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When is it wrong to eat animals? The relevance of different animal traits and behaviours

Stefan Leach, Robbie M. Sutton, Kristof Dhont and Karen M. Douglas

School of Psychology, University of Kent, UK

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Acknowledgments and Author Note

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Accepted Article

DR. STEFAN LEACH (Orcid ID : 0000-0003-4065-3519)

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Abstract

Research suggests that animals' capacity for agency, experience, and benevolence predict beliefs about their moral treatment. Four studies built on this work by examining how fine-grained information about animals' traits and behaviours (e.g., can store food for later vs. can use tools) shifted moral beliefs about eating and harming animals. The information that most strongly affected moral beliefs was related to secondary emotions (e.g., can feel nostalgia), morality (e.g., will share food with others), empathy (e.g., can feel others pain), social connections (e.g., will look for deceased family members), and moral patiency (e.g., can feel pain). In addition, information affected moral judgements in line with how it affected superordinate representations about animals' capacity for experience/feeling but not agency/thinking. The results provide a fine-grained outline of how, and why, information about animals' traits and behaviours informs moral judgements.

Keywords: Animals, Morality, Mind Attribution, Meat Eating

When is it wrong to eat animals? The relevance of different animal traits and behaviours

If you had five chickens could you tell them apart by just the way they acted? Or would they all just be walking around? Cluck, cluck, cluck? Because if they have individual personalities I don't think we should be eating them.

- George Costanza, *Seinfeld*

Research has begun to document why some animals are deemed worthy of moral concern and others are not (Bastian & Loughnan, 2017; Dhont & Hodson, 2019; Possidónio, Graça, Piazza, & Prada, 2019). However, we still have a relatively coarse-grained understanding of how information is likely to shift moral beliefs about animals. As articulated by George Costanza, idiosyncratic and fine-grained information (e.g., this animal has a personality) may bear on how we view the moral treatment of animals. To investigate this, we tested how a wide range of fine-grained information about animals' traits and behaviours affected moral judgements related to meat eating. We also captured how this information affected beliefs about animals' capacity for agency/thinking and experience/feeling. We then integrated these data with an established perspective on mind perception (H. M. Gray et al., 2007) by examining whether the relative moral importance of each trait and behaviour was driven by the degree to which it reflects a capacity for agency/thinking and experience/feeling.

Which animals are wrong to eat?

People make moral distinctions between animals on the basis of several factors. Seminal work highlights the importance of animals' perceived mental sophistication and, more specifically, their capacity for experience and agency (Bastian, Loughnan, Haslam, & Radke, 2012; H. M. Gray et al., 2007). Experience and agency arise from judgements about the extent to which animals possess several mental capacities. Statistical analyses reveal that judgements about the extent to which animals have mental capacities related to emotions and feelings (e.g., anger, pleasure) and thinking and reasoning cohere (e.g., using tools, communicating; H. M. Gray et al., 2007). This suggests that judgements about animal minds can be organized along two superordinate dimensions (but see also Piazza et al., 2014 and Weisman, Dweck, & Markman, 2017). Broadly construed, experience reflects the capacity for feeling and consciousness, whilst agency reflects the capacity for thinking and intelligence. These dimensions subsequently predict beliefs about the morality of eating and harming animals (Bastian et al., 2012; H. M. Gray et al., 2007; Possidónio et al., 2019).

Work done in parallel finds that people differentiate between animals along other dimensions. People are more concerned with the welfare of benevolent compared to harmful animals (Study 1, Piazza, et al., 2014). Animals that are more similar to humans (Possidónio et al., 2019) or are endearing

(Piazza, McLatchie & Olesen, 2018) are held in higher regard than those that are not. Lastly, people are less concerned with the suffering of animals that are culturally defined as sources of food (Loughnan, Haslam, & Bastian, 2010). Taken together, these data capture why some animals are afforded greater moral concern than others. However, these data do not capture how, and why, new information about animals shifts moral concern.

How does new information shift beliefs about which animals are wrong to eat?

A wealth of information exists about animals that could potentially bear on moral judgements. In this paper, we use the term 'characteristic' to refer to animals' latent traits (e.g., is capable of planning) and observable behaviour (e.g., will hide food for later). People seem to be sensitive to new information about animals' characteristics. For example, those who are familiar with animals, or interact with them on a regular basis, hold them in higher regard (McConnell, Brown, Shoda, Stayton, & Martin, 2011; Possidónio et al., 2019); perhaps because they have first-hand experience of animals' traits and behaviours (Maust-Mohl, Fraser, & Morrison, 2012). More controlled studies find corroborating results. Ascribing animals' several characteristics associated with the capacity for experience/feeling or agency/thinking causes people to be more reluctant to harm and eat them (Piazza et al., 2014; Piazza & Loughnan, 2016; Sytsma & Machery, 2012). Other work demonstrates that ascribing animals' several characteristics associated with benevolence prompts people to be more concerned with their welfare (Piazza, et al., 2014). This finding aligns with broader perspectives on the relevance of social and moral capacities (Haslam & Loughnan, 2014). Taken together, the work shows that moral beliefs are sensitive to new information about animals' capacity for experience (e.g., are capable of pain and rich emotions), agency (e.g., are capable of problem solving and tool use) and benevolence (e.g., are gentle and peaceful).

These data provide a useful picture of how new information about animals' shifts moral beliefs. However, it is worthwhile to examine more fine-grained information. This is because important distinctions could exist between characteristics that are not captured by the present literature. As an example: the capacity to use tools and the capacity to plan are subsumed by the superordinate category of agency but might evoke different amounts of moral concern. Theoretical perspectives suggest that such distinctions may exist. Complex human-like states (e.g., nostalgia) ought to evoke greater moral concern than simple animal-like states (e.g., anger; Demoulin et al., 2004; Leyens et al., 2001). Likewise, negative feelings (e.g., pain) should confer greater moral standing than positive feelings (e.g., pleasure; K. Gray, Young, & Waytz, 2012). These latter characteristics might otherwise be subsumed under the

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superordinate category of experience. These findings suggest that it could be fruitful to examine how fine-grained information about animal characteristics affects moral beliefs.

