**Revisiting the motivated denial of mind to animals used for food:**

**Replication of Bastian et al. (2012)**

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Ho Loong, Siu, Mahika Khanna, Ka Wan Chan, and Ho Ting Chau were students at the University of Hong Kong during the academic year 2021/22.

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## Authorship declaration:

Ho Loong, Siu, Mahika Khanna, Ka Wan Chan, and Ho Ting Chau designed the study, developed the experimental materials for each study respectively, and wrote an initial draft of the Registered Report Stage 1. Tyler P. Jacobs and Meiying Wang revised the designs and experimental materials, wrote the analysis scripts, conducted the data analyses, and drafted the manuscript for submission. Stefan Leach drafted the manuscript, guided, provided feedback, and verified. Katy Y. Y. Tam provided feedback and guidance in the initial stages. Gilad Feldman guided the replication efforts, supervised each step in the project, ran data collection, conducted the pre-registration, and edited the manuscript for submission.  
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## Target article for replication

Bastian, B., Loughnan, S., Haslam, N., & Radke, H. R. M. (2012). Don’t mind meat? The denial of mind to animals used for human consumption. *Personality and Social Psychology Bulletin*, 38(2), 247–256. <https://doi.org/10.1177/0146167211424291>

## CRediT - Contributor Roles Taxonomy

In the table below, we employed CRediT ([Contributor Roles Taxonomy](https://www.casrai.org/credit.html)) to identify the contribution and roles played by the contributors in the current replication effort.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Role | Tyler P. Jacobs | Meiying Wang | Stefan Leach | Ho Loong, Siu, Mahika Khanna, Ka Wan Chan and Ho Ting Chau | Katy Y. Y. Tam | Gilad |
| Conceptualization |  |  |  | ✓ |  | ✓ |
| Pre-registration | ✓ | ✓ |  | ✓ |  | ✓ |
| Data curation |  |  |  |  |  | ✓ |
| Formal analysis | ✓ | ✓ |  | ✓ |  |  |
| Funding acquisition |  |  |  |  |  | ✓ |
| Investigation | ✓ | ✓ |  |  |  |  |
| Pre-registration peer review / verification | ✓ | ✓ |  | ✓ |  |  |
| Data analysis peer review / verification |  |  | ✓ |  |  | ✓ |
| Methodology | ✓ | ✓ |  | ✓ |  |  |
| Project administration |  |  |  |  |  | ✓ |
| Resources |  |  |  |  |  | ✓ |
| Software | ✓ | ✓ |  |  |  |  |
| Supervision |  |  |  |  | ✓ | ✓ |
| Validation | ✓ |  | ✓ |  |  |  |
| Visualization | ✓ | ✓ |  |  |  |  |
| Writing-original draft | ✓ | ✓ | ✓ |  |  |  |
| Writing-review and editing |  |  | ✓ |  |  | ✓ |

# Abstract

**[IMPORTANT:   
Method and results were written using a randomized dataset produced by Qualtrics to simulate what these sections will look like after data collection. These will be updated following the data collection. For the purpose of the simulation, we wrote things in past tense, but no pre-registration or data collection took place yet.]**

Bastian et al. (2012) argued that the ‘meat paradox’–caring for animals yet eating them–is maintained by motivated moral disengagement driven by a psychologically aversive tension between people’s moral standards (caring for animals) and their behavior (eating them). One disengagement mechanism that is thought to play a central role is the denial of food animal minds, and therefore their moral status. This idea has garnered substantial interest and has framed much of the psychological approach to meat consumption. We propose to subject Studies 1 and 2 of Bastian et al. (2012) to high-powered direct replications. For Study 1, our replication [failed to find/found] support for the original findings: perceptions of animals’ minds were negatively related to their perceived edibility, and positively related to moral concern for them and negative affect related to eating them, [summary effect sizes + CIs will be added here]. For Study 2, our replication [failed to find/found] an effect of learning that animals will be used for food on the tendency to deny them mental capabilities. Overall, our findings [matched/did not match] with the original’s, and we [found/failed to find] support for the relationship between animal mind denial and perceptions of their status as sources of food. Materials, data, and code are available on the OSF: <https://osf.io/h2pqu/>.

*Keywords:* cognitive dissonance, mind attribution, mind denial, morality, meat, animals, registered replication

**PCIRR-Study Design Table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question | Hypothesis | Sampling plan | Analysis plan | Rationale for deciding the sensitivity of the test for confirming or disconfirming the hypothesis | Interpretation given different outcomes | Theory that could be shown wrong by the outcomes |
| How are perceived mental capabilities of animals related to their perceived edibility? | H1a: Greater perceived animal mental capabilities will be associated with lower perceived edibility. | The current study aims to recruit 1000 participants, well powered enough to detect effects much weaker than the smallest effects in the target. See Power analysis section. | Pearson Correlation | We follow the statistical analysis of the original paper. | We examine the replicability of the findings of Bastian et al. (2012) Studies 1 and 2 based on the criteria used by LeBel et al. (2019). | The “meat paradox” is maintained via the denial of food-animals’ minds. |
| How are perceived mental capabilities of animals related to negative affect regarding eating them? | H1b: Greater perceived animal mental capabilities will be associated with greater negative affect regarding eating them. |
| How are perceived mental capabilities of animals related to moral concern for animals? | H1c: Greater perceived animal mental capabilities will be associated with greater moral concern for animals. |
| How does learning that an animal will be used for food affect perceptions of its mental capabilities? | H2: Learning that an animal will be used for food will lead to reduced perceptions of that animal’s mental capabilities. | Paired-Samples *t*-Test |

