

# The Effects of Animal-Free Food Technology Awareness on Animal Farming Opposition

**Jamie Harris**

Researcher

May 14, 2020

© 2019 Sentience Institute

*Edited by Jacy Reese Anthis. Many thanks to Matti Wilks, Chris Bryant, Jacob Peacock, Pegah Maham, Tom Beggs, Marta Wronska, and Jamie Parry for providing feedback.<sup>1</sup>*

---

## Abstract

There is limited research on the effects of animal-free food technologies (AFFT), such as cultured meat and new plant-based foods that accurately mimic animal products, on attitudes toward animal farming. This study found that providing participants with information about AFFT significantly lowered animal farming opposition (AFO) relative to participants who were provided with information about low-technology plant-based foods or about an unrelated topic. The results suggest that including information about AFFT in advocacy materials can be detrimental to attitudinal change. Information about low-technology plant-based foods had no significant effects on AFO relative to information about an unrelated topic, so does not seem to have this downside.

---



---

<sup>1</sup> This is the initial analysis for work we may publish in an academic journal in the future. The work has not yet been peer-reviewed.

# Table of Contents

Abstract	1
Introduction	2
The effects of AFFT on Animal Farming Opposition	3
Comparison to plausible counterfactuals	8
Moderators and correlates	11
Value for further research	13
Methodology	14
Results	17
Exploratory analysis	20
Discussion	21
Appendix	24
Message Texts	24
Guided Track code	27
R code	38
Exploratory analysis	39
Information visible to participants on Positly's advert	42
References	43

## Introduction

Many animal advocates support the development of new animal-free food technologies (hereafter AFFT), such as new plant-based foods that accurately mimic animal products and cultured meat (that is, products cultured from animal cells without requiring the slaughter of any animals). These technologies have the potential to dramatically displace the consumption of conventional animal products and thereby reduce the harms of animal agriculture.<sup>2</sup> The market for highly meat-like plant-based products is growing<sup>3</sup> and the cultured meat market is poised to take off in the coming years.<sup>4</sup>

Therefore, the market effects of the future mass adoption of AFFT, if it happens as predicted, seem likely positive, but the social effects of today's discussions of AFFT are less clear. How does discussion of AFFT affect attitudes towards animal farming and AFFT? This question has important implications for the foundational question of whether effectiveness-focused advocates should prioritize working on social change, such as through activism, or on developing better AFFT.<sup>5</sup> For example, if awareness of AFFT reduces support for policies that restrict animal farming (e.g. a ban on slaughterhouses), perhaps because consumers

---

<sup>2</sup> See, for example:

“Animal Cruelty,” Compassion In World Farming, accessed September 9, 2019, <https://www.ciwf.org.uk/factory-farming/animal-cruelty/>,

“5.4.3 Greenhouse gas emissions from livestock” in “Chapter 5: Food Security” in “Climate Change and Land,” Intergovernmental Panel on Climate Change (August 2019), [https://www.ipcc.ch/site/assets/uploads/2019/08/2f.-Chapter-5\\_FINAL.pdf](https://www.ipcc.ch/site/assets/uploads/2019/08/2f.-Chapter-5_FINAL.pdf),

“Meat in your diet,” National Health Service, last edited May 24, 2018, <https://www.nhs.uk/live-well/eat-well/meat-nutrition/>, and

The various references in Bobbie Macdonald and Eva Vivalt, “The Impact of New Products on Ethical Beliefs” (November 8, 2017), <https://osf.io/4dczh/> for their comment that “[c]onventional animal agriculture causes more pollution than clean meat; causes animal suffering; and is associated with a growing incidence of antibiotic resistance.”

<sup>3</sup> Various market research firms predict high growth of plant-based foods. For example, “How Will Cultured Meat and Meat Alternatives Disrupt the Agricultural and Food Industry,” ATKearney (2019), though noting that, “[q]ualitative forecasting is required as historical patterns cannot be applied,” predicts that by 2030, “novel vegan meat replacements” and cultured meat will equal or surpass conventional meat in all analyzed criteria, including scalability, consumer acceptance, and regulatory approval. They conclude that, “[c]ultured meat will win in the long run. However, novel vegan meat replacements will be essential in the transition phase.” “The Great Protein Shake-up?” Jeffries (September 17, 2019) estimates that the meat industry “is set to reach \$2.7tn by 2040. Alternative meat is still in an embryonic stage (our best case is \$470bn of total meat market by 2040, worst case a mere \$90bn).” Such predictions for future growth are, of course, highly speculative, though several such reports note strong growth of highly meat-like plant-based foods in the past few years. See, for example, the rising success of Beyond Meat, as described by Mary Allen, “Beyond Meat Goes Public, Raises \$241 Million” (May 2019), <https://www.gfi.org/beyond-meat-ipo>.

<sup>4</sup> Matti Wilks and Jacy Reese, “Consumer Acceptance,” in *Cellular Agriculture: Developing Animal Products Without Animals* (Amsterdam, Netherlands: Elsevier, 2020).

<sup>5</sup> For a summary of evidence relating this question, see the section on “Social change vs. food technology” in “Summary of Evidence for Foundational Questions in Effective Animal Advocacy,” Sentience Institute, last updated December 24, 2019, <https://www.sentienceinstitute.org/foundational-questions-summaries#social-change-vs.-food-technology>.

think the ethical and environmental problems of animal farming will be solved anyway by AFFT, then this is a negative impact of activism that emphasizes AFFT.

The full list of hypotheses for this study and our estimates of the likelihood of particular outcomes are available [here](#). The second tab provides summaries of our views on the foundational questions that we hoped that this study would provide evidence on, before, and after the data was collected.

## The effects of AFFT on Animal Farming Opposition

The main aim of this study was to assess whether and to what extent Animal Farming Opposition (AFO) is affected by the provision of information about AFFT.

In this study, AFO was measured through five questions from Sentience Institute's 2017 and 2019 US surveys, selected based on exploratory factor analysis.<sup>6</sup> These questions ask about people's willingness to support bans on animal farming, factory farming, or slaughterhouses, their willingness to join a demonstration against factory farming, and their discomfort with the way animals are used in the food industry.

There are several plausible psychological mechanisms through which AFFT might influence AFO:

- It might increase the cognitive dissonance experienced by omnivores by emphasizing that conventional animal products are made using animals and that alternatives to these products exist.<sup>7</sup> To reduce this dissonance, omnivores may change the underlying beliefs that are dissonant with the emphasized information, such as by reducing their care for animals.<sup>8</sup> Alternatively, if emphasizing the

---

<sup>6</sup> Jacy Reese, "Survey of US Attitudes Towards Animal Farming and Animal-Free Food October 2017" (November 2017), <https://www.sentienceinstitute.org/animal-farming-attitudes-survey-2017> and Jacy Reese, "Animals, Food, and Technology Survey 2019" (forthcoming).

<sup>7</sup> Hank Rothgerber, "Efforts to Overcome Vegetarian-Induced Dissonance Among Meat Eaters," *Appetite* 79 (2014), 32 summarizes that "[m]eat eaters face dissonance whether it results from inconsistency ('I eat meat; I don't like to hurt animals'), aversive consequences ('I eat meat; eating meat harms animals'), or threats to self image ('I eat meat; compassionate people don't hurt animals')."

