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Empirical: Single or Multiple Studies

Understanding Animal Minds and Mirroring Their Emotions: Validation of the Affective and Cognitive Animal Empathy Scale (AC-AES)

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Supplementary Materials: Data, Materials, Preregistration [see Index of Supplementary Materials]

Abstract

Current approaches to measuring empathy towards animals often fail to discriminate between understanding what animals might be feeling (cognitive empathy) and emotionally responding in a consonant way to what animals are feeling (affective empathy). Across two studies we developed and validated, with UK-based samples, a new self-report scale for assessing tendencies to experience affective and cognitive empathy towards animals—the Affective and Cognitive Animal Empathy Scale (AC-AES). The AC-AES contains 22 situation-based items that cover a range of animal species and human-animal interactive domains, 11 items per subscale. The two-factor structure was confirmed via preliminary testing (Study 1) and confirmatory factor analysis (Study 2). The subscales showed good independence, test-retest reliability, converged with human-oriented components of empathy, and predicted animal-oriented attitudes (e.g., endorsement of non-lethal animal management) and behaviours (e.g., animal-product avoidance), with some divergences; for example, cognitive empathic tendencies better predicted expansive moral concern for animals, whereas sharing in animals' emotions correlated with a wider range of meat avoidance. Implications for future animal-advocacy research are discussed.

Keywords

affective empathy, animals, cognitive empathy, emotion, prosocial behaviour

Non-Technical Summary

Background

Empathy plays a central role in motivating helping behaviour. This capacity is not limited to interactions among humans but extends to our responses to non-human animals as well. Research on empathy towards humans has identified two distinct processes: cognitive empathy (understanding what another individual might be experiencing) and affective empathy (sharing in another's feelings in a consonant manner). While both likely shape our relationships with other animals, many assume they are distinct and that affective empathy is the more powerful driver of prosocial helping—especially towards animals which are mistreated or exploited.

Why was this study done?

Existing questionnaires assessing empathy toward animals equate responses such as "Seeing animals in pain upsets me" and "I find it irritating when dogs try to greet me by jumping up and licking me" and even "I would always try to help if I saw a dog or puppy that seemed to be lost". By doing so, they obscure the distinctions between cognitive and affective empathy, and willingness to help animals. This makes it difficult to properly measure animal-directed empathy and test its assumed relationship with helping behaviour. It is also unclear whether such a division is meaningful when applied to animals or what the practical benefits might be. Current measures also focus on companion animals, at the neglect of other animals. Given that many animals face hardships, often at the hands of humans, it is important to improve on existing measures, by separating out affective and cognitive facets, as well as broadening the scope of animals included within the measurement.

What did the researchers do and find?

We developed a new questionnaire to measure affective and cognitive empathy toward animals. First, we generated 56 candidate questions about emotional sharing or affective empathy (e.g., "Seeing a fish taken out of water makes me gasp for air too") and understanding animal minds or cognitive empathy (e.g., "Rats stuck in glue traps feel terror"). The questions covered eight domains of human-animal interaction and a vast range of species. In Study 1, 150 UK students and adults answered these questions, along with other questions about animals, their eating habits and personality. Based on a statistical analysis of their responses, we selected 22 questions—11 per type of empathy—that showed good reliability and discriminated between affective and cognitive empathy. We found the same pattern in another sample of 301 UK adults (Study 2), who completed the 22 questions at two points in time.

Across studies, women tended to score higher on animal-directed empathy than men, particularly on affective empathy. Empathy directed at animals correlated with measures

of human-directed empathy. Furthermore, individuals who exhibited higher affective and cognitive empathy for animals tended to exhibit more prosocial attitudes toward animals (e.g., supported non-lethal approaches to animal management). The findings also show that attributing emotional states to animals is not the same thing as mirroring animals' emotions. The tendency to mirror animals' emotions was particularly associated with the avoidance of meat, like chicken, and the consumption of plant-based meat alternatives, while understanding the minds of animals was a relatively stronger predictor of the range of animals people believe they have moral obligations towards.

What do these findings mean?

The novel instrument offers a more thorough and differentiated way of measuring empathy towards animals that distinguishes between the tendency to understand the emotional states of animals (cognitive empathy) and the tendency to emotionally resonate with those emotional states (affective empathy). The findings highlight the independence of the two animal-directed tendencies and the unique importance of each for predicting behaviours and attitudes that impact on animal lives. The researchers envision future applications of the instrument to better understand when individuals are likely to respond positively to animal-welfare messaging and advocate for neglected and exploited animals.

The capacity to perceive and relate to the minds of others, including those of non-human animals, has been described as the "psychological superglue" that holds society together (Zaki, 2019). The ways in which people attribute mental states, interpret emotions, and respond to suffering has important ethical and moral implications, influencing not only individuals' attitudes and behaviour (Batson, 2011), but also broader debates about non-human animal rights, welfare, and moral consideration (Leach et al., 2021). For example, research shows that individuals who attribute greater cognitive and emotional abilities to animals also tend to reject harming animals for human consumption (Piazza et al., 2015). Further, the UK recently granted legal recognition of cephalopods and crustaceans, like octopuses, crabs and lobsters, based on their sentience and capacity to suffer (Ares, 2022). These examples demonstrate how engagement with the minds of animals can directly inform ethical judgments and, ultimately, policy decisions.

