate research assistant, sit with the child individually in a quiet room. The researcher provided a short description of the study and asked if they were happy to participate. All children assented prior to commencing the study.

After completing Study 2 and completing an entertaining, filler task (identifying which animals compose a hybridised novel animal, Appendix C) the children were shown both the laminated pictures of the animals and the identical images on the iPad. The researcher read off the iPad the description of the cow in either the low intelligence or high intelligence condition. There were then two attention checks. The first asked if the cow had an awesome (or awful) memory based on the condition. The second was whether cows would stay with their injured friends, this was taken directly from a statement in the description. This was followed by the intelligence manipulation check. The children were then asked if they ever eat hamburgers, beef, or steak, and whether they knew what animal hamburgers, beef, or steak come from. Then the participants in the "other" category were asked whether John eats hamburgers, beef, or steak.

The study ended with two demographic questions about age and gender. Finally, the children were debriefed and asked if they had any questions about the two studies they had completed.

Procedure for adults

The adults completed the study online via Qualtrics on their own. The adults completed Study 2 and the filler task in the same way the children did. The adult participants

had an additional demographic question about nationality to enable comparison with the child samples.

COVID-19 Changes for Child Participants

As in Study 2, prompts were put in place and reminders were repeated to have their children answer the question by themselves rather than having adults help, they were reminded that they could discuss the questions afterwards but that they needed to allow the child to answer the questions independently first. The study was conducted online in the same format as for adults. The participants first completed Study 2 and the filler task then moved on to the current study. The parent/guardian first presented the child the picture and then read the description of the animal's intellectual abilities. This was followed, as above, with the attention and manipulation checks, questions about whether they or John eat hamburger beef or steak and the moral concern questions, flowed by demographics. At the end there was a section just for parents/guardians about whether they let the child answer the questions for themselves and if they helped the child. There was also a section for parents to volunteer any information they thought the researcher should know such as whether their child understood the descriptions or their child lost interest in the tasks.

Results

Analysis plan

We first tested whether our two moral judgment measures correlated reliably. If so, they would be aggregated into a single index of moral concern. We used a 2x2x2 ANOVA to assess participants' ratings of moral concern, with follow-up simple effects in the event of significant two-way and three-way interactions, particularly the interaction of perspective and animal intelligence. All analyses were completed in R using stats, rstatix, and tidyverse (Kassambara, 2021; R Core Team, 2020; Wickham et al., 2019). The tables in this study were

created using apaTables (Stanley, 2021) and the graphs were created using ggplot2 and ggpubr (Kassambara, 2020; Wickham, 2016).

Manipulation check – Intelligence

The intelligence manipulation was highly effective, with ratings of cow's intelligence being much higher in the high-intelligence vs. low-intelligence condition (means in Table 3.2). The adults and children did not differ in their ratings of intelligence between the high and low intelligence conditions (Table 3.3). Intelligence ratings were not affected by the perspective variable, nor were there any interaction effects that impacted on intelligence ratings.

Table 3.2

Means and standard deviations for Intelligence Rating as a function of a 2(Intelligence) X 2(Perspective) X 2(Age)

		Perspective			
		Other		Self	
	Intelligence	*M*	*SD*	*M*	*SD*
Adults	High	4.35	0.54	4.16	0.63
	Low	1.63	0.55	1.54	0.50
Children	High	4.28	0.85	4.34	0.86
	Low	1.92	1.02	1.90	1.06

Note. M and *SD* represent mean and standard deviation, respectively.

Table 3.3

Fixed-Effects ANOVA results using Intelligence Rating as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1685.32	1	1685.32	3556.64	.000		
Intelligence	344.96	1	344.96	727.99	.000	.58	[.54, .62]
Perspective	1.77	1	1.77	3.73	.054	.01	[.00, .02]
Age	0.14	1	0.14	0.29	.589	.00	[.00, .01]
Intelligence x Perspective	0.28	1	0.28	0.58	.445	.00	[.00, .01]
Intelligence x Age	1.75	1	1.75	3.70	.055	.01	[.00, .02]
Perspective x Age	0.83	1	0.83	1.74	.187	.00	[.00, .02]
Intelligence x Perspective x Age	0.24	1	0.24	0.51	.475	.00	[.00, .01]
Error	249.25	526	0.47				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

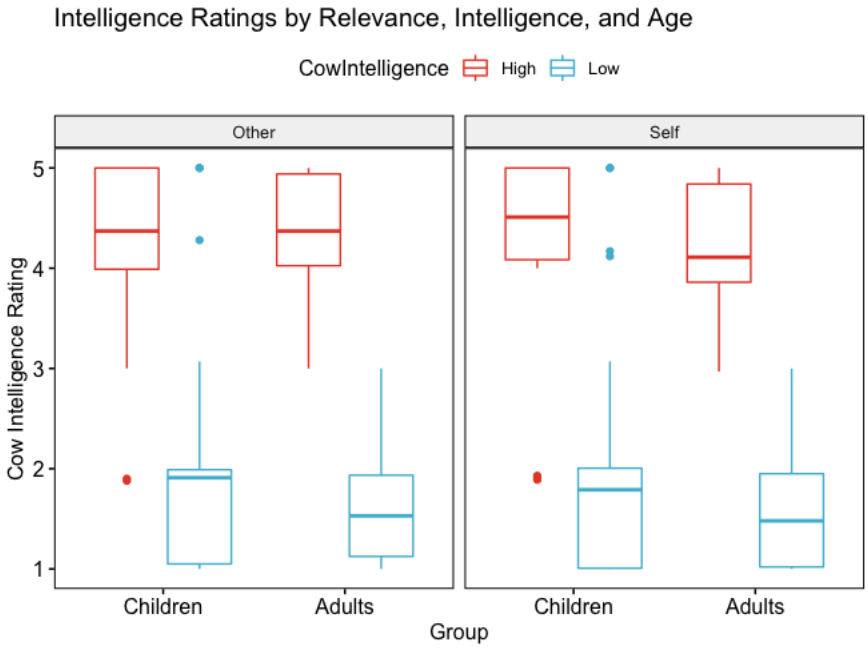


Figure 3.2. Box plot of intelligence ratings by perspective, intelligence category, and age group.

Main Analysis of moral concern for cows- ANOVA

As per the preregistration, the two moral concern questions were checked to see if they correlated and could be combined into one measure of moral concern. They correlated at $r = 0.82$ and were thus combined into one measure of moral concern.

Table 3.4

Means and standard deviations for Moral Judgement as a function of a 2(Intelligence) X 2(Perspective) X 2(Age)

		Perspective			
		Other		Self	
	Intelligence	*M*	*SD*	*M*	*SD*
Adults	High	2.66	1.17	1.70	1.25
	Low	1.55	1.12	1.62	1.25
Children	High	2.62	1.33	2.85	1.47
	Low	2.32	1.32	2.76	1.67

Note. M and *SD* represent mean and standard deviation, respectively.

Table 3.5

Fixed-Effects ANOVA results using Moral as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	630.55	1	630.55	387.52	.000		
Intelligence	57.27	1	57.27	35.19	.000	.06	[.03, .10]
Perspective	43.86	1	43.86	26.96	.000	.05	[.02, .08]
Age	0.04	1	0.04	0.02	.879	.00	[.00, .00]
Intelligence x Perspective	25.82	1	25.82	15.87	.000	.03	[.01, .06]
Intelligence x Age	8.46	1	8.46	5.20	.023	.01	[.00, .03]
Perspective x Age	18.12	1	18.12	11.13	.001	.02	[.01, .04]
Intelligence x Perspective x Age	4.47	1	4.47	2.75	.098	.01	[.00, .02]
Error	859.14	528	1.63				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

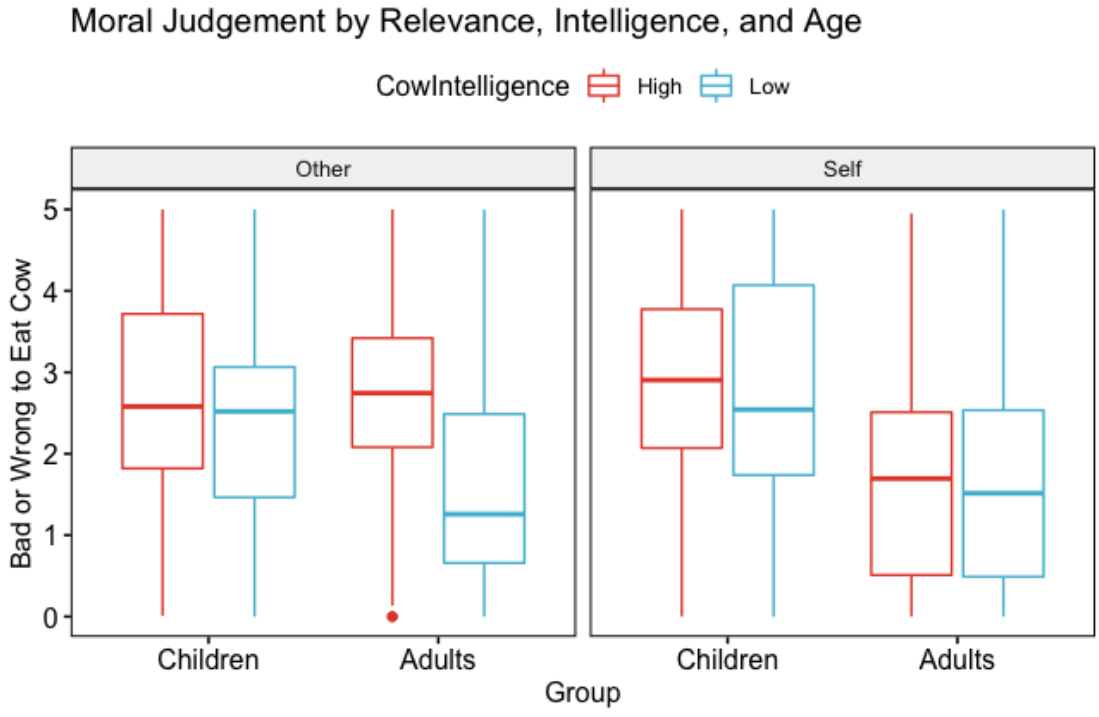


Figure 3.3. Box plot of moral judgement by perspective, intelligence category, and age group.

As can be seen in Table 3.5, there was a main effect of intelligence on moral concern for cows such that it was judged more wrong to eat cows when they were presented as intelligent. There was also a main effect of perspective, but no main effect of age group on moral concern for cows. However, as expected, animal intelligence also interacted with perspective, and intelligence also interacted with age group. Finally, perspective also interacted with age group. The three-way interaction did not reach levels of significance.

To test Hypothesis 1 and decompose the Perspective x Age interaction, next, we investigated the simple effect of age group first within the self-perspective condition, and secondly within the other-perspective condition. Consistent with Hypothesis 1, children judged it more wrong to eat beef than adults did when forming the judgment from their own perspective, $F(1, 528) = 43.90$, $p < 0.001$, $\eta^2 = 0.077$. When taking another person's perspective, the moral judgments of children and adults were less distinctive, though the mean scores for children were still higher than for adults, $F(1, 528) = 4.79$, $p = 0.002$, $\eta^2 = 0.009$. When ignoring intelligence levels, simple effects showed that adults' moral judgements were lower when they were judging for themselves versus someone else $F(1, 528) = 10.50$, $p = 0.001$, $\eta^2 = 0.02$. The children did not vary their judgements between themselves and another person, $F(1, 528) = 2.54$, $p = 0.112$, $\eta^2 = 0.005$.

Next to decompose the Intelligence x Age interaction we investigated the simple effect of age group first within the high intelligence condition, and secondly within the low intelligence condition. Children judged it more wrong to eat beef than adults did when forming the judgment about high intelligence animals, $F(1, 528) = 10.80$, $p = 0.001$, $\eta^2 = 0.02$. Children also judged it more wrong to eat beef than adults did when forming judgments about low intelligence animals, $F(1, 528) = 31.60$, $p < 0.001$, $\eta^2 = 0.056$. Adults judged it

more wrong to eat high intelligence animals than low intelligence animals, $F(1, 528) = 18.8$, $p < 0.001$, $\eta^2 = 0.034$, while the children did not differ in how wrong it would be to eat high or low intelligence animals, $F(1, 528) = 0.78$, $p = 0.378$, $\eta^2 = 0.001$.

To further explore these two-way interactions, simple effects tests were conducted first to explore whether participants' moral judgments differed as a function of perspective and intelligence condition. First, when ignoring developmental age group, the simple effects decomposing the Intelligence x Perspective showed that moral concern for cows was higher in the high intelligence condition than low intelligence condition when participants were judging for another person, $F(1, 528) = 31.20$, $p < 0.001$, $\eta^2 = 0.056$, but not when judging for themselves $F(1, 528) = 0.10$, $p = 0.747$, $\eta^2 = 0.000$.

Next, this interaction was explored separately for adults and children. For adults, when looking within the high-intelligence condition, adults rated it more wrong to eat beef from John's perspective (what he would think) than from their own perspective, $F(1, 528) = 27.00$, $p < 0.001$, $\eta^2 = 0.049$. However, there was no effect of perspective on judgments in the low-intelligence condition, $F(1, 528) = 0.15$, $p = 0.703$, $\eta^2 = 0.0003$. Likewise, when focused on the other-perspective condition, there was a significant effect of intelligence on adult judgments, with greater condemnation of beef when John learned about the high (vs. low intelligence) of cows, $F(1, 528) = 35.20$, $p < 0.001$, $\eta^2 = 0.062$. However, adult judgments did not vary as a function of intelligence within the self-perspective condition, $F(1, 528) = 0.18$, $p = 0.671$, $\eta^2 = 0.0003$. This pattern of results for adults is consistent with Hypothesis 2a and is a conceptual replication of Piazza & Loughnan (2016, Study 3)

Next, we conducted simple effects for our child participants, first with regards to the effect of perspective there were no differences due to perspective both in the high-intelligence condition, $F(1, 528) = 0.56$, $p = 0.455$, $\eta^2 = 0.001$, and in the low-intelligence condition, $F(1, 528) = 2.29$, $p = 0.131$, $\eta^2 = 0.004$. Turning to the effect of intelligence, the

level of animal intelligence did not influence children's moral judgments of eating beef in either the self-perspective condition, $F(1, 528) = 0.09$, $p = 0.764$, $\eta^2 = 0.0002$ or other-perspective condition, $F(1, 528) = 1.00$, $p = 0.318$, $\eta^2 = 0.002$. These patterns are consistent with Hypothesis 2b that children's moral judgments of food animals are less impacted by perspective, compared to the judgments of adults. They also suggest that children's judgments of eating beef were insensitive to the perceived degree of cows' intelligence.

Discussion

In this study we looked at whether children would disregard morally relevant information when they were asked how bad or wrong it would be to eat an animal when judging for themselves or another person. Unlike adults, children did not exhibit a self-serving use of bovine intelligence information when evaluating the consumption of beef. For adults, the information about bovine intelligence failed to impact on their moral judgment when judging for themselves. They did however infer that the moral judgment of another person would be affected by this information. We found that, unlike adults, children judged it equally wrong to eat meat from cows with high versus low intelligence. Children also condemned eating beef at the same rate as they judged others would.

We hypothesised that children would show more concern for food animals compared to adults (Hypothesis 1) and that this developmental difference would be qualified by the perspective participants were asked to adopt, with adults, but not children, evincing a self-other distinction in how they react to information about the intelligence of food animals (Hypothesis 2a-b). These hypotheses were largely supported by the results. Children were more condemning of eating beef than the adults, though this developmental difference only emerged when children and adults evaluated the action for themselves. When participants

assumed the perspective of another person (John), children and adults attributed guilt to this person at comparable levels when the person learned of the high intelligence of cows.

We hypothesised that children would exhibit little difference in their moral judgment based on which perspective they adopted (Hypothesis 2b), and this was also supported by the data as well. Children's evaluations of beef consumption did not differ whether they were answering for themselves or another person. By contrast, adults exhibited evaluative differences across perspectives as a function of the intelligence information presented to them versus the other. As predicted (Hypothesis 2a), and replicating Piazza and Loughnan (2016, Study 3), adults thought others would be more condemning of beef when learning about the intelligence of cows, but they did not adjust their condemnation of beef when they personally received this information.

Our manipulation of intelligence was highly successful, both for adults and children. Thus, the analysis of intelligence ratings rules out the possibility that the self-other distinction observed within adults is due to adults rejecting the truth value of the information that was presented to them. Instead, the results appear to be more parsimoniously explained in terms of adults *disregarding* morally relevant information when judging the wrongness of beef consumption for themselves, but *regarding* this information when judging how others would perceive its wrongness.

Some key findings from this study are that children do not show motivated use of intelligence information when condemning harm to animals when they personally consume the animal. Children may not be connecting that they are causing harm by consuming beef themselves (Rothgerber, 2020). The lack of parent's communication with their children about where meat comes from (Bray et al., 2016) may be limiting how they connect meat with animals even if they know generally that meat comes from animals. As a consequence, they may fail to experience any personal conflict about eating meat that would motivate self-

protective responding. Instead, we found that children's condemnation of beef was on par with the condemnation that they believed others would exhibit. This suggests that children actually think others will feel as bad as they do. Thus, they did not display the self-other distinction typifying adults' motivated thinking about animal consumption (Piazza & Loughnan, 2016). This highlights the difference between children and adults, in that, children feel worse about their own meat consumption than when adults assume this first-person perspective.

Rothgerber (2020) suggests that children may be dissociating (or, more likely, *failing to connect*) the living animal from the meat on their plates. He also suggests that being able to keep meat and animals separate in their minds would allow children to act on internalised social standards that frame meat as a pleasurable, social, and healthy activity. This may be one reason children may have been able to remain moralistic in their judgements of how to treat animals in this study. They were asked about how they would feel about eating meat from a cow when the cow was just made salient. They may not respond in the same way at a meal time when other cues are the most salient factor, such as being told to eat what is on their plate (Nucci, 2001).

Limitations and Future Directions

We only examined children's judgments about eating beef but did not explore their justifications for their judgments. It would be interesting to explore whether children engage in rationalisations for meat consumption, specifically endorsement of meat being *natural, normal, necessary,* and *nice* (the 4Ns, Piazza et al., 2015). It is likely they would report these justifications for their meat consumption since food is a socialised activity. However, children may respond differently when they are made aware that their meat consumption involves harming animals.