<sup>8</sup> Leon Festinger, *A Theory of Cognitive Dissonance* (Stanford: Stanford University Press, 1957), 3 and 19.

Hank Rothgerber, "Efforts to Overcome Vegetarian-Induced Dissonance Among Meat Eaters," *Appetite* 79 (2014), 32-41 found that "participants exposed to a vegetarian were more likely to perceive emotions as unique to humans than were those exposed to a gluten-free individual,  $F(1,88) = 7.95, p = .006$ . In addition, those presented with a vegetarian target were less likely to believe animals possessed mental capacities than were those exposed to a gluten-free individual,  $F(1,88) = 4.38, p = .039$ ." These were the only two outcomes measured in the experiment. Rothgerber hypothesized that this was because "the mere presence of a vegetarian will increase dissonance experienced from consuming animal flesh. In the present study, participants seemed to attempt to reduce this conflict by increasing beliefs in human-animal dissimilarity, the effect of which is to minimize the discrepancy between eating animals and not liking to hurt them." However, dissonance increase is just one potential mechanism through which this observed change might have occurred.

Drawing from previous work, Rothgerber "identified eight mechanisms that omnivores employ to reduce the discomfort they experience from eating animals, including avoidance, dissociation, perceived behavioral change, denial of animal pain, denial of animal mind, pro-meat justifications, reduction of perceived choice, and behavioral change."

availability of AFFT leads omnivores to expect that they will eat fewer animal products in the future,<sup>9</sup> this might reduce the need for omnivores to engage in these dissonance-reducing strategies. In other words, omnivores might expect to gain the freedom to care about animals, so they might move towards the level of care that they would have in a world where they did not eat animals.

- It might challenge the justifications for animal product consumption. In one survey, the “4 N’s” of meat consumption (“the belief that eating meat is natural, normal, necessary, and nice”) accounted for 83–91% of the top three justifications given by each consumer for why they believe it is acceptable to eat meat.<sup>10</sup> Awareness of AFFT could reduce confidence in the beliefs that eating

---

<sup>9</sup> Evidence suggests that practical considerations are more of a barrier to reduced animal product consumption than ethical considerations, which suggests in turn that awareness of high-quality animal-free foods (including new AFTTs) would lead omnivores to expect that they will eat fewer animal products in the future:

Nick Cooney, “Report: What Elements Make a Vegetarian Leaflet More Effective?” (May 20, 2014), <http://www.humaneleaguelabs.org/blog/2014-05-20-what-elements-make-vegetarian-leaflet-more-effective/> notes that activists gave study participants surveys and one of eight booklets or no leaflet, as a control. Half the leaflets focused “on the reasons why to go vegetarian,” with “four out of six relevant pages,” while the other half focused on “how to eat vegetarian.” Though only 569 of the 3,233 initial participants completed a survey at three months follow-up, Cooney found that, “[t]hose who received a booklet that focused primarily on how to go vegetarian reported diet changes that spared 50% more animals than those who received a booklet that focused primarily on why to go vegetarian.”

“Diet Change and Demographic Characteristics of Vegans, Vegetarians, Semi-Vegetarians, and Omnivores,” Humane League Labs (April 2014), <http://www.humaneleaguelabs.org/static/reports/2014/04/diet-change-and-demographic-characteristics1.pdf> shared a survey to “Facebook pages relating to vegetarian eating, vegetarian meat products, and sociological research.” They found that 34% of the omnivores they surveyed were willing to reduce their animal product consumption, but only 54% of those who were willing knew how to start. Of those who wanted to go vegetarian but haven’t, 20% of respondents to a free-form question noted reasons that coded as relating to “convenience,” though only 6% noted “what to cook” reasons and 5% noted “how to cook” reasons. In a subsequent question, among all dietary groups, a “lack of options when eating out” was a much more widely reported reason that eating meat-free meals was difficult than a “loss of initial motivation.” The relative importance of a “lack of food at grocery store” varied by group.

Christopher John Bryant, “We Can’t Keep Meating Like This: Attitudes towards Vegetarian and Vegan Diets in the United Kingdom,” *Sustainability* 11, no. 23 (December 2, 2019), <https://www.mdpi.com/2071-1050/11/23/6844/htm> found in a survey of “1000 UK meat-eaters” that, “[t]he majority agreed that vegetarian and vegan diets are ethical, good for the environment and healthy. The majority also agreed that both vegetarianism and veganism were socially acceptable. However, there were three consistent negative beliefs about vegetarian and vegan diets: that they are difficult, that they are not enjoyable and that they are expensive.”

Bobbie Macdonald and Eva Vivalt, “The Impact of New Products on Ethical Beliefs” (November 8, 2017), <https://osf.io/4dczh/> randomized individuals to receive information about cultured meat or vegetarian substitutes and found that participants who “who had more positive reactions to the new product or who thought it would be easy to reduce their consumption of conventional meat products did exhibit changes in their stated [ethical] beliefs and also were more likely to make a donation to the animal welfare charity.” They also primed some respondents with negative information about cultured meat and found that “those not primed to think of the naturalistic heuristic were more likely to say that it was morally preferable to be vegetarian and to place more personal weight on the harm they perceived done to animals.”

There is also evidence that increased familiarity with AFTTs and perceptions that cultured meat is more widely consumed are associated with stronger intentions to consume them (see footnote 10).

<sup>10</sup> Jared Piazza, Matthew B. Ruby, Steve Loughnan, Mischel Luong, Juliana Kulik, Hanne M. Watkins, Mirra Seigerman, “Rationalizing Meat Consumption. The 4Ns,” *Appetite* 91 (2015), 116-7.

animal products is necessary (if AFFT is seen as a viable alternative), nicer than the alternatives (if AFFT are also seen to be similarly enjoyable to consume), or normal (if consumption of AFFT is perceived to be widespread). There is evidence that increased familiarity with AFFTs and perceptions that cultured meat is more widely consumed are associated with stronger intentions to consume them.<sup>11</sup> Awareness could, however, strengthen the naturalness rationale by suggesting that animal-free alternatives are unnatural.

- It might decrease the extent to which people associate animals with food by disentangling animals with meat, dairy, or egg products. Previous studies have demonstrated that people ascribe lower mental capacities to animals that they consider appropriate for human consumption.<sup>12</sup> Alternatively,

---

<sup>11</sup> Christopher John Bryant, Keri Szejda, Varun Deshpande, Nishant Parekh, and Brian Tse, “A Survey of Consumer Perceptions of Plant-Based and Clean Meat in the USA, India, and China,” *Frontiers in Sustainable Food Systems* 3 (2019) found that for both plant-based meat and cultured meat, purchase intention is significantly higher for those who are more familiar with clean meat.

J. Mohorčič, “What Can Nuclear Power Teach Us About the Institutional Adoption of Clean Meat?” (November 28, 2017), <https://www.sentienceinstitute.org/nuclear-power-clean-meat> notes evidence that, “public opinion toward nuclear in non-nuclear countries remained far frostier than in countries with nuclear power programs. If there was a backlash effect, it appears to have been outweighed by a familiarity effect of some kind.”