Perceiving and responding to suffering are often understood with reference to the broad construct of *empathy*, yet empathy itself is multifaceted, encompassing distinct psychological components (Engen & Singer, 2012; Heyers et al., 2025). While some perspectives emphasize the importance of perspective taking or accurately inferring another's mental states (sometimes referred to as "cognitive empathy"; see e.g., Bloom, 2017; Jordan et al., 2016), others argue that more affective dimensions, such as emotional mirroring or experiencing distress in response to another's suffering, may be critical for motivating moral concern and a willingness to help (e.g., Zaki, 2019). Investigating these ideas requires empirical tools that can reliably capture and differentiate the components

of empathy and distinguish them from related but distinct constructs, such as moral concern. We argue that current measures of empathy towards animals frequently fail to do so, limiting both theoretical clarity and practical application.

In this paper, we address this gap by developing and validating a novel measure of animal-directed empathy. By clearly separating cognitive and affective dimensions of empathy from one another and from general attitudes toward animals, the work offers a more precise tool for studying how people understand and respond to non-human minds.

Empathy and Its Components

Empathy can be difficult to pin down, largely because of its multi-component nature. Most definitions recognise that empathy involves multiple capacities working together (Engen & Singer, 2012). Strictly speaking, empathy involves the capacity to feel, to some degree and in an isomorphic way, the emotional states inferred in others, sometimes referred to as "affective empathy" (Heyers et al., 2025). However, the capacity to feel what others plausibly feel, arguably, additionally requires perspective-taking abilities—the capacity to infer and represent the content of another's mind, that is, cognitive empathy (Bloom, 2017; Dadds et al., 2008).

Research into the neural structures supporting empathy has confirmed its multi-component nature. Neuroscience studies have uncovered distinct neural circuitry underlying affective and cognitive empathy (Engen & Singer, 2012), and research with neurodivergent populations has observed dissociations of affective and cognitive components, with some personality disorders (e.g., psychopathy) reflecting impairments in mirroring others' emotions, but not an impairment in accurately perceiving their mental states, while other presentations (e.g., ASD, borderline personality) reflect the opposite pattern (Harari et al., 2010; Mazza et al., 2014).

Psychometric research has likewise demonstrated the multi-factorial structure of empathy (e.g., Jolliffe & Farrington, 2006; Jordan et al., 2016). Several scales, focused on human-directed empathy, distinguish between affective and cognitive tendencies. For example, Jolliffe and Farrington (2006) developed the Basic Empathy Scale with a two-factor structure relating to affective (e.g., "I often become sad when watching sad things on TV or in films") and cognitive empathy (e.g., "I can understand my friend's happiness when she/he does well at something"). Dadds et al. (2008) likewise developed a two-factor empathy scale for use with children, with affective and cognitive components (see also Jordan et al., 2016). These approaches have revealed a degree of convergence between the two components, as well as some divergences, with both components playing an important role as predictors of prosocial behaviour (e.g., willingness to help someone in need; Dadds et al., 2008) and concern for nature (Martin et al., 2023).

Empathy Towards Animals and Its Measurement

The General Empathy Hypothesis posits that the same cognitive and affective skills required for empathy with humans are needed to establish empathy for animals (Paul, 2000; Taylor & Signal, 2005). Consistent with this hypothesis, previous work on animal empathy has observed some degree of convergence with human-oriented empathy. An fMRI study observed common neural circuitry activated when people view humans and animals in emotionally negative contexts (e.g., crying, being harmed; Mathur et al., 2016). Paul (2000) developed a measure of animal empathy directly modelled after an existing human empathy scale, and observed a correlation of .26. Other research has sought to correlate human-oriented empathy with empathy-relevant attitudes towards animals. These studies have observed weak to modest correlations, for example, between human-directed empathic concern and protective attitudes towards animals (Taylor & Signal, 2005; see also Signal & Taylor, 2007), and between human-oriented empathy and empathy towards nature (Martin et al., 2023). Thus, current evidence seems to confirm some degree of overlap between empathy towards humans and animals, though with some divergence.

This divergence justifies the development of stand-alone measures of empathy towards animals, since human-oriented measures may not fully capture the phenomenon. Yet, current tools for measuring animal empathy are deficient in that they fail to reliably discriminate between different components of empathy, and they tend to conflate empathy with related constructs like moral concern and prosociality.

The most popular instrument for assessing animal empathy, Paul's (2000) Animal Empathy Scale (AES), is a single factor scale that, on the surface, covers a range of constructs, some of which relate to affective empathy (e.g., "Seeing animals in pain upsets me"). However, many of the items appear incidental to empathy and instead relate to: (a) non-resonate emotional reactions to animals (e.g., "I find it irritating when dogs try to greet me by jumping up and licking me"); (b) evaluations of people who express affection towards animals (e.g., "People who cuddle and kiss their pets in public annoy me"); (c) beliefs about how animals should be treated (e.g., "Animals deserve to be told off when they're not behaving properly"); and (d) prosocial actions toward animals (e.g., "I would always try to help if I saw a dog or puppy that seemed to be lost"). While the AES consistently obtains good scale reliability (see e.g., Paul, 2000; Rothgerber & Mican, 2014), it is questionable whether the items assess a single construct. Additionally, the AES lacks scope, as references to "pets", "dogs" and "cats" account for half of the 22 items (notably, the focus on companion animals in empathy measurement parallels a wider trend in the animal abuse literature; see e.g., Martin et al., 2023). Other animal-oriented empathy scales, such as Tam's (2013) Dispositional Empathy with Nature Scale (DENS), have similar limitations—for example, the DENS items use a vague target ("animals and plants"), rather than focusing on specific situations or animal or plant targets.