# Revisiting the motivated denial of mind to animals used for food: Replication of Bastian et al. (2012)

As a society, we care for animals yet eat them. Loughnan et al. (2010) coined this phenomenon the ‘meat paradox’ and explained it in terms of motivated moral disengagement driven by an aversive tension between people’s moral standards (caring for animals) and their behavior (eating animals). One mechanism that is thought to play an important role in resolving this tension and maintaining the paradox is the motivated denial of food-animals' minds and therefore their capacity to feel pain and be harmed (Bastian & Loughnan, 2017; Loughnan & Davies, 2020). By positing that people are motivated to deny the minds of the animals they eat, Bastian et al. (2012) present a psychological explanation of how we can care for animals and simultaneously eat them. This idea has garnered substantial interest and has framed much of the psychological approach to meat consumption (Bastian & Loughnan, 2017; Dhont & Hodson, 2020; Loughnan & Davies, 2020; Rothgerber, 2014; Piazza, 2020). It therefore seems timely and worthwhile to revisit Bastian et al.’s (2012) seminal studies on the motivated denial of food-animals’ minds.

## The meat paradox

How can people care for animals yet eat them? This seems paradoxical, given the wide- and deeply held beliefs against harm (Graham et al., 2009; Gray et al., 2012), human fondness for animals (Amiot & Bastian, 2015; Kellert & Wilson, 1993), and the necessity of harming animals to produce meat. Bastian and Loughnan (2017) provide an answer by drawing on Cognitive Dissonance Theory (Festinger, 1957; Harmon-Jones et al., 2015). They posit that paradoxes like these are maintained through the recruitment of psychological mechanisms that effectively resolve the aversive conflict between people’s beliefs and behaviors. These mechanisms are evident when, for example, meat-eaters derogate those who do not eat meat (Minson & Monin, 2012; De Groeve et al., 2022a, 2022b) and justify meat eating as acceptable by virtue of it being ‘nice’, ‘necessary’, ‘normal’, and ‘natural’ (Piazza et al., 2015).

One psychological mechanism that is thought to play a particularly important role in minimizing cognitive dissonance and maintaining the meat paradox is the tendency to deny food-animals' minds (Bastian & Loughnan, 2017; Loughnan & Davies, 2020). This is because mental capacities, including the capacity to suffer, are grounds for moral status (Bentham, 1843; Gray et al., 2007; Leach et al., 2021a; Singer, 1975; Sytsma & Machery, 2012). The conflict between harming animals and eating them therefore depends on the perceived quality of their minds. When animals are perceived to lack minds, eating them is less morally fraught because they are inherently less capable of being harmed (Leach et al., 2021a; Sytsma & Machery, 2012). Given that mind perception is malleable (Epley et al., 2008; Marcu et al., 2007), the tension between caring for animals and eating them can be resolved by seeing them as possessing unsophisticated minds and lacking the ability to feel suffering.

## Revisiting Bastian et al. (2012)

Bastian et al. (2012) presented two crucial tests of the perspective. In an initial study, they asked 71 students about their perceptions of 32 animals and found that the degree to which animals were perceived to be edible was positively related to beliefs that they lacked minds. In a follow-up study, they prompted 66 students to consider two animals, one which was destined to be taken to an abattoir and slaughtered for meat and one which was destined to be moved to a paddock and spend its time eating grass. The animal that was destined to be slaughtered for meat was perceived to possess a less sophisticated mind than the animal that was destined to be moved to a paddock. On the basis of these findings, the authors argue that: 1) those animals that are perceived to be edible are also likely to be perceived as lacking a mind, and 2) making an animals’ status as a source of food salient can lead people to perceive it as lacking a mind. Taken together, the studies suggest that how we perceive animal minds is directly related to their status as sources of food.

## Rationale for replication

We chose to conduct a replication of Bastian et al. (2012) due to its strong academic impact and the absence of direct replications. At the time of the writing, the target article has been cited 435 times (as indexed by Google scholar, April 2022) and its findings and perspective has framed much of the subsequent psychological research on meat consumption (Bastian & Loughnan, 2017; Bratanova et al., 2011; Buttlar & Walther, 2018; Camilleri et al., 2020; Dhont et al., 2021; Dowsett et al., 2018; Graça et al., 2016; Haslam & Loughnan, 2014; Kunst & Hohle, 2016; Leach et al., 2021a, 2021b, 2022; Loughnan et al., 2010; Loughnan & Davies, 2020; Piazza et al., 2015; Piazza, 2020; Piazza & Loughnan, 2016; Rothgerber, 2014). These metrics indicate strong academic impact, therefore raising the importance of revisiting, reproducing, and replicating its methods and findings.