Jonathon McPhetres, Bastiaan T. Rutjens, Netta Weinstein, and Jennifer A. Brisson, “Modifying Attitudes About Modified Foods: Increased Knowledge Leads to More Positive Attitudes,” *Journal of Environmental Psychology* 64 (2019), 21-9 used a longitudinal experimental design and found that “learning about the science behind GM technology leads to more positive explicit attitudes towards GM foods, greater willingness to eat GM products, and lowered perceptions of GM foods as risky.”

Peter Slade, “If You Build It, Will They Eat It? Consumer Preferences for Plant-Based and Cultured Meat Burgers,” *Appetite* 125 (2018), 428-37 summarizes that, “[b]efore answering the choice question, each respondent was given a set of randomly chosen hypothetical market shares for beef, plant-based, and cultured meat burgers... Previous research has found that consumer preferences are impacted by the market share of a product — the higher the perceived popularity of a product, the stronger the preference for it.” They found in their first model that perceived market share was a significant predictor of purchasing intent. They note that, “the coefficient on the hypothetical market share is statistically insignificant (though still positive) in models 2, 3, and 4.”

<sup>12</sup> For example, Brock Bastian, Steve Loughnan, Nick Haslam, and Helena R. M. Radke, “Don’t Mind Meat? The Denial of Mind to Animals Used for Human Consumption,” *Personality and Social Psychology Bulletin* 38, no. 2 (2012), 249-50 note that, among responses from 63 participants to “a questionnaire that required them to rate 32 animals... perceived mind was negatively associated with the animal’s edibility ( $r = -.42, p < .001$ ; see Figure 1) and positively with feeling bad about eating the animal ( $r = .77, p < .001$ ) and with how morally wrong it would be to eat the animal ( $r = .80, p < .001$ ).”

Other studies showing a similar effect include:

Boyka Bratanova, Steve Loughnan, and Brock Bastian, “The Effect of Categorization as Food on the Perceived Moral Standing of Animals,” *Appetite* 57, no. 1 (2011), 193–6, a study of 80 participants, where multivariate regression suggested that categorization of an animal as food “was sufficient to reduce the animal’s perceived capacity to suffer, which in turn restricted moral concern.” The same was not the case for manipulation of whether the animal was killed or whether humans were responsible for its death.

Steve Loughnan, Nick Haslam, and Brock Bastian, “The Role of Meat Consumption in the Denial of Moral Status and Mind to Meat Animals,” *Appetite* 55, no. 1 (2010), 156–9, a study with 108 participants that suggested that eating dried beef as opposed to dried nuts “reduced the perceived obligation to show moral concern for animals in general and the perceived moral status of the cow.”

it could increase the association of animals with food by emphasizing that many food products currently contain animals.<sup>13</sup>

- It might increase people's optimism that animal farming will end. This could make people less likely to dismiss actions to help animals as only a "drop in the bucket," making a small contribution to addressing a vast and unsolvable problem. Previous studies have found evidence of a *collapse of compassion* as awareness of the number of victims increases,<sup>14</sup> and of *proportion dominance*, the phenomenon whereby addressing a large proportion of a problem is preferred to making a larger absolute contribution when the proportion of the problem that would be addressed in the latter case is lower.<sup>15</sup> Alternatively, it could encourage perceptions of the end of animal farming as inevitable, and make people more likely to dismiss actions to help animals as unnecessary.
- It might be viewed as an alternative to animal farming, and thus if participants see it as a good alternative, it makes animal farming seem relatively less appealing and AFO could increase. If participants see AFFT as a bad alternative, it makes animal farming seem relatively more appealing and AFO could decrease. Macdonald and Vivalt (2017) found evidence that changes in beliefs could be contingent upon perceptions of the quality of AFFT, which fits with this mechanism.<sup>16</sup>

---

Jared Piazza, Matthew B. Ruby, Steve Loughnan, Mischel Luong, Juliana Kulik, Hanne M. Watkins, Mirra Seigerman, "Rationalizing Meat Consumption. The 4Ns," *Appetite* 91 (2015), 117-9, a study of 171 participants, in which a scale of 16 items to represent the 4 N's was negatively correlated ( $r = -.47, p < 0.001$ ) with a moral circle measure and where there was "a very large overall effect" of diet on "overall 4N endorsement."

Jared Piazza and Steve Loughnan, "When Meat Gets Personal, Animals' Minds Matter Less: Motivated Use of Intelligence Information in Judgments of Moral Standing," *Social Psychological and Personality Science* 7, no. 8 (2016), 867-74 found evidence in three studies that, "intelligence plays a major role in the moral concern afforded to animals in the abstract," that manipulations in information about intelligence affects views of tapirs and fictional animals but not of pigs, and that, "people believe that learning about pig intelligence will lead to high levels of moral concern, yet when they themselves learn about pig intelligence, moral concern remains low."

<sup>13</sup> Bobbie Macdonald and Eva Vivalt, "The Impact of New Products on Ethical Beliefs" (November 8, 2017), <https://osf.io/4dczh/> found mixed evidence for the hypothesis that certain features of meat may become more salient to study participants who had information about AFFT emphasized to them. They found that "providing subjects with information about clean [that is, cultured] meat did not lead them to take a more negative view of conventional methods of animal agriculture (i.e. concentrated animal feeding operations, also known as factory farming) or place more weight on the environment or animal suffering. In fact, those told about new products - both clean meat and a vegetarian substitute, but especially clean meat - were less likely to change their beliefs than those who were not told about new products." To test this further, they conducted a second experiment in which they "explicitly varied whether information was presented in an ethical framing, but this framing did not significantly alter our results. Instead, we found support for an alternative hypothesis: that presently too many consumers find clean meat unappealing."

<sup>14</sup> See, for example, C. Daryl Cameron and B. Keith Payne, "Escaping Affect: How Motivated Emotion Regulation Creates Insensitivity to Mass Suffering," *Journal of Personality and Social Psychology* 100, no. 1 (2011), 1-15.

<sup>15</sup> See, for example, Daniel M. Bartels and Russell C. Burnett, "A Group Construal Account of Drop-in-the-Bucket Thinking in Policy Preference and Moral Judgment," *Journal of Experimental Social Psychology* 47, no. 1 (2011), 50-7, including the summary of previous literature in the introduction.

<sup>16</sup> Bobbie Macdonald and Eva Vivalt, "The Impact of New Products on Ethical Beliefs" (November 8, 2017), <https://osf.io/4dczh/> summarize that, "clean meat does not on average lead to changes in ethical beliefs, but this appears due in large part to the high proportion of respondents that deem it to not be a good substitute for conventional animal products. When we experimentally vary how positively respondents view clean meat, we find that those induced to think more positively do seem to change their ethical beliefs." This suggests that messaging that focuses on AFFT that people are more optimistic about could improve attitudes towards farmed animals.