The Present Study and Its Aims

The central research aims were to develop and validate a novel instrument for assessing affective and cognitive components of empathy towards animals. We envisioned an instrument with comprehensive scope, both in terms of animal species and domains of human-animal interaction. In Study 1, we generated a large set of situation-based items that would adhere closely to accepted definitions (affective: the sharing of an animal's emotional state; cognitive: understanding and attributing situationally plausible subjective experiences to an animal; see e.g., Bloom, 2017; Heyers et al., 2025) to provide a high level of face validity. The initial pool of items was presented to a sample of adults to explore their factor structure and reduce the number of items (Study 1); candidate items were then presented to a second sample to confirm the factor structure (Study 2). In each study, we conducted tests of discriminant, convergent, and predictive validity. In terms of discriminant and convergent validity we explored the scale's relationship with existing measures of human-oriented empathy, including empathic concern and affective empathy (e.g., Jordan et al., 2016). Predictive validity tests included gender and measures of belief in animal mind, speciesism, lethal animal management, animal-product consumption, and Big-Five personality. See Piazza et al. (2026a) for anonymised data sets and Piazza et al. (2026b) for study materials (qsf files).

Study 1

We did not have strict hypotheses, but a few loose expectations based on prior research. First, we expected female participants to score higher on both components of animal empathy, given that past research has observed consistent gender differences in human-oriented empathy and empathy with nature (e.g., Martin et al., 2023). Second, we expected that individuals who practice meat-restricted diets would score higher on both components, given that plant-forward eaters tend to be concerned about animal welfare and exhibit concern for a wide range of animals (e.g., Piazza et al., 2015). Finally, we expected components of animal empathy to relate negatively to speciesism (Caviola et al., 2019) and endorsement of lethal approaches to animal management (Knight et al., 2004), and positively to beliefs in animal minds (Knight et al., 2004) and two aspects of personality—agreeableness and openness—found to correlate with human-oriented components of empathy (e.g., Jolliffe & Farrington, 2006).

Method

Participants

In G*Power 3.1, we calculated our target sample size for a correlation test, two-tailed with alpha set at .05. A sample range of $N = 112–138$ would give 90–95% power to identify correlations of .30—close to the typical effect size observed in social psychology

(Lovakov & Agadullina, 2021). We aimed to recruit beyond this minimum to mitigate incomplete responses. Participants were recruited using a combination of undergraduate student sampling at Lancaster University, in exchange for course credit, and snowball sampling from friends and family of psychology students at the same university. One hundred and seventy-six individuals consented, however, only 150 participants fully completed the study (35 male; 111 female; 4 non-binary or other). The mean age of the sample was 23.3 years (*SD* = 12.0; range = 17–73); 94.7% identified as British, 5.3% other nationalities. Ethnic identities included 88.7% White; 4.7% Asian; 6.7% mixed or other. The dietary orientation of the sample included 24 meat lovers, 88 omnivores, 22 semi-vegetarians, 7 pescatarians, 6 lacto- or ovo-vegetarians, 2 strict vegetarians, and 1 lifestyle vegan. The average political orientation of the sample was 2.8 (*SD* = 1.2; range: 1 = "extremely liberal" to 7 = "extremely conservative").

Item Development

Our team set out to generate an initial pool of items for assessing affective and cognitive empathy towards animals. Our approach to item construction was to develop situation-based items that capture ways of relating to animals within specific contexts, as opposed to writing general statements of trait tendencies. One guiding principle was to develop items that covered a range of human-animal interaction domains and animal species identified in research (e.g., Knight et al., 2004; Vera et al., 2025) and animal advocacy—for example, depicted on websites from organisations such as Network for Animals and The Humane League. Eight domains were identified: (1) companion animals; (2) farming and food; (3) wildlife use and management; (4) aquatic animals; (5) pests and feared animals; (6) animal testing; (7) animal confinement; and (8) entertainment and eco-tourism. We aimed for 3–4 items per domain that included a range of animal species and emotional experiences.

We applied several criteria when writing the items: (a) for simplicity, each item should be a single sentence; (b) each item should relate to a situation where an animal could plausibly experience a negative or positive emotion; (c) each item should contain sufficient detail for readers to identify which emotion is implicated; (d) for each scenario, we generated a cognitive and affective version; (e) affective items were written to describe mirroring of the plausible feelings of the animal in the scenario; (f) the cognitive items were written as claims about what the animal might plausibly be experiencing in the situation; (g) some items should be reverse-phrased; and (h) all items were designed to be assessed in terms of level of agreement/disagreement. The final pool of candidate items included 56 statements, covering 28 unique empathy-relevant situations (see Piazza et al., 2026 and Piazza et al., 2025b for all 56 items).

Survey Materials

The 56 items were rated in terms of level of agreement/disagreement on a 1–7 Likert scale (1 = *strongly disagree*; 4 = *neither agree nor disagree*; 7 = *strongly agree*). All additional measures, except the Food Frequency questionnaire and demographic questions, were assessed on the same 1–7 Likert scale.

Additional Measures

Animal Empathy Scale (AES) — The AES (Paul, 2000) contains 22 statements designed to assess empathic responses to animals. Half of the items are reverse phrased. The AES had good reliability (Cronbach's α = .87).