Present research

Current perspectives capture how new information about animals' experience, agency, and benevolence shifts moral judgements. However, less work has gone beyond experience, agency, and benevolence to examine how fine-grained information confers moral standing in animals. It is important to examine how different information affects moral beliefs, given that such information features in popular scientific communications (e.g., de Waal, 2016) and is likely to affect how we treat animals (Dhont & Hodson, 2019; Joy, 2010; Ruby, 2012). As such, we test how a large set of fine-grained information about animals' latent traits and observable behaviours shifts beliefs about the moral treatment of animals.

We present four studies examining how moral judgements shift in response to information about whether animals have and lack different characteristics. We measure moral beliefs in terms of meat eating, but also in terms of judgements related to harm, as these are salient moral concerns related to human-animal relations (e.g., Bastian & Loughnan, 2017). Furthermore, we examine if the effects are moderated by the cultural status of the animal (i.e., whether the animal is typically reared for food). This is because people represent and process information pertaining to food animals in a motivated fashion (Bastian et al., 2012; Bratanova et al., 2011; Loughnan et al., 2010). Finally, we examine if superordinate representations of experience/feeling and agency/thinking (H. M. Gray et al., 2007) might account for why some characteristics are more morally relevant than others. As previously mentioned, ascribing animals different characteristics shifts beliefs about the animals' capacity for agency and experience (Piazza et al., 2014; Piazza & Loughnan, 2016), which then feed into the moral distinctions people make between animals (H. M. Gray et al., 2007; Piazza et al., 2014; Piazza & Loughnan, 2016; Sytsma & Machery, 2012). This suggests that superordinate representations about the capacity for experience and agency might account for why some characteristics afford greater moral standing than others.

We posit several predictions. First, we expect mental sophistication to elevate moral concern. That is, animals that are described as having mental characteristics will be more wrong to eat and harm compared to animals that are described as lacking mental characteristics. We also expect some characteristics to be stronger drivers of moral judgements than others. Specifically, we expect characteristics related to experience (H. M. Gray et al., 2007), socio-morality (Piazza et al., 2014; Haslam & Loughnan, 2014), complex secondary emotions (Demoulin et al., 2004; Leyens et al., 2001), and moral

patency (K. Gray, Young, & Waytz, 2012) to most strongly affect moral judgements. Finally, following prior work, we expect the moral relevance of each characteristic to be related to perceptions of experience and agency (H. M. Gray et al., 2007; Sytma & Machery, 2012). We present four studies testing these predictions.¹ The data, stimulus materials, and analysis scripts are available online (osf.io/4t2mg/?view_only=01183bb932524067a778dade7f1507f6).

Studies 1a & 1b

Studies 1a and 1b document how people perceive a range of characteristics in terms of their relevance for moral judgements related to meat eating. Studies 1a and 1b examine how people perceive animals for which they have no prior knowledge and therefore have no obvious cultural significance. We examine a range of characteristics ($i = 16$) that capture important traits associated with animal minds.

Participants & Design

Samples. Study 1a comprised two hundred and forty-one students (211 female; $M_{age} = 19.12$, $SD = 2.43$) from a British University participated in exchange for course credit. Participants identified their diet as follows: omnivore ($n = 194$), pescatarian ($n = 14$), vegetarian ($n = 26$) and vegan ($n = 7$). Study 1b comprised two hundred and thirteen students (179 female; $M_{age} = 19.84$, $SD = 3.93$) from a British University participated in exchange for course credit. Participants identified their diet as follows: omnivore ($n = 180$), pescatarian ($n = 11$), vegetarian ($n = 15$) and vegan ($n = 7$).

Statistical power. A sensitivity analysis conducted via *G*Power* ($n_{Study1a} = 241$, $n_{Study1b} = 213$; $\alpha = .05$; two-tailed) suggested that both samples afforded greater than 80% power to detect a small-to-medium main effect ($\eta_p^2_{\text{have-lack}} = .03$) and two-way interaction ($\eta_p^2_{\text{have-lack} \times \text{characteristic}} = .01$).

Design. Both studies followed a 2 (have vs. lack) \times 16 (characteristic) mixed design. Participants were randomly assigned to read about animals that had or lacked characteristics (between-participants). Participants were presented with 16 different animals, each described in terms of a single characteristic (within-participants). The study was conducted in accordance with the Declaration of Helsinki and approved by an internal ethical review board in compliance with British Psychological Society's code of ethics and conduct. All participants provided informed consent prior to participation.

¹ An additional study (Study S1) examined how a small set of characteristics ($i = 4$) shifted moral judgements in real food animals and fictitious neutral animals. In contrast to Studies 1-3, we found no evidence that judgements differed across characteristics. These results may be due to differences in the judgement contexts of Studies 1-3 versus S1. We discuss these results further in the Supporting Information.

Procedure and Materials

The experimental procedure was largely identical in Studies 1a and 1b. Participants read 16 excerpts capturing mental characteristics described in studies on animal cognition (de Waal, 2016; Shettleworth, 2001) and psychological theory (Demoulin et al., 2004; H. M. Gray et al., 2007; Haslam & Loughnan, 2014), including: empathy (e.g., feeling what others feel), morality (e.g., cooperation, fairness, benevolence), primary positive emotions (e.g., pleasure), primary negative emotions (e.g., pain), secondary positive emotions (e.g., awe), secondary negative emotions (e.g., shame), social connections (e.g., seeking comfort with others), social recognition (e.g., recognizing self and others), object recognition (e.g., classifying images), learning (e.g., learning commands), theory of mind (e.g., following other's gaze), planning (e.g., hiding food for later), communication (e.g., warning others of predators), tool use (e.g., using rocks to break nuts), spatial reasoning (e.g., remembering location of food), and play (e.g., chasing balls). Full descriptions of the characteristics are presented in Table S1. Participants were either presented with animals that had (e.g., "...is capable of spatial reasoning...") or lacked (e.g., "...is not capable of spatial reasoning...") characteristics. To minimize effects of prior knowledge, participants were asked to imagine fictitious animals (e.g., trablans; Piazza et al., 2014; Sytsma & Machery, 2012). Following each characteristic, participants judged the extent to which the animal had the capacity for eight mental states (thought, self-control, planning, remembering, fear, pain, pleasure, suffering). Participants then judged, on a two-item measure, how morally wrong it would be to eat the animal and how guilty they would feel to eat the animal. Responses were provided on a relative scale in Study 1a, from -3 (much less than a typical animal) to +3 (much greater than a typical animal); and an absolute scale in Study 1b, from 1 (not at all) to 7 (very much). Study 1a adopted a relative scale to maximize differences across characteristics. Study 1b adopted an absolute scale to ensure the results replicate with more typical measurement instruments.