This study also did not directly assess children's conflict with their own eating behaviour or their perceived responsibility as meat eaters. When adults experience the psychological conflict between their dietary preference for meat and their moral response to animal suffering they will engage in practises that reduce their cognitive dissonance (Bastian & Loughnan, 2017). These processes involve denying meat production causes harm to animals, denying personal responsibility, and claiming that eating meat is part of their personal and group identity. While adults have all these processes in place to help them engage in activities that may otherwise be disturbing, children may not understand the hypocrisy that is condemning eating beef while continuing to eat it.

Since we see that adults use intelligence information strategically in this study it can be assumed that at some point children integrate specific meat with different animals. Adults disregard intelligence information when asked about their own meat consumption and guilt. This suggests a motivated use in order to reduce cognitive dissonance around the subject of eating meat. Future research should look at the developmental timing of when motivated cognition emerges. Adolescence is a likely period of increased self-awareness, autonomy of food choices, and a deepening understanding of consumer responsibility. It is also the period where we see a substantial increase in vegetarian identification (e.g., Patelakis et al., 2019).

Making children aware of the meat process and encouraging them to integrate what they know about animals may allow children to process feelings around eating meat and have an open dialogue about their choice in participating in meat eating behaviour. This may be a way to encourage critical thinking about continued meat consumption behaviour into adulthood or it may encourage children to engage in the same motivated use of information that adults engage in at a younger age.

Conclusion

From this study we can conclude that adults use intelligence information in a motivated way to minimise their own discomfort around eating meat. By contrast, school-age children do not exhibit such motivated behaviour. Rather, they condemn meat consumption equally for themselves and when judging for another person. Additionally, their moral evaluation appears to be less sensitive to the specific characteristics of the animal eaten (e.g., intelligence) than that of adults. These findings suggest that children are not yet intuiting their causal role in the production of meat or, perhaps, not connecting this consumer role to their judgments of meat eating.

Study Four: A tale of two birds (take two): Replication of Study 2 controlling for possible confounds

Overview

In Study 4, we conducted a conceptual replication of Study 2, exclusively with adult participants, and made several modifications to the research materials. First, we described both birds as animals eaten by people somewhere in the world to isolate the personal relevance of chickens (but not kakapos) as an animal that participants *themselves* eat (as opposed to animals that can be conceptualised as "food"). Second, we altered the images of the two birds to black-and-white images, to standardise the colouration of the birds and reduce the potential confounding influence of animal aesthetics. Finally, we described both birds as non-endangered animals to address the concern that some adults may be aware of the endangered status of kakapos. We sought to replicate the interaction of bird type and intelligence observed for the "killing for food" measure in Study 2 with a new sample of adults and these changes to the materials.

Introduction

Study 2 of this thesis showed that adults were inconsistent in application of intelligence information in their judgements of moral status to two birds, particularly in the context of killing animals for human consumption. When considering the wrongness of killing kakapos for food, adults thought it was worse to harm kakapos when they were described as intelligent, rather than unintelligent. By contrast, they rated it equally acceptable to kill chickens for food. This finding aligns with the findings of Piazza and Loughnan (2016), which found that adults ignored morally relevant information when pertaining to food animals but factored it in when pertaining to non-food animals when deciding about the morality of harming those non-food animals.

One way in which our research materials differed from Piazza and Loughnan (2016)— besides using birds instead of mammals, as the target animal—is that we did not clarify that kakapos are animals that could potentially be consumed as food. In Piazza and Loughnan's study, all three mammals were described as consumed for food in some part of the world (pigs in the West; tapirs in South America; and trablans in a future world). Pigs were the only animal that participants themselves consumed. Thus, the researchers standardised the edibility of the animal across the three animal conditions. In Study 2, we did not standardise perceptions of the edibility of the two birds—thus, a categorisation explanation (see Bratanova et al., 2011) remains a viable account for the differential treatment of kakapos relative to chickens (as opposed to a motivational account).

In Study 4, we focused on adult participants and we sought to eliminate the categorisation account by explicitly describing both birds as food for (some) humans. This allowed us to more confidently attribute differences in moral standing to the *personal motives* of our participants who all ate chicken, but not kakapos. Additionally, we made modifications to the research materials to help address some other potential confounds that were unintentionally introduced into the descriptions of the two birds, related to the aesthetics of the birds and their perceived conservation status.

Aesthetics

The bright green plumage of the kakapo may have been more appealing than the mostly black and white of the chicken. Aesthetic qualities of animals have been shown to influence people's moral concern for animals. Klebl et al. (2021) had participants rate 120 target animals across several dimensions and found that aesthetics were predictive of moral standing independent from an animal's perceived patiency, agency, and harmfulness. The authors also found that participants attributed more moral standing to beautiful versus ugly animals when they were matched on patiency, agency, and harmfulness. Additionally, they

observed a large positive correlation between intelligence and beauty ratings (Klebl et al., 2021, Study 1). We also observed a similar relationship in Study 1 of this thesis, thus we checked for halo effects in the current study. This clearly shows the importance of aesthetics. In addition to beauty ratings, more colourful animals and more human-like faces are some specific properties that shape human concern for the animal. More vibrant colours on penguins have been shown to influence people's preference for different penguins (Stokes, 2007). In Study 4, we minimised the aesthetic differences between the two birds by presenting the images in black and white to the participants.

Conservation status and exoticness

Endangered and rare species can sometimes be given moral priority in people's efforts to protect animals. Tisdell et al. (2006) presented people with a list of animals and highlighted an animal that was more endangered and at risk of extinction than the others on the list. When comparing animals of a similar appearance and place on the phylogenetic tree the animal that was highlighted was placed higher in the order of preference to save the animals. Skibins et al. (2017) examined the characteristics of animals that made participants engage more with them during zoo visits and found that an animal's conservation status increased conservation caring for the animal. Thus, we conveyed to participants that kakapos are not endangered, thus, minimising this as a potential confound between the two bird species.

In addition to its endangered status, the kakapo may have been regarded as an exotic animal compared to a chicken. The term kakapo would have been unfamiliar to most participants. People may have attributed this lack of familiarity with the kakapo as a measure of its conservation status. In this study we used the name of the breed of chicken in order the limit the commonness of the term chicken.

Categorising animals as food

Simply identifying an animal as a food source can alter people's moral judgments of those animals, at least for adults. Bratanova et al. (2011) manipulated how the same animal was viewed and observed that when the animal was described as food people ascribed it less capacity to suffer and less moral concern than when it was described in terms that did not relate to food. In contrast, Piazza and Loughnan's (2016, Study 2) animals could all be categorised as "food," yet only the animals that were not personally eaten by the participants were given more moral regard. This showed that any difference was not due to the perceived "food status" of the animal. Instead, the difference was specifically due to the motivational influence of personally consuming meat from the animal.

Overview of the Present Study

The present study attempted to reproduce the "motivated disregard" effect observed in Study 2 of this thesis, and by Piazza and Loughnan (2016, Study 2), using a revised version of the materials. The study focused exclusively on adult participants, as children did not show this motivated disregard for chicken intelligence. A new sample of adults were presented the same research design as in Study 2 with the following modifications: (1) the images of the birds were black and white; (2) an exotic variety of chicken was used to make it sound as exotic as the kakapo; (3) we explicitly stated that neither of the birds are endangered (a deception with regards to kakapos that we revealed and explained in the debriefing statement); (4) we stated that both chicken and kakapo are species that are eaten for food. Our hypotheses for Study 4 were similar to Study 2.

Hypothesis 1: Adults will utilise in their moral judgment intelligence information more for the animal they do not personally consume (kakapos) than for the animal they consume (chickens).

This was an attempt to replicate the findings of Piazza and Loughnan (2016), and Study 2 for the "killing for food" measure, characterised by an interaction of animal category and intelligence.

Hypothesis 2: Adults will be more, overall, condemning of harm to the animal they do not personally consume (kakapos) than the animal they do consume (chickens).

This was an attempt to replicate the main effect of bird type from Study 2 for all measures of harm.

Preregistration and Open Science

We preregistered our research objectives, recruitment strategy, methods, and analysis plan on AsPredicted [see https://aspredicted.org/59T_18Q]. An anonymised version of our data set and copies of our research materials are available on Open Science Framework [see https://osf.io/p94cu/?view_only=19ad241f33bd4bf4a03b45d707a668fb. This research was conducted within the guidelines of the Faculty of Science and Technology Research Ethics Committee at Lancaster University.

Method

Participants

Two-hundred and fifty-five adults started the survey and 251 completed it. We had a total of 223 participants after exclusions (females n = 74, M_{age} = 26.17 years, *SD* = 9.77). Participants were recruited via Prolific Academic, participants from past studies were not eligible to participate in this study. Participants received £0.75 for completing the study, the entire survey lasted approximately 5 minutes. The sample was varied with the three most frequent nationalities being Portuguese (24%), Polish (20%), British (14%); and the remaining participants had a variety of nationalities. This is similar to the distribution of nationalities for the first sample set of Study 2.

Exclusions

We included the following exclusion criteria in the preregistration: we excluded those who incorrectly answered two or more attention checks for the study. We also excluded those who reported that they were familiar with the "unfamiliar" bird (kakapos) and indicated that it is an endangered species, contrary to the statement we provided. We identified extreme outliers on the intelligence manipulation check: extreme scores (> 2 SD) in the direction opposite to the manipulation were eligible for exclusion. We also excluded pescatarians, vegetarians, and vegans from the sample, since they do not eat meat from the target "food" animal (chicken) and thus should not be motivated in any way to disregard relevant information about the animal. For the same reason, omnivorous participants who indicated not eating chicken were excluded. Table 4.1 details the number of participants excluded in relation to each of the preregistered criteria.

Table 4.1

Numbers of exclusions within each category

Reason for exclusion	Number excluded
Failed to complete the study	4
Pescatarian, Vegetarian or Vegan diet	4
Does not eat chicken	5
Failed attention checks	1
Perceived kakapos as familiar and endangered	1
Outlier with regards to the intelligence manipulation	17
Total	32

Materials and Measures

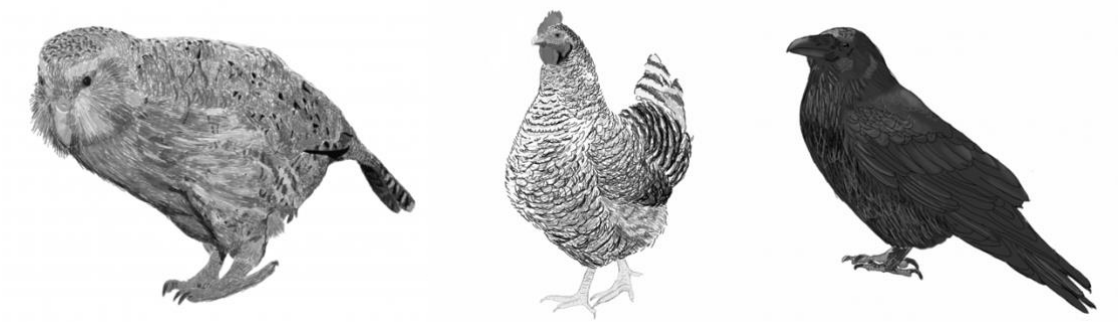


Figure 4.1. Images of black and white versions of the kakapo, chicken, and raven.

We used the same structure as Study 2 but made a few changes to the images and the phrasing of the descriptions. We changed the pictures to greyscale to make the images visually aesthetically more similar (Figure 4.1). We included lines that described both the chicken and kakapo as not endangered and used as a source of food. When asking about the chicken we referred to it by its common species name ("Dominique chicken") to balance the exoticness of the kakapo name. We included another attention check which also served as a manipulation check asking if the bird was endangered. We checked personal relevance by asking if the participant eats chicken.

Animal category. The kakapo was an unfamiliar animal that should not be recognisable as a western food source. The chicken represented an animal that would be recognised as a western source of food. To be more in line with the methods of Piazza and Loughnan (2016, Study 2), it was stated that both animals were used as a food source by people local to the area. Both the kakapo and chicken were described as either low intelligence or high intelligence. This was achieved, as in Study 2, by providing evidence that the animal was less intelligent or of equal intelligence as a raven (the referent animal).

Attention and manipulation checks. We had two attention checks at the end of the description in order to a) check they read or listened to the description and b) to reinforce the manipulation. We asked "do kakapos (chickens) have amazing (awful) memories" based on whether it was the high or low intelligence condition. This was taken verbatim out of the description and should always be answered "yes." The second question was "can kakapos (chickens) solve puzzles?" This was taken from the last bullet point in the description and would be either yes or no depending on the condition. We also asked if the bird was endangered. The birds were both described as not endangered before the intelligence information began. We then had the manipulation check on the next page. We asked, "how smart do kakapos (chickens) seem to you?" This was answered with a sliding scale from 0 to 5 that went to the second decimal place. Guides above the slider went from 'not smart at all' to 'really smart.'

Moral concern. The dependant variable was measured in the same way as Study 2. The first questions were "is it OK or not OK to (harm, take away from its home, keep locked in a cage, and finally to be killed to be eaten for food.)" If the answer was not OK, then the follow up of how bad would it be to do those things ranging from bad to very, very bad. These questions varied in intensity of harm, the first asked if it was OK to harm the bird, the next was it OK to take it away from its home, next was is it OK to keep it locked in a cage, and lastly is it OK to kill and eat it for food.

Aesthetics and familiarity. In order to assess whether the aesthetics of the animals were controlled for by our change to black and white pictures we asked participants to rate the aesthetics of the bird they had just seen. This was on a slider that went from 0 to 100. The guides went from very unattractive to very attractive. We also asked the participants in the kakapo condition how familiar they were with kakapos before the study. The reasoning for this was that if they were familiar with the bird they would know kakapos are endangered and

not used as a food animal. They would also be less likely to believe the low intelligence manipulation.

Demographics. We asked basic demographic questions, these were age, gender, nationality, and diet. We also asked if they ate chicken.

Procedure

This study was advertised on Prolific Academic and completed via Qualtrics. They were required to consent before participating in the study. They followed the same procedure as in Study 2. Consent was required to participate. Then the study followed the same order as Study 2 with the description of the bird followed by the attention checks, the manipulation check, the moral questions, aesthetics and familiarity questions, and the demographic questions then debriefed.

Results

Analysis Plan

We used a 2x2 ANOVA to assess participants' ratings of animal treatment, with follow-up simple effects in the event of a significant two-way interaction (we were particularly interested in the two-way interaction of animal type and intelligence, as evidence of differential treatment of the use of intelligence information regarding the two birds). If intelligence information is moderated by the nature of the animal's instrumental value for the participant, we should observe a significant two-way interaction of animal type and intelligence, such that the intelligence information impacts on participants' attitudes about animal slaughter only for kakapos, with greater moral concern for the animal in the high intelligence condition relative to the low intelligence condition in this context. To address the potential confound of aesthetics, we checked for a main effect of bird type on the aesthetic

ratings (e.g., kakapos being rated more attractive than chickens). To determine if there might be a "halo effect" (Nisbett & Wilson, 1977) caused by the manipulation of intelligence (e.g., the high intelligence birds being rated more attractive than low intelligence birds), consistent with findings from Klebl et al. (2021), we also tested for a main effect of intelligence on aesthetic ratings. We preregistered that only in the event of a main effect of bird type on aesthetics would we run ANCOVAs for the animal treatment measure, using aesthetic ratings as a covariate of bird type in the analysis. All analyses were completed in R using stats, rstatix, and tidyverse (Kassambara, 2021; R Core Team, 2020; Wickham et al., 2019). The tables in this study were created using apaTables (Stanley, 2021) and the graphs were created using ggplot2 (Wickham, 2016).

Did we control confounds?

The intelligence manipulation was successful, both chicken and kakapo in the high intelligence condition were rated higher on intelligence than the birds in the low intelligence condition (Table 4.2). We did not successfully standardise the intelligence ratings between the birds. The kakapo was still rated as more intelligent than the chicken by a small but statistically significant amount (Table 4.3). The difference was about the same margin observed in Study 2. This may be because the kakapo was still identified as a parrot which are generally seen as more intelligent birds than crows and chickens (e.g., see Piazza et al., 2014, Study 1).

Table 4.2

Means and standard deviations for Intelligence Rating as a function of a 2(Intelligence) X 2(Bird) design

	Bird			
	Chicken		Kakapo	
Intelligence	*M*	*SD*	*M*	*SD*
High	4.04	0.53	4.39	0.49
Low	0.18	0.24	0.29	0.34

Note. M and *SD* represent mean and standard deviation, respectively.

Table 4.3

Fixed-Effects ANOVA results using Intelligence Rating as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	$_{\text{partial}}\,\eta^2$	$_{\text{partial}}\,\eta^2$ 90% CI [LL, UL]
(Intercept)	896.64	1	896.64	5098.07	.000		
Intelligence	419.91	1	419.91	2387.53	.000	.92	[.90, .93]
Bird	3.54	1	3.54	20.14	.000	.08	[.03, .15]
Intelligence x Bird	0.81	1	0.81	4.63	.032	.02	[.00, .06]
Error	38.52	219	0.18				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

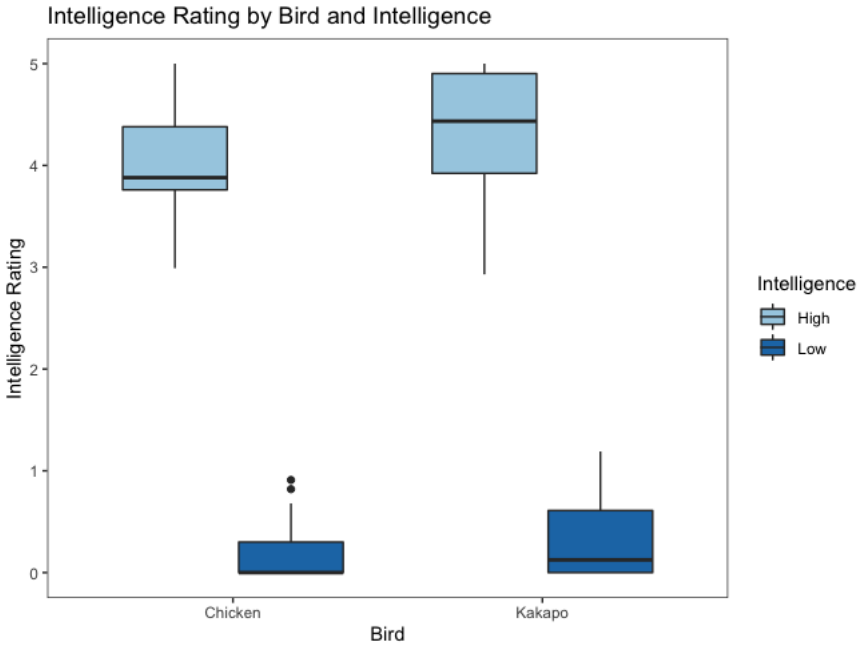


Figure 4.2. Box plot of intelligence ratings by bird and intelligence category.