Measures of Human-Oriented Empathy — Two measures of human-oriented empathy were assessed. The Empathic Concern subscale of Davis' (1983) Interpersonal Reactivity Index (IRI) was used to assess human-oriented empathic concern. This subscale contains seven items designed to measure concern for individuals in need (e.g., "Other people's misfortunes do not usually disturb me a great deal" [reverse scored]). It had acceptable reliability (α = .78) and has been used extensively in research on human-oriented empathy.

We also included Jordan et al.'s (2016) Empathy Index "Empathy" subscale, which is a 7-item measure of human-oriented affective empathy. The items relate to the experience of mirrored feelings within empathy-relevant situations (e.g., "If I hear an awkward story about someone else, I might feel a little embarrassed"). The scale had acceptable reliability (α = .76).

Big Five Personality — Big Five personality was measured with the 10-item Big Five Inventory (BFI-10; Rammstedt & John, 2007). It contains ten statements, covering five components of personality: Neuroticism, Openness, Conscientiousness, Extraversion, and Agreeableness; two items per component.

Belief in Animal Mind (BAM) — BAM was measured with four items adapted from Knight et al. (2004) (e.g., "Most animals are unaware of what is happening to them" [reverse scored]). It is a measure of general belief that animals (broadly defined) have mental capacities related to problem solving, decision making, and emotion. The scale had less than satisfactory reliability (α = .62).

Speciesism — Speciesist beliefs were measured with Caviola et al.'s (2019) Speciesism scale, which contains six items, related to a belief that human life is more valuable than animal life (e.g., "Morally animals always count for less than humans") and permissive attitudes toward animal use (e.g., "It is morally acceptable to trade animals like

possessions"). Higher scores represent greater speciesism endorsement. The scale had acceptable reliability (α = .74).

Animal Management — We used Knight et al.'s (2004) Animal Management scale to assess attitudes toward the use of lethal vs. non-lethal methods of managing wild animal populations, with six items total (e.g., "Hunting is an acceptable means for controlling overpopulation in wild animals"), half reverse phrased. Higher scores represent greater approval of lethal force. The scale had acceptable reliability (α = .72).

Food Frequency Questionnaire — We assessed the frequency with which people consume a range of animal-sourced food products (9 items), and plant-based alternatives (3 items), on a 0 to 4 scale (0 = never; 1 = occasionally or only on special occasions; 2 = multiple times per week; 3 = most days; 4 = multiple times per day), with higher scores representing greater frequency of consumption. See Piazza et al. (2026b) for details of the 12 items.

Dietary Classification — Participants classified their dietary orientation using one of eight options, ranging from "meat lover" to "lifestyle vegan", see Piazza et al. (2026b) for the category definitions provided to participants. Participants were asked to select the option that best describes them.

Procedures — Participants read information about the study prior to consenting. They were presented with the 56 animal-empathy items in random order. Next, they answered the AES, BAM, Speciesism, and Animal Management scale, in a randomised order. This was followed by IRI-Empathic Concern and the Empathy Index subscale, in a randomised order. Next, they completed the BFI-10, followed by the Food Frequency questionnaire. They finished by answering the demographic questions (gender, age, nationality, ethnicity, dietary classification, and political orientation), were debriefed and thanked.

Analysis Plan

Item Reduction and Selection — We subjected item ratings to exploratory factor analysis (Principal Component Analysis) without rotation and with (Varimax with Kaiser Normalization; Oblimax was also consulted). Bartlett's test of sphericity, $\chi^2(1540) = 5011.2$, $p < .001$, and KMO = .88 suggested that factor analysis was appropriate. Two components emerged with substantial eigenvalues (> 2.0) irrespective of rotation method. The first component (eigenvalue = 16.8) included 26 of the affective items loading greater than .45. The second component (eigenvalue = 5.8) included 22 of the cognitive items loading greater than .45, and one affective item.

We aimed to reduce the set of items for each subscale, and applied the following criteria: (a) we omitted any items which did not load onto their respective component by at least .45 or higher; (b) we omitted any items which cross-loaded onto the other

component at a level of .30 or higher (to optimize independence); (c) to ensure a diversity of animal species, we only included an animal once across the subscales; (d) we aimed for comprehensive representation of the eight animal domains per subscale; (e) we sought to include at least one reverse-phrased item; (f) we aimed for good-to-strong subscale reliabilities, that could not be improved by dropping an item from the scale; and (g) we aimed for an equivalent number of items within each subscale.

The final selection of items—with 11 items per subscale—can be viewed in Table 1, with the factor loadings and respective domains. The scale reliabilities were high for Affective (α = .92) and good for Cognitive (α = .80). The subscales exhibited good discriminant validity, with a moderate positive correlation of $r(148) = .34$, $p < .001$. Overall, participants reported higher levels of cognitive ($M = 6.2$, $SD = 0.6$) than affective animal empathy ($M = 4.1$, $SD = 1.4$), $t(149) = 19.36$, $p < .001$, 95% CI [1.90, 2.34], $d = 1.95$.