Increased awareness of AFFT could therefore encourage positive or negative changes in AFO.<sup>17</sup>

## Comparison to plausible counterfactuals

AFFT proponents can incorporate information about AFFT into online ads, op-eds, and documentaries, or choose to omit such information and focus on other messaging tactics. Previous research has found evidence that, compared to a no-information control, providing information about conventional animal farming affects attitudes and behaviors towards animals,<sup>18</sup> but Macdonald and Vivalt (2017) found slightly negative effects of including information about AFFT within messaging about the harms of conventional animal farming.<sup>19</sup> This

---

<sup>17</sup> By comparison, research on e-cigarettes suggests that they can serve as useful aids in quit attempts for tobacco smokers but also as gateways to tobacco use for non-smokers (see the section on “Convincing imitations” in “Smoking” in Jamie Harris, “Health Behavior Interventions Literature Review” (forthcoming)). AFFT could backfire in comparable ways, and thus empirical testing of the net effect is particularly important.

<sup>18</sup> Peter Hurford and Marcus A. Davis, “Animal Equality Showed that Advocating for Diet Change Works. But is it Cost-Effective?” (June 7, 2018), <https://www.rethinkpriorities.org/blog/2019/2/21/animal-equality-showed-that-advocating-for-diet-change-works-but-is-it-cost-effective-1> note that, “[i]mmediately after the video, 67.0% of the control group and 79.4% of the treatment groups agreed or strongly agreed with the fact that eating pork contributed to suffering of pigs ( $p < 0.0001$ , Chi-squared test).” Additionally, “60.0% of the control group and 77.0% of the treatment groups agreed or strongly agreed with the fact that it is important to minimize pork eating ( $p < 0.0001$ , Chi-squared test).” At one month follow-up, the differences were smaller but remained statistically significant. Using the behavioral results, Hurford and Davis concluded that the intervention cost “\$150 per pig saved (90% interval: \$23 to \$560)” from a lifetime in factory farming.

<sup>19</sup> Bobbie Macdonald and Eva Vivalt, “The Impact of New Products on Ethical Beliefs” (November 8, 2017), <https://osf.io/4dczh/> summarize that, “[a]ll subjects completed a baseline survey measuring demographic characteristics, current eating habits, attitudes towards meat products and substitutes, and other relevant variables.” After being randomly allocated to one of three groups and provided with information about cultured meat, an “‘animal-free’ meat substitute” or “the same information without mention of a new product,” participants were asked a second round of questions about “ethical beliefs, asked some questions about expected future consumption, and asked if subjects would like more information about vegetarian products or, if they received information about a new product, if they would like to know when the product that was described became available in their area.” In a “Regression of Change in Beliefs and Donations on Treatments,” the authors note that the cultured meat treatment had a significant negative effect and the “vegetarian substitute” treatment had no significant effect.

Somewhat relatedly, Michael Siegrist, Bernadette Sütterlin, and Christina Hartmann, “Perceived Naturalness and Evoked Disgust Influence Acceptance of Cultured Meat,” *Meat Science* 139 (2018), 213-9 describe an experiment where one treatment group was provided with the following information: “In vitro meat is produced by means of biotechnology. In doing so, red meat such as ground beef is produced in the laboratory. This production method is more environment-friendly and associated with less animal suffering compared with traditional meat production. Consumption of in vitro ground beef is comparable with consumption of ground beef from traditional meat production, also with regard to taste.” The other group was provided with comparable information about organic meat. They found that, “[t]he participants assigned to the in vitro meat condition perceived traditional meat as significantly more natural ( $M = 73.03$ ,  $SD = 18.85$ ) compared with the participants in the organic meat group ( $M = 53.96$ ,  $SD = 22.14$ ),  $t(202) = 6.63$ ,  $p < 0.001$ . Furthermore, the experimental manipulation affected the participants’ willingness to eat traditional meat. The participants assigned to the in vitro meat condition indicated that they were more likely to consume traditional meat ( $M = 77.13$ ,  $SD = 25.16$ ) compared with the participants in the organic meat group ( $M = 58.15$ ,  $SD = 32.69$ ),  $t(202) = 4.65$ ,  $p < 0.001$ .”

However, the description of the production methods of cultured meat seems less favorable than the descriptions that the proponents of AFFT, or indeed journalists and news outlets, seem likely to use. Indeed, a subsequent experiment, described in the same paper, suggests that nontechnical descriptions of cultured meat evoke less disgust and perceived



suggests that animal advocates should prioritize messaging tactics that do not focus on AFFT, though Macdonald and Vivalt leave some room for optimism that some messaging around AFFT may still be effective.<sup>20</sup> The present study provides more evidence on this topic using different messaging conditions and outcome measures. Two intervention groups received information about the development of AFFT products and one of the control groups received information about the development of a low-tech plant-based food product. Comparison between these groups reflects the differing effects of some of the messaging strategies available to farmed animal advocates and other AFFT proponents, such as emphasizing “conventional” or “low-tech” animal-free foods.

Food companies and researchers that produce, support, or sell AFFT can actively seek media attention through press releases or choose to share progress towards their goals only with investors and donors.<sup>21</sup> News items about AFFT will not always compete for space on news sites, televisions, and social media feeds with other content about the harms of animal agriculture; instead, they may compete with mostly unrelated topics.<sup>22</sup> To the authors’ knowledge, no experiment has evaluated the effects of news articles about AFFT compared to unrelated news content. Indirect evidence on this question has unclear implications. An experiment found that participants who read articles about animal welfare changes “were more likely to intend to reduce their consumption of animal products than participants who read the control articles”<sup>23</sup> and an observational analysis of the US from 1982 to 2008 showed a negative association between media coverage of farmed animal welfare and meat consumption.<sup>24</sup> However, there is evidence that increased public awareness of

---

unnaturalness than technical descriptions do, though the experiment does not analyze whether nontechnical descriptions encourage positive evaluations of conventional meat in a manner comparable to the first experiment. Additionally, these experiments measured attitudes towards cultured meat and conventional meat rather than attitudes towards animal farming more generally.

<sup>20</sup> See footnote 15.

<sup>21</sup> Such decisions may not always be as readily available to academic researchers working on AFFT, though academics have proactively sought media attention in the past, as with Mark Post’s public unveiling of “the world’s first cultured beef burger” at “an event attended by 200 journalists and academics” where “the cultured beef burger was cooked and tasted live” (“Launch of the world’s first cultured meat hamburger (August 5, 2013),” Mosa Meat (Jan 13, 2018), <https://www.youtube.com/watch?v=s1s1QLZL2EI>).

<sup>22</sup> Information on AFFT could plausibly displace news or marketing content on technology and food topics. For example, Helen Briggs, “Artificial meat: UK scientists growing ‘bacon’ in labs” (19 March, 2019), <https://www.bbc.co.uk/news/science-environment-47611026> was posted in the BBC’s “Science and Environment” news category. Headlines in this category at the time of checking (September 11, 2019) included “Glasgow to host UN climate change summit,” “the day the dinosaurs’ world fell apart,” “UK farms plan for going ‘carbon neutral,’” “US adventurer reaches deepest points in all oceans,” “Climate change: ‘Invest \$1.8 trillion to adapt,’” “Earliest evidence of milk consumption,” and “Vet says badger culls caused ‘immense pain.’” Clearly, some content that could positively affect AFO may be displaced by news stories about AFFT, but other irrelevant content could also be displaced. Similarly, Mike Brown, “Lab-Grown Meat: Beyond Burgers, the 7 In-Vitro Foods Coming to Plates” (September 10, 2019), <https://www.inverse.com/article/58515-lab-grown-meat-beyond-burgers-the-7-in-vitro-foods-coming-to-plates> is listed in Inverse’s “Food” subsection of the “Innovation” topic section.