Results and Discussion

Data Preparation

We aggregated measures of moral wrongness and guilt within each characteristic ($\alpha > .68$). We then conducted a factor analysis within each characteristic on the eight mental states terms (thought, self-control, planning, remembering, pain, pleasure, suffering, fear) extracting two factors via a maximum likelihood method with promax rotation. The two factors accounted for 60-85% and 7-23% of the variance, respectively, and differentially loaded on items related to agency (thought, self-control, planning, remembering) and experience (pain, pleasure, suffering, fear). The factors were correlated (r_s

= .44 - .81). We calculated composite scores for agency ($\alpha > .90$) and experience ($\alpha > .82$). Further descriptive statistics can be found in Tables S3 and S4.

Main Analysis

We conducted an Analysis of Variance with 2 (have vs. lack) \times 16 (characteristic) on moral judgements, perceptions of agency, and perceptions of experience. Including diet (omnivore vs. pescatarian vs. vegetarian vs. vegan) in these models did not qualify any of the central effects, $F_s < 2.09$, $p_s > .102$.² As such, we do not consider this factor any further. The results from Studies 1a and 1b were largely identical. Looking first at moral judgements, animals that had characteristics were less permissible to eat than those that lacked characteristics (Study 1a: $F(1, 239) = 169.61$, $p < .001$, $\eta^2_{\square} = .42$; Study 1b: $F(1, 211) = 46.55$, $p < .001$, $\eta^2_{\square} = .18$). Importantly though, some characteristics more strongly affected moral judgements compared to others (Study 1a: $F(13.18, 3149.58) = 10.76$, $p < .001$, $\eta^2_{\square} = .04$; Study 1b: $F(11.59, 2445.45) = 6.30$, $p < .001$, $\eta^2_{\square} = .03$). We explored these effects further by examining the differences for each characteristic (lack vs. have). These differences provide an index of the importance of each characteristic for each judgement, with large scores reflecting a strong effect of a characteristic on judgements, whereas small scores reflect a small effect. For brevity, we only plot the results from Study 1a. Figure 1 shows that empathy, morality, secondary and primary negative emotions, and social connections shifted moral judgements the most; whilst play, spatial reasoning, and tool use shifted moral judgements the least.

² These models also revealed few main effects of diet, $F_s < 1.63$, $p_s > .182$, bar an effect on moral judgement in Study 1b ($M_{\text{omnivore}} = 3.98$, $M_{\text{pescatarian}} = 5.56$, $M_{\text{vegetarian}} = 5.76$, $M_{\text{vegan}} = 6.70$), $F(3, 205) = 18.69$, $p < .001$, $\eta^2_p = .21$.

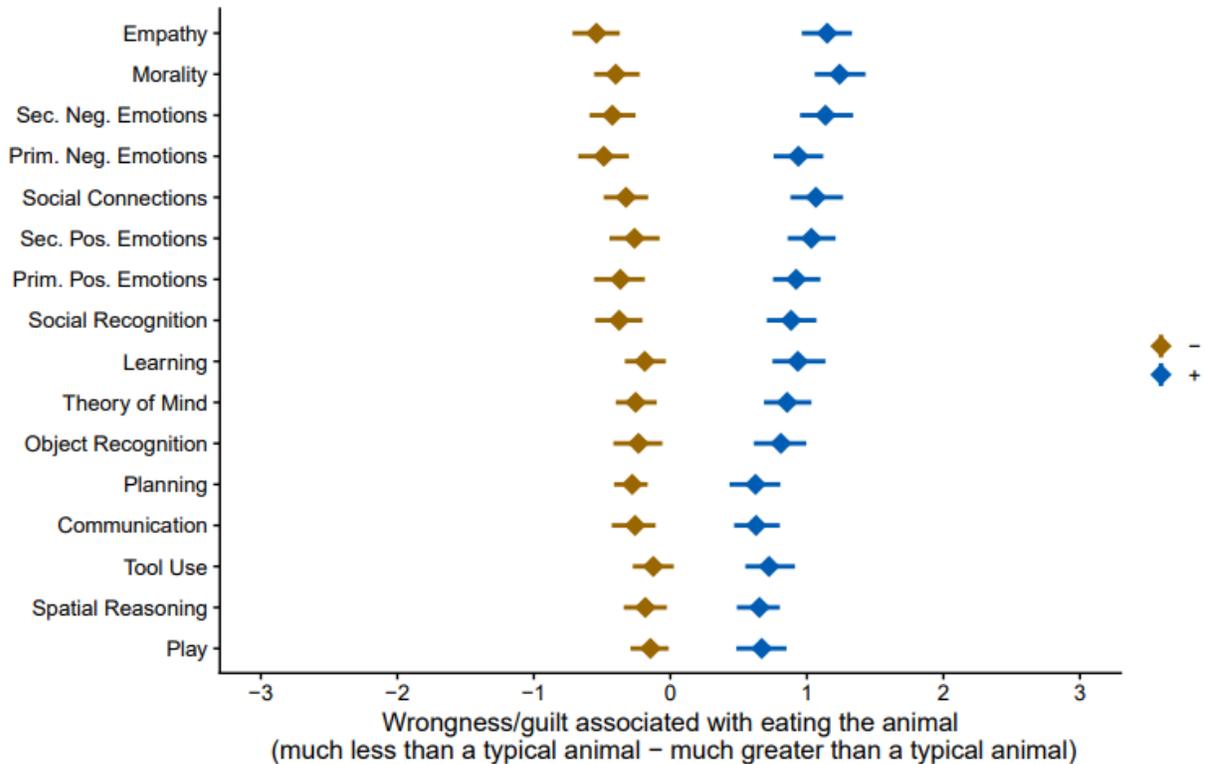


Figure 1. Wrongness/guilt associated with eating an animal that lacks (-) and has (+) each characteristic in Study 1a. Characteristics are organized from most to least impactful. Figure shows the 95% bootstrap confidence interval surrounding the mean. Further details can be found in Tables S3 and S4.