Table 1

Selected Items for the Affective and Cognitive Animal Empathy Scale: Item Descriptions, Factor Loadings, and Respective Animal Domain

Domain	Item	Affective loading	Cognitive loading
Affective subscale			
Wildlife	When I think about a coyote with their paw caught in a steel trap, I can't help but feel pain in my own hand.	**.810**	.023
Aquatic	Seeing lobsters together in small tanks in a restaurant makes me feel claustrophobic as well.	**.784**	.135
Entertainment	Thinking about an injured racehorse with a broken leg makes my leg feel funny.	**.777**	.114
Aquatic	Seeing a fish taken out of water makes me gasp for air too.	**.775**	.077
Confinement	Seeing birds trapped in small cages in pet shops makes me feel stressed out too.	**.753**	.227
Companion	When I see someone step on a cat's foot, I feel a twinge in my own foot.	**.721**	.156
Animal testing	Thinking about pharmaceutical companies testing harsh chemicals on the eyes of rabbits, I start to almost feel an itching sensation in my own eyes.	**.712**	.070
Wildlife	If I were to see a deer hit by a car and stumble away, it would feel like my own body had been hit.	**.698**	.181
Farmed	Thinking about cattle being branded with a hot iron feels as if something hot is being pressed against my own skin.	**.697**	.107
Farmed	It makes me gag to think of ducks being force-fed with pipes down their throats to enlarge their livers for foie gras.	**.606**	.189
Confinement	When I see a gorilla alone in a zoo enclosure, I can't help but feel lonely too.	**.568**	.191

Domain	Item	Affective loading	Cognitive loading
Cognitive subscale			
Companion	Isolated dogs feel loneliness.	.177	**.651**
Wildlife	I don't think elephants experience sadness when another elephant dies. [R]	.071	**.605**
Animal testing	Monkeys used in sensory deprivation experiments must feel scared.	.182	**.602**
Wildlife	Crocodiles that are skinned alive to make designer bags feel agonising pain before they die.	.025	**.596**
Pests	Rats stuck in glue traps feel terror.	.181	**.565**
Farmed	Hens experience a lot of distress when they are confined in battery cages with other hens.	.239	**.557**
Aquatic	Octopus experience great pain when they have their arms cut while they are alive.	.088	**.548**
Farmed	Dairy cows feel distressed when their calves are taken from them.	.101	**.538**
Entertainment	Donkeys that have to carry tourists on their back must be exhausted.	.032	**.507**
Entertainment	Killer whales are happy in tanks at entertainment parks. [R]	-.042	**.483**
Pests	Flies and spiders likely suffer when sprayed with insect poison.	.069	**.474**

Note. R = reverse score. Bolded values have a factor loading > .45 (with Varimax rotation applied).

Tests of Validity — Tests of convergent and discriminant validity involved running correlations between the subscales and the other scales. We tested our hypotheses regarding gender and meat-restricted diets, using independent *t*-tests. For comparison purposes, we contrasted female- and male-identified participants (omitting non-binary and "other" genders) and grouped meat lovers and omnivores as "meat-centric diets" (n = 112) and everyone else as "meat-restricted diets" (n = 38).

Results

Convergent and Discriminant Validity

As predicted, the subscales correlated at moderate levels with Paul's AES (affective: $r(149) = .51$; cognitive: $r(149) = .56$, ps < .001). This provides evidence of both convergent and discriminant validity.

Consistent with the General Empathy Hypothesis, the subscales correlated moderately with human-oriented empathic concern (affective = .44; cognitive = .32, ps < .001), suggesting that individuals who tend to experience empathic concern for humans, likewise experience both affective and cognitive animal empathy. The affective subscale also correlated with human-oriented affective empathy at high levels, $r(149) = .66$, $p < .001$, while the cognitive subscale correlated weakly with human-oriented affective empathy,

$r(149) = .18$, $p = .025$. Thus, participants who tend to mirror the emotions of humans also mirror the emotions of animals.

Predictive Validity

Gender Differences — As expected, females scored higher on affective animal empathy ($M = 4.2$, $SD = 1.4$) than males ($M = 3.6$, $SD = 1.4$), $t(144) = 2.31$, $p = .022$, 95% CI [.09, 1.15], $d = 0.43$. However, females did not score higher on cognitive animal empathy ($M = 6.2$, $SD = 0.6$) than males ($M = 6.0$, $SD = 0.7$), $t(144) = 1.40$, $p = .163$, 95% CI [-.42, .07], $d = 0.31$. Thus, expectations regarding gender were partially supported.

Political Orientation — The affective subscale was unrelated to political orientation, $r(148) = -.06$, $p = .45$, whereas cognitive empathy toward animals related negatively to being conservative, $r(149) = -.25$, $p = .002$.

Personality — As expected, affective animal empathy correlated significantly with agreeableness and openness (see Table 2); however, cognitive animal empathy was unrelated with these personality traits. The two measures of human-oriented empathy components also correlated with agreeableness (but not openness).

Animal Attitudes — Both animal empathy subscales correlated positively with BAM, negatively with speciesism, and negatively with lethal animal management (see Table 2).

Diet — As expected, meat-restricted individuals scored higher on affective animal empathy ($M = 4.6$, $SD = 1.2$) than meat-centric eaters ($M = 3.9$, $SD = 1.4$), $t(148) = 2.80$, $p = .007$, 95% CI [.20, 1.23], $d = 0.54$. However, meat-restricted eaters did not score higher on cognitive animal empathy ($M = 6.3$, $SD = 0.6$) than meat-centric eaters ($M = 6.1$, $SD = 0.6$), $t(148) = 1.44$, $p = .075$, 95% CI [-.06, .40], $d = 0.33$. Thus, our expectations regarding diet were partially supported.

We explored, in a more nuanced manner, the relationship between the animal empathy subscales and the food frequency items (see Table 3; note results using Spearman's rho are very similar). Affective animal empathy correlated with lower levels of beef, pork, and chicken consumption, and higher levels of meat alternative consumption. Cognitive animal empathy correlated with lower levels of beef and pork consumption.