To the best of our knowledge, there are no published direct replications of the original article. We were able to identify two conceptual replications of Study 1: Ruby and Heine (2012) and Possidónio et al. (2019). Ruby and Heine (2012) found that perceptions of animals’ intelligence were positively related to feelings of disgust at eating them, whilst Possidónio et al. (2019), on the other hand, found no support for the link between perceptions of animals’ capacity to think or feel and their perceived edibility. The mixed results of conceptual replications and the absence of direct replications suggest the need to revisit the original studies.

We aimed to revisit the phenomenon to examine the reproducibility and replicability of the findings. Following the recent and growing recognition of the importance of reproducibility and replicability in psychological science (e.g., Brandt et al., 2014; Open Science Collaboration, 2015; van‘t Veer & Giner-Sorolla, 2016; Zwaan et al., 2018), we embarked on a well-powered pre-registered close replication of Bastian et al. (2012).

## Original findings

Bastian et al. (2012) tested and found support for a number of hypotheses derived from their account of the meat paradox. We summarized these in Table 1. In Study 1, they found that animals’ perceived mind was negatively related to their edibility, *r*(69)= -.42, 95% CI [ -.60, -.21], positively related to feeling bad about eating the animal, *r*(69) = .77, 95% CI [.65, .85], and positively related to how morally wrong it would be to eat the animal, *r*(69)= .80, 95% CI [.70, .87]. In Study 2, they found that meat eaters denied animal mental capacities more after being informed that it would be used for food compared to not used for food, *t*(65) = 3.24, *d* = 0.40, 95% CI [0.15, 0.65].

Table 1

*Bastian et al. (2012) Studies 1 and 2: Summary of hypotheses*

|  |  |
| --- | --- |
| Hypothesis | Prediction |
| 1a | Mind attribution is negatively associated with perceived edibility of animals. |
| 1b | Mind attribution is positively associated with negative affect regarding eating animals. |
| 1c | Mind attribution is positively associated with moral concern for animals. |
| 2 | Being told that animals will be raised for meat consumption (compared to being told it will live as a grazing animal) leads to denial of mind to those animals. |

## Overview of the replication

Bastian et al. (2012) conducted three experiments, and our replication focused on Studies 1 and 2, which were simpler in design, and can be administered to our target sample. We combined the two studies into a singular data collection, displayed in random order, with some slight adjustments. This design allowed us to both test the designs of the original studies, and to run further tests in comparing the effects of the different studies with the potential of additional insights. We have successfully employed similar designs in previous replications in our team (e.g., Adelina & Feldman, 2022; Vonasch et al., 2022; Yeung & Feldman, 2022). Also, we added one manipulation check item per condition in Study 2 and two attention check items (Aust et al., 2013) at the end of the survey in order to encourage and measure attentive participant engagement.

## Pre-registration and open-science

We will pre-register the experiment on the Open Science Framework (OSF) and data collection will be launched soon after. Pre-registrations, power analyses, and all materials used will be made available in the supplementary materials. We will provide all materials, data, code, and pre-registration on the OSF: <https://osf.io/h2pqu/>. We will provide additional open-science details and disclosures in the supplementary materials under “Open Science disclosures” sub-section.

All measures, manipulations, exclusions conducted for this investigation are reported, all studies will be pre-registered, and data collection will be completed before any analyses.

# Method

**[IMPORTANT: Method and results were written using a randomized dataset produced by Qualtrics to simulate what these sections will look like after data collection. These will be updated following the data collection. For the purpose of the simulation, we wrote things in past tense, but no pre-registration or data collection took place yet.]**

## Power analysis

To ensure the current replication sample has sufficient power, we calculated effect sizes and confidence intervals (CI) based on the statistics reported in the target article. To account for possible overestimation of effect sizes, we then conducted a conservative power analysis using the ‘safeguard’ method (Perugini et al., 2014) in R with the <pwr> package, which uses the lower bound of 60% CI of the original effect size. The required sample sizes for Studies 1 and 2 were determined by analysis on the smallest effect size from each study. More details of calculations and results are given in the “Power Analysis” section of the supplementary manuscript.

The results of the power analyses suggested that the sample size should be 112 in Study 1 to have 95% probability of detecting the safeguard effect size: *r =* -.33. However, we modified the original’s design for each participant to only rate 8 out of the 32 animals (see Table 4). To account for this, we multiplied by four, resulting in a total sample size of 448. For Study 2, we estimated the power for the within-subject design based on the safeguard effect size Cohens’s *d =* 0.29*.* As a result, 157 participants are required in Study 2. The largest sample size required from the two studies is 448. Results from power analyses are summarized below.

There are several things to be noted regarding our study design. First, Study 1 will result in a multi-level data structure, where each participant will rate multiple animals. The power analysis described above does not take the multi-level nature of the data into account. Second, this replication has combined Studies 1 and 2 from Bastian et al. (2012) into one single data collection and we made adjustments accordingly. To account for the uncertainty and deviations discussed above and possible exclusions, we aimed for a much larger sample size of 1000 in our data collection. A sensitivity analysis conducted using the <pwr*>* package in R indicated that a sample of 1000 participants at 95% power would be able to detect minimum effect sizes of *r* = .11 and *d* = 0.11 which are much smaller than the safeguard effect sizes (see the “Power analysis” section of the Supplementary Materials for more details).