We successfully controlled the potential aesthetic confound. There was no difference in aesthetic ratings between the birds (Table 4.5). There was a difference in aesthetic rating in terms of intelligence, meaning more intelligent animals were rated as more aesthetically appealing which was expected and consistent with Klebl et al. (2021) and the correlation between intelligence and aesthetics ratings in Study 1.

Table 4.4

Means and standard deviations for Aesthetics as a function of a 2(Intelligence) X 2(Bird) design

	Bird			
	Chicken		Kakapo	
Intelligence	*M*	*SD*	*M*	*SD*
High	56.80	22.05	58.13	23.81
Low	52.54	19.66	49.33	26.21

Note. M and *SD* represent mean and standard deviation, respectively.

Table 4.5

Fixed-Effects ANOVA results using Aesthetics as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	607018.47	1	607018.47	1144.89	.000		
Intelligence	2204.94	1	2204.94	4.16	.043	.02	[.00, .06]
Bird	46.06	1	46.06	0.09	.768	.00	[.00, .02]
Intelligence x Bird	265.65	1	265.65	0.50	.480	.00	[.00, .03]
Error	107629.85	203	530.20				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

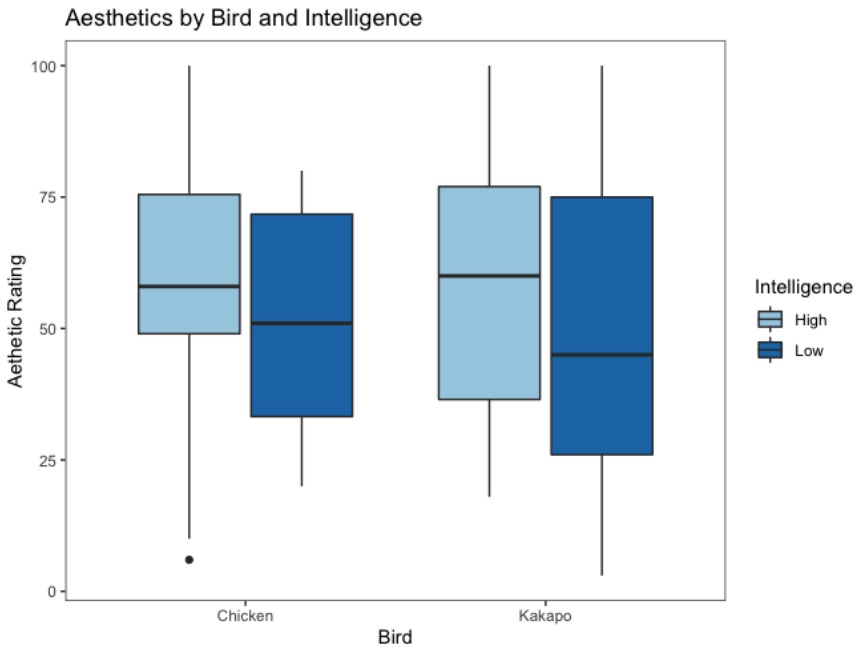


Figure 4.3. Box plot of aesthetic ratings by bird type and intelligence category.

Harming

There was a main effect of intelligence on judgments of harming the animal. Unexpectedly, participants judged it less acceptable to harm a bird with low intelligence than a bird with high intelligence (see Table 4.7). Oddly, the direction of the effect appears to run counter to previous findings that intelligent animals deserve *greater* protection from harm

than less intelligent animals (e.g., Bastian et al., 2012; Piazza et al., 2014; Piazza & Loughnan, 2016; Study 1).

Consistent with Study 2, and as predicted (Hypothesis 2), there was a main effect of bird type (Table 4.7). it was judged worse to harm a kakapo than it is to harm a chicken. There was no interaction between bird type and intelligence with regards to general harming.

Table 4.6

Means and standard deviations for Harm as a function of a 2(Intelligence) X 2(Bird) design

	Bird			
	Chicken		Kakapo	
Intelligence	*M*	*SD*	*M*	*SD*
High	3.16	1.37	3.79	1.25
Low	3.64	1.19	4.15	0.94

Note. M and *SD* represent mean and standard deviation, respectively.

Table 4.7

Fixed-Effects ANOVA results using Harm as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	$_{\text{partial}}\ \eta^2$	$_{\text{partial}}\ \eta^2$ 90% CI [LL, UL]
(Intercept)	3025.49	1	3025.49	2088.78	.000		
Intelligence	9.70	1	9.70	6.70	.010	.03	[.00, .08]
Bird	18.25	1	18.25	12.60	.000	.05	[.02, .11]
Intelligence x Bird	0.18	1	0.18	0.12	.725	.00	[.00, .02]
Error	317.21	219	1.45				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

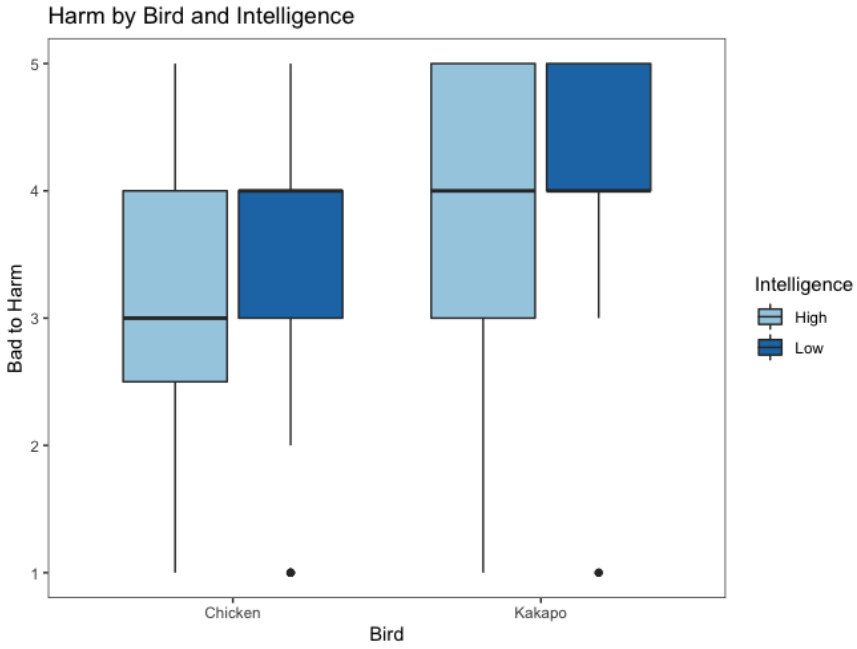


Figure 4.4. Box plot of condemnation of harm ratings by bird and intelligence category.

Displacement

The results for displacing the bird from its home showed that the type of bird matters. As in Study 2, it was judged less acceptable to take a kakapo away from its home than to displace a chicken. There was no main effect of intelligence but there was an interaction between bird and intelligence (Table 4.9). Simple effects tests showed that, unexpectedly, it was judged more acceptable to displace a high intelligence kakapo than a low intelligence kakapo, $F(1, 406) = 4.30$, $p = .039$, $\eta^2 = .01$. There was no difference for high vs. low intelligent chickens, $F(1, 406) = 1.16$, $p = .282$, $\eta^2 = .003$. It was also judged more acceptable to displace a high intelligence chicken than a high intelligence kakapo, $F(1, 406) = 13.40$, $p < .001$, $\eta^2 = 0.032$, and the same was true for low intelligence chickens and kakapos, $F(1, 406) = 45.40$, $p < .001$, $\eta^2 = 0.101$.

Table 4.8

Means and standard deviations for Displacement as a function of a 2(Intelligence) X 2(Bird) design

	Bird			
	Chicken		Kakapo	
Intelligence	*M*	*SD*	*M*	*SD*
High	2.67	1.50	3.55	1.43
Low	2.41	1.50	4.06	1.19

Note. M and *SD* represent mean and standard deviation, respectively.

Table 4.9

Fixed-Effects ANOVA results using Displacement as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	$_{partial}\eta^2$	$_{partial}\eta^2$ 90% CI [LL, UL]
(Intercept)	2241.96	1	2241.96	1117.54	.000		
Intelligence	0.85	1	0.85	0.42	.516	.00	[.00, .02]
Bird	88.53	1	88.53	44.13	.000	.17	[.10, .24]
Intelligence x Bird	8.14	1	8.14	4.06	.045	.02	[.00, .06]
Error	439.35	219	2.01				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

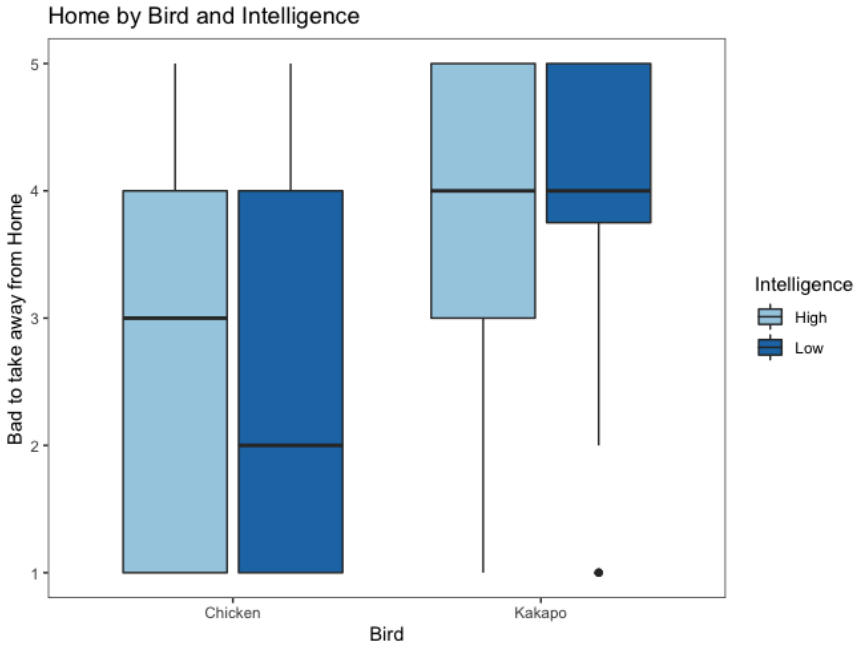


Figure 4.5. Box plot of condemnation of displacement ratings by bird and intelligence category.

Caging

Bird type and intelligence had separate main effects when judging the wrongness of keeping the birds locked in cages (Table 4.11). It was judged worse to keep high intelligence birds in cages and, as predicted, worse to keep kakapos in cages than chickens. There was no interaction between bird type and intelligence for this judgment. These results are consistent with Study 2.

Table 4.10

Means and standard deviations for Cage as a function of a 2(Intelligence) X 2(Bird) design

	Bird			
	Chicken		Kakapo	
Intelligence	*M*	*SD*	*M*	*SD*
High	3.56	1.36	4.14	1.12
Low	2.83	1.43	3.90	1.36

Note. M and *SD* represent mean and standard deviation, respectively.

Table 4.11

Fixed-Effects ANOVA results using Cage as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	2897.43	1	2897.43	1664.49	.000		
Intelligence	13.09	1	13.09	7.52	.007	.03	[.01, .08]
Bird	37.89	1	37.89	21.77	.000	.09	[.04, .15]
Intelligence x Bird	3.50	1	3.50	2.01	.157	.01	[.00, .04]
Error	381.22	219	1.74				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

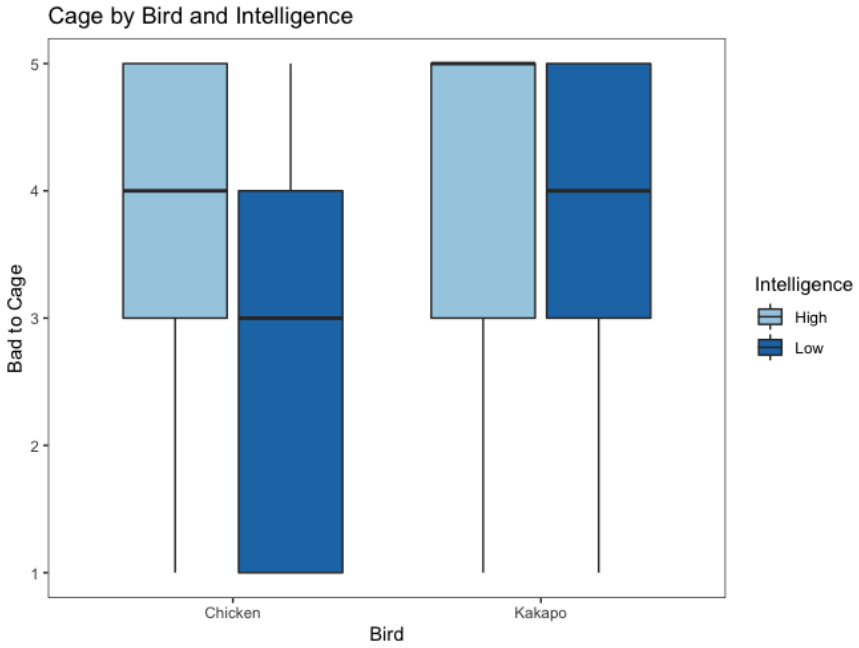


Figure 4.6. Box plot of condemnation of caging ratings by bird and intelligence category.

Killing for food

As to the question whether it was acceptable to kill the birds for food, there was only a main effect for bird type (Table 4.13), with participants rating it more acceptable to kill and eat chicken than kakapos. This was consistent with Hypothesis 2 but inconsistent with

Hypothesis 1. Ratings of the acceptability of killing chickens had a floor effect, meaning the participants judged it overwhelmingly acceptable to kill chickens for food. This was expected as all the participants personally ate chicken. Compared to our previous study, the mean score for the kakapo dropped. This was particularly visible in the high-intelligence condition (*M* = 3.87 [Study 2] vs. 2.67 [Study 4]). The means for the low-intelligence kakapo conditions were quite comparable: *M* = 2.99 [Study 2] vs. 2.71 [Study 4]. Thus, compared to Study 2, it was judged more acceptable for the kakapo to be killed and used for food in Study 4, in which participants were explicitly told kakapos are used as food by a group of people.

Table 4.12

Means and standard deviations for Food as a function of a 2(Intelligence) X 2(Bird) design

	Bird			
	Chicken		Kakapo	
Intelligence	*M*	*SD*	*M*	*SD*
High	1.47	0.94	2.67	1.65
Low	1.12	0.56	2.71	1.66

Note. M and *SD* represent mean and standard deviation, respectively.

Table 4.13

Fixed-Effects ANOVA results using Food as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	$_{\text{partial}}\,\eta^2$	$_{\text{partial}}\,\eta^2$ 90% CI [LL, UL]
(Intercept)	885.15	1	885.15	536.51	.000		
Intelligence	1.36	1	1.36	0.83	.365	.00	[.00, .03]
Bird	108.31	1	108.31	65.65	.000	.23	[.15, .31]
Intelligence x Bird	2.13	1	2.13	1.29	.257	.01	[.00, .03]
Error	361.31	219	1.65				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

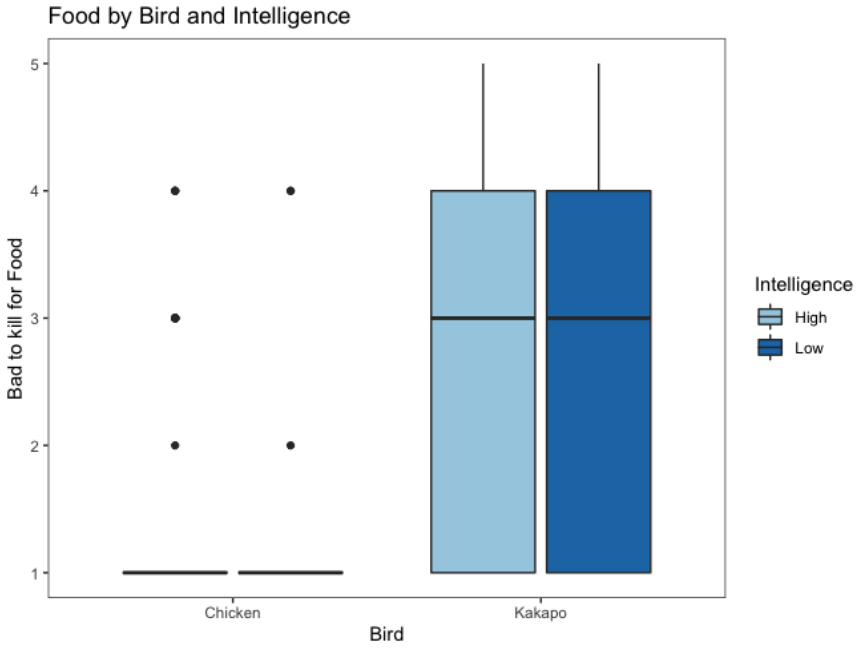


Figure 4.7. Box plot of condemnation of killing for food ratings by bird and intelligence category.

Discussion

The aims of Study 4 were to (a) isolate the personal relevance of the food animal as the principal factor driving the devaluing of chickens, relative to kakapos, that we observed for adult participants in Study 2, and (b) control for possible confounds that may have been present in Study 2. The focus was on the adult participants, and the modifications made to the materials were designed to more tightly standardise perceptions of the two animals with regards to their perceived (a) edibility (i.e., categorisation as a species that *some* people use as a food source), and (b) beauty or how physically attractive the animals were perceived. We also included a measure to check, and rule out, awareness of kakapos as an endangered species.