Table 2

Pearson's Correlations Between Affective and Cognitive Animal Empathy Subscales, Human-Oriented Empathy, Big Five Personality, and Animal Attitudes

	Agreeableness	Openness	Conscient.	Extraversion	Neuroticism	BAM	Speciesism	Lethal animal management
Affective subscale	.23**	.22**	.16	-.09	.02	.38***	-.32***	-.28***
Cognitive subscale	.13	.12	.11	-.03	.05	.46***	-.41***	-.38***
IRI-Empathic concern	.25**	.10	.19*	.05	.05	.38***	-.31***	-.22**
Empathy index	.22**	.14	.01	-.02	.29***	.37***	-.33***	-.29***

Note. BAM = Belief in Animal Mind. IRI = Interpersonal Reactivity Index.

*$p < .05$. **$p < .01$. ***$p < .001$.

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Table 3

Pearson's Correlations Between Affective and Cognitive Animal Empathy Subscales and Food Frequency Ratings

	Beef	Pork	Chicken	Other meats	Dairy products	Fish	Shellfish	Egg	Whey	Meat alt.	Dairy alt.	Whey alt.
Affective	-.27***	-.35***	-.21*	-.15	-.08	-.07	-.03	-.12	-.05	.22**	.12	.15
Cognitive	-.24**	-.23**	-.15	-.13	.13	-.06	-.10	.06	-.04	.08	.07	-.02

*$p < .05$. **$p < .01$. ***$p < .001$.

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Exploratory Test of Discriminant Predictive Validity

To explore whether animal-empathy components contribute to prosocial orientations towards animals over and above the human-oriented measures, we conducted an exploratory regression analysis with the two human-oriented components (IRI-empathic concern; Empathy index) in the analysis along with the two animal-empathy components, predicting endorsement of lethal animal management (a measure of prosocial intentions). This analysis revealed that only cognitive empathy towards animals predicted (negatively) endorsement of lethal methods of wild animal management, $\beta = -.33$, $t(145) = -4.13$, $p < .001$, when the four measures were entered as simultaneous predictors. Thus, at least one animal-empathy component outperformed the human-oriented measures with regards to predicting prosocial intentions towards animals.

Discussion

Study 1 provided a preliminary foundation for moving forward to the confirmatory stage. The 11-item affective and cognitive subscales showed promising reliability, good discriminant validity, and reasonable convergent validity with a pre-existing measure of animal empathy and human-oriented empathy components. Preliminary validity tests revealed results quite consistent with expectations—for example, females and meat-restricted eaters scored higher on affective animal empathy than males and meat-centric eaters. Having identified two promising subscales, we moved towards confirming the structure of the scale, dubbed *Affective and Cognitive Animal Empathy Scale* (or AC-AES; pronounced "aces").

Study 2

We preregistered our plan to use Confirmatory Factor Analysis (CFA) and investigate the test-retest reliability of the subscales (see Piazza & Leach, 2025). We also included a few additional tests of discriminant and predictive validity: (1) we sought to show divergence between the animal-empathy subscales and "solidarity with animals", a measure of shared group identification with animals (Amiot & Bastian, 2017); (2) we explored the subscales' ability to predict the size of a person's "circle of moral concern" (i.e., the range of animals that a person perceives they have moral obligations towards; Laham, 2009). Solidarity with animals is a reliable predictor of concern for animals (Amiot & Bastian, 2017) and the moral circle task has been used extensively to assess moral concern (e.g., Piazza et al., 2015), making them suitable measures for consideration. We expected both animal-empathy components to relate to moral circle size, but that the affective component would be the stronger predictor.

Method

Participants

We sought to double our sample size from Study 1 to provide sufficient power to run a CFA. We recruited participants via Prolific, and used recruitment features that allowed us to follow-up with participants for Part 2 (the retest session). We limited recruitment to participants based in the UK, with English fluency, and balanced male-to-female participants. We limited participation to computers and tablets. For Part 1 (hosted 21 June 2025), participants were paid £1.20 for an 8-minute study (£9.00/HR); 301 participants completed Part 1, and 271 participants returned to complete Part 2 (90.0% adherence rate), one week later. Part 2 was made available to all 301 participants from Part 1 and was hosted between 29 June to 7 July 2025. Participants were matched across the two time points using their Prolific IDs, and were paid £0.60 for a 4-minute study (£9.00/HR).

The 301 adults who participated in Part 1 had a mean age of 42.9 years (*SD* = 14.1; range 18-77 years); 150 identified male, 149 female, 2 non-binary or other; 87.7% identified as British, 12.3% other nationality (e.g., Polish); 78.7% identified as White, 11.3% Black, 8.3% Asian, and 1.6% mixed or other ethnicity. The dietary classifications included 55 meat lover, 164 omnivore, 40 semi-vegetarian or reducetarian, 13 pescatarian, 12 lacto- or ovo-vegetarian, 5 strict vegetarian, and 12 dietary or lifestyle vegan. The average political orientation of the sample was 3.5 (*SD* = 1.5).