If such news sites do not have quotas or constraints on the types of content that can fit into particular topic categories, then articles about AFFT could displace entirely unrelated content, such as on recent minor political developments.

<sup>23</sup> Krystal Caldwell, “Welfare Reforms and Meat Consumption” (November 14, 2016), <https://mercyforanimals.org/welfare-reforms-survey>.

<sup>24</sup> Glynn T. Tonsor and Nicole J. Olynk, “Impacts of Animal Well-Being and Welfare Media on Meat Demand,” *Journal of Agricultural Economics* 62, no. 1 (February 2011), 59-72. For discussion, see “Modeling Media Influence on Demand for

genetically modified foods was linked with increased negative sentiment.<sup>25</sup> The effects of an overall increase in media reporting of AFFT are therefore unclear. Given that one of the control groups received information about an unrelated news topic, the use of mobile data to prevent traffic jams, this study provides insight into the likely effects of an overall increase in media reporting of AFFT.<sup>26</sup>

## Moderators and correlates

Several demographic and psychological characteristics have been found to predict interest in animal-free food or AFO (though not using the same scale), including gender, age, region, level of education, income, political orientation, food neophobia, distrust in science, preferences for naturalness, the extent to which people attribute mental capabilities to animals, and speciesist attitudes.<sup>27</sup> This study aims to evaluate how these

---

Meat” in “Models of Media Influence on Demand for Animal Products,” Animal Charity Evaluators, last edited June 2016, <https://animalcharityevaluators.org/research/other-topics/models-of-media/>.

<sup>25</sup> “Increased public awareness was linked with increased negative sentiment” in J. Mohorčich, “What Can the Adoption of GM Foods Teach Us About the Adoption of Other Food Technologies?” (June 20, 2018), <https://www.sentienceinstitute.org/gm-foods#increased-public-awareness-was-linked-with-increased-negative-sentiment> notes that “double-digit drops in support for GM products in Europe... coincide with activist efforts that, starting in 1996, led to ‘20 point increases in awareness’ of GM food in multiple European countries.” Mohorčich also quotes Rae Goodell noting that the city counsellors in Cambridge, MA, decided to act on DNA regulation because of “three essentially non-technical grounds: (1) the size of the response from Harvard and MIT, the press, and the scientists; (2) the size of the rift between proponents and opponents, with impressive credentials and heavy emotion on both sides; and (3) their view that the scientists at Asilomar, NIH, and Harvard had been delinquent in their provisions for public involvement.”

<sup>26</sup> The authors are interested in using intervention articles that could plausibly represent content that would be shared by AFFT proponents and animal advocates. Further research may assess the effects of variations in framing in subsequent experiments.

Though the intervention articles here use a more positive framing than seems likely to be typical in the media, a forthcoming paper includes content analysis of US and UK elite media which classified only 3% of the coverage as “negative” (James Painter, “Promising the Earth: The Coverage of Cultured Meat in the US and UK Elite Media” (forthcoming)).

The control was designed to be bland and unrelated to animal farming but to have a technological theme, to reflect the content that stories about AFFT might compete for space with on news sites, televisions, and social media feeds (see footnote 20).

<sup>27</sup> Matti Wilks and Jacy Reese, “Consumer Acceptance,” in *Cellular Agriculture: Developing Animal Products Without Animals* (Amsterdam, Netherlands: Elsevier, 2020) summarize that, “several studies have found that liberals are more likely to support cell-based meat than conservatives and males are generally found to have more positive views than women—but this pattern was reversed in one Chinese sample. People from urban/educated/higher income backgrounds also tend to be more supportive. Finally, current meat consumption predicts cell-based meat attitudes, but it varies in whether it predicts positive or negative attitudes... lower food neophobia and higher meat attachment have been linked to interest in buying cell-based meat.”

They also summarize that, “[a]cross two experiments, perceived naturalness was found to account for negative perceptions of cultured meat. And in one study, health risks associated with cell-based meat were less acceptable than the same risks associated with conventional meat—this effect was fully accounted for by perceived naturalness of the two products. Finally, a recent study found that a number of scales measuring general preferences for natural food were all predictive of negative attitudes to cell-based meat.”

This experiment did not include a measure of meat attachment, since most of the questions used in the most appropriate scale to measure this (João Graça, Maria Manuela Calheiros, and Abílio Oliveira, “Attached to Meat? (Un) Willingness and Intentions to Adopt a More Plant-Based Diet,” *Appetite* 95 (2015), 113-25) seem fairly likely to be affected by the varying treatment articles, such as “Meat is irreplaceable in my diet,” whereas others, such as “I love meals with meat,” do not.

Matti Wilks, Clive J. C. Phillips, Kelly Fielding, and Matthew J. Hornsey, “Testing Potential Psychological Predictors of Attitudes Towards Cultured Meat,” *Appetite* 136 (2019), 137-45 found that distrust of food scientists was one of “the most powerful predictors” of “negative attitudes and intentions toward cultured meat.” Political conservatism and food neophobia were also negative predictors of attitudes and intentions towards cultured meat. This analysis found that naturalness bias and speciesism were not significant predictors.

The section on “The Eaten” in Steve Loughnan, Brock Bastian, and Nick Haslam, “The Psychology of Eating Animals,” *Current Directions in Psychological Science* 23, no. 2 (2014), 104-8 summarizes several studies that provide evidence for the claim that, “an animal’s perceived mind and its perceived similarity to humans are key factors influencing people’s willingness to eat it.”

Catherine A. Forestell and John B. Nezlek, “Vegetarianism, Depression, and the Five Factor Model of Personality,” *Ecology of Food and Nutrition* 57, no. 3 (2018), 246-59 found that “vegetarians and pesco-vegetarians were more open to new experiences and less food neophobic” than omnivores.

Tessa M. Pollard, Andrew Steptoe, and Jane Wardle, “Motives Underlying Healthy Eating: Using the Food Choice Questionnaire to Explain Variation in Dietary Intake,” *Journal of Biosocial Science* 30, no. 2 (1998), 165-79 found no significant differences between vegetarians and those with “standard diet” in terms of their views on the importance of “natural content” in food choices, though “Respondents describing their diet as low in red meat attributed greater importance to... natural content... than did those who described their diets as standard.”

For a review and summary of studies linking speciesism to behaviors that discriminate against animals, see Kristof Dhont, Gordon Hodson, Ana C. Leite, and Alina Salmen, “The Psychology of Speciesism,” in Kristof Dhont and Gordon Hodson (eds.) *Why We Love and Exploit Animals: Bridging Insights from Academia and Advocacy* (Abingdon: Routledge, 2019), 29-49. Though the speciesism scale in Lucius Caviola, Jim A. C. Everett, and Nadira S. Faber, “The Moral Standing of Animals: Towards a Psychology of Speciesism,” *Journal of Personality and Social Psychology* (2018) has not been directly linked to meat consumption, this seems highly likely, given that Caviola, Everett, and Faber found that it predicted donations to animal causes and whether individuals choose a meat snack or a vegetarian snack as an additional reward for participation in the study.