We were generally successful in standardising the perceived aesthetics between the birds and establishing that each bird was a member of the "food" category. With a few exceptions, the results of the study were quite similar to Study 2, particularly with regards to

how participants judged harming chickens versus kakapos. However, we failed to replicate participants motivated disregard for kakapos' intelligence when judging the wrongness of killing them for food. We attribute this replication failure to the explicit classification of kakapos as food animals (for humans), which likely drove down the perception that it was wrong to kill and eat intelligent kakapos. Compared to Study 2, the mean ratings of condemnation were substantially lower in the high-intelligence condition for kakapos in this replication study, but largely indistinguishable when comparing the low-intelligence conditions between studies. Although this interpretation is speculative, if correct, it highlights the power (and moral consequence) of categorising animals as food, in a manner consistent with the work of Bratanova et al. (2011).

With regards to the potential role of aesthetics in Study 2, by making both images of the birds black and white and getting participants to rate the aesthetics of the birds we are confident we eliminated the potential confound of aesthetics from Study 2. We controlled for rarity by claiming neither bird was endangered, a deception regarding kakapos that was revealed and explained within our debriefing procedure. All of these controls allow us to make firmer claims that kakapos were given greater moral concern than chickens due to participants own personal use of the animal and not other, extraneous factors distinguishing the two birds.

Much as in Study 2, the questions we asked to ascertain moral concern varied in the level of harm that was occurring to the animals. Because we had participants consider a range of different harms, there was variability in the pattern of results for each measure, particularly with regards to our manipulation of intelligence. Nonetheless, there was one consistency across the four items: consistent with Hypothesis 2, kakapos tended to be judged less acceptable to harm than chickens. This result highlights the self-serving nature of adult judgments of animals that have personal, instrumental value to the consumer (Piazza &

Loughnan, 2016)—an interpretation strengthened by our methodological elimination of a category-based interpretation of the results.

Use of birds

The use of birds in this study provides a deviation from the common use of mammals in similar studies (Mather, 2019). Up to 93% of articles published in animal welfare journals included mammals. While the intelligence manipulation was successful in driving up intelligence ratings in the high-intelligence condition relative to the low-intelligence condition, participants' views of chicken and kakapo intelligence may still have been low in absolute terms or when anchoring on human intelligence as the referent. Birds are dissimilar to humans in several respects, and there may be epistemological constraints on how far our materials could drive up participants' beliefs about bird intelligence. Participants were able to rate the intelligence of the birds compared to ravens, which are known to be very intelligent; however, they are still birds. Thus, animal category may be a limit on the generalisability of emphasising intelligence information as a mechanism for promoting an animal's moral standing, particularly when an animal is widely used for human consumption. A recent campaign emphasised the intelligence of fish in an attempt to improve their welfare (CWFI, 2018), however, research has yielded inconclusive results regarding the efficacy of this approach (HLUK, 2021). Our results in this study highlight the difficulties in overcoming human-centric views of animal intelligence as a barrier to animal-welfare efforts.

Animal category – personal use

Even though we replicated most results from Study 2, we did not observe the full interaction of intelligence and bird type for judgments of killing the bird for food. In Study 2 we saw that, for adults, intelligence did not impact on evaluations of killing chickens. However, more intelligent kakapos were deemed less acceptable to kill than the kakapos in

the low intelligence condition. In the current study, chickens regardless of intelligence level were deemed more acceptable to kill than kakapos at any level of intelligence. These results indicate that bird type was the main driver of moral concern of animal treatment.

Upon further examination of the means from Study 2, the condemnation of killing the high intelligence kakapo was lowered in the current study. The level of condemnations for the low intelligence kakapo remained at similar levels. It seems the change we made, describing both birds as used by some as food, allowed participants to give less concern for the highly intelligent kakapo. It is likely that the categorisation of the kakapo as a food animal by some peoples (though none of the participants), was enough to lower their moral concern. This is consistent with Bratanova et al. (2011) who found that when people were presented with a scenario where a tree kangaroo was being hunted, or simply cooked and used as food, participants attributed to it less capacity to suffer and diminished their moral concern for the animal relative to scenarios where the tree kangaroo was viewed as an animal or died accidentally and not used for human consumption.

Even given this difference between Study 2 and the present study in relation to the high intelligence kakapo, the results still support a motivational perspective of participants' use of morally relevant information. We controlled for categorisation of the two animals as "food" for some people. The main difference was that our participants personally ate chickens and not kakapos. The lower moral standing of chickens cannot be attributed to a categorisation effect since we controlled for this. It is better attributed to the fact that our participants eat chickens, but not kakapos.

This study adds to the literature about how powerful an animal's category membership can be, as well as research showing how the personal use of an animal interferes with consistent moral thinking about an animal's moral worth. Finally, it should be noted that while the food category of the animal greatly affected whether adults thought it was

acceptable to kill the birds to eat, it does not seem to as strongly affect judgments of whether the birds should be harmed, displaced, or caged. This should be encouraging in terms of animal welfare while the animals are alive.

Strengths, Limitations and Future Directions

The strengths of this study include that we were successful in isolating the role of personal relevance as an independent variable while addressing a few potential confounds and were able to mostly replicate the original study. However, there were still minor discrepancies between the intelligence ratings of the two birds, favouring kakapos. We also observed a, perhaps unavoidable, halo effect caused by the intelligence manipulation enhancing the overall attractiveness of the birds. The remaining intelligence discrepancy may be the result of extraneous factors such as pre-existing beliefs about the qualities of parrots versus chickens, particularly, parrots being seen as more intelligent than chickens (Piazza et al., 2014). This should be looked into further using evaluations of animal intelligence outside of a motivational context and in the absence of information provision. As in Study 2, we observed mixed results regarding the harming measures not cast within a consumer context (e.g., caging, displacement). We also observed the unusual finding that participants rated it, overall, worse to harm (in a general way) low-intelligent birds relative to high-intelligent birds. Though this was not anticipated and deserves further empirical attention, it possibly reflects the attitude that harming an already cognitively vulnerable animal, particularly in the absence of any good reason to harm them, exacerbates the offense.

Due to the impact of the COVID-19 pandemic on data collection, we were unable to examine how children would react when confronted with the kakapo being a food animal, and when minimising the aesthetic differences between the birds. It is likely they would remain highly condemning of killing the kakapo as they were with the chicken in Study 2. We were also unable to isolate aesthetics for children between the chicken and kakapo.

Future research should continue to examine how the instrumental value of an animal, their intelligence and aesthetics, interact to impact on the moral evaluations children form of animals across early to late childhood, and how these variables may take on new meaning and potency within adolescence.

Conclusion

We confirmed personal use was the most important predictor of motivated use of morally relevant information. Standardising the animals on edibility in Study 4 allowed us to more confidently attribute the evaluative differences caused by bird type to the consumer interests of our participants (as consumers of chicken and not kakapo meat). While controlling for several potential confounds, we still found that adults generally condemned harming animals, however, when offered a justification (killing for food), they readily accepted the harm to the animal, particularly for animals they themselves eat.

General Discussion

The aim of this thesis was to find out whether children and adults differ in the way they prioritise, conceptualise, and value animals. We addressed these questions in several parts. In Study 1, we considered which characteristics of animals children focus on when prioritising the lives of different animals and whether this differs from adults. In Study 2, we examined whether children show use of predefined categories of animals, particularly as an animal's status as "food," to evaluate its moral standing. And, in Study 3, we looked at whether children use information about animals in a motivated way, as adults do, when considering how an animal should be treated. The findings reported in this thesis substantially advance how we understand children's concern for animal life. They also highlight the developmental nature of the specific criteria children and adults use to prioritise animals in their own lives. Several themes emerged from these studies, the first was that children differ from adults in that they do not focus on the characteristics of animals that benefit humans, such as their edibility. Instead, children place more value on the animals' intrinsic properties, such as their aesthetic qualities. Another theme was that, at least prior to adolescence, children are less likely than adults to devalue an animal simply because it provides an instrumental value for human consumption. By contrast, adults are often motivated to treat food animals quite differently from non-food animals, arguably because of the moral conflict they represent.

Summaries of studies and key findings

Overview

When we integrate the four studies of this thesis together, we found that there is a developmental trajectory of moral concern for animals. The way animals are treated becomes more complex with increased knowledge with more nuanced characteristics interplaying with

and against each other. Study 1 gave us the overview of how characteristics interact with each other to predict which animals children value and exhibit moral concern for. It also showed that children demonstrate differences in their valuing of animal life when compared to adults. Specifically, Study 1 showed children seem to focus on a narrower range of characteristics of animals (aesthetics, similarity, harmfulness) when they are placing value on the lives of animals and children then develop and use a greater range of assessments as they age. The valuation structure then expands and further differentiates different kinds of animals in the minds of adults. In addition to the characteristics children use to prioritise animals, adults will focus on the intellectual abilities and sentience that go into the valuation of similarity to humans and the utility that the animals can provide to humans (in the form of a source of food). This adult structure was seen to be increasing/developing in older children (8 to 10 years old) but had not fully reached the full-strength associations that could be seen in the adults. Study 1 also showed that with age, children had an increased knowledge of which animals are eaten by people, this could partially, but not fully, explain the increased reliance and importance of the edibility factor in the moral concern structures we observed in older children and adults.

In Study 2 we found that while for adults the categorisation of an animal as food affects moral standing (specifically in relation to the killing of animals) children did not use the category membership of an animal in the same way as adults did. Children treated food and non-food animals quite similarly to each other when they judged the wrongness of harming those animals. Compared to children, adults lowered their level of concern for animals classed as food sources. Adults also disregarded intelligence information of an animal classed as a food source, while children did not.

Our findings from Study 3 showed that children did not devalue food animals as a function of the animal's intelligence level. Furthermore, children expected others to condemn

harm to food animals as strongly as they themselves did. By contrast, adults disregarded intelligence information when they judged their level of moral concern for the animals they eat. Moreover, they expected others to show greater concern for more intelligent food animals, even though they themselves did not. These observations illustrate that children are not motivated to devalue the animals that they eat when they learn about the animal's abilities in the way adults are motivated. Below, I speculate about what these results likely reveal about the developmental requirements for the experience of moral dissonance, and the need for dissonance-reducing strategies, in the domain of food (e.g., Rothgerber, 2020).

Study 4 further showed that while the category of the animal (as "food" for people) was important, the *personal relevance* of the animal (as "food" for the participant) was more important to adults. This means that while an animal may be considered a food source by another, the adult participants judged it more acceptable to kill an animal if they themselves were the ones who were to consume it—in this case, they judged it more acceptable to kill a chicken (that they consume) over a kakapo (that they know others consume). This statement remained true even when the aesthetics of the two birds were controlled for. Study 4 also showed that intelligent animals are rated more attractive (a possible "halo" effect), and the perceived intelligence of the animal affects its judged moral standing. This finding ties back to Study 1 and highlights how an animal's characteristics interact to influence a person's moral concern for the animal.

Study 1 – Valuing different animal lives

In Study 1, we developmentally modelled moral concern for animals from school age into adulthood. We found that participants used a more complex set of characteristics with increased age. For our adult participants, there was a positive relationship between intelligence and sentience, and this has been consistently found among adults (e.g., Bastian et al., 2012; Piazza et al., 2014). This relationship between intelligence and sentience was not

found for children in our study because the children conceptualised sentience in a different way; they used body size as a heuristic for gauging an animal's capacity for pain. Another study found that children under 7 years of age tend to struggle with the concept of animal sentience (Burich & Williams, 2020). Another key finding was that participants of all ages showed greater concern for beautiful animals. This emphasis on beauty has also been found by Klebl et al. (2021) when they correlated beauty with moral standing independently of patiency, agency, and harmfulness. They further found that beauty predicted moral standing when pairs of beautiful and ugly animals from the Animal Images Database (Possidónio et al., 2019) were matched on patiency, agency, harmfulness, familiarity, similarity to humans and edibility.

In addition to a high reliance on beauty, our younger children also tended to value animals that they perceived to be benevolent. Other research, focused on adults, has found mixed results on the importance of benevolence. Piazza et al. (2014) found harmfulness (reverse of benevolence) negatively predicted moral concern for animals independent of an animal's intelligence and sentience. They also showed that it is the violent *disposition* of an animal that is specifically evaluated by adults, much like how people judge the underlying character of humans and not simply their individual actions. By contrast, Klebl et al. (2021) observed a minimal, independent contribution of perceived harmfulness, when several dimensions, including aesthetics and intelligence, are modelled as simultaneous predictors of moral concern. Indeed, harmfulness was not a strong correlate or predictor of moral rank for our adults and older children in Study 1. Another important finding from Study 1 was that older children have a greater awareness of the animal origins of meat compared to younger children and they include this when they are placing value on animals' lives. The older children seemed to have a greater understanding of the role meat plays in their life and wider society when they choose to save animals because of their usefulness to humans.

Study 1 used a zero-sum medicine allocation task in order to ascertain moral concern for a range of different animal targets. While this allowed for a range of characteristics across the animal targets to be entered into a model, it did not allow for more subtle variation in moral concern to be gleaned from the model. The subsequent studies allowed for more nuanced gradation in our measure of moral concern, for example, by having participants evaluate a range of actions that could be construed as varying levels of "harm" to animals (Study 2). Study 1 laid out how sentience, intelligence, benevolence, aesthetics, and edibility characteristics interplay with each other, but we wanted to explore how manipulating certain variables might affect children's moral concern for animals. Since Study 1 showed all ages relied on human similarity to some degree for moral valuations and intelligence was a predictor of similarity for all age groups, we selected intelligence as our trait to manipulate in Studies 2-3. There was a developmental shift in the awareness and use of the edibility characteristic in our models, so we decided to explore edibility further to perhaps pinpoint an age where reliance on this characteristic changes. Studies 2-3 also focused on meat consumption because this has a high impact on the animals themselves, as rearing and slaughtering animals for food accounts for the vast majority of worldwide, human-caused suffering to animal life. Thus, the lessons derived from these studies could potentially have extensive welfare implications for animals. Though we manipulated the perceived food status of the animal in Study 2, by selecting an animal (chickens) we believed children would be most familiar with as food eaten by them (based on our observations in Study 1), our materials failed to control for a more abstract, less personal notion of edibility – that an animal could be eaten by humans, even if the participant themselves judges the animal non-edible. Though this realisation occurred subsequent to data collection with children, we were able to rule out this more abstract notion of edibility among adults in Study 4 with a simple alteration to the materials which clarified that both bird species (chickens, kakapos) are eaten

by some people. This study allowed us to isolate the personal relevance of the animal as food in Study 4, at least for the adult participants who were the only group that showed some amount of motivated disregard for intelligence information (e.g., when judging the wrongness of slaughtering the birds for food).

Studies 2 and 4 – Motivated use of intelligence information for animals we eat

There were several main takeaways from Study 2. Firstly, adults were using the intelligence information of the animal to discern their acceptance of harm to the animal, as in, for the less intelligent animals, adults were more likely to accept harms being done to them. In contrast, the children did not discern between the intelligence levels of the animals and were just as likely to condemn harm of the less intelligent animals as they were to the intelligent animals.

We also observed in Study 2 that adults were more accepting of slaughter as a justification to harming an animal, particularly when the animal was one that they themselves eat. In contrast, children were less inclined to accept harm for any reason. Children also did not place high emphasis on an animal's category as a food source. We specifically used chickens because 91% (from Study 1) of young children knew that chickens were eaten by people. Thusly, a claim that children did not understand that the animal in this study is used as a source of food can be ruled out. Considering this, although children understand chicken is a food source, they may not be applying that knowledge when they are judging the acceptance of harm to the animal. Children are capable of viewing animals in ways that may be contrary to the generally accepted adult categories even if they understand an animal is a food source. Children, aged 9 to 11 years old, have a tendency to classify animals as pets instead of food, for example, with regards to pigs (McGuire et al., 2022).

Both children and adults generally gave more moral concern to the kakapo (non-meat animal) than the chicken (meat animal), though adults showed a much larger bifurcation in

their appraisals of the two birds. We were unable to determine whether this elevated status for the non-meat bird was because of its classification as "food" (Bratanova et al., 2011) or because of its personal relevance as an animal participants eat (cf. Piazza & Loughnan, 2016). We were aware that the kakapo had a more unique sounding name and given that few people may have heard of it, it was possible that the kakapo was considered more rare, possibly endangered. We also were concerned that the two birds may have incidentally differed in their perceived physical attractiveness, given that the image of the kakapo involved more vibrant coloration than the image of the chicken. Therefore, in Study 4 we sought to address these possible confounds between the birds. First, we accompanied the chicken with its breed to address the name and we also stated that both birds were not endangered. The aesthetics of the animals was better controlled by using black-and-white images of the birds. We did this because beauty can elevate moral status as we observed from our own Study 1 and has been found by others (e.g. (Klebl et al., 2021). Even when rareness, aesthetics, and status as a meat animal were controlled for, we found that adults were more accepting of harm done to the animal they personally consumed, and they continued to disregard the intelligence of the animal they eat (chickens) when evaluating the wrongness of slaughtering the animal for food. By comparing the results of the question about killing for food between Studies 2 and 4 (the kakapo was more acceptable to kill in Study 4 than Study 2 but participants remained equally condemning of harm against the kakapo in the other three questions), we surmised, consistent with the findings and theorising of Bratanova et al. (2011), that just stating that an animal is used as a food source will make it easier to justify killing them even when people are unfamiliar with the animal.

Study 3 – Self vs. others' perspective

In Study 3, we saw that adults used intelligence information in a motivated way to minimise their own discomfort around eating meat while children did not. Children

condemned harms equally both for themselves and when judging for another. Adults used intelligence information when judging for another person but not for themselves—that is, they believe that others will alter their moral evaluations of food animals when learning about their intelligence, but they are not moved by this information (even if they recognise that the animal is intelligent – as confirmed by the high scores we observed on the intelligence manipulation check). These results conceptually replicate the adult-oriented findings of Piazza and Loughnan (2016, Study 3), and extend their findings to another food animal (cows, instead of pigs). When answering from their own point of view, adults fail to make use of intelligence information when asked about their own meat consumption and guilt. This suggests a motivated use in order to reduce cognitive dissonance around the subject of eating meat. Adults seemed to be *disregarding* morally relevant information when judging the wrongness of beef consumption for themselves, but *regarding* this information when judging how others would perceive its wrongness.