Materials and Procedure

Part 1 — After the informed consent, the 11 Affective and 11 Cognitive items were presented in a randomised order. Participants rated their level of agreement/disagreement on the same 1–7 Likert scales from Study 1. Afterwards, participants completed the 7-item Solidarity with Animals scale (e.g., "I feel a strong bond toward animals"; Amiot & Bastian, 2017) using the same 1–7 scale, and Laham's (2009) Moral Circle task. The order of completion was randomised. For the Moral Circle task, participants were provided 32 animals (see Supplements) and asked to drag each into one of two boxes, based on their personal choice: one labelled "I have a moral obligation to show concern for these animals" and another "I DO NOT have a moral obligation to show concern for these animals". The sum of all animals placed in the former box is the measure of a person's circle of moral concern. Afterwards, demographic questions were answered, and participants were debriefed and paid.

Part 2 — Approximately one-week later participants answered the Affective and Cognitive items, and demographic questions, a second time, were fully debriefed and paid.

Results

Scale Descriptives

The mean scores for the subscales (Part 1) were very similar to Study 1: affective (M = 4.2, SD = 1.5); cognitive (M = 6.0, SD = 0.8). At Time 2, the mean scores were virtually identical to Time 1: affective (M = 4.2, SD = 1.6); cognitive (M = 6.1, SD = 0.8).

Consistent with Study 1, the affective subscale had high reliability (α = .94); the cognitive subscale had good reliability (α = .84). The subscales, again, showed good discriminant validity and correlated moderately, $r(300) = .44$, $p < .001$ (Time 1); $r(270) = .39$, $p < .001$ (Time 2). Affective empathy towards animals was, again, unrelated to political orientation, $r(300) = .01$, $p = .99$, whereas cognitive animal empathy was negatively correlated with being conservative, $r(300) = -.19$, $p < .001$.

Confirmatory Factor Analysis

We used AMOS to build a one-factor and two-factor model for comparison, using data from Part 1. There was no missing data. The data structure was again suitable for factor analysis, Bartlett's test of sphericity, $\chi^2(231) = 3401.00$, $p < .001$, KMO = .93. We used Maximum Likelihood Estimation with robust standard errors. We added an error correlation between the two reverse-phrased items to capture a potential measurement effect. We contrasted the one-factor model with the preferred two-factor model, where the affective and cognitive subscales are represented as separate-but-correlated latent variables. See Table 4 for model fit indices.

Table 4

Model Comparison for the One-Factor and Two-Factor Solutions for the Affective and Cognitive Animal Empathy Scale

Model	*df*	X^2	RMSEA	CFI	TLI	RMR	AIC	BIC
One-factor	208	1107.8***	.120	.725	.694	.212	1197.08	1363.90
Two-factor	207	476.7***	.066	.917	.908	.154	568.68	739.20

Note. RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMR = Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.
***$p < .001$.

As can be seen in Table 4, the one-factor model had poor fit. The two-factor model had comparatively better fit, with indices at mostly satisfactory levels, based on recommended cut-off values (e.g., Hooper et al., 2008). For example, the RMSEA value .066 fell under the conventional cut-off of .08, and the CFI value of .917 was above the conventional .90 cut-off. However, the model Chi-square was statistically significant

suggesting less than "perfect" fit. In sum, the CFA confirmed the two-factor structure of the 22-item scale.

Test-Retest

The subscale means between Time 1 and 2 were nearly identical and thus satisfied the requirements for test-retest correlations. Both the affective subscale, $r(270) = .87$, $p < .001$, and cognitive subscale, $r(270) = .79$, $p < .001$, exhibited good test-retest reliability.

Gender and Dietary Differences

Once again, female participants reported significantly higher levels of affective animal empathy ($M = 4.6$, $SD = 1.6$), relative to male participants ($M = 3.9$; $SD = 1.5$), $t(297) = 4.31$, $p < .001$, 95% CI [.38, 1.03], $d = 0.45$. This time, female participants also scored higher than males on cognitive animal empathy ($M = 6.2$, $SD = 0.8$ vs. $M = 5.9$, $SD = 0.7$), $t(297) = -3.89$, $p < .001$, 95% CI [.16, .50], $d = 0.40$.

We grouped participants into binary dietary groups as in Study 1. Affective animal empathy was higher among meat-restricted eaters ($M = 4.8$, SD = 1.5) than meat-centric eaters ($M = 4.0$, SD = 1.4), $t(299) = 4.60$, $p < .001$, 95% CI [.48, 1.21], $d = 0.55$. Different from Study 1, cognitive animal empathy was also higher among meat-restricted eaters ($M = 6.4$, SD = 0.7) than meat-centric eaters ($M = 5.9$, SD = 0.7), $t(299) = 4.90$, $p < .001$, 95% CI [.27, .65], $d = 0.71$. Thus, consistent with our expectations from Study 1, females and participants with meat-restricted diets scored higher on animal-empathy components.

Tests of Discriminant and Predictive Validity

Both subscales correlated moderately with solidarity with animals (affective: $r(300) = .56$; cognitive: $r(300) = .53$, $ps < .001$), thus exhibiting both convergence and divergence. Somewhat different from expectations, the affective subscale correlated weakly (though significantly) with moral circle size, $r(300) = .26$, $p < .001$, while the cognitive subscale correlated moderately, $r(300) = .47$, $p < .001$, and to a comparatively larger degree, Steiger's $z = 3.79$, $p < .001$. An exploratory regression analysis (not pre-registered), with the subscales and solidary with animals entered as simultaneous predictors of moral circle size, revealed cognitive animal empathy, $\beta = .34$, $t(297) = 5.73$, $p < .001$, and solidarity with animals, $\beta = .30$, $t(297) = 4.65$, $p < .001$, as independent predictors. Affective empathy towards animals, $\beta = -.06$, $t(297) = -0.94$, $p = .35$, was not related to moral circle size, once shared variance was accounted for.