Next, we examined judgements of agency and experience. We found that, across characteristics, having versus lacking affected both perceptions of agency (Study 1a: $F(1, 239) = 739.31, p < .001, \eta^2_{\text{p}} = .75$; Study 1b: $F(1, 211) = 353.66, p < .001, \eta^2_{\text{p}} = .63$) and experience (Study 1a: $F(1, 239) = 522.36, p < .001, \eta^2_{\text{p}} = .69$; Study 1b: $F(1, 211) = 226.64, p < .001, \eta^2_{\text{p}} = .52$). Some characteristics shifted perceptions of agency more than others (Study 1a: $F(12.05, 2879.86) = 41.16, p < .001, \eta^2_{\text{p}} = .15$; Study 1b: $F(12.14, 2562.21) = 18.02, p < .001, \eta^2_{\text{p}} = .08$). The same was true for perceptions of experience (Study 1a: $F(12.67, 3027.87) = 76.40, p < .001, \eta^2_{\text{p}} = .24$; Study 1b: $F(12.22, 2579.01) = 30.67, p < .001, \eta^2_{\text{p}} = .13$). Planning and spatial reasoning shifted perceptions of agency the most, whilst primary and secondary negative emotions shifted perceptions of experience the most.

Lastly, we explored if the degree to which characteristics affected moral judgements was related to perceptions of experience and agency. To do this we analysed the data at the level of the characteristic. We examined the difference scores (have-lack) for experience, agency, and moral judgements for each characteristic. Experience closely tracked which characteristics affected moral

judgements the most (Study 1a: $r(14) = .82$, 95% CI [.55, .94], $p < .001$; Study 1b: $r(14) = .62$, 95% CI [.17, .85], $p = .011$) whilst agency did not (Study 1a: $r(14) = -.21$, 95% CI [-.64, .32], $p = .467$; Study 1b: $r(14) = -.26$, 95% CI [-.67, .27], $p = .327$). The experience-morality relationship was also significantly stronger than the agency-morality (Study 1a: $Z = 2.97$, $p = .003$; Study 1b: $Z = 2.19$, $p = .026$; Steiger, 1980). For completeness, we also analysed the relationship between experience and agency across characteristics (Study 1a: $r(14) = -.34$, 95% CI [-.72, .18], $p = .193$; Study 1b: $r(14) = -.27$, 95% CI [-.67, .26], $p = .315$).

The results from Studies 1a and 1b provide an initial indication of how different animal characteristics predict moral beliefs about meat eating. We found largely the same pattern of results when measuring judgements in relation to the typical animal (Study 1a) and in absolute terms (Study 1b). The characteristics that most strongly influenced moral judgements were related to complex emotions (secondary positive and negative emotions), socio-morality (morality, empathy, social connections) and patiency (negative emotions). Importantly, perceptions of experience predicted the relative moral importance across characteristics more so than perceptions of agency. These results suggest that shifts in animals' moral standing are more likely to occur in response to information related to, for example, socio-morality because such information cues greater perceptions of experience.

Study 2

Study 2 examines whether the cultural status of the animal affects the degree to which different characteristics confer moral standing. We test for differences between fictitious animals of which participants have no prior knowledge and therefore possess no particular cultural status (as in Studies 1a and 1b), and real animals which are culturally appropriate to eat (i.e., pigs, sheep, cows, chickens). This represents an important extension since food animals are associated with particular cultural and normative standards that are not present for other animals (Bastian & Loughnan, 2017; Loughnan & Davies, 2019), which may lead people to be unreceptive to new information about their minds (Piazza & Loughnan, 2016). Study 2 expands our measures to capture broader prohibitions against harm (e.g., wrong to harm the animal) in addition to more specific judgements related to meat eating (e.g., wrong to eat the animal). In addition to the predictions outlined in the introduction, we expect that having (vs. lacking) characteristics will affect moral judgements related to food animals less than moral judgements related to neutral animals, suggesting a tendency to avoid representing food animals as morally significant.

Participants & Design

Sample. Three hundred and eighteen students (278 female; $M_{age} = 19.40$, $SD = 3.41$) from a British University participated in exchange for course credit. Participants identified their diet as follows: omnivore ($n = 272$), pescetarian ($n = 16$), vegetarian ($n = 22$) and vegan ($n = 8$).

Statistical power. A sensitivity analysis conducted via *G*Power* ($n = 318$, $\alpha = .05$, two-tailed) suggested that the sample afforded greater than 80% power to detect a small-to-medium main effect ($\eta_p^2_{\text{have-lack}} = .02$) and two-way interactions ($\eta_p^2_{\text{have-lack} \times \text{characteristic}} = .01$, $\eta_p^2_{\text{neutral-food} \times \text{characteristic}} = .01$).

Design. The study followed a 2 (fictitious-neutral vs. real-food) \times 2 (have vs. lack) \times 16 (characteristic) mixed design. Participants were randomly assigned to read about an animal that was fictitious and culturally neutral or real and associated with food; and had or lacked characteristics (between-participants). Participants were presented with a single animal that was described in terms of 16 characteristics (within-participants). The study adhered to the same ethical guidelines outlined in Studies 1a and 1b (see Participants and Design).

Procedure and Materials

Participants read about the same characteristics as in Study 1a and 1b with the exception that the characteristics referred to a fictitious animal that held no particular cultural status (trablans, kedor, bovan, or gera) or an animal that is culturally identified as food (pig, sheep, cow, or chicken). To enhance the realism and believability of the experiment we embedded the information within a mock, but ostensibly real, scientific article (see Figure S1). Following each characteristic participants judged the extent to which the animal had the capacity for eight mental states (thought, self-control, planning, remembering, fear, pain, pleasure, suffering). Participants then judged, on two two-item measures, how morally wrong it would be, and how guilty they would feel to eat the animal, and to harm the animal, from 1 (not at all) to 7 (very much).