By contrast, the children showed more concern for animals in their judgments of cow treatment and eating beef when compared to adults. Compared to adults, the children were more condemning of eating the cow when judging for themselves, and we found that children exhibited little difference in their moral judgments based on which perspective they took. The children did not seem to be connecting their personal behaviour (i.e., of eating beef) to the wider societal practise of slaughtering cows for food. There are several possible interpretations of why this may be the case, discussed below in the section 'Children's understanding of meat'.

Children's prioritisation of animals and Moral development

Adults' defining qualities for moral concern were intelligence, sentience, similarity to humans, aesthetics, and usefulness to humans. From this set of studies, we can see that children develop into what we see in adults, they do not start that way. Children start with a

simplified understanding of animals and only use a few select characteristics, largely tied to their observable properties, to judge different animals. The first aspect children focused on was the aesthetic qualities of the animal (Study 1). This is consistent with other studies of children including Borgi and Cirulli (2015) which found young children preferred what the researchers described as more beautiful animals. While this focus on aesthetics starts in childhood it continues into adulthood. We see from Study 1 that this aspect is important for adults and in Study 4 we see how it interacts with other characteristics (the more intelligent birds were rated, the more beautiful they were rated). There may be a halo effect occurring here, much like with social evaluations in humans (Nisbett & Wilson, 1977), where one positive trait enhances the perception of other positive traits. Klebl et al. (2021) also found that perceived beauty positively influenced the moral standing adults gave to a set of animals independent of patiency, agency, and harmfulness. Thus, the aesthetic qualities of an animal continue to be an important dimension for understanding which animals people value throughout their lifespan.

The next focus for children was on an animal's perceived harmfulness. Younger children may be exhibiting a heightened sensitivity to potentially threatening aspects of animals. Hoehl et al. (2017) showed children are attentive to spiders and snakes while Bertels et al. (2020) showed infants are able to detect snakes in their natural environment, which shows that even infants are attentive to potential dangers around them. Children's focus on aesthetics and harmfulness may be related. Ptáčková et al. (2017) found that in a survey of snakes children preferred snakes that had inconspicuous heads and small bodies which they interpreted as being less dangerous than snakes with large heads which would be poisonous and snakes with large bodies which would be more of a danger to children. This heightened focus on perceived dangerous animals would certainly allow these attributions to influence children's moral considerations about which animals are deserving of their concern. While

previous research has shown that harmfulness is a relevant characteristic for adults (Piazza et al., 2014) we did not find it to be of much importance for our older children and adult participants. This finding may be a result of how we measured the dimension (with a single item) rather than a battery of trait items, as others have done (e.g., Piazza et al., 2014). Our materials also utilised a novel ranking task to assess "moral concern" - the medicine allocation task – which differs from previous operational definitions of moral concern, e.g., with self-report items such as "I have sympathy for [the animal]" (see Piazza et al., 2014). Thus, caution is warranted when making direct comparisons. It is interesting to note that Klebl et al. (2021) did not find support for harmfulness affecting moral concern independently of intelligence and beauty. Though, like Piazza et al. (2014), they utilised self-report items for measuring moral concern. Possidonio et al. (2019) observed a small (but significant) negative relationship (r = -0.14) between adult appraisals of how "dangerous" an animal is and feelings of care for them, using ratings across 120 different animals and single-item measures. Future work is needed to further examine the role perceived harmfulness plays in moral standing judgments as current findings have yielded mixed results.

The next characteristic children prioritised is the intelligence of an animal. This finding has been seen in many other studies with adults (Morris et al., 2012) and children (Hawkins & Williams, 2016). Because we demonstrated in Study 1 that intelligence has such a reliable effect on moral concern, we used it in all three subsequent studies. Adults place such high importance on intelligence that they will downplay the intelligence of an animal if they want to deny moral concern for the animal (Bastian, Loughnan, et al., 2012). Indeed, adults will intentionally avoid exposing themselves to information about animal intelligence that has the potential to impact on their attitudes towards how certain animals, e.g., farmed animals, are treated (see Leach, Piazza et al., 2022). When such information cannot be avoided or denied, studies by Piazza and Loughnan (2016) suggest that adults may simply

fail to factor this information into their moral calculus. In Studies 2 and 3 we saw that children do not use the intelligence information about an animal in this strategic way. Furthermore, they condemned the slaughter of cows as much as they thought others would when learning about their intelligence. Taken together, Studies 2-3 suggests that children's moral concern for animals does not seem to take into consideration the personal implications of the food animal's status. Children were not much influenced by the instrumental value of an animal as food for the participant —that it is an animal they eat—nor do they display motivated uses of information in the way that adults do.

Another finding from this thesis that converges with other emerging work in this area is that children seem to be less speciesist than adults in their relationships with animals. Evidence for this claim emerged in the present studies in the following ways: In Study 2, the children did not strongly differentiate, in their moral concerns, different classes of animals. And, in Study 1, they were more willing to help entities that lacked a strong similarity to human beings. These findings are consistent with other findings in the literature, including Wilks et al. (2020) who found that young children are more likely than adults to save a dog or a pig, over a person, all else equal, when presented with sacrificial dilemmas requiring them to choose between two different options. The findings also complement those of McGuire et al. (2022) who found that, relative to adults, children are less likely to classify a farm animal as food than they are to classify them as pets. They also found that children scored less highly on a speciesist scale than adults. Indeed, the empirical studies of this thesis all converge on children granting more moral status to animals, particularly those animals which society largely deems as having value mostly because of their instrumental value to humans. In stark contrast, children tend to value animal life more in terms of intrinsic properties that one can determine an animal to possess. The fact that the younger children in Study 1 also placed dogs above people, in line with Wilks et al. (2020), shows that even with different methods of

research in this area, there is a growing consensus regarding children's unique relationship to animals vis-à-vis adults. This is reassuring that children are not starting out overtly biased against certain animals (e.g., those humans tend to exploit), but instead it develops externally, which offers unique opportunities for educational interventions in late childhood.

In an attempt to find a starting place for interventions, Muldoon et al. (2016) had discussions with 53 children, aged 7 to 13 years old, in fourteen focus groups about what they already knew about the welfare needs of their pets. The results of what children knew were mixed. The children were able to identify when their pets (mostly dogs) were hungry or injured but had trouble identifying other cues of the welfare state of their pets such as needing to go outside or have their enclosure cleaned. The children also reported that they believed different kinds of pets had different sets of basic needs such as fewer children believing cats need water and fish need to be protected from pain, injury, suffering, disease, fear, or distress. The authors suggest that direct experience with animals may be necessary to enhance children's skills in identifying welfare needs in their pets. In Rule and Zhbanova's (2013) review of how children learn about animals, they also suggest that effective programs would need to focus on children's concrete sensory ways of knowing rather than presenting abstract material to children about animals' mental lives.

Children's understanding of meat

There are a few reasons children may have been able to remain moralistic in their judgements of how to treat animals that they themselves eat (Studies 2 and 3). One may be that children have less understanding of meat and where it comes from. Evidence for this argument can be found in Study 1 where we found that younger children had less understanding than adults of which animals are eaten by people (older children displayed more extensive knowledge than the younger children). We also found in Study 3 that the

children had less understanding than adults that hamburgers came from cows. This disconnection, regarding where meat comes from, may allow children to blanket condemn killing of animals while still eating meat. As Rothgerber (2020) argued, for children to exhibit cognitive dissonance and motivated behaviour (i.e., efforts to reduce dissonance such as adults' disregard of the animal's intelligence when reasoning about animals they eat (Study 2 and 4)) children must first understand that their actions (e.g., of eating meat) are in conflict with their ideals (e.g., not harming animals). However, contrary to the argument that children lack the understanding that animals are eaten, nearly all the children in Study 1 understood that chickens were eaten by people. Indeed, this was the reason we used chickens as our target animal in Study 2. Therefore, even given some of the children had less understanding, this alone would not explain the lack of motivated thinking that was observed in adults.

An alternative explanation for what we found, is that, in addition to understanding that animals are used for meat, children must comprehend that their actions are in some manner *implicated* in the production of meat. That is, children must have a sense of their *personal responsibility* for the suffering inflicted on food animals. Such a claim would align with the New Look Model of cognitive dissonance (Cooper, 2007), which posits that a sense of personal responsibility is a key requirement for the elicitation of cognitive dissonance (as is an understanding that one's actions are causally connected to a negative outcome).

In the context of 'meat conflict' (e.g., Rothgerber & Rosenfeld, 2021), a sense of personal responsibility would entail an understanding and affirmation of at least three premises: (a) that meat production requires the harming of animals; (b) that meat products, such as beef, chicken, pork, and so on, are the flesh of animals; and (c) that, by partaking in meat consumption, one furthers the economy of meat production and, hence, animal

suffering. As we observed in Study 1, children are beginning to grasp some of these premises (e.g., premise B) to some degree in early childhood.

Regarding premise B, we can begin to see that children mostly understand the source of meat later in childhood (8 to 10 years, Study 1). However, this does not mean they acknowledge that the sole purpose of farmed animals is to become meat. Hahn et al. (2021) found that children started to make considerable advances in their knowledge about food in the span between 4 and 7 years old. The children started being more accurate when differentiating between food and non-food targets. However, even amongst their older children the cow and pig were incorrectly classified as "not OK to eat" at a level greater than what would have been predicted by chance. Other research found similar findings with regards to children not categorising farmed animals as food as often as adults. McGuire et al. (2022) asked children (9 – 11 years old) and adults to categorise one farm animal, one companion animal, one animal food product, one non-animal food product, and one unrelated object as 'food', 'pet', or 'object'. The forced choice between food and pet allowed the researchers to ascertain the first intuition of the children on the farm animals. They found that, compared to adults, children were more likely to categorise the farm animals as pets than as food. Other findings from this study were that the children rated eating animals as significantly less permissible than adults, that children were less speciesist than adults (in a direct measure of speciesism), and children believed farm animals should be treated better than adults. These findings indicate that children are more inclined to value animals beyond their role as meat.

In our Study 2, children did not seem to rely heavily on the 'food' category when determining moral concern for the meat and non-meat animals. This may not be a classification breakdown but a failure to integrate the category into their concern judgements. Put differently, children may grasp that 'chicken' comes from birds but when they judge how

chickens ought to be treated, they are not thinking about their status as ‘my food’. Thus, there is no need to defend or rationalise the killing of chicken. This may be one possible explanation for why pre-adolescent children’s reasoning about food animals does not yet exhibit the self-serving processes characteristic of adult meat eaters.

It may be difficult for children to integrate their knowledge about which animals are consumed and their own role in the process given that society tends to shield children from this reality. Stewart and Cole (2009) determined children are not rushed into learning about their role in continued slaughter of animals. In their review of children’s media, they found that there is a separation that occurs in the media children consume to subtly but strongly differentiate farmed animals, working animals, and dead meat. They claim that when the happy meal toy of Babe (a pig) is served alongside meat the context is that this Babe transcended his farmed animal status, and this status allows children to care for him while the children should feel nothing about the animal they are eating. Children’s seeming contradiction of wanting to treat farm animals well and actively participating in their slaughter can be explained by their lack of detailed knowledge of how their actions affect those animals.

According to Cooper (2019) a person must feel they have personal responsibility for an action that they are taking in order to feel cognitive dissonance. If someone were to choose to partake in a behaviour that was incongruent with their ideals, then dissonance has a chance to occur. If the person were forced to partake in the action, they would not see it as their choice and dissonance would not occur. It would be seen as the responsibility of the authority that forced them to partake. To apply this in the context of premise C, children have little choice in what they eat, their parents give them food and expect them to eat it. According to Bray et al. (2016), when some children found out about the origin of meat they would refuse to eat meat for a time. Most of the children would go back to eating meat. This may be

because it is not their choice in what is made for dinner, so it is not their responsibility. When children become older, they have more autonomy and thus more responsibility for their actions, they may start to experience cognitive dissonance, in regards to their meat eating behaviour, and take action. In Germany, the rate of vegetarianism among children aged 6 to 11 was 1.4% but among children aged 12 to 17 years was 5% (Patelakis et al., 2019) which is a 257% increase. Pallotta (2008) interviewed several people who had initial resistance is to meat when they were young children but were unable to continue to resist because of pressures from their parents. When they were older, and in control of what they ate, they were able to act on their initial resistance.

The experience of conflict about meat consumption might require endorsement of additional propositions—e.g., that animals killed for human consumption can suffer, have moral worth, and so on—beyond a sense of personal responsibility. But, arguably, such arguments are orthogonal to a sense of personal responsibility (e.g., vegans could endorse them) and so they would not be *sufficient* to elicit cognitive dissonance in the absence of a sense of personal responsibility. Thus, an important direction for future research is to better understand the developmental processes by which children come to develop a sense of personal responsibility for their own meat consumption. Such an investigation would benefit from a sampling strategy that extends beyond the age ranges covered here, into adolescence, and that utilised direct measures of meat conflict, such as measures of meat ambivalence (Buttlar & Walther, 2018) or omnivore conflict (Piazza et al., 2022), adapted for younger populations.

Limitations and Future directions

While every research project has limitations, we tried to mitigate potential problems at the time the research was conducted. Upon reflection, there are a few limitations of this research we would like to discuss. Beginning with the measure of moral concern we used in

Study 1. The ranking task provided a measure of moral concern relative to the other targets. However, this did not provide an independent measure of concern for each target individually. Participants may have wished to rate some of the targets as equally valued, but they were not able to in this ranking task. They may also have wished to create an even greater separation between the targets, differentiating between high and low value animals. Asking a distinct question about how much they valued an individual target would have provided absolute values that could have been compared between targets and more easily enabled further studies with different targets. Indeed, this is how previous research has measured moral concern for animals (see Leach et al., 2021; Piazza et al., 2014; Possidónio et al., 2019). This ranking task was also different from how we measured moral concern in Studies 2-3, which focused on a single animal, used multiple items (Study 2), focused on active harm to the animal (as opposed to saving the animal), and was rated on a likert scale. However, the fact that our measure of moral concern varied between studies presents another limitation of the present research. In Study 1, we focused on the valuing of an animal in an affirmative manner – participants placed targets in an order based on their concern for the animal's welfare. In the subsequent studies, we turned to judgments of active forms of harm. In Studies 2 and 4, we covered a range of realistic 'harms' that measured the construct 'harm to animals' This measured the level of participants' agreement with the degrees of increasing harm to the birds. While in Study 3, we ascertained levels of feeling bad and guilty when confronted with eating an animal. The variations in measuring moral concern may have added extra noise and with a more refined scale between studies it would be easier to generalise the findings to other targets or actions. However, since our results are relatively consistent across our measures this variation contributes to the robustness of the research findings.

Another limitation was that the children in Study 1 had trouble understanding the question about whether an animal experiences physical pain. They did not seem to think that large animals would experience as much pain as small animals. This suggests children were using body size as a proxy for pain capacity. By contrast, the adults did not associate body size with pain capacity. The adults associated sentience with animal intelligence – both of which were important predictors of adults' moral concern judgements. The children's lack of understanding of sentience, and their failure to apply it in their moral judgments, is worth reflecting on for several reasons. First, it reveals a clear developmental discontinuity. Research with adults has consistently found that adults value an animal's capacity to suffer when forming judgements of moral standing. For example, Leach et al. (2021) gave participants descriptions of an animal that either possessed or lacked a range of 51 qualities (i.e., pain, sadness, fear, loneliness, surprise, anger) and then participants judged how morally wrong it would be to eat the animal. They found that a few of the most impactful characteristics an animal could possess that would influence moral standing were the ability of the animal to experience pain and suffering, as well as the ability to experience and empathise with the pain of others. Second, an understanding that animals experience pain is fundamental to caring and taking action against their suffering. Indeed, a popular idea from animal ethics (e.g., the utilitarian position of Singer, 1971, on 'animal equality') is that sentience constitutes a bedrock foundation on which to confer moral standing to animals and discern a moral 'equivalence' with humans. Young children's failure to grasp this critical dimension of animal mentation highlights an important gap in children's understanding that needs addressing if educators wish to articulate the value of sentience as an ethical principle to children at this age.

Sentience is increasingly becoming an important concept for promoting animal standing in society. Recently, the United Kingdom's government acknowledged crabs,

octopuses, and lobsters are to be recognised as sentient beings (Benyon & Goldsmith, 2021) Once enacted into law, this will affect the societal treatment of these animals in several important ways, such as not being allowed to be boiled alive. Scientific research has been a catalyst for enabling such changes in policy. Crump et al. (2022) described eight criteria they used to test whether decapod crustaceans had sentience, with a focus on pain experience. These include neurobiological criteria, such as 'the animal possesses neural pathways connecting the nociceptors to the integrative brain regions' and behavioural criteria such as 'the animal shows flexible self-protective behaviour' and 'the animal shows associative learning in which noxious stimuli become associated with neutral stimuli.' When the researchers applied their criteria to decapod crustaceans, there was strong evidence that crabs possess sentience.

It is possible that our method of assessing children's understanding of pain capacity obfuscates what children actually know about this concept. We attempted to place context around the question about animals experiencing pain by referencing the child hitting, kicking, or stepping on the animal. Instead of focusing on the animal's capacity for emotional states, they may have focused too much on the animal's bodily vulnerability to the blow. Future research could address this issue in several ways. One might standardise the size of the animal within the experimental materials or direct children to consider the inner feelings of the animal. One might also use different forms of bodily injury that are likely to be less dependent on the size or 'toughness' of the animal, e.g., a cut to the skin. This is a promising direction as future research might bear out that children's understanding of sentience is more advanced than research has hitherto revealed.