Jo Anderson and Linda Tyler, “Attitudes Toward Farmed Animals in the BRIC Countries,” (September 2018), <https://faunalytics.org/attitudes-towards-farmed-animals-bric-countries/> found that 3% of US males and 5% of US females reported eating no meat or fish over the past year. For India, the figures were 28% and 34% respectively, and for Brazil, the figures were 1% and 2% respectively, although for both Russia and China the results were 2% and 1% respectively. Younger people tended to be vegetarian or vegan in the US but the opposite was the case in China and India; there was no consistent trend in Russia or Brazil.

Jayson Lusk, “Who are the Vegetarians?” (September 2014), <http://jaysonlusk.com/blog/2014/9/30/who-are-the-vegetarians> found that vegetarians tended to have higher incomes and tended to be more educated; these differences were statistically significant but quite small. For example, 24% of surveyed vegetarians earned more than \$100,000, and 54% had a college degree, compared to 18% and 45% respectively of surveyed non-vegetarians.

Matthew B. Ruby, “Vegetarianism. A Blossoming Field of Study,” *Appetite* 58, no. 1 (2012), 146 summarizes from previous research that “Western vegetarians tend to be liberal in their political views.” Ruby also summarizes on page 145 similar findings from two studies: “both education level and income were positively related to preferences for

factors moderate the effects of information about animal-free foods on AFO, which could affect how advocates of AFFT vary their messaging across different targeted audiences.

Cultured meat and meat-like plant-based food may not have identical effects on AFO; including separate intervention groups for each of these product types, as well as for low-tech plant-based foods, allows clearer testing of the effects of all such variations on AFO. The authors are not aware of previous research that distinguishes between the effects of these three product types on AFO.<sup>28</sup>

## Value for further research

Finally, questions of effective animal advocacy and food activism are still relatively neglected research questions, which can be addressed with a variety of research methods.<sup>29</sup> Researchers have used experiments to test the effect of advocacy messages on short-term reductions in animal product consumption,<sup>30</sup> but have rarely used them with the explicit purpose of addressing gaps in our understanding of long-term social change, such as shaping behavior and attitudes that seem likely to be most influential in the future of the food

---

meatless meals, and inversely related to preferences for red meat. Also, age was positively correlated with preferences for more meatless meals and negatively correlated with the consumption of red meat.”

Benjamin Allès, Julia Baudry, Caroline Méjean, Mathilde Touvier, Sandrine Péneau, Serge Hercberg, and Emmanuelle Kesse-Guyot, “Comparison of Sociodemographic and Nutritional Characteristics between Self-Reported Vegetarians, Vegans, and Meat-Eaters from the NutriNet-Santé Study,” *Nutrients* 9, no. 9 (September 2017), 1023, similarly to Faunalytics’ results for the US, found that a larger proportion of surveyed vegetarians (85.0%) than meat-eaters (77.9%) were female. Slightly fewer surveyed vegans were female (75.4%), although the numbers are close. A larger proportion of surveyed vegetarians (18.2%) and vegans (28.5%) than meat-eaters (10.2%) were aged 18-30. They found similarities between vegetarians, vegans, and meat-eaters on educational level and occupational categories. For example, 72.2% of vegetarians, 66% of vegans, and 65.7% of meat eaters included in the sample had an educational level of either undergraduate or post-graduate.

Jacy Reese, “Survey of US Attitudes Towards Animal Farming and Animal-Free Food October 2017” (November 2017), <https://www.sentienceinstitute.org/animal-farming-attitudes-survey-2017> found that females, people from the Northeast, as well as black and Hispanic people had more positive attitudes towards farmed animals, but found no significant differences by age, education, or income.

<sup>28</sup> No distinction was made between meat-like plant-based foods and low-tech plant-based foods in Bobbie Macdonald and Eva Vivalt, “The Impact of New Products on Ethical Beliefs” (November 8, 2017), <https://osf.io/4dczh/>.

<sup>29</sup> For a summary of evidence relating this question, see the section on “[meta] Social movements vs. EAA randomized controlled trials (RCTs) vs. intuition/speculation/anecdotes vs. external findings” in “Summary of Evidence for Foundational Questions in Effective Animal Advocacy,” Sentience Institute, last updated December 24, 2019, [https://www.sentienceinstitute.org/foundational-questions-summaries#\[meta\]-social-movements-vs.-eaa-randomized-controlled-trials-\(rcts\)-vs.-intuition/speculation/anecdotes-vs.-external-findings](https://www.sentienceinstitute.org/foundational-questions-summaries#[meta]-social-movements-vs.-eaa-randomized-controlled-trials-(rcts)-vs.-intuition/speculation/anecdotes-vs.-external-findings).

Jacy Reese, “Effective Animal Advocacy Researcher Survey June 2017” (June 2017), <https://www.sentienceinstitute.org/blog/eaa-researcher-survey-june-2017> found that answers to questions on the value of different types of evidence had ranges on scales of 1 (less valuable) to 10 (more valuable) of 2 to 10, 1 to 9, 1 to 7, and 2 to 9.

<sup>30</sup> See, for example, Nick Cooney, “Do Online Videos of Farmed Animal Cruelty Change People's Diets and Attitudes?” (March 2016), <https://mercyforanimals.org/impact-study>.

system decades or centuries from now.<sup>31</sup> As such, this experiment also aims to explore the tractability of this research approach.

## Methodology

The methodology for this study was pre-registered on the Open Science Framework.<sup>32</sup>

This survey was hosted on [GuidedTrack](#), a survey platform that uses easily-customizable code. We used Amazon Mechanical Turk workers as our sample pool. We excluded participants from outside the US and participants who failed a comprehension check question or an attention check question, which was partly based on Hauser (2015).<sup>33</sup> The participants were recruited via Positly, which has additional quality checks on participants, such as blocking duplicate IP addresses and blocking suspicious IP addresses.<sup>34</sup> We ran separate versions of the survey for different age and gender groups so that our sample was representative of the US for these two demographic characteristics.<sup>35</sup>

---

<sup>31</sup> For an exception, see Krystal Caldwell, “Welfare Reforms and Meat Consumption” (November 14, 2016), <https://mercyforanimals.org/welfare-reforms-survey>.

<sup>32</sup> Jamie Harris and Jacy Reese, “The Effects of Animal-Free Food Technology Awareness on Animal Farming Opposition” (April 2, 2020), <https://osf.io/xq86b>.

<sup>33</sup> David J. Hauser and Norbert Schwarz, “Attentive Turkers: MTurk Participants Perform Better on Online Attention Checks than do Subject Pool Participants,” *Behavior Research Methods* 48, no. 1 (2016), 400-7. The difficulty of the included attention check was intentionally lower than the recommendations of Hauser and Schwartz.