Results and Discussion

Data Preparation

We approach the data preparation and analysis in the same fashion as in Studies 1a and 1b. The four items tapping moral judgements related to meat eating and harm were highly correlated ($\alpha_s > .88$), as such, we aggregated across these items. Two factors extracted from the eight mental state items accounted for 69-83% and 8-22% of the variance and differentially loaded on items related to agency (thought, self-control, planning, remembering) and experience (fear, pain, pleasure, suffering). The factors were correlated ($r_s = .50 - .79$). We calculated composite scores for agency ($\alpha_s > .95$) and experience ($\alpha_s > .91$). For descriptive statistics see Table S5.

Main Analysis

We conducted an Analysis of Variance with 2 (fictitious-neutral vs. real-food) \times 2 (have vs. lack) \times 16 (characteristic) on moral judgements, perceptions of agency, and perceptions of experience. Diet (omnivore vs. pescatarian vs. vegetarian vs. vegan) did not qualify any of the central effects, $F_s < 1.13$, $p_s > .335$.³ As such, we do not consider this factor any further. Animals that were culturally identified as food were afforded less moral standing than those that were culturally neutral ($M_{food} = 4.73$, $M_{neutral} = 5.48$), $F(1, 314) = 15.74$, $p < .001$, $\eta_p^2 = .05$. Unexpectedly, we found no evidence that the cultural status of the animal qualified the central main effect (have vs. lack), $F(1, 314) = 0.25$, $p = .615$, $\eta_p^2 < .01$, nor the two-way interaction (have vs. lack \times characteristic), $F(12.27, 3851.74) = 1.31$, $p = .203$, $\eta_p^2 < .01$. As such, we focused on the results across both animal types. As in Studies 1a and 1b, animals that had characteristics were afforded greater moral standing than those that lacked characteristics, $F(1, 314) = 56.25$, $p < .001$, $\eta_p^2 = .15$, and this was qualified by the characteristic, $F(12.27, 3851.74) = 10.23$, $p < .001$, $\eta_p^2 = .03$. Characteristics associated with socio-morality and patency most strongly influenced judgements of moral standing, whilst characteristics associated with reasoning only weakly influenced judgements of moral standing (Figure 2).

³ Empty cells due to small n s in some dietary groups prohibited an Analysis of Variance with 2 (fictitious-neutral vs. real-food) \times 2 (have vs. lack) \times 16 (characteristic) \times 5 (diet). Because of this we examined the effects of diet in a simpler model with 2 (have vs. lack) \times 16 (characteristic) \times 5 (diet). This analysis revealed a main effect of diet on moral judgement ($M_{omnivore} = 4.83$, $M_{pescatarian} = 6.57$, $M_{vegetarian} = 6.53$, $M_{vegan} = 6.96$), $F(3, 310) = 25.61$, $p < .001$, $\eta_p^2 = .20$, agency ($M_{omnivore} = 4.10$, $M_{pescatarian} = 3.74$, $M_{vegetarian} = 4.63$, $M_{vegan} = 5.52$), $F(3, 310) = 6.71$, $p < .001$, $\eta_p^2 = .06$, and experience ($M_{omnivore} = 4.18$, $M_{pescatarian} = 4.30$, $M_{vegetarian} = 4.88$, $M_{vegan} = 6.02$), $F(3, 310) = 7.98$, $p < .001$, $\eta_p^2 = .07$.

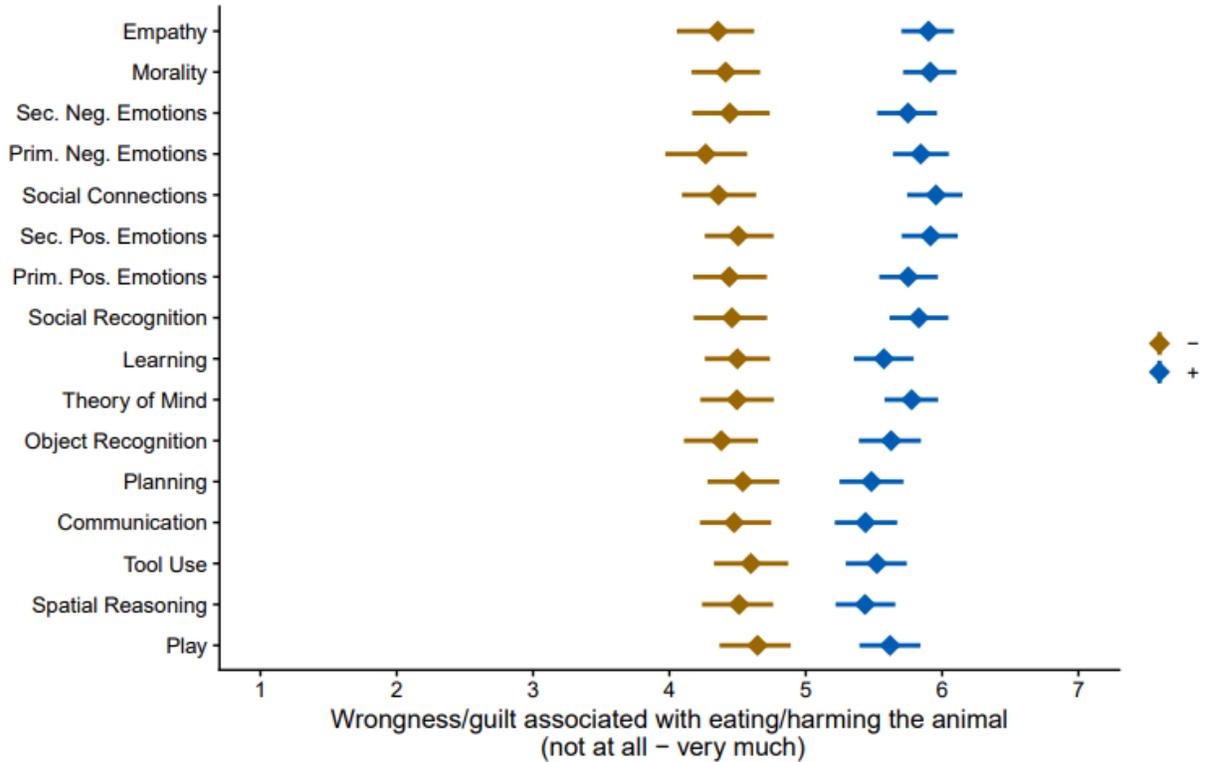


Figure 2. Wrongness/guilt associated with eating/harming an animal that lacks (-) and has (+) each characteristic, in Study 2. Characteristics are organized from most to least impactful. Figure shows the 95% bootstrap confidence interval surrounding the mean. Further details can be found in Table S5.