General Discussion

Study 2 confirmed the two-factor structure of the newly developed AC-AES. The subscales showed good test-retest reliability, and, again, showed good discriminant validity and convergence with related constructs (e.g., solidarity with animals). In Piazza et al.

(2026b), Table S1 summarises the correlates of the subscales across the studies. The two animal empathy components shared many correlates, with a few notable exceptions. For instance, affective empathy towards animals was associated with aspects of personality (e.g., agreeableness), as well as meat-reduction and replacement practices, at levels not found for cognitive animal empathy. By contrast, cognitive empathy towards animals was a stronger predictor of prosocial intentions, such as having moral concern for a wide variety of animals. It is unclear why cognitive empathy (i.e., perspective taking with animals) was a stronger predictor of an expansive moral concern. One possibility relates to arguments made by Bloom (2017), that affective empathy may not be necessary to motivate altruism especially when considering actions that could help a large number of (animal) lives. That said, a tendency to experience affective empathy towards animals was related to several meat-reduction practices that cognitive empathy was only weakly related to (e.g., avoiding chicken; substituting meat with plant-based alternatives). This might suggest that sharing animals' emotional experiences—even nonmammalian animals such as chickens—could shift diets in a more compassionate direction. Thus, rather than viewing affective empathy as limited for motivating action on behalf of animals, each empathy component may contribute in unique ways to animal-directed altruism. Nonetheless, additional tests with more diverse samples are required before firmly concluding about the additive value of affective empathy for meat avoidance.

Limitations & Future Directions

Continued validation of the AC-AES will be needed to confirm the two-factor structure within populations that extend beyond the current UK samples. Furthermore, validation tests with diverse populations—for example, "dark" personalities who tend to exhibit lower affective empathy towards humans and animals (Kavanagh et al., 2013)—will be of great importance. Moreover, many fruitful directions for continued hypothesis testing can be envisioned, such as exploring the unique role of affective and cognitive animal empathy in predicting people's willingness to help victimised animals or to alter their diets in response to animal welfare campaigns. Might animal advocates who work closely with exploited or victimised animals exhibit chronically higher levels of affective empathy towards animals? Might such individuals who fail to effectively down-regulate these empathic emotions over time be at risk of empathy fatigue?

Our approach to item construction was grounded in documented ways that humans relate to animals, covering a range of species and domains of human-animal interaction. This increases the scope and ecological validity of the scale, though we acknowledge this approach may depart somewhat from previous approaches that use abstract statements—e.g., "When I'm upset at someone, I usually try to 'put myself in his shoes' for a while" (from the IRI [Davis, 1983]); "I imagine how I would feel if I were the suffering animals and plants" (from DENS [Tam, 2013])—and requires continued validation with non-western samples. Nonetheless, the use of situation-based items is, arguably, consistent with

self-report methods that involve the aggregation of concrete instances. More critically, the range of human-animal interactions utilised within the scale extends beyond what is typical for empathy measurement and represents a clear advance in content validity.

Conclusion

We developed the AC-AES to separately assess affective and cognitive aspects of empathic tendencies towards animals. Our preliminary validation work suggests that affective and cognitive components contribute in unique ways to animal-directed attitudes and prosocial intentions. Future work should continue to clarify the relative value of each animal-empathy component. Here we have shown that the tendency to mentally represent what animals are experiencing is an important aspect of our moral concern for animals. Yet, there may be added motivational benefits of feeling, in a reciprocal way, what animals are feeling. Future research with AC-AES should help clarify the discriminant value of each component for further aspects of pro-animal attitudes and animal advocacy beyond what was examined in this initial research.

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Competing Interests: The authors have declared that no competing interests exist.

Ethics Statement: Both studies received ethics approval from the FST Ethics Committee at Lancaster University prior to data collection.

Data Availability: For this article, data is freely available (see Piazza et al., 2026a).

Supplementary Materials

For this article, the following Supplementary Materials are available:

- Preregistration (see Piazza & Leach, 2025)
- Data sets (see Piazza et al., 2026a)
- Study materials, food frequency items, dietary classifications, and all 56 scale items used in Study 1, animals used in the moral circle task (Study 2), and a summary table of the findings from Study 1 and 2 (see Piazza et al., 2026b)

Index of Supplementary Materials

Piazza, J., & Leach, S. (2025). *'Cognitive and Affective Empathy toward Animals Scale - CFA and test-retest'* [Preregistration]. AsPredicted. https://aspredicted.org/kfmp-qhzn.pdf

Piazza, J., Leach, S., Burchell, J., Lloyd, F., Strenkowski, K., & Warhurst, I. (2026a). *Supplementary materials to "Understanding animal minds and mirroring their emotions: Validation of the*

Affective and Cognitive Animal Empathy Scale (AC-AES)" [Data]. PsychOpen GOLD. https://doi.org/10.23668/psycharchives.22401

Piazza, J., Leach, S., Burchell, J., Lloyd, F., Strenkowski, K., & Warhurst, I. (2026b). *Supplementary materials to "Understanding animal minds and mirroring their emotions: Validation of the Affective and Cognitive Animal Empathy Scale (AC-AES)"* [Materials]. PsychOpen GOLD. https://doi.org/10.23668/psycharchives.22402

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