Another limitation of this research was in Study 2 and 4 where we presented two birds as targets of moral concern. In a review of animal groups located in recent publications of welfare-related journals, Mather (2019) found mammals to be the most common group

included. The use of birds is less common than use of mammals when manipulating aspects of the target and ascertaining moral concern. Mammals (being more phylogenetically similar to humans) are easier for participants to believe they possess certain characteristics like rich social lives. Our description of the birds was highly focused on elevating intelligence level but not the social aspects of bird life. It would be interesting to manipulate the social aspects of the birds instead of just intelligence. Leach et al. (2021) found that if an animal possessed more social aspects participants rated them more wrong to eat than if the animal had a higher intellect. Items relating to intelligence (such as being able to learn a simple maze, use a stick as a tool, use rocks to break open nuts, and gather food and hide it for later) were all below items related to social aspects (such as sharing food with others, responding to others pain, looking for deceased family members, and saying goodbye to others) when participants judged the wrongness of eating the animal. While our intelligence manipulation was successful, a greater emphasis on the social aspects of intelligence may influence the moral concern people have for birds even more.

Turning to another aspect of this research, some of the measures that we used had ceiling effects, which did not allow us to compare a full range of values. However, this, per se, may not have been a limitation in this case. The question in Study 2, about general harm, had a mean that indicated participants had answered to the most extreme, that it was very bad to harm the birds. It is generally considered bad to harm entities, so the very nature of this question would enable ceiling effects. In order to offset this, we gave the participants the opportunity to indicate agreement or disagreement by starting with a binary answer (okay or not okay). Only after indicating disagreement did the participants progress to answer to what degree of wrongness they felt that the action would have upon the birds. Using this two-part answering method, we were able to capture more nuanced levels of disagreement. We also delved into different types of harms with subsequent questions, which allowed us to explore

participants' reactions to specific situations. The methods we employed are indeed the methods we would have recommended to combat the ceiling effects we found.

Something that these studies cannot answer is when does the shift to more adult thinking happen. The developmental trajectory for this shift is likely between 6 and 12 years old (Kellert, 1985; McGuire et al., 2022; Wilks et al., 2020). Though we spanned this age gap, we did not pinpoint a specific developmental shift in thinking. Our original intention was to obtain a larger set of child participants but, due to school closures caused by the COVID-19 pandemic, we were unable to get the numbers we needed in order to compare younger and older children. Ideally, we would have separated children between 5 to 7 years old and 9 to 11 years old into groups, much like in Study 1. The developmental shift might have been apparent between these two age groups. But it is also possible that the shift comes later – during adolescence. More direct questions about the topic of meat and a wider range of questions would help to pinpoint this shift in thinking or understanding that occurs between early childhood and adulthood. Presenting children with open-ended questions and allowing them to justify their answers might also help in pinpointing the developmental shift. An interview methodology would be most appropriate for such an endeavour because it would give the experimenter the opportunity to help clarify children's understanding and answer any questions the children may have. Direct assessments of omnivore conflict (e.g., Piazza et al., 2022) appropriate for use with children would also be helpful in addressing this empirical gap.

Exploring children's understanding of meat would have to be done in a very sensitive fashion. Previous research has been done by asking the parents of children the children's understanding of meat (Bray et al., 2016). Parents are quite controlling when the subject of meat comes up, recruiting for a study with that subject would likely end up with a bias towards children who understand the sources and processes of meat because their parents,

who have already explained it to them, would have to give consent for them to participate. It is unlikely that parents who shelter their children from the realities of meat production would allow their children to participate.

One final limitation deserves attention. The present set of studies has looked at children's views in a social vacuum. A direction for future research could take would be to explore how children negotiate their moral attitudes about animals in relation to pressures from family, peers and the larger society. Eventually children learn that it is "normal" to treat animals in certain ways (e.g., to slaughter for food; Piazza et al., 2015). Exploring how these normative pressures impact on children's moral judgments would be a natural direction to take this research. Adolescence may also be an interesting developmental time period to examine because this is when young people are highly attuned to the perspective of their peers and they are asserting important group identities (Tanti et al., 2011). It is also the time period that children start to actively differentiate their actions and dietary practices from their family, as observed within patterns of "teenage vegetarianism" (Worsley & Skrzypiec, 1998).

An avenue that also could be taken would be looking at when children accept different rationales for killing animals. Pnevmatikos (2018) found that between the ages of 6 years and 8 years old children start to lower the level of severity they place on the act of killing if there are mitigating circumstances (i.e., killing cows or chickens for food). They asked children from ages 4 to 12 years old if a person killed (another person or animal) because of a set of six different conditions how bad would that act be. Three of the six conditions were considered mitigating circumstances (i.e., killing in self-defence, killing accidentally, and killing animal for food) and the others were considered unjustifiable (i.e., killing intentionally without any obvious reason, killing an animal due to greed for food, and overestimation of the risk). Participants classified the wrongness of the act on the Likert-type scale (1 = not bad at all to 4 = extremely bad act). Children of all ages judged it worse to kill

mammals than non-mammals but between the years of 6 and 8 they began to soften the severity of the acts committed under mitigating circumstances. By the age of 10 years, they were fully softening the acts committed under mitigating circumstances. Social learning would suggest that the children are learning what is acceptable for other people and are integrating that into how they are forming their own responses.

Applications of this research

There are several ways in which the findings in this thesis could be applied. The first application involves the characteristics that people use to prioritise animals and how those characteristics interact with each other (Study 1). By looking at which characteristics people prioritise, we can pinpoint what to highlight when attempting to engage people in animal advocacy, including encouraging people to reduce their meat consumption. The next applicable part of this research is that it showed that children do not use the same set of evaluative criteria as adults. In particular, they are less guided by the instrumental value of animals. This opens up the possibility that children may be more receptive to messages around the ethically problematic ways in which people use animals in society

Another way to approach these aspects of the research is that we might encourage adults to continue thinking about animals similar to the way children think about them. Young children tend to see animals for their own sake, whereas adults tend to see animals for what they can provide them. While adults do factor an animal's sentience into their moral concern, the sentience of that animal is often disregarded when the animal is of utility, for example, when the adults disregarded the intelligence of chickens in Study 2 or failed to alter their own moral view of cattle slaughter in Study 3. One possible way to increase the moral standing of animals may be to highlight the sentience and intelligence of an animal in a context where the utility for humans is not salient. An example of this context can be seen in

a viral video of a donkey who got excited when the donkey recognised someone they had not seen in a week (Hodgson, 2020). This video demonstrates the social intelligence of the donkey in an emotional context and did not highlight the working nature of the donkey. However, creating content such as this and sharing it widely may prove the more difficult feat.

The research in this thesis shows which aspects of animals are important, if we are to highlight certain characteristics to improve moral standing of animals, we could make salient certain aspects of the animals, like the rich social lives of animals (Leach et al., 2021) at point of purchase, such as cash registers or in the grocery aisles. The aspects to highlight would change whether children or adults are the intended recipients of these messages. The children would be more convinced by positive aesthetics of the animal (beautiful animals hold more moral status) while adults would be more convinced by social aspects and an animal's ability to experience pain. Indeed, a campaign like this has been trialled by Choueiki et al. (2021) when they placed messages on meat items. These messages highlighted that the animals had mental, social, and pain experiences similar to people. The messages about sentience made people less likely to intend to buy meat items in the future. While this type of messaging applied to products may seem unlikely, under the right circumstances it may be achievable. The Government of the United Kingdom ensures that images and warnings are placed on cigarette packaging in order to reduce smoking (Team et al., 2021). An even larger effort to end smoking is taking place in New Zealand. The government of New Zealand is planning to enact a law in 2027 in which people born after 2008 will never be legally allowed to purchase cigarettes (McCall, 2022). Given the efforts some governments have gone to keep their population healthy and prevent the cancers associated with smoking, it is possible the health risks associated with eating red meat, such as heart disease and cancers (Wolk, 2017), may not be far behind.

The focus on adult's use of animals is difficult to overcome. Adults ascribe more value to some creatures even when using a greater expanse of characteristics. Indeed, Study 3 showed that, in their own personal use of meat, adults will deny animal minds. In order to be effective, instead of highlighting people's personal use of meat, it may be more pertinent to have them adopt a substitute instead of having them feel guilt over their current activities which may cause them to want to deny their implication in the practice of meat and cause them to become reactive in the face of an anti-meat message (Cooper, 2019). By encouraging adults to use a meat, egg, or dairy alternative, this would allow them to avoid feeling guilty about their use of animal products. It would prevent them from only focusing on how animals can be of use (Bryant et al., 2022). While anger is a common reaction when people feel like their freedom is under threat (Richards & Larsen, 2017), by encouraging people to try replacements for meat as an addition to their regular meals, it is possible that reactance may be avoided (Hong & Page, 1989). Once people have freely tried replacers, so long as they find them appealing, this would help address the problem of people feeling they are losing something by giving up meat (Lacroix & Gifford, 2020).

While it is important to know how adults value animals in a campaign to lessen their animal product consumption it is also worthwhile to understand when these processes and characteristics start to take shape in children. This thesis suggests that it may be possible to address the constructs of how children value animals early in childhood. Early childhood is a time when children are developing how they value animals, which may make them more amenable to change. It may be easier to mould the minds of children instead of trying to convince adults to change how they think when their minds are already set in how they value animals.

Among the multiple directions to focus on with children, a promising direction would be to target children's understanding of meat animals. Since many children are shielded from

meat consumption and the realities of farming meat (Bray et al., 2016) we may want to encourage adults to have conversations with their children about the origins of meat and where it comes from. This would allow children to be open to the idea of making decisions for themselves about whether to keep meat in their diet in the future when they are able to choose what they eat for themselves. Another possible benefit of telling children about where meat comes from might be that it enables them to advocate for animals in their household which could encourage family-level efforts to reduce meat consumption. Reduction in meat consumption, even if it is once a day, would be a beneficial change a family could make.

Exposing children to the realities of meat production could be done in a way that emphasises animal's sentience and intelligence. There are programs like 4-H programs in the United States that have children tend and raise animals in order to learn about best husbandry practises and show skill in looking after for their project animal. However, the ultimate purpose of raising the animals is for slaughter (Ellis & Irvine, 2010). The children may care for the animals, but they know, in the end, they are raising them to die. These actions likely desensitise children to the fate of animals and their own participation in the meat process. Likewise, euphemistic language and the failure of society to openly identify meat eating in plain terms – as contact with "dead animals" (Adams, 1990/2015)– likely adds to this obfuscation in children's ability to link meat eating with animal slaughter.

Another avenue for improving human-animal relationships among school-age children, connected to our findings from Study 1, could involve efforts to address children's potentially exaggerated perceptions of the threat posed by certain animals. It may be of interest to expand children's understanding of animals to other aspects so children can understand the social qualities or intelligence of animals. Bexell et al. (2013) found that a five day summer camp at a zoo that included interactions with animals affected children's empathy towards animals and knowledge of animals. Ballouard et al. (2015) found that

children do not necessarily hate and fear animals like snakes but that their culture has a strong influence on whether they fear snakes. The researchers did find, encouragingly, that only 38% of the children in a cross-cultural study had a fear of snakes. This is a promising sign that most children are ready to learn about how to protect all different kinds of animals including ones that might provoke a strong fear response.

Conclusion

This research advances what we know about how children evaluate and prioritise animals. Moral valuations have their basis in childhood and move from more surface level constructs to more complex intellectual understandings of animals' minds. When children judge harms against animals, they are not yet strongly guided by social constructs such as the edibility of an animal. Instead, they are broadly moralistic and condemn all types of harms, seemingly irrespective of animal target. Children are much less accepting of harms done to animals for the reasons adults are often willing to accept. This is especially apparent in the context of animal slaughter. Children's lack of understanding about the nature of meat production may partly contribute to this developmental discontinuity. Even though children often eat meat, they are less knowledgeable than adults about which animals are used for food and much less accepting of animal slaughter as a means to obtain meat. Adults are more willing to use nuances in their moral concern judgments, incorporating, among other aspects, sentience and being motivated by personal use. This research shows that it is a good time frame for children between 7 and 10 years old to be educated about the deeper qualities of animals in order to learn more about their mental capacities and sentience, instead of focusing mostly on surface-level aspects, such as their physical attractiveness. Teaching children about the psychological sensitivities of animals and the questionable ways in which animals are used for human consumption, are likely important mechanisms for fostering more mindful practices that children may carry forward into their adult lives.

Appendices

Appendix A (Study 1 Supplements)

Supplemental Materials - How Children and Adults Value Different Animal Lives

A priori Expectations of Animal Targets Guiding our Selection

To arrive at a sufficiently variable set of animals for our study, we initially classified a wider set of animals from Borgi and Cirulli (2015) and Piazza et al. (2014) on the dimensions of (i) taxa (biological classification), (ii) whether the animal is domesticated or wild, (iii) used as food or not, (iv) harmfulness (based on ratings from Piazza et al.), and (v) intelligence (from Piazza et al.). We allowed our intuitions about each trait dimension to guide our selection. For instance, wolves, sharks, bees, jellyfish, and spiders were included because of their *prima facie* relevance for the harmfulness dimension. Pigs, sheep, and chickens are animals typically used as food. We thought frogs, lizards, butterflies, and worms had face-validity relevance for the aesthetic dimension (ugly). Spiders, jellyfish, and worms also had face-validity relevance with regards to (low) pain and intelligence.

See Table S1 for a breakdown of our expectations, for each dimension, which guided of selection of animal targets. For the final set of 19 targets, we sought to cover a range of exemplars representative of different classifications or ratings across the five dimensions.

Table S1

Preliminary experimenter expectations of 55 animal targets along five dimensions. Source and preference ranking from Borgi and Cirulli's (2015) study also provided.

Animal	BC Cluster	Article	Taxa	Domestic	Food	Harmful	Intelligence
Chicken	3	BC and PLG	Bird	Yes	Yes	Low	Low

Parrot	1	BC and PLG	Bird	No	No	Low	High
Crow		PLG	Bird	No	No	Low	Medium
Shark	2	BC and PLG	Fish	No	No	High	Medium
Butterfly	1	BC and PLG	Invertebrate	No	No	Low	Low
Octopus	5	BC and PLG	Invertebrate	No	No	Medium	Medium
Bee	6	BC	Invertebrate	Both	No	High	Low
Earthworm	6	BC and PLG	Invertebrate	No	No	Low	Low
Spider	6	BC and PLG	Invertebrate	No	No	Medium	Low
Dolphin	1	BC and PLG	Mammal	No	No	Low	High
Dog	1	BC and PLG	Mammal	Yes	No	Medium	High
Wolf	2	BC and PLG	Mammal	No	No	High	High
Elephant	2	BC and PLG	Mammal	No	No	Medium	High
Pig	3	BC and PLG	Mammal	Yes	Yes	Low	Medium
Monkey	4	BC	Mammal	No	No	Medium	High
Lizard	4	BC and PLG	Reptile	No	No	Low	Low
Jellyfish	5	BC	Invertebrate	No	No	Medium	Low
Hedgehog	2	BC	Mammal	No	No	Low	Medium
Horse	1	BC and PLG	Mammal	Yes	No	Medium	High
Cat	2	BC and PLG	Mammal	Yes	No	Low	High

Lion	2	BC and PLG	Mammal	No	No	High	High
Sheep	3	BC and PLG	Mammal	Yes	Yes	Low	Medium
Bear	3	BC and PLG	Mammal	No	No	High	High
Turtle	2	BC and PLG	Reptile	No	No	Low	Low
Frog	4	BC and PLG	Amphibian	No	No	Low	Low
Newt	5	BC	Amphibian	No	No	Low	Low
Eagle owl	2	BC	Bird	No	No	Low	Medium
Duck	2	BC	Bird	Both	Yes	Low	Low
Sparrow	3	BC	Bird	No	No	Low	Medium
Ostrich	3	BC	Bird	No	No	Medium	Medium
Pigeon		PGL	Bird	No	No	Low	Low
Trout	2	BC and PLG	Fish	No	Yes	Low	Low
Snail	4	BC	Invertebrate	No	No	Low	Low
Crab	5	BC	Invertebrate	No	Yes	Low	Low
Millipede	5	BC	Invertebrate	No	No	Low	Low
Scorpion	6	BC	Invertebrate	No	No	High	Low
Mosquito	6	BC	Invertebrate	No	No	High	Low
Beetle	6	BC	Invertebrate	No	No	Low	Low
Hornet		PLG	Invertebrate	No	No	High	Low
Shrimp		PLG	Invertebrate	No	Yes	Low	Low
Lobster		PLG	Invertebrate	No	Yes	Low	Low
Rabbit	1	BC and PLG	Mammal	Both	Yes	Low	Medium

Mouse	1	BC and PLG	Mammal	Both	No	Low	Medium
Kangaroo	2	BC	Mammal	No	No	Medium	Medium
Sea lion	2	BC	Mammal	No	No	Low	High
Donkey	2	BC	Mammal	Yes	No	Medium	High
Hippopotamus	3	BC	Mammal	No	No	Medium	Medium
Cow	3	BC and PLG	Mammal	Yes	Yes	Low	Low
Chimpanzee	3	BC and PLG	Mammal	No	No	Medium	High
Deer	4	BC	Mammal	No	No	Medium	Medium
Bat	5	BC and PLG	Mammal	No	No	Medium	Medium
Seal		PLG	Mammal	No	No	Low	High
Whale		PLG	Mammal	No	No	Medium	High
Alligator	4	BC	Reptile	No	No	High	Low
Snake	4	BC and PLG	Reptile	No	No	High	Low

Note. BC = Borgia & Cirulli (2015); PLG = Piazza, Landy & Goodwin (2014).

Photo Criteria

In selecting the images, we applied the following criteria to help enhance the identifiability of the species and to reduce the presence of idiosyncratic or confounding features across the targets:

- *The image depicted a single animal with the animal's head facing forward or at an angle so that at least one eye was visible (for animals that have eyes)*. We did this to increase the identifiability of the animal by having the participant focus their

attention on a single exemplar and not split their attention between multiple exemplars and to ensure that most of the animal's face was visible.

- *A large portion of the body was included in the frame*. We did this to increase the identifiability of the animal by providing participants with a fuller representation of it.
- *The animal was still or resting on something (e.g., flying animals are not flying, terrestrial animals are not engaged in any extraordinary activity like running, jumping, or swinging through trees)*. We did this to standardize the posture of animals across targets, and to not prioritize one aspect of the animal's behavioural repertoire over another.
- *The animal had a neutral face; we avoided images of animals that looked particularly friendly, frightening, or had teeth showing*. Children associate sharp teeth and open mouths with 'evil' or harmful animals (Lee & Kang, 2012). To avoid irregularities in the presence of these emotionally salient features across targets (e.g., a wolf but not a dog with teeth bared), we sought to minimize the occurrence of such cues in the images where possible.
- *For animals that come in a wide variety of colors (e.g., lizards), we selected images depicting the animal with a more subdued coloration.* This was done to limit the idiosyncratic effects of aesthetics for a particular species.
- *The image had a neutral background that depicted the animal in its natural habitat.* This was done to keep the focal attention on the animal and to avoid overt references to humans.