## Participants

For the Stage 1 PCI Registered Reports, we stimulated a dataset of 1000 participants using Qualtrics (*M*age = 50.7, *SD* = 29.0; 263 females, 239 males, 250 others, and 248 rather not disclose). We provided a comparison of the target article sample and the replication samples in Table 2.

We will recruit participants from Prolific, a high-quality online participant recruitment platform commonly used in social science research (Palan & Schitter, 2018). To ensure that our sample only includes meat-eaters, we will use their “Diet” filter to exclude vegans and vegetarians. Additionally, to improve data quality and generalizability, we will include only participants with a 95% or greater approval rate and specify a gender balanced sample. We will also employ the Qualtrics fraud and spam prevention measures: reCAPTCHA, prevent multiple submission, prevent ballot stuffing, bot detection, security scan monitor, relevantID, etc.

Assignment pay was based on the federal wage of 7.25USD/hour, per minute, so for example - 5-8 minutes survey would be paid 1 USD per participant. We first pretested survey duration with 30 participants to make sure our time run estimate was accurate and then adjust pay as needed. The data of the 30 participants was not analyzed separately from the rest of the sample other than to assess survey completion duration and needed pay adjustments.

Table 2

*Difference and similarities between samples from the original study and replication*

|  |  |  |
| --- | --- | --- |
|  | Bastian et al. (2012) | Replication |
| Sample size | Study 1: 71 (after exclusion 63); Study 2: 66 | 1000 | |
| Geographic origin | Australian | Prolific (US) | |
| Gender | 59 Females; 12 Males (before exclusion; not specified after exclusion) | 263 females, 239 males, 250 others, and 248 rather not disclose | |
| Median age (years) | N/A | 51 | |
| Mean age (years) | 19.13 | 50.7 | |
| Standard deviation age (years) | N/A | 29.0 | |
| Age range (years) | 17-29 | 0-100 | |
| Medium (location) | Australian University | Computer (online) | |
| Compensation | N/A | 1 USD | |
| Year | 2010 (estimate) | 2022 | |

## Design and procedure

[*For review: The Qualtrics survey .QSF file and an exported DOCX file are provided on the OSF folder. A preview link of the Qualtrics survey is provided on:* [*https://hku.au1.qualtrics.com/jfe/preview/SV\_2uIicOfR63gS34y?Q\_CHL=preview&Q\_SurveyVersionID=current*](https://hku.au1.qualtrics.com/jfe/preview/SV_2uIicOfR63gS34y?Q_CHL=preview&Q_SurveyVersionID=current)]

We summarized the overall design for Studies 1 and 2 in Table 3. We combined Studies 1 and 2 from Bastian et al. (2012) into one single survey, with the order randomized and counterbalanced. Additional details, summaries, and all measures are provided in the supplementary materials and survey files on the OSF.

Table 3

*Summary of study design for replications*

|  |  |  |
| --- | --- | --- |
| **Study 1 Replication** | **Animals**  8 out of the following 32 (within-subject):   * 20 mammals: Bull, Pig, Goat, Kangaroo, Rabbit, Deer, Horse, Wolf, Dolphin, Dog, Cat, Elephant, Lion, Monkey, Gorilla, Rat, Antelope, Squirrel, Mole, Sloth. * 3 birds: Sparrow, Chicken, Pigeon * 2 fish: Fish, Shark * 3 crustaceans: Prawn, Crab, Lobster * 1 amphibian: Frog * 1 reptile: Turtle * 1 mollusk: Snail * 1 insect: Housefly |  |
| **DV1: Mental Capacities**  The degree to which each animal possessed 10 mental capacities  (1 = *Definitely does not possess*, 7 = *Definitely does possess*)  10 mental capacities: hunger, fear, pleasure, pain, rage, self-control, morality, memory, emotion recognition, planning  **DV2: Animal Edibility**  “Would you choose to eat this animal” and “Would you eat this animal if asked to?”  (1 = *Definitely would not*, 7 = *Definitely would*)  **DV3: Negative affect**  “How bad would you feel if you ate this animal?”  (1 = *Not at all*, 7 = *Extremely*)  **DV4: Moral concern**  “How morally wrong would it be to eat this animal”  (1 = *Not at all*, 7 = *Extremely*) |  |
| **Study 2 Replication** | **IV (Within-Subjects): Animal Use Condition**  **Food condition:** Description that the animal will be taken to an abattoir and butchered as a meat product for human consumption.  **Nonfood condition:** Description that the animal will be moved to other paddocks and will spend most of its time eating grass with other animals. |  |
| **DV: Perceived Animal Mental Capabilities**  “To what extent does this animal possess the following mental capacities?” for 15 mental capacities (pleasure, fear, rage, joy, happiness, desires, wishes, planning, goals, pride, pain, hunger, tasting, seeing, hearing)  (1 = *Definitely does not possess*; 7 = *Definitely does possess*) |  |

First, participants answered a question indicating that they consent to completing studies with attention, comprehension, and manipulation checks. Then, participants began the main studies. Both Studies 1 and 2 in Bastian et al. (2012) were combined into a single survey, and the presenting order of Studies 1 and 2 was randomized.