<sup>34</sup> “What are Participant Quality filters?” Positly, last edited January 21, 2019, <https://www.positly.com/support/quality-filters/>. When setting up a run, Positly provides further detail to users:

- “Block duplicate IP addresses”
- “Block suspicious IP addresses” — this “[p]revents participants from ISPs that are suspected to enable fraudulent activity”
- “Require high approval rate and experience” — this “[r]estricts to participants above 96% approval rate and 500 approved assignments”
- “Require attentive participants” — this “[r]estricts participants to those that consistently pass attention checks”
- “Restrict IP address geolocation by Country” — this “[p]revents participants from IP addresses geolocated outside the targeted country.”
- Positly is currently restricted to adults aged 18 or over.

We used all of these participant quality filters.

Amazon Mechanical Turk samples are more representative of general audiences than some alternative sampling methods, such as student samples, but are not perfectly representative. Gabriele Paolacci and Jesse Chandler, “Inside the Turk: Understanding Mechanical Turk as a Participant Pool,” *Current Directions in Psychological Science* 23, no. 3 (2014), 185 summarize that, “[i]n general, workers are diverse but not representative of the populations they are drawn from, reflecting that Internet users differ systematically from non-Internet users. Workers tend to be younger (about 30 years old), overeducated, underemployed, less religious, and more liberal than the general population (Berinsky, Huber, & Lenz, 2012; Paolacci et al., 2010; Shapiro, Chandler, & Mueller, 2013). Within the United States, Asians are overrepresented and Blacks and Hispanics are underrepresented relative to the population as a whole (Berinsky et al., 2012).”

<sup>35</sup> See [this](#) spreadsheet for the calculations. The US population data was from “2018: American Community Survey 1-Year Estimates Data Profile,” United States Census Bureau, accessed January 29, 2020, <https://data.census.gov/cedsci/table?q=United%20States&table=DP05&tid=ACSDP1Y2018.DP05&g=&lastDisplayedRow=24>.

Our calculations suggested that a sample size of around 1500 would be sufficient to detect small effects.<sup>36</sup> This exceeds the sample size that Cohen (1992) suggests would be needed to detect small effects in a multiple regression with 20 independent variables.<sup>37</sup>

Participants were assigned to one of two AFFT groups or to one of two control groups using simple randomization, with an equal allocation ratio between the four.

The first intervention group was shown a short article about the development of cultured meat. The second intervention group was shown a similar article about the development of high-tech plant-based meats that accurately mimic meat. The first control group was shown an article about the development of low-tech plant-based foods that do not attempt to accurately mimic meat. The second control group was shown an unrelated article about the use of mobile data to prevent traffic jams.

The articles were chosen to represent plausible media coverage of animal-free food. The articles were developed from those used in previous studies of the effects of variations in the naming of cultured meat.<sup>38</sup> Word count and reading ease were similar for all four articles.<sup>39</sup>

---

<sup>36</sup> G\* Power was used to compute the required sample size *a priori* — see Franz Faul, Edgar Erdfelder, Albert-Georg Lang, and Axel Buchner, “G\* Power 3: A Flexible Statistical Power Analysis Program for the Social, Behavioral, and Biomedical Sciences,” *Behavior Research Methods* 39, no. 2 (2007), 175-91.

The option “Linear multiple regression: Fixed model, R<sup>2</sup> deviation from zero” was selected. The f<sup>2</sup> effect size was set to 0.02, which is the conventional cutoff for “small” effect sizes, following J. E. Cohen, *Statistical Power Analysis for the Behavioral Sciences* (Hillsdale, NJ: Lawrence Erlbaum Associates Inc., 1988). Alpha (the risk of false positive results) was set to 0.05, the power (the risk of false negative results) was set to 0.80, and the number of predictors was set to 20. This suggested that a total sample size of 1064 would be needed.

However, in our main analysis, we intend to use the methods described by Yoav Benjamini and Yosef Hochberg, “Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing,” *Journal of the Royal Statistical Society: Series B (Methodological)* 57, no. 1 (1995), 289-300 to adjust for multiple hypothesis testing. For the sample size calculation, the alpha should therefore be lower than 0.05, but higher than 0.0025, the value that would be needed for the highly conservative Bonferroni correction, which would suggest a required sample size of 1705.

<sup>37</sup> Jacob Cohen, “A Power Primer,” *Psychological Bulletin* 112, no. 1 (1992), 158 notes that with a significance criterion of .05 and power at .80, a sample size of 757 would be needed to detect small differences in a multiple regression with 8 independent variables. For each additional independent variable included in the regression beyond 8 independent variables, it seems that the increase in required sample size will be 31 or fewer; this study used 20 independent variables, suggesting that a total sample size of around 1100 would have been sufficient.

<sup>38</sup> “‘Clean’ Meat or ‘Cultured’ Meat: A Randomized Trial Evaluating the Impact on Self-Reported Purchasing Preferences,” Animal Charity Evaluators (March 2017), <https://animalcharityevaluators.org/blog/clean-meat-or-cultured-meat-a-randomized-trial-evaluating-the-impact-on-self-reported-purchasing-preferences/> and “Clean Meat: The Naming of Tissue-Engineered Meat,” The Good Food Institute, accessed June 11, 2019, <http://mfait.gfi.org/the-naming-of-clean-meat>.

<sup>39</sup> The word count and reading ease scores were calculated using the “Flesch Kincaid Calculator” at <https://goodcalculators.com/flesch-kincaid-calculator/>. The cultured meat article had 243 words and a reading ease score of 47.6. The high-tech plant-based meat article had 218 words and a reading ease score of 49.2. The low-tech plant-based foods article had 220 words and a reading ease score of 47.1. The control article had 232 words and a reading ease score of 47.3. The mean word count was 228 and the mean reading ease score was 47.9.

The appendix contains the full text of the messages. Participants each saw only one message, followed by the AFO outcome questions, demographic questions, and other relevant psychological measures.

The AFO outcome measures were chosen based on Sentience Institute's 2017 and 2019 US surveys.<sup>40</sup> The order in which these AFO outcome measures were presented to participants was randomized.

The demographic questions were chosen to enable cross-comparability with SI's (2019) US survey.<sup>41</sup> The questions on distrust in science and food neophobia follow Wilks et al. in adapting questions from Frewer, Scholderer, and Bredahl (2003) and Pliner and Hobden (1992).<sup>42</sup> The questions on preference for naturalness were also from Wilks et al. (2019).<sup>43</sup> Following the recommendations of Hays, Hayashi, and Stewart (1989), a five-item measure of socially desirable response set was used.<sup>44</sup> The questions on attribution of mental capabilities to animals follow Rothgerber's (2014) adaptation of the scale used by Bastian et al. (2011).<sup>45</sup> The speciesism scale was developed by Caviola, Everett, and Faber (2018).<sup>46</sup> The order in which participants saw the questions on these psychological scales and on demographics was randomized, as was the order of the sub-questions within each psychological scale. Before the demographic questions, participants also saw

---

<sup>40</sup> Jacy Reese, "Survey of US Attitudes Towards Animal Farming and Animal-Free Food October 2017" (November 2017), <https://www.sentienceinstitute.org/animal-farming-attitudes-survey-2017> and Jacy Reese, "Animals, Food, and Technology Survey 2019" (forthcoming).