When photos fulfilling all of these criteria were not obtainable, criteria higher in the list were given priority.

Modeling the Development of Moral Concern: Detailed Procedures by Age Group

Adults' Moral Concern for Animals

Our initial model for adults was guided primarily by the observed correlations (discussed earlier, see also Table 3) as well as empirical insights from past research. The human target was not included in the model tests, for any age group, since we did not have participants make edibility judgments for the human target. In Model 1 we entered capacity for pain, intelligence, aesthetics, harmfulness and edibility as independent predictors of moral concern. The model was over-identified (see Table 4), meaning that there were multiple ways of adequately structuring the variables within the model (Chen, 2016). In this model, harmfulness was a non-significant predictor. Thus, for our second model, we removed harmfulness as a predictor. However, the model was still over-identified.

Our third model used the previous one but inserted similarity to humans as a higher-order variable connecting pain, intelligence, and aesthetics, all of which correlated with similarity (see Table 3). We retained edibility as a direct predictor of moral concern because it was a significant direct predictor in the previous model. Aesthetics was not a significant indirect predictor of moral concern via similarity to humans. Thus, in our subsequent model (our best fit model), we moved aesthetics as a direct predictor of moral concern, keeping everything else as before (see Table 4). This model indicates that while pain capacity and intelligence are important factors when valuing animals, they are filtered through how similar the animal is to humans. Furthermore, although appearance is highly related to pain capacity and intelligence, it directly informs the moral valuing of animals independent of, and in parallel with, similarity and edibility. Though harmfulness seemed to be related to intelligence, it did not inform adults' moral valuing of animals, directly or indirectly.

Younger Children's Moral Concern for Animals

As with the adult sample, in our first model for younger children we used the correlations to guide our inclusion of variables, and we omitted similarity to humans in this initial model. Harmfulness and aesthetics were entered along with intelligence as predictors of moral concern. This first model gave a saturated fit with a Chi-square value of zero (see Table 4). In our second model, we inserted similarity into the model, due to its strong relationship with moral concern, but, in line with our *a priori* criteria, we treated it as a higher-order variable relative to the others. We connected all three lower-order variables to similarity, so that they indirectly predicted moral concern via similarity. This gave a poor model fit and the path from aesthetics to similarity was not significant (see Table 4). Our final, best fit model moved the path of aesthetics from similarity so that it was directly predicting moral concern. Harmfulness had a direct and indirect relationship with moral concern, while intelligence remained as an indirect predictor of moral concern via similarity to humans. This model had good fit (see Table 4) and all paths, except from harmfulness to moral concern, were significant (see Figure 3). Though the path from harmfulness to moral concern was not significant, it significantly improved the overall model fit and so was retained.

Older Children's Moral Concern for Animals

We again allowed correlations to inform our initial model structure for older children, while leaving aside the potential higher-order variable of similarity. Intelligence, aesthetics and edibility were all significant correlates of moral concern for older children. All three variables were entered into the model predicting moral concern, which resulted in a saturated model with a Chi-square value of zero (see Table 4). Next, we added similarity to the model as a higher-order variable, with intelligence and aesthetics predicting it. Because edibility did not correlate with similarity (see Table 3), we set edibility to directly predict moral concern,

independent of similarity. Similarity and aesthetics were also given direct links to moral concern. This gave a good model fit (see Table 4) and all paths were significant (see Figure 4).

Developmental Differences in Attributions by Animal Grouping

To reduce the animal targets to a more manageable number, we conducted a hierarchical cluster analysis. The animal targets clustered into three groups, ostensibly on the basis of the dimensions of edibility and harmfulness, which were dimensions guiding our selection of the animal targets (see above). We labelled the three groups "food animals," "benign animals," and "dangerous animals." We made a fourth group consisting of only humans for comparison purposes. Next, within each animal group, we contrasted the average attribution ratings by age group, using pairwise comparisons. This allowed us to explore any developmental differences in the attribution styles of our three participant groups (see Table S2). Some noteworthy findings were that adults tended to attribute more pain capacity to animals than did children, and this was true for all three animal groups. Younger children tended to attribute greater abilities to food animals than did adults, whereas adults tended to attribute greater edibility to food animals than did children. Additionally, younger children tended to attribute greater similarity between humans and animals, for all animal groups, relative to adults.

Table S2

Animal groups: Mean attributions and standard deviations by age group.

Group			Pain		Intel.		Similar		Harmful		Edible		Ugly		Ability	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
People	Human	Adult	4.80_{a}	0.49	4.51_{a}	0.82	4.53_{a}	0.91	3.45_{a}	1.28	N/A		1.30_{a}	0.69	4.22_{a}	1.07
		Older	4.11_{b}	0.82	4.62_{a}	0.56	4.49_{a}	1.08	2.34_{b}	1.32	N/A		1.29_{a}	0.68	3.99_{a}	1.11
		Younger	4.23_{b}	1.03	4.71_{a}	0.63	4.78_{a}	0.76	1.97_{b}	1.37	N/A		1.37_{a}	0.96	4.00_{a}	1.32
Dangerous Animals	Shark Dolphin Wolf Jellyfish Spider Octopus Bee Frog	Adult	4.03_{c}	1.21	3.32_{b}	1.31	1.69_{b}	1.00	3.07_{c}	1.28	1.97_{a}	1.14	2.22_{b}	1.39	3.21_{b}	1.22
		Older	3.60_{d}	1.33	3.53_{c}	1.13	1.86_{bc}	0.98	3.38_{d}	1.28	1.84_{ab}	1.05	2.33_{bc}	1.35	3.63_{c}	1.10
		Younger	3.67_{d}	1.37	3.63_{c}	1.22	1.98_{c}	1.17	3.60_{d}	1.33	1.77_{b}	1.11	2.46_{c}	1.44	3.60_{c}	1.22
Food Animals	Sheep Chicken Pig	Adult	4.57_{e}	0.68	2.61_{d}	1.17	1.84_{d}	0.98	1.58_{e}	0.72	4.23_{c}	1.13	1.87_{d}	1.01	2.04_{d}	1.06
		Older	3.94_{f}	0.95	2.59_{d}	0.82	1.84_{d}	0.91	1.92_{f}	0.91	3.67_{d}	1.36	2.11_{d}	1.03	2.35_{d}	1.08
		Younger	3.92_{f}	1.15	2.89_{d}	1.17	2.27_{e}	1.29	1.89_{f}	1.01	3.47_{d}	1.57	2.12_{d}	1.27	2.77f	1.28
Benign Animals	Dog Elephant Parrot Lizard Monkey Butterfly Worm	Adult	4.27_{g}	1.13	3.36_{e}	1.36	2.15_{f}	1.29	2.02_{g}	1.13	1.74_{e}	0.96	1.69_{e}	1.13	3.13_{g}	1.24
		Older	3.87_{h}	1.27	3.44_{e}	1.21	2.34_{fg}	1.20	2.14_{g}	1.18	1.68_{e}	0.85	1.67_{e}	1.06	3.58_{h}	1.15
		Younger	3.93_{h}	1.36	3.52_{e}	1.29	2.53_{g}	1.39	2.13_{g}	1.28	1.50_{f}	0.89	1.74_{e}	1.18	3.69_{h}	1.27

Note. Means that differed significantly between ages within the animal groupings have been denoted with differing subscripts, means with the same subscript did not differ.

Gender and Background Experiences with Animals

We preregistered that we would approach in an exploratory manner potential differences based on gender and background experiences with animals, as these individual difference variables were not central to our research aims. For gender, we used between-participants *t*-tests, with a Bonferroni correction of $p = .05/7 = .007$, to contrast attributions of males and females for each age group.

Gender. Among adults, there were significant differences in how men and women rated the intelligence, pain, and edibility of animals, but no differences for aesthetics or harmfulness (see Table S3). Women rated animals as overall smarter and possessing a greater capacity for pain, compared to men, whereas men rated animals as overall more edible, compared to women. There were no significant differences (i.e., *p*-values below .007) in the ratings of younger and older boys and girls.

Table S3

Attribution ratings and inferential statistics by gender and age group.

	Males	Females			95% Confidence Interval		
	Mean (SD)	*Mean (SD)*	*t*	*p*	*Lower limit*	*Upper limit*	*d*
Adults							
Intelligence	3.10 (0.49)	3.39 (0.66)	t (140) = -3.04	0.003	-0.47	-0.10	-0.47
Pain	4.07 (0.58)	4.35 (0.55)	t (107) = -2.92	0.004	-0.48	-0.09	-0.50
Ability	2.92 (0.57)	3.14 (0.72)	t (135) = -2.08	0.040	-0.43	-0.01	-0.33
Similarity	1.93 (0.51)	2.09 (0.60)	t (129) = -1.76	0.081	-0.34	0.02	-0.28
Edibility	2.43 (0.61)	2.15 (0.59)	t (109) = 2.79	0.006	0.08	0.48	0.48
Aesthetic	4.03 (0.64)	4.10 (0.53)	t (96) = -0.65	0.518	-0.27	0.14	-0.12
Harmfulness	2.50 (0.45)	2.45 (0.40)	t (103) = 0.67	0.505	-0.10	0.19	0.12
Younger children							
Intelligence	3.50 (0.49)	3.66 (0.61)	t (131) = -1.69	0.093	-0.34	0.03	-0.29
Pain	3.73 (0.65)	3.99 (0.62)	t (137) = -2.36	0.020	-0.47	-0.04	-0.40
Ability	3.46 (0.66)	3.63 (0.62)	t (136) = -1.55	0.124	-0.39	0.05	-0.26
Similarity	2.48 (0.70)	2.51 (0.64)	t (135) = -0.24	0.810	-0.25	0.20	-0.04
Edibility	2.06 (0.61)	1.84 (0.65)	t (137) = 2.07	0.040	0.01	0.43	0.35
Aesthetic	3.88 (0.56)	4.03 (0.65)	t (135) = -1.44	0.154	-0.35	0.06	-0.24
Harmfulness	2.71 (0.51)	2.61 (0.55)	t (137) = 1.08	0.283	-0.08	0.28	0.18
Older children							
Intelligence	3.45 (0.55)	3.49 (0.52)	t (97) = -0.36	0.718	-0.25	0.17	-0.07
Pain	3.77 (0.50)	3.80 (0.62)	t (84) = -0.19	0.849	-0.25	0.21	-0.04
Ability	3.47 (0.60)	3.44 (0.62)	t (93) = 0.23	0.815	-0.21	0.27	0.05
Similarity	2.19 (0.42)	2.39 (0.62)	t (74) = -1.84	0.069	-0.41	0.02	-0.38
Edibility	2.15 (0.52)	1.99 (0.56)	t (91) = 1.53	0.129	-0.05	0.38	0.31
Aesthetic	3.96 (0.62)	4.16 (0.51)	t (100) = -1.81	0.073	-0.42	0.02	-0.35
Harmfulness	2.68 (0.51)	2.53 (0.47)	t (97) = 1.55	0.125	-0.04	0.34	0.31

We also explored gender differences for children in terms of the relationship between children's age and the moral concern median rankings each individual animal received. Figure S1 presents the results of these analyses, with higher scores representing greater moral concern for the animal. As can be seen, there were a few differences in the way boys and girls ranked animals, and how this ranking changed across development. There were main effects of gender for butterflies (β = -.18, $t(238) = -3.01$, $p = 0.003$) and frogs (β = -0.18, $t(238) = -2.78$, $p = 0.006$). Girls tended to assign greater moral concern to butterflies ($M = 10.77$, $SD = 5.24$) compared to boys ($M = 8.63$, $SD = 5.08$), whereas boys tended to assign greater moral concern to frogs ($M = 8.46$, $SD = 4.49$), compared to girls ($M = 7.03$, $SD = 4.19$). Age x Gender interaction effects were observed for several animal targets, with boys tending to rank humans (β = .18, $t(124) = 2.00$, $p = 0.048$), pigs (β = .18, $t(124) = 2.07$, $p = 0.040$), and elephants (β = .37, $t(124) = 4.46$, $p < 0.001$) higher with age, but spiders (β = -.19, $t(124) = -2.13$, $p = 0.035$) and frogs (β = -.34, $t(124) = -4.10$, $p < 0.001$) lower with age, whereas girls tended to rank wolves (β = .24, $t(113) = 2.59$, $p = 0.011$) and octopuses (β = .20, $t(113) = 2.17$, $p = 0.032$) higher with age.

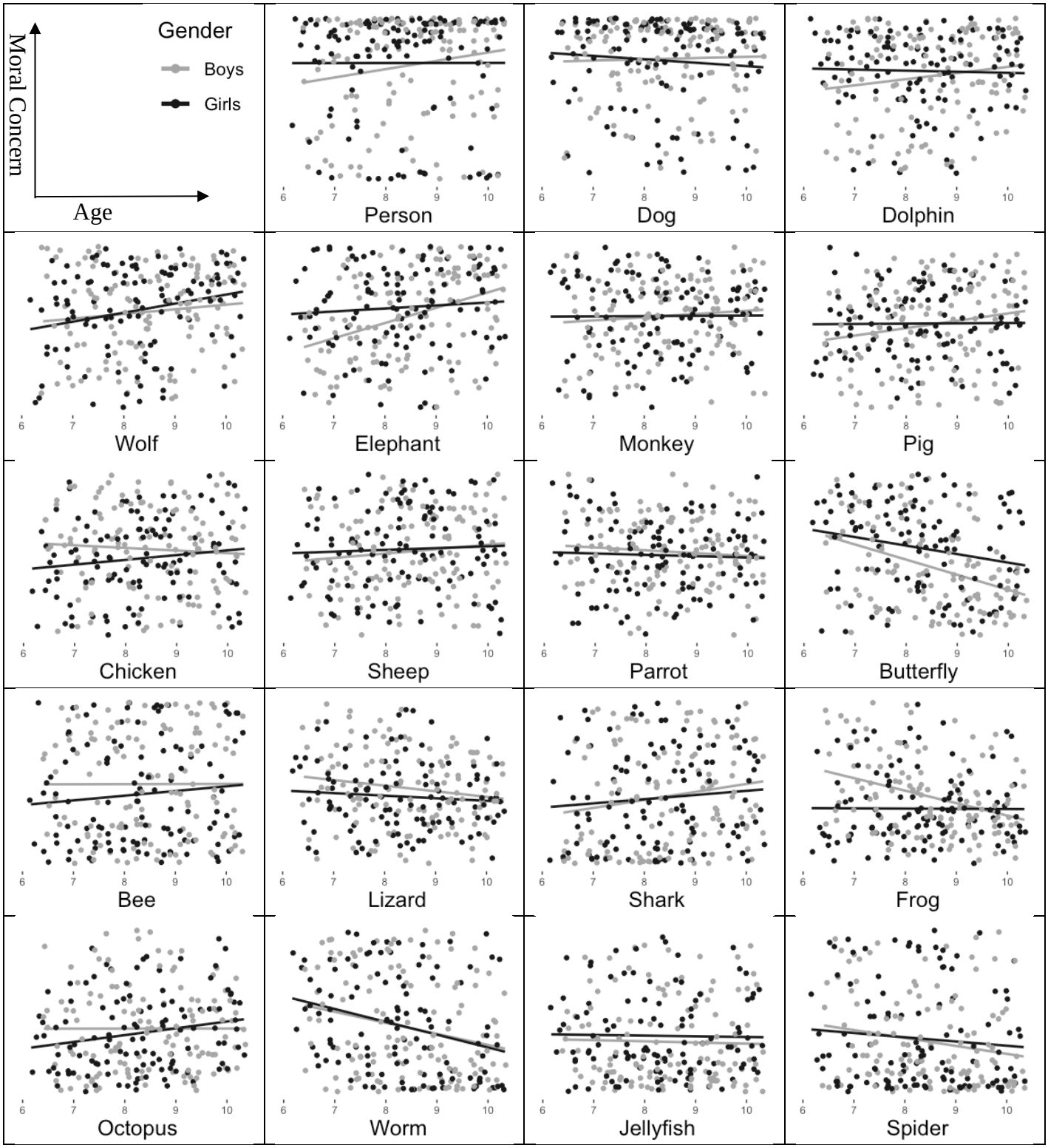


Figure S1. The relationship between children's age and moral concern for animals plotted separately for boys and girls.

Background activities involving animals. Participants were assessed on seven activities: hunting, fishing, birdwatching, going to the zoo, discussing animals with friends or family, watching documentaries, and learning about animals. The activities were assessed in terms of frequency of engagement from 'never' to 'very often'.

We ran a factor analysis with oblique (Promax) rotation, pooling ratings from all participants. A two-factor solution explained 30% of the variance—see Table S4 for factor loadings. "Birdwatching", "documentaries (tv)", "talking", and "learning" loaded together on the first factor ("benign activities"; eigenvalue = 2.02), with "hunting" and "fishing" loading on the second factor ("harmful activities"; eigenvalue = 1.15). "Visiting the zoo" did not load on either factor so it was removed. We used this factor structure to create a frequency of engagement in harmful and benign activities index for each participant by averaging across the relevant items (harmful activities: adults, $M = 1.17$, $SD = 0.41$, older children, $M = 1.54$, $SD = 0.60$, younger children, $M = 1.58$, $SD = 0.73$; benign activities: adults, $M = 2.71$, $SD = 0.75$, older children, $M = 2.90$, $SD = 0.68$, younger children, $M = 2.96$, $SD = 0.75$). We then correlated these two indices with their attribution ratings, averaged across the targets (see Table S5).

Table S4

Results from a Factor Analysis of the Animal Experiences Questionnaire

Item	Factor loading	
	1	2
Factor 1: Harmful activities		
Fishing	-0.03	**0.49**
Hunting	-0.08	**0.40**
Factor 2: Benign activities		
Talking about animals	**0.81**	-0.27
Documentaries	**0.61**	-0.01
Birdwatching	**0.43**	0.24
Learning about animals	**0.41**	0.04
Removed		
Visiting the zoo	0.13	0.16

Note. $N = 307$. The extraction method was principal axis factoring with an oblique (Promax with Kaiser Normalization) rotation. Factor loadings above .30 are in bold.