In Study 1, participants were asked to rate each animal’s mental capacities (10 items), edibility (2 items), negative affect about eating it (1 item), and how morally wrong it would be to eat it (1 item). They did so for 8 animals that were randomly selected from 32. In Study 2, participants were shown two animals. The first was described as an animal that will be removed to other paddocks (nonfood condition), and the second was described as an animal that will be killed and made into meat product for human beings (food condition). The animals were a cow and a lamb, which were randomly assigned to either the nonfood or food conditions. In other words, if a participant first saw a lamb depicted as a nonfood animal, then the cow will be later depicted as the food animal, vice versa. Below each picture, participants were asked to rate the perceived mental capacities of the animal. At the end of the survey, participants were asked to answer some demographic questions. Summary tables and detailed experimental instructions for Studies 1 and 2 procedures are available in the supplementary (see Table S8).

## Study 1 Materials

Participants rated 8 animals randomly selected out of a list of 32 animals. Each animal was rated using 14 questions, which can be found in Table 3. Animals listed in the survey were the same as the one in the original study except for 2 animals. “Ox” and “Pig” replaced “Cow” and “Sheep” due to the repetition of animals in Study 2. The list of animals is provided in Table 3.

## Study 2 Materials

### Pictures with descriptions

Participants were presented with pictures of either a cow or a lamb surrounded by grass. Preceding each picture was a description of the animal, which was manipulated to describe the animal as the source of the meat product or not. In the nonfood condition that appears first, the description for the animal reads “*This lamb[cow] will be moved to other paddocks, and will spend most of its time eating grass with other lambs[cows].*” In the food condition, the description reads “*This lamb[cow] will be taken to an abattoir, killed, butchered, and sent to supermarkets as meat products for humans.*”

### Manipulation Checks

In order to ascertain whether participants carefully read the manipulation and to assess whether the manipulation was effective, we included manipulation checks in each condition. This was not included in the original study, yet we felt was important to measure if participants read and understood the manipulation and because factual manipulation checks such as the ones used in this study can increase attentiveness without weakening the experimental effect (Kane & Barabas, 2019). Our manipulation checks consisted of the following question: *“To make sure that you’ve read and understood the scenario, in the described scenario, what was the fate of the animal?”* There were three possible answers: “*It was sent to other paddocks to eat grass with other animals”*, “*It was released to live in a forest*”, or “*It was butchered and treated as a meat product*”. Participants completed these manipulation checks after rating the mental capabilities of each animal.

**Attention Checks**

Two attention checks were used to measure participant attentiveness for use as an exploratory exclusion criterion, particularly because participant attention is sometimes reduced during online studies (Aust et al., 2013). The first was a logical statement attention check (Abbey & Meloy, 2017) that has been used in past research (Jacobs & McConnell, 2022). The check consists of one question in which participants selected which everyday activities they have performed in the last week from a list. One of the items is “*Used a computer, tablet, or mobile phone”*. Participants should select this item because using a computer, tablet, or mobile phone is required to complete the study (the complete measure can be found in the Supplementary Materials under “Attention check questions”). Failing to select this item could be possible grounds for exclusion in analyses. The second attention check is an honesty check (Abbey & Meloy, 2017) in which participants respond to the item “*How serious were you in filling out this questionnaire?*” on a 1 (*Not at all*) to 5 (*Very much*) scale. Low scores indicate that participants self-reported that they were not completing the study seriously. As an exploratory analysis and to examine any potential data issues, we will also examine the results with failed attention and comprehension checks excluded if we fail to find support for the findings (see the “Exclusion criteria” section of the Supplementary Materials for more details on exclusions).

## Deviations from the original

Since this replication combined Study 1 and Study 2 of the original study together, research designs were modified. We summarized the deviations between the original study and our replication in Table 4.