Next, we examined judgements of agency and experience. Animals that were culturally identified as food were perceived to possess less agency ($M_{food} = 3.85$, $M_{neutral} = 4.48$), $F(1, 314) = 5.20$, $p = .023$, $\eta^2_{\square} = .02$, but, unexpectedly, no less experience ($M_{food} = 4.19$, $M_{neutral} = 4.44$), $F(1, 314) = 0.01$, $p = .926$, $\eta^2_{\square} < .01$, compared to culturally neutral animals. Looking across characteristics, having characteristics elevated perceptions of agency, $F(1, 314) = 941.91$, $p < .001$, $\eta^2_{\square} = .75$, and experience, $F(1, 314) = 308.09$, $p < .001$, $\eta^2_{\square} = .50$. Some characteristics shifted judgements of agency and experience more than others, $F(11.34, 3562.30) = 39.04$, $p < .001$, $\eta^2_{\square} = .11$, $F(12.18, 3825.92) = 58.05$, $p < .001$, $\eta^2_{\square} = .16$. We found no evidence that characteristics shifted judgements of agency and experience more for food animals compared to neutral animals, $F(11.34, 3562.30) = 0.62$, $p = .818$, $\eta^2_{\square} < .01$, $F(12.18, 3825.92) = 1.17$, $p = .300$, $\eta^2_{\square} < .01$.

Finally, we examined agency, experience, and morality at the level of the characteristic. We again analysed difference scores between animals described as having and lacking each characteristic.

Perceptions of experience closely tracked which characteristics conferred the most (and least) moral standing, $r(14) = .84$, 95% CI [.60, .94], $p < .001$; whilst perceptions of agency did not, $r(14) = -.34$, 95% CI [-.72, .18], $p = .194$ ($Z = 3.31$, $p < .001$). There was no evidence that the relationship between agency, experience and moral standing across characteristics differed for food animals compared to non-food animals $Z_s < 0.89$, $p_s > .372$. Finally, there was some weak evidence of a negative relationship between experience and agency across characteristics, $r(14) = -.48$, 95% CI [-.79, .03], $p = .062$.

Study 2 replicates and extends our findings. We replicated the findings of Studies 1a and 1b, demonstrating that characteristics conferred varying degrees of moral standing. Characteristics associated with secondary emotions, socio-morality, and patience conferred the greatest amount of moral standing. Judgements related to morality and mind differed for food animals compared to neutral animals. Food animals were afforded less moral standing and agency but no less experience. This is somewhat unexpected as experience, more than agency, typically underlies moral standing (H. M. Gray et al., 2007). We found little evidence that the cultural status of the animal moderated the effects. This latter finding is important because it demonstrates that the findings generalize to real animals that hold a particularly relevant cultural status.

Study 3

Study 3 conceptually replicates and extends our findings. Here we take a closer look by examining a larger set ($i = 51$) of even more fine-grained characteristics (e.g., can recognise itself in a mirror). This allows us to take an important step towards understanding how people interpret concrete animal behaviours, by (1) removing interpretive frames from our stimuli (e.g., "...is capable of spatial reasoning"), and (2) widening the stimulus set to include a number of concrete behaviours that actual animals demonstrate (e.g., de Waal, 2016; Shettleworth, 2001). In doing so, we are able to examine the degree to which participants abstract morally relevant information about animal minds from concrete behaviours (see also Spence, Osman, & McElligott, 2017).

Participants & Design

Sample. Two hundred and ten students (165 female; $M_{age} = 19.38$, $SD = 1.93$) from a British University participated in exchange for course credit. Participants identified their diet as follows: omnivore ($n = 161$), pescetarian ($n = 16$), vegetarian ($n = 24$) and vegan ($n = 9$).

Statistical power. A sensitivity analysis conducted via *G*Power* ($n = 210$, $\alpha = .05$, two-tailed) suggested that the sample afforded greater than 80% power to detect a small-to-medium main effect ($\eta_p^2_{\text{have-lack}} = .04$) and two-way interaction ($\eta_p^2_{\text{have-lack} \times \text{characteristic}} = .01$).

Design. The study followed a 2 (have vs. lack) × 51 (characteristic) mixed design. Participants were randomly assigned to read about animals that had or lacked characteristics (between-participants). Participants were presented with 51 animals, each described in terms of a single characteristic (within-participants). The study adhered to the same ethical guidelines outlined in Studies 1a and 1b (see Participants and Design).

Procedure and Materials

Participants read 51 statements describing various characteristics, many of which were taken from the larger excerpts used in Studies 1a, 1b and 2. The full list of the stimuli is available in Table S2. Participants were either presented with animals that were capable (e.g., “...can remember which of four boxes contains food”) or incapable (e.g., “...cannot remember which of four boxes contains food”). Each characteristic was attributed to a fictitious animal. We opted to capture superordinate dimensions of mind more directly, by having participants judge the extent to which each animal could think and feel. These judgements were made via two single-item measures. Finally, participants judged how morally wrong it would be to eat the animal. All measures were anchored from -3 (much less than a typical animal) to +3 (much greater than a typical animal).

Results and Discussion

Data preparation

We analysed the single-items measures of thinking, feeling, and moral wrongness. Judgements of thinking and feeling were correlated ($r_s = .16 - .72$).