Some key findings were that adults who engaged in benign activities with animals tended to rate animals as overall more intelligent, able, beautiful, and similar to humans. Older children who engaged more in harmful activities tended to rate animals as more dangerous, and older children who engaged more in benign activities tended to rate animals as intelligent, able, and beautiful. Younger children who engaged more in benign activities tended to rate animals as more able. Adults who had pets (Table S6) rated animals as overall

more able, compared to those without pets. Pet ownership did not impact on children's attribution tendencies.

Table S5

Correlations between experiences with animals and overall attribution ratings across all animals

	Activities with animals					
	Adult		Older Children		Younger Children	
	Harmful	Benign	Harmful	Benign	Harmful	Benign
Intelligence	-0.07	**0.27**	0.01	**0.20**	0.03	0.15
Pain	-0.03	0.15	-0.07	0.09	-0.02	0.09
Ability	-0.07	**0.44**	0.05	**0.28**	0.07	**0.21**
Similarity	0.00	**0.30**	0.02	0.18	0.05	0.09
Edibility	0.07	-0.14	-0.00	-0.01	0.03	0.15
Aesthetic	0.01	**0.35**	-0.19	**0.43**	-0.11	0.14
Harmfulness	0.02	-0.10	**0.20**	0.04	-0.01	-0.15

Note. Bolded values are significant at $p < .05$. Edibility attributions do not include the human target.

Table S6

Attribution ratings and inferential statistics by pet ownership and age group.

	Yes	No			95% Confidence Interval		
	Mean (SD)	*Mean (SD)*	*t*	*p*	*Lower limit*	*Upper limit*	*d*
Adults							
Intelligence	3.33 (0.61)	3.21 (0.63)	t (120) = 1.23	0.222	-0.08	0.33	0.21
Pain	4.34 (0.56)	4.11 (0.58)	t (120) = 2.49	0.014	0.05	0.43	0.42
Ability	3.18 (0.67)	2.85 (0.63)	t (129) = 3.07	0.003	0.12	0.54	0.50
Similarity	2.10 (0.63)	1.93 (0.46)	t (146) = 1.86	0.065	-0.01	0.34	0.29
Edibility	2.16 (0.63)	2.39 (0.55)	t (135) = -2.32	0.022	-0.42	-0.03	-0.38
Aesthetic	4.16 (0.55)	3.94 (0.57)	t (120) = 2.39	0.018	0.04	0.41	0.40
Harmfulness	2.44 (0.41)	2.52 (0.44)	t (117) = -1.02	0.309	-0.21	0.07	-0.17
Younger children							
Intelligence	3.57 (0.59)	3.60 (0.46)	t (88) = -0.27	0.785	-0.21	0.16	-0.05
Pain	3.87 (0.64)	3.84 (0.68)	t (66) = 0.19	0.853	-0.23	0.27	0.04
Ability	3.58 (0.65)	3.46 (0.64)	t (70) = 0.95	0.345	-0.13	0.36	0.18
Similarity	2.52 (0.66)	2.44 (0.69)	t (67) = 0.65	0.515	-0.17	0.34	0.13
Edibility	1.94 (0.64)	1.97 (0.64)	t (69) = -0.26	0.797	-0.27	0.21	-0.05
Aesthetic	3.97 (0.62)	3.91 0.59)	t (72) = 0.52	0.605	-0.17	0.28	0.10
Harmfulness	2.64 (0.55)	2.72 (0.50)	t (76) = -0.83	0.408	-0.27	0.11	-0.15
Older children							
Intelligence	3.44 (0.48)	3.54 (0.65)	t (40) = -0.79	0.437	-0.38	0.17	-0.20
Pain	3.74 (0.55)	3.88 (0.56)	t (51) = -1.09	0.282	-0.38	0.11	-0.24
Ability	3.46 (0.55)	3.44 (0.73)	t (41) = 0.10	0.919	-0.29	0.32	0.03
Similarity	2.32 (0.54)	2.18 (0.46)	t (60) = 1.30	0.198	-0.07	0.35	0.27
Edibility	2.15 (0.51)	1.88 (0.58)	t (46) = 2.14	0.038	0.02	0.51	0.50
Aesthetic	4.09 (0.55)	3.95 (0.65)	t (45) = 1.03	0.310	-0.14	0.42	0.24
Harmfulness	2.63 (0.48)	2.59 (0.53)	t (47) = 0.30	0.765	-0.19	0.26	0.07

Note. Applying a Bonferroni correction of .05/7 = .007, contrasts with $p < .007$ are significant.

Appendix B

Study 2 alternative analyses with outliers removed.

Table B.1

Means and standard deviations for Intelligence Rating as a function of a 2(Intelligence) X 2(Relevance) X 2(Age)

		Bird			
		Chicken		Kakapo	
	Intelligence	*M*	*SD*	*M*	*SD*
Adults	High	4.12	0.51	4.32	0.64
	Low	0.22	0.34	0.40	0.46
Children	High	4.30	0.73	4.53	0.66
	Low	0.41	0.52	0.73	0.73

Note. M and *SD* represent mean and standard deviation, respectively.

Table B.2

Fixed-Effects ANOVA results using Intelligence Rating as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1547.14	1	1547.14	5143.20	.000		
Intelligence	746.19	1	746.19	2480.57	.000	.82	[.80, .84]
Bird	1.94	1	1.94	6.45	.011	.01	[.00, .03]
Age	0.77	1	0.77	2.55	.111	.00	[.00, .02]
Intelligence x Bird	0.01	1	0.01	0.02	.882	.00	[.00, .00]
Intelligence x Age	0.00	1	0.00	0.01	.903	.00	[.00, .00]
Bird x Age	0.02	1	0.02	0.05	.816	.00	[.00, .00]
Intelligence x Bird x Age	0.07	1	0.07	0.23	.633	.00	[.00, .01]
Error	164.24	546	0.30				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

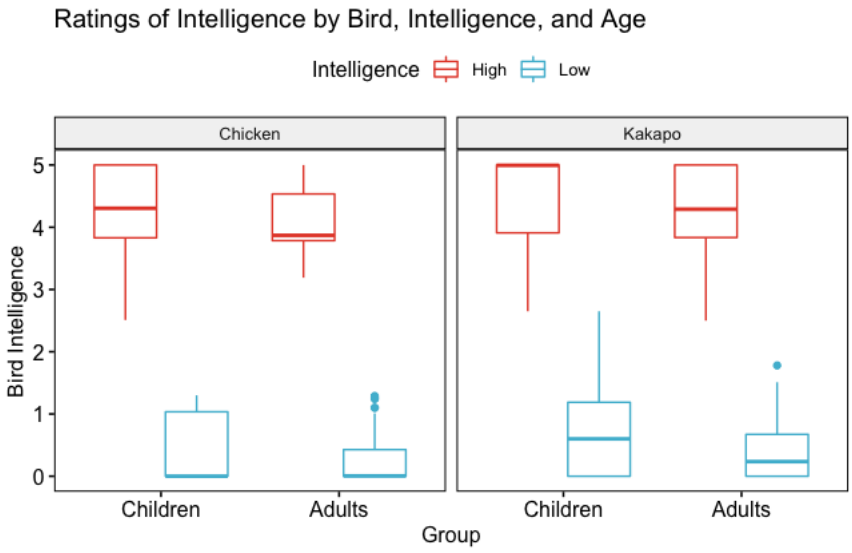


Figure B.1. Box plot of intelligence ratings by bird, intelligence category, and age group

Table B.3

Means and standard deviations for Harming, Displacement, Caging, Kill for food as a function of a 2(Intelligence) X 2(Bird) X 2(Age)

		Harming				Displacement				Caging				Kill for food			
		Chicken		Kakapo		Chicken		Kakapo		Chicken		Kakapo		Chicken		Kakapo	
	Intelligence	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Adults	High	3.34	1.39	4.42	0.77	2.74	1.46	3.97	0.98	3.85	1.19	4.09	1.07	1.30	0.90	3.87	1.37
	Low	3.56	1.35	4.48	0.82	2.42	1.50	4.15	1.13	3.27	1.52	3.85	1.40	1.34	0.99	2.99	1.58
Children	High	3.71	1.38	3.74	1.42	3.79	1.37	4.21	1.15	3.76	1.26	3.82	1.22	2.88	1.74	4.50	1.05
	Low	3.53	1.52	3.17	1.58	4.15	0.99	4.10	0.85	3.35	1.55	3.38	1.50	3.09	1.69	4.31	1.02

Note. M and *SD* represent mean and standard deviation, respectively.

Harming

Table B.4

Fixed-Effects ANOVA results using Harm as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1015.56	1	1015.56	687.69	.000		
Intelligence	2.28	1	2.28	1.55	.214	.00	[.00, .02]
Bird	57.35	1	57.35	38.83	.000	.07	[.04, .10]
Age	3.30	1	3.30	2.24	.135	.00	[.00, .02]
Intelligence x Bird	0.65	1	0.65	0.44	.506	.00	[.00, .01]
Intelligence x Age	1.94	1	1.94	1.32	.252	.00	[.00, .01]
Bird x Age	13.94	1	13.94	9.44	.002	.02	[.00, .04]
Intelligence x Bird x Age	0.36	1	0.36	0.24	.624	.00	[.00, .01]
Error	804.85	545	1.48				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

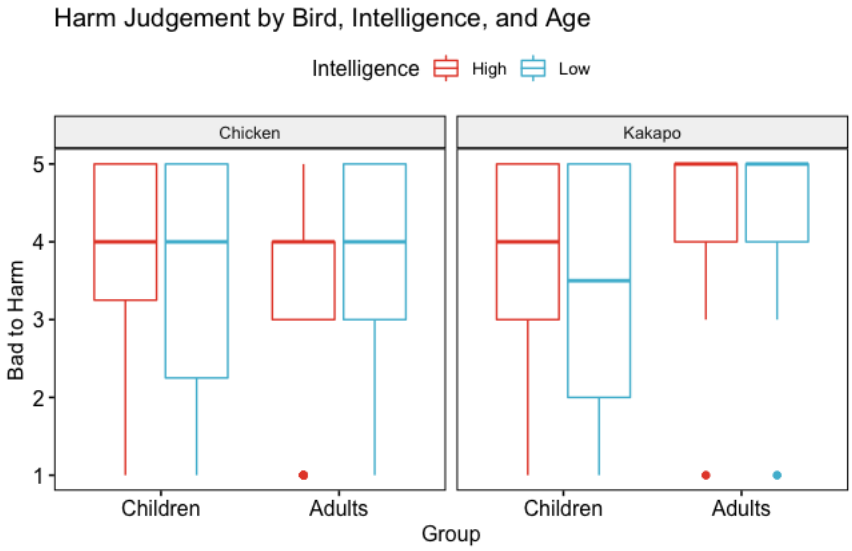


Figure B.2. Box plot of condemnation of harm by bird, intelligence category, and age group

Displacement

Table B.5

Fixed-Effects ANOVA results using Displacement as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	681.33	1	681.33	448.79	.000		
Intelligence	5.05	1	5.05	3.33	.069	.01	[.00, .02]
Bird	75.09	1	75.09	49.46	.000	.08	[.05, .12]
Age	27.70	1	27.70	18.25	.000	.03	[.01, .06]
Intelligence x Bird	6.38	1	6.38	4.20	.041	.01	[.00, .02]
Intelligence x Age	5.73	1	5.73	3.78	.052	.01	[.00, .02]
Bird x Age	8.58	1	8.58	5.65	.018	.01	[.00, .03]
Intelligence x Bird x Age	6.14	1	6.14	4.04	.045	.01	[.00, .02]
Error	828.91	546	1.52				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

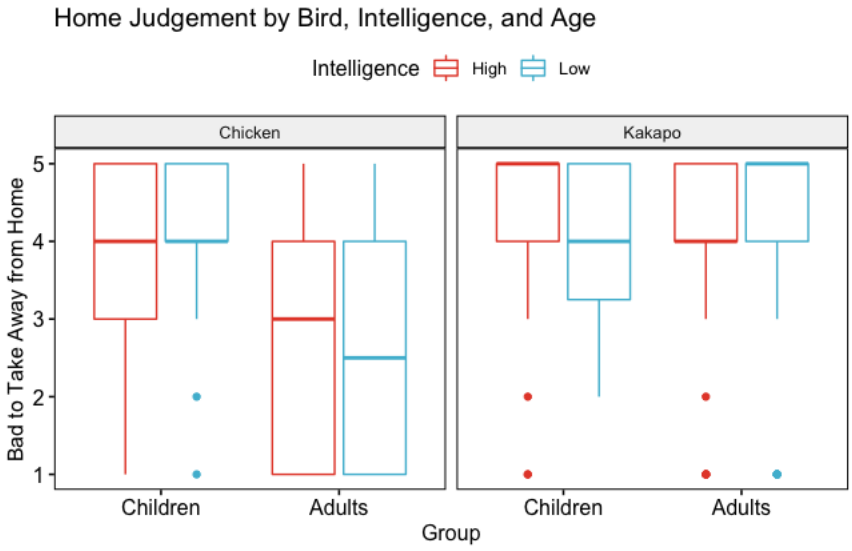


Figure B.3. Box plot of condemnation of displacement by bird, intelligence category, and age group

Caging

Table B.6

Fixed-Effects ANOVA results using Cage as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1346.15	1	1346.15	757.50	.000		
Intelligence	16.05	1	16.05	9.03	.003	.02	[.00, .04]
Bird	3.01	1	3.01	1.69	.194	.00	[.00, .02]
Age	0.16	1	0.16	0.09	.761	.00	[.00, .01]
Intelligence x Bird	2.75	1	2.75	1.55	.214	.00	[.00, .02]
Intelligence x Age	0.33	1	0.33	0.18	.668	.00	[.00, .01]
Bird x Age	0.45	1	0.45	0.25	.615	.00	[.00, .01]
Intelligence x Bird x Age	0.85	1	0.85	0.48	.489	.00	[.00, .01]
Error	970.29	546	1.78				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

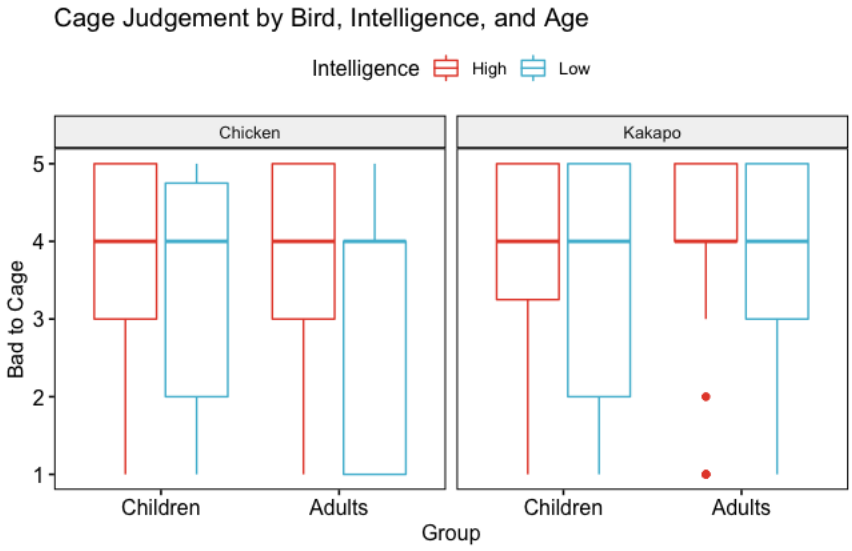


Figure B.4. Box plot of condemnation of caging by bird, intelligence category, and age group

Killing for food

Table B.7

Fixed-Effects ANOVA results using Food as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	153.01	1	153.01	91.64	.000		
Intelligence	0.09	1	0.09	0.05	.816	.00	[.00, .00]
Bird	325.43	1	325.43	194.90	.000	.26	[.21, .31]
Age	62.23	1	62.23	37.27	.000	.06	[.03, .10]
Intelligence x Bird	21.66	1	21.66	12.97	.000	.02	[.01, .05]
Intelligence x Age	0.34	1	0.34	0.20	.654	.00	[.00, .01]
Bird x Age	11.52	1	11.52	6.90	.009	.01	[.00, .03]
Intelligence x Bird x Age	1.82	1	1.82	1.09	.296	.00	[.00, .01]
Error	911.66	546	1.67				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

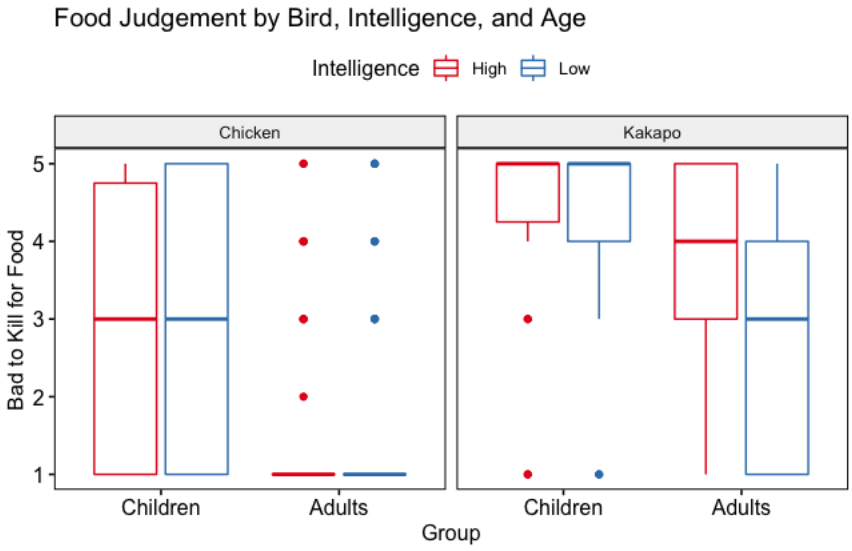


Figure B.5. Box plot of condemnation of killing for food by bird, intelligence category, and age group

Appendix C

Figure C1. Drawings of hybrid animals used for the filler task between Studies 2 and 3.

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