Table 4

*Summary of deviations between Original Article and Current Replication*

|  |  |  |  |
| --- | --- | --- | --- |
| **Deviations** | **Original Article (Bastian et al., 2012)** | **Replication** | **Reason for changes** |
| Study 1:  Number of animals to rate | 32 animals | Randomly select **8** out of 32 animals for each participant; We multiplied required sample size by 4 in order to compensate for the modification. | Shorten survey, decrease participants’ cognitive load. |
| Study 1:  List of Animals | 32 animals including “cow” and “sheep” | Replaced “cow” and “sheep” with **“Ox” and “Pig”** | Avoid repetition of animals (Studies 1 and 2 were combined) |
| Study 1:  Measure Wordings | In Study 1, animal edibility item: “Would you choose to **each** this animal?” | “**each**” was changed to “**eat**” | A typo was detected from original article |
| Study 2:  5 min unrelated filler task | There was a 5 min unrelated task between two pictures in Study 2 | We did not implement 5 min unrelated filler task | There was no indication of what that task was, and it was not indicated as theoretically or empirically important. Online participants have limited cognitive capacity and patience for long surveys, so we removed the unrelated filler task as a tradeoff for data quality. |
| Study 2:  Manipulation Check | No manipulation checks were included | We included a manipulation check for each level of the IV | It is possible that participants could miss the manipulated caption, particularly online. Thus, manipulation checks measure if participants read the scenarios carefully. |
| Studies 1 and 2: Item Randomization | Unclear if items for mental capacities in both Studies 1 and 2 were randomized | Items for the mental capacities in both Studies 1 and 2 were **randomized** | Prevent bias introduced by order and/or survey fatigue |
| Attention Check | No attention checks were included | Two attention checks were included | Measures whether participants carefully read survey items, which can be an issue with online research |
| Exclusion | Vegetarians were excluded at the end of Study 1 survey  Exploratory analyses using exclusion criteria | Vegetarians were excluded at the very **beginning** of the survey, rather than post-hoc.  See the “Exclusion Criteria” section of the Supplemental Materials | The research aims for non-vegetarians and non-vegans, a filtering question should be added in the beginning of the study. Additional verification questions were added to increase data quality. If we fail to find support for the hypotheses we will also examine the results using our exclusion criteria. In that case, we will report the exclusions in detail and will report results for both the full sample and with exclusions. |

## Evaluation criteria for replication findings

We aimed to compare the replication effects with the original effects in the target article using the criteria set by LeBel et al. (2019) (see section “Replication evaluation” in the supplementary). For Study 1, we will consider it to be a successful replication if all three hypotheses (1a-1c) are supported, a mixed replication if only one or two of the hypotheses are supported, and a failed replication if none of the hypotheses are supported. Study 2 will be considered a successful replication if Hypothesis 2 is supported.

## Replication closeness evaluation

We provided details on the classification of the replications using the LeBel et al. (2018) criteria in Table 5 (see section “replication closeness evaluation” in the supplementary for details on this criteria). We summarized the replication as a “very close” replication.

Table 5

*Classification of the replication, based on LeBel et al. (2018)*

|  |  |  |
| --- | --- | --- |
| **Design facet** | **Replication** | **Details of deviation** |
| Effect/hypothesis | Same | - |
| IV construct | Same | - |
| DV construct | Same |  |
| IV operationalization | Similar | In the study 1 replication, each participant rated **8** animals randomly selected out of 32, instead of rating all the 32 animals. |
| DV operationalization | Similar | We randomized the presentation order of the mental capacity items in both Studies 1 and 2. |
| IV stimuli | Similar | In Study 1 replication, animal items “**sheep**” and “**cow**” were changed to “**pig**” and “**ox**”, given that the same animals were rated in Study 2. |
| DV stimuli | Similar | In study 1 replication, one of the items on edibility, “Would you choose to **each** this animal?”, was corrected to “Would you choose to **eat** this animal?” |
| Procedural details | Different | 1) In the original study, participants of Studies 1 and 2 were separately recruited. Whereas in our replication, the same participants participated in both Studies.  2) The unrelated task between the cow/lamb ratings in study 2 was eliminated  3) Vegetarians and vegans were excluded at the very beginning instead of the endof the survey.  4) Manipulation and attention checks were added in the replication. |
| Physical settings | Different | In the original study, the study was conducted in an Australian university campus. Whereas in our replication, the study was conducted on Qualtrics, completed by online Prolific participants. |
| Contextual variables | Different |  |
| Replication classification | Very close replication | Based on the above analysis, we summarized our replications as a “very close” replication of the  original studies. |

## Data analysis strategy

### Replication

We conducted statistical analyses in accordance with the tests reported in the original article. Therefore, we will conduct correlational tests for Study 1 and paired t-tests for Study 2. All analyses will use two-sided significance tests.

We note that while analyzing the methods used in the target article, we noticed an error in Study 2, which reported an independent-samples *t*-test. However, the within-subjects research design and reported degrees-of-freedom both indicated that a paired-samples *t*-test was used. We then contacted the first author, who verified that reporting it as an independent-samples *t*-test was a typo and that the reported result was indeed from a paired-samples *t*-test.

**Additional** **Analyses**

To better explore some nuances of the combined studies and the animals used, we will conduct several exploratory analyses. First, in Study 2, we will use a 2 X 2 mixed factorial ANOVA with animal food status (food vs. nonfood) as the within-subjects factor and animal species (cow-first vs. lamb-first) as the between-subjects factor and perceived animal mental capacities as the dependent variable in order to determine any effects of animal species. If the animal species order makes a meaningful difference or if there is an interaction, it would suggest that participants are judging cows and lambs differently and that perceptions of meat animals' minds vary by species and should be tested separately in future research. Next, we will examine Pearson correlations between the Study 1 and Study 2 measures to examine the degree to which the combined studies were associated., with a positive correlation indicating that participants were responding to the studies similarly.

Additionally, we will use moderated multiple regression analyses to test if study order moderated the results of Study 1 and a mixed ANOVA to test if study order moderated the results of Study 2. We will also rerun the primary analyses considering only those participants for whom the study was displayed first.