Main Analysis

We conducted an Analysis of Variance with 2 (have vs. lack) × 51 (characteristic) on moral judgements, perceptions of agency, and perceptions of experience. Including diet (omnivore vs. pescatarian vs. vegetarian vs. vegan) in these models did not qualify any of the central effects, $F_s < 2.59$, $p_s > .054$.⁴ We therefore do not consider this factor any further. We found that animals that had (vs. lacked) characteristics were less permissible to eat, $F(1, 208) = 68.78$, $p < .001$, $\eta_p^2 = .25$. We again found that some characteristics more strongly affected moral judgements than others, $F(24.57, 5111.31) = 6.95$, $p < .001$, $\eta_p^2 = .03$. Focusing on these differences showed that sharing food, pain and suffering were amongst the most important characteristics for judging whether or not it was permissible to eat an

⁴ This analysis revealed a main effect of diet on moral judgement ($M_{\text{omnivore}} = 0.19$, $M_{\text{pescatarian}} = 0.00$, $M_{\text{vegetarian}} = 0.85$, $M_{\text{vegan}} = 0.28$), $F(3, 202) = 3.25$, $p = .023$, $\eta_p^2 = .05$, and experience ($M_{\text{omnivore}} = 0.01$, $M_{\text{pescatarian}} = -0.25$, $M_{\text{vegetarian}} = 0.70$, $M_{\text{vegan}} = 0.16$), $F(3, 202) = 4.07$, $p = .008$, $\eta_p^2 = .06$, but not agency ($M_{\text{omnivore}} = 0.03$, $M_{\text{pescatarian}} = -0.19$, $M_{\text{vegetarian}} = 0.48$, $M_{\text{vegan}} = 0.14$), $F(3, 202) = 1.20$, $p = .309$, $\eta_p^2 = .02$.

animal, whereas calmness, understanding new objects and mimicking yawns were amongst the least important (see Figure 3).

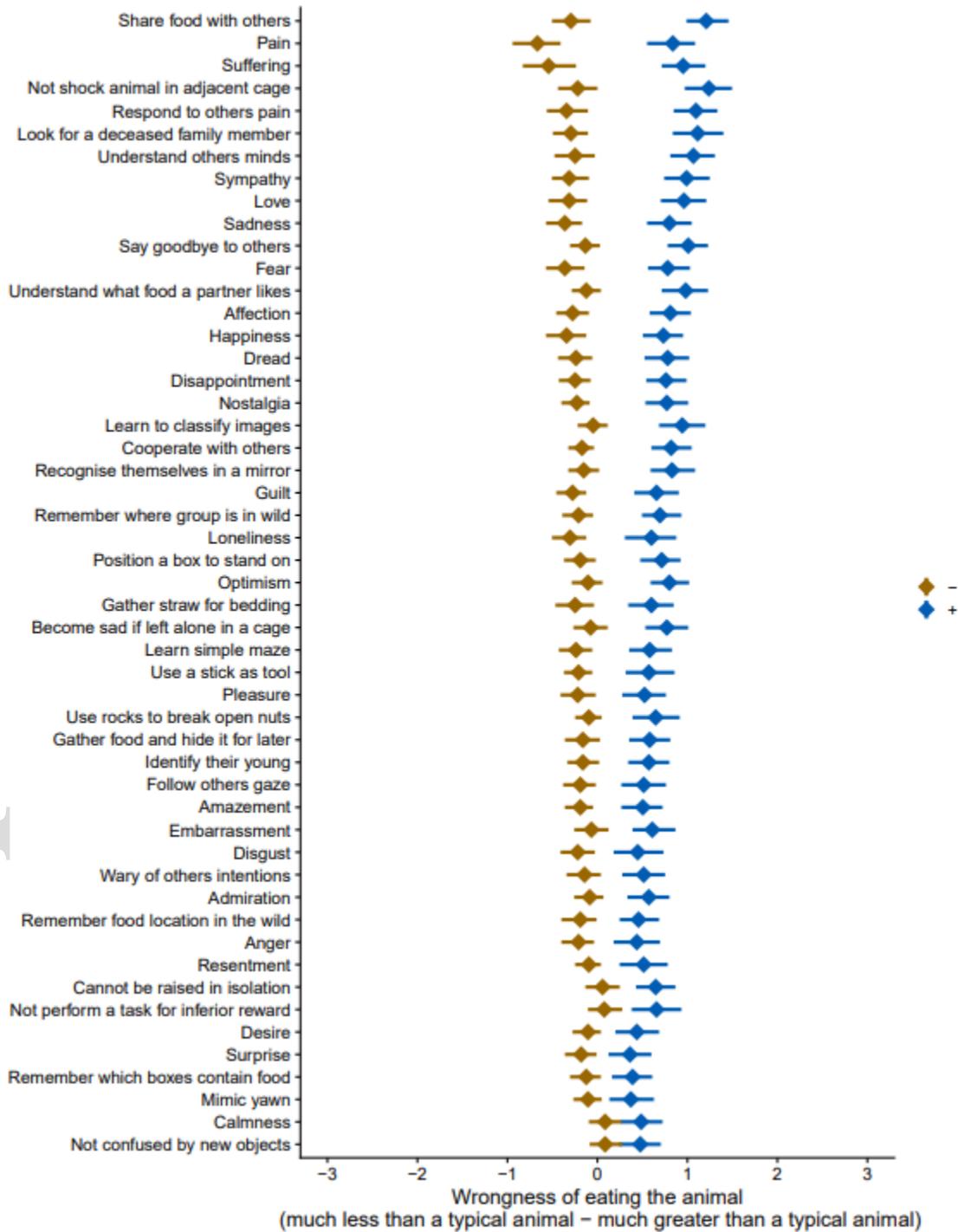


Figure 3. Wrongness of eating an animal that lacks (-) and has (+) each characteristic, in Study 3. Characteristics are organized from most to least impactful. Figure shows the 95% bootstrap confidence interval surrounding the mean. Further details can be found in Table S6.

Turning to judgements of thinking and feeling, people again attributed greater capacity to think, $F(1, 208) = 303.74, p < .001, \eta^2_{\text{p}} = .59$, and feel, $F(1, 208) = 382.92, p < .001, \eta^2_{\text{p}} = .65$, to animals that had versus lacked characteristics. Similarly, some characteristics were more central drivers of these judgements than others, $F(22.93, 4769.56) = 15.30, p < .001, \eta^2_{\text{p}} = .07$, $F(21.53, 4477.70) = 27.14, p < .001, \eta^2_{\text{p}} = .12$. For example, remembering mazes and using boxes as tools more strongly affected perceptions of the animals' capacity to think, whilst suffering and sadness more strongly affected judgements related to feeling (further descriptive statistics can be found in Table S6).