### Outliers and exclusions

Only meat-eaters will be recruited for these studies. This will be accomplished using Prolific recruitment filters. To verify that participants are not vegetarians or vegans, participants will complete the following item in the funneling section at the end of the survey: *Please indicate: Do you eat meat?* with options “*Yes, I eat meat”* and “*No I do not eat meat*”.

In the event of an unsuccessful replication, we will conduct exploratory analyses in which participants who failed to pass our data quality tests and attention checks will be excluded from analysis (we will also run the analyses with these participants included).

We provided details regarding exclusion criteria in the supplementary (see “Exclusion Criteria”).

# Results

**[IMPORTANT: Method and results were written using a randomized dataset produced by Qualtrics to simulate what these sections will look like after data collection. These will be updated following the data collection. For the purpose of the simulation, we wrote things in past tense, but no pre-registration or data collection took place yet.]**

## Study 1

First, mean scores for mental capacities, edibility, negative affect, and moral concern were collapsed across animals. We then conducted Pearson correlations to assess the relationship between perceived mental capacities and perceived edibility, negative affect, and moral concern. We summarized the results of these analyses in Table 6.

We found no support for perceived mental capacity being associated with perceived animal’s edibility (H1a).

We found no support for perceived mental capacity being associated with feeling bad about eating animals (H1b).

Finally, we found no support for perceived animals’ mental capacity being associated with how morally wrong it would be to eat the animal (H1c).

Table 6

*Study 1: Summary of means, standard deviations, and correlations with animal’s perceived mental capacities*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | *Mean* | *SD* | *r* | *p* | ***95% CI Upper*** | ***95% CI Lower*** |
| Mental Capacities | 4.01 | 0.23 | - | - | - | - |
| Animal Edibility | 4.00 | 0.49 | -.06 | .068 | .00 | -.12 |
| Negative Affect | 4.00 | 0.71 | -.01 | .868 | .06 | -.07 |
| Moral Concern | 4.01 | 0.71 | -.01 | .684 | .05 | -.08 |

*Note*. *N* = 1000

## Study 2

We calculated mean mental capacity ratings for the food (*N* = 1000, *M* = 4.02, *SD* = 0.53) and nonfood conditions (*M* = 3.99, *SD* = 0.56). We then conducted a paired-samples *t*-test. As seen in Figure 1, there was no support for the hypothesis: being informed that an animal would be used for food did not lead to lesser perceptions of the animal’s mental capacities, compared to being informed that an animal would not be used for food, *t*(999) = 1.39, *p* = .165, *d* = 0.04, 95% CI [-0.01, 0.08]. The effect size was very small, failing to support Hypothesis 2 in this simulation.

Chart

Description automatically generated

*Figure 1.* Violin plot of the effect of animal food status on perceived animal mental capacities in Study 2.

## Additional Analyses

For our first additional analysis, we conducted a 2 X 2 mixed factorial ANOVA with animal food status (food vs. nonfood) as the within-subjects factor and animal species (cow-first vs. lamb-first) as the between-subjects factor and perceived animal mental capacities as the dependent variable. There was no support for a main effect of animal food status on perceived animal mental capacities, *F*(1, 998) = 1.93, *p* = .165, *ηp*2 = .002, 90% CI [.00, .01]. There was some support for a main effect of animal species on perceived animal mental capacities (*F*(1, 998) = 5.55, *p* = .019, *ηp*2 = .01, 90% CI [.00, .02]) such that participants perceived animals as having significantly more mental capabilities when the cow was presented first (*M* = 4.03, *SE* = 0.02, 95% CI [3.94, 4.01]) compared to when the lamb was presented first (*M* = 3.97, *SE* = 0.02, 95% CI [4.00, 4.06]), although the effect size was small. There was no support for an interaction between animal food status and animal species order, *F*(1, 998) = 1.03, *p* = .311, *ηp*2 = .001, 90% CI [.00, .01].

Next, we calculated Pearson correlations between the variables in Study 1 and the dependent variables in Study 2. We conducted this analysis as a measure of whether completing both studies in the same session was leading to the responses converging in a way that would not otherwise occur. As seen in Table 7, there were no significant correlation between Study 1 perceived animal mental capacities and Study 2 perceived mental capacities for food or nonfood animals and these effects were very small. There were no significant correlations between Study 1 perceived animal edibility and Study 2 perceived mental capacities for food or nonfood animals and these effects were very small. There were no significant correlations between Study 1 negative affect and Study 2 perceived mental capacities for food or nonfood animals and these effects were very small. Finally, there were no significant correlations between Study 1 moral concern and Study 2 perceived mental capacities for food or nonfood animals and these effects were very small.