Finally, we explored judgements of thinking, feeling, and morality at the level of the characteristic. To do this we analysed difference scores between animals described as having and lacking each characteristic. Perceptions of the capacity to feel closely predicted which characteristics were most (and least) important for moral judgements, $r(49) = .56, 95\% \text{ CI } [.34, .72], p < .001$, whilst perceptions of the capacity to think did not, $r(49) = .22, 95\% \text{ CI } [-.06, .47], p = .124$; although there was no strong evidence that these effects differed, $Z = 1.72, p = .086$. There was some evidence of a negative relationship between perceptions of the capacity to think and feel across characteristics, $r(49) = -.31, 95\% \text{ CI } [-.54, -.04], p = .026$.

The results from Study 3 corroborate our findings, suggesting that moral judgements about meat eating are most sensitive to secondary emotions (e.g., love), socio-morality (e.g., sharing food) and patency (e.g., pain). As expected, beliefs about the capacity for feeling (as opposed to thinking) largely accounted for the relative impact of each characteristic on moral beliefs. Importantly, these results demonstrate that information about concrete behaviours inform moral judgements about meat eating.

General Discussion

Four studies documented how and why different characteristics shifted moral judgements related to animals with varying cultural status. We found considerable heterogeneity in the degree to which different characteristics conferred moral standing. Descriptively, the most morally important characteristics were related to experience, secondary emotions, socio-morality, and moral patency. We found that the relative moral importance of each characteristic was related to representations of experience/feeling but not agency/thinking. We found analogous effects in animals for which

participants had no prior knowledge and animals that are culturally defined as food—a point we return to later.

The findings support various theoretical stances and highlight fine-grained distinctions between different animal characteristics. The results suggest that experience (K. Gray et al., 2012), secondary emotions (Demoulin et al., 2004; Leyens et al., 2001), socio-morality (Piazza et al., 2014; Haslam & Loughnan, 2014) and moral patiency (K. Gray et al., 2012) are strong drivers of animals' moral standing. In all four studies we found that animals that had the capacity to feel secondary emotions (e.g., love, nostalgia), understand morality (e.g., sharing food with others), empathize with others (e.g., feeling others pain), form social bonds (e.g., looking for deceased family members), and feel negative emotions (e.g., pain, suffering) were consistently perceived to be more wrong to eat than animals that had other capacities. These results (especially those from Study 3) help move towards a more comprehensive understanding of how novel information about animals shifts moral judgement.

The findings point to why some characteristics shifted moral judgements more than others. Shifts in moral judgements across characteristics were closely related to shifts in superordinate representations of experience/feeling but not agency/thinking, suggesting that novel information is likely to affect moral judgement to the degree that it affects superordinate perceptions of animals' capacity for experience/feeling. This supports the idea that moral standing flows from perceptions of experience more so than agency (H. M. Gray et al., 2007; K. Gray et al., 2012; cf. Sytsma & Machery, 2012). That said, the findings also point to the importance of benevolence/harmfulness (Piazza et al., 2014)—also captured by Weisman et al.'s (2017) 'heart' dimension. For example, animals that felt love and shared food with others were amongst the most wrong to eat, suggesting that moral standing likely also follows from superordinate beliefs about benevolence/harmfulness (Piazza et al., 2014). Finally, it is worth noting that other characteristics and superordinate dimensions that we did not measure may be equally important as experience/feeling and benevolence/harmfulness (e.g., seeing, having free will; Weisman et al., 2017). It remains for future research to examine how other characteristics and superordinate dimensions are related to moral standing in animals.

We measured moral beliefs about eating and harming animals. These beliefs reflect important concerns related to the treatment of animals and are indications of animals' moral standing (Bastian & Loughnan, 2017; Goodwin, 2015). Different patterns may arise for other moral beliefs. Recent work has shown that ascribing cognitive capacities to entities shifts beliefs about harming the entity for instrumental reasons but not for moral reasons (Rai, Valdesolo & Graham, 2017). These data suggest that new information about animals' mental characteristics may fall by the wayside when it is seen as

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morally necessary to harm animals (e.g., in cases of culling). Given the multitude of ways in which humans engage with animals, it seems pertinent to be cautious when generalising the findings.

The present findings provide a potentially useful tool for research on human-animal relations. We went to considerable lengths to include a large sample of actual animal behaviours (e.g., de Waal, 2016; Shettleworth, 2001) and theoretically relevant capacities (e.g., Haslam & Loughnan, 2014). We provide full information on all our stimuli and data so that others can utilize them (see Tables S1-S6). We hope this will prove useful to those interested in studying moral judgement and mind attribution in animals.

Lastly, the findings suggest that moral judgements are sensitive to information about animal minds even when related to animals that are typically reared for food. This finding may have practical implications for researchers interested in shifting how people think about meat consumption and animal minds. Applied approaches often assume that providing novel information about food animals' mental capacities will shift moral beliefs. Moreover, advocates often put information about animal suffering front and centre to prompt people to consider their meat consumption (Packwood-Freeman, 2010). Our results support these intuitions, suggesting that beliefs are affected by these messages and that the strongest messages likely include information related to pain and suffering. However, our results also highlight some characteristics that are perhaps less commonly assumed to confer moral standing in animals; for example, sociability and morality (see Piazza et al., 2014).

In sum, across four studies we investigated how information related to mental traits and behaviours informed moral judgement related to eating animals. The results revealed fine-grained distinctions and suggest that information related to secondary emotions, socio-morality and patiency affect moral judgements most strongly. The data support an established perspective on mind perception by confirming that the relative moral importance of each characteristic was driven by the degree to which it suggests an animal was capable of experience (feeling) or agency (thinking). Taken together, the findings help move towards a more complete understanding of mind perception in animals and contribute to understanding how novel information about animal minds relates to shifts in moral standing.

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