Table 7

*Pearson correlations between Study 1 and Study 2 Variables*

|  |  |  |
| --- | --- | --- |
|  | *Study 2* |  |
|  | Food Condition Capacities | Nonfood Condition Capacities |
| *Study 1* |  |  |
| Mental Capacities |  |  |
| *r* | .02 | .03 |
| *p*-value | 0.505 | 0.396 |
| 95% CI | [-0.04, 0.08] | [-0.04, 0.09] |
| Animal Edibility |  |  |
| *r* | -.03 | -.02 |
| *p*-value | 0.372 | 0.606 |
| 95% CI | [-0.09, 0.03] | [-0.08, 0.05] |
| Negative Affect |  |  |
| *r* | < -.001 | -0.01 |
| *p*-value | 0.880 | 0.671 |
| 95% CI | [-0.06, 0.06] | [-0.08, 0.05] |
| Moral Concern |  |  |
| *r* | .06 | .02 |
| *p*-value | 0.080 | 0.494 |
| 95% CI | [-0.01, 0.12] | [-0.04, 0.08] |

We also ran a set of additional analyses to test if the order of two studies moderated any effects. First, in Study 1, there was no interaction between study order and perceived animal mental capabilities for perceived animal edibility (*β* = 0.02, *t*(996) = 0.36, *p* = .717, 95% CI [-0.10, 0.15]) and there was no main effect of study order (*β* = -0.07, *t*(996) = -1.58, *p* = .115, 95% CI [-0.15, 0.02]) or perceived animal mental capabilities order (*β* = -0.04, *t*(996) = -0.40, *p* = .115, 95% CI [-0.15, 0.02]) on perceived animal edibility.

Second, in Study 1, there was no interaction between study order and perceived animal mental capabilities for negative affect (*β* = -0.02, *t*(996) = -0.26, *p* = .793, 95% CI [-0.14, 0.11]) and there was no main effect of study order (*β* = -0.08, *t*(996) = 0.20, *p* = .844, 95% CI [-0.20, 0.05]) or perceived animal mental capabilities order (*β* = 0.00, *t*(996) = 0.07, *p* = .947, 95% CI [-0.08, 0.09]) on negative affect.

Third, in Study 1, there was no interaction between study order and perceived animal mental capabilities for moral concern for animals (*β* = 0.03, *t*(996) = 0.45, *p* = .657, 95% CI [-0.10, 0.15]) and there was no main effect of study order (*β* = -0.06, *t*(996) = -0.49, *p* = .621, 95% CI [-0.18, 0.07]) or perceived animal mental capabilities order (*β* = -0.03, *t*(996) = -0.59, *p* = .554, 95% CI [-0.11, .06]) on moral concern.

Next, in Study 2, a mixed ANOVA found that there was no interaction between food status of the animal and study order for perceived animal mental capabilities, *F*(1, 998) = 0.28, *p* = .598, *ηp*2 < .001, 90% CI [.00, .01]. There were also no main effects of food status of the animal (*F*(1, 998) = 1.96, *p* = .161, *ηp*2 = .002, 90% CI [.00, .01]) or study order (*F*(1, 998) = 0.01, *p* = .939, *ηp*2 < .001, 90% CI [.00, .01]). These findings all suggest that study order did not moderate the effects (or lack thereof) in either study.

To further explore any impacts of the order of the studies, we reexamined our primary analyses for only when a given study was presented first. The results for Study 1 when presented first can be found in Table 8. We found no support for perceived mental capacity being associated with perceived animal’s edibility (H1a). We found no support for perceived mental capacity being associated with feeling bad about eating animals (H1b). Finally, we found no support for perceived animals’ mental capacity being associated with how morally wrong it would be to eat the animal (H1c). This is the same pattern of findings as in our original analyses with both study orders included.

Table 8

*Study 1 when presented first: Summary of means, standard deviations, and correlations with animal’s perceived mental capacities*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | *Mean* | *SD* | *r* | *p* | ***95% CI Upper*** | ***95% CI Lower*** |
| Mental Capacities | 4.01 | 0.23 | - | - | - | - |
| Animal Edibility | 4.01 | 0.49 | -.07 | .114 | .02 | -.16 |
| Negative Affect | 4.02 | 0.70 | .00 | .946 | .09 | -.08 |
| Moral Concern | 4.03 | 0.77 | -.03 | .540 | .06 | -.11 |

*Note*. *N* = 1000

Finally, we reexamined the findings of Study 2 for when it was presented first. We calculated mean mental capacity ratings for the food (*N* = 489, *M* = 4.03, *SD* = 0.53) and nonfood conditions (*M* = 3.98, *SD* = 0.54). We then conducted a paired-samples *t*-test. As seen in Figure 1, there was no support for the hypothesis: being informed that an animal would be used for food did not lead to lesser perceptions of the animal’s mental capacities, compared to being informed that an animal would not be used for food, *t*(999) = 1.41, *p* = .160, *d* = 0.06, 95% CI [-0.02, 0.11]. The effect size was very small, failing to support Hypothesis 2 in this simulation. This is the same pattern of findings as in our original analyses with both study orders included.

# Conclusion

To conclude, our simulated replication findings are inconsistent with the original article. From the results, we found only very small effect sizes compared to the medium and large effect sizes in the original Study 1 and the small-to-medium effect size in the original Study 2. Exploratory analyses did not support the possibility that study order moderated the effects.

**Because our current results are generated from Qualtrics simulated data, these results should not be interpreted and merely serve to provide an example of how we plan to analyze and report our data.**

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