<sup>41</sup> Jacy Reese, "Animals, Food, and Technology Survey 2019" (forthcoming).

<sup>42</sup> Matti Wilks, Clive J. C. Phillips, Kelly Fielding, and Matthew J. Hornsey, "Testing Potential Psychological Predictors of Attitudes Towards Cultured Meat," *Appetite* 136 (2019), 137-45, adapting questions from the scales used by and Lynn J. Frewer, Joachim Scholderer, and Lone Bredahl, "Communicating about the Risks and Benefits of Genetically Modified Foods: The Mediating Role of Trust," *Risk Analysis: An International Journal* 23, no. 6 (2003), 1117-33 and Patricia Pliner and Karen Hobden, "Development of a Scale to Measure the Trait of Food Neophobia in Humans," *Appetite* 19, no. 2 (1992), 105-20.

Although other scales have been developed for food neophobia, the authors' impression is that this scale is the most widely used, including among studies of cultured meat.

<sup>43</sup> Matti Wilks, Clive J. C. Phillips, Kelly Fielding, and Matthew J. Hornsey, "Testing Potential Psychological Predictors of Attitudes Towards Cultured Meat," *Appetite* 136 (2019), 137-45.

Fabienne Michel and Michael Siegrist, "How Should Importance of Naturalness be Measured? A comparison of different scales," *Appetite* 140 (2019), 298-304 recommended that the shortest and oldest scale for measuring preferences for naturalness be used, which was developed by Andrew Steptoe, Tessa M. Pollard, and Jane Wardle, "Development of a Measure of the Motives Underlying the Selection of Food: The Food Choice Questionnaire," *Appetite* 25, no. 3 (1995), 267-84. However, Matti Wilks advised us (private email exchange, received December 3, 2019) that a focus on naturalness preferences in food, as in Steptoe, Pollard, and Wardle's (1995) scale may be tautological when applied to AFFT; people who like natural food dislike an unnatural food. Wilks et al.'s (2019) scale includes questions on more general preferences for naturalness.

<sup>44</sup> Ron D. Hays, Toshi Hayashi, and Anita L. Stewart, "A Five-item Measure of Socially Desirable Response Set," *Educational and Psychological Measurement* 49, no. 3 (1989), 629-36.

<sup>45</sup> Hank Rothgerber, "Efforts to Overcome Vegetarian-Induced Dissonance Among Meat Eaters," *Appetite* 79 (2014), 32-41, adapting questions from the scale used by Brock Bastian, Steve Loughnan, Nick Haslam, and Helena R. M. Radke, "Don't Mind Meat? The Denial of Mind to Animals Used for Human Consumption," *Personality and Social Psychology Bulletin* 38, no. 2 (2012), 247-56.

<sup>46</sup> Lucius Caviola, Jim A. C. Everett, and Nadira S. Faber, "The Moral Standing of Animals: Towards a Psychology of Speciesism," *Journal of Personality and Social Psychology* (2018).

questions about familiarity with animal-free foods, based on the question used by Bryant et al. (2019),<sup>47</sup> and a question on participants' intention to change their consumption of animal products.<sup>48</sup>

## Results

The statistical analysis was done with R with code available in the appendix, which was preregistered.<sup>49</sup> A small number of data cleaning decisions were made following data collection.<sup>50</sup> For the AFO outcome measures, the mean of question responses was used as the scale. Non-responses and participants who failed the attention or quality checks were excluded. A controlled false discovery rate (FDR) of 0.1 was used, meaning we are 90% sure any given significant result reflects an actual difference in responses, for the 20 tests in the confirmatory analysis.<sup>51</sup>

After data cleaning, there were 1,502 valid responses.

We constructed a linear model to predict AFO “score.” The regression assessed whether and to what extent the AFO score was affected by 1) whether the participant was shown information about AFFT (either cultured meat or meat-like plant-based meat) or one of the two control groups (low-tech plant-based meat or the use of mobile data to prevent traffic jams), 2) participant demographic variables, using the most common

---

<sup>47</sup> Christopher John Bryant, Keri Szejda, Varun Deshpande, Nishant Parekh, and Brian Tse, “A Survey of Consumer Perceptions of Plant-Based and Clean Meat in the USA, India, and China,” *Frontiers in Sustainable Food Systems* 3 (2019). The answers to these questions were used in exploratory analysis. They were not included in the confirmatory analysis, since the experiment was designed to manipulate familiarity with animal-free foods and the authors expected that controlling for self-reported prior familiarity would reduce the apparent effect size of emphasizing information about AFFT.

<sup>48</sup> The question on participants' intention to change their consumption of animal products is original.

Intention is associated with behavior. For example, Mark Conner and Paul Norman, “Predicting and Changing Health Behaviour: A Social Cognition Approach,” in Mark Conner and Paul Norman (eds.), *Predicting and Changing Health Behaviour: Research and Practice with Social Cognition Models* (Maidenhead: Open University Press, 2015; first published 1995), 17-8 list the results of several meta-analyses, showing the effect sizes of eight different predictors on intentions to change health behaviors and on the health behaviors themselves. The effect size on behavior averages as 69% of the effect size on intention. The correlation between “Behavioural intention/protection motivation/goals” and behaviour is listed as  $r = 0.42$ . They also summarize that “Webb and Sheeran (2006) reviewed studies that significantly changed intentions ( $d = 0.66$ ) and reported that these studies had medium-sized effects on behaviour ( $d = 0.36$ ).”

<sup>49</sup> Jamie Harris and Jacy Reese, “The Effects of Animal-Free Food Technology Awareness on Animal Farming Opposition” (April 2, 2020), <https://osf.io/xq86b>.

<sup>50</sup> The following changes were made:

- Six participants noted in the feedback on the survey that they had clicked on the wrong option for a demographic question and provided specific details about what the correct answer should have been. These mistakes were manually corrected (see the “[Positly feedback for AFFT study](#)” spreadsheet).
- One participant (7d79186d) was listed as having completed the variant of the comprehension question that was only given to those randomized to the mobile data article. However, they were not recorded as having been part of the “control” group as all other participants who had answered this question were. This participant was manually entered as having been part of the “control” group.

<sup>51</sup> The methods described in Yoav Benjamini and Yosef Hochberg, “Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing,” *Journal of the Royal Statistical Society: Series B (Methodological)* 57, no. 1 (1995), 289-300 were used to control the FDR.



characteristic as the comparison group for categorical variables with three or more categories, and 3) other relevant psychological measures, where the mean of question responses was used as the scale, except for in the five-item measure of socially desirable response set (SDRS), which was analyzed as a score between 0 and 5.

The regression finds that increasing individuals' awareness of animal-free food technology has significant negative effects on animal farming opposition. The regression coefficient is -0.17 on the 5-point scale.<sup>52</sup> Several other predictors are significantly correlated with AFO, as shown in table 2.

Table 2: Results of the confirmatory analysis linear regression

Variable	Coefficient	FDR-adjusted p-value	Interpretation of finding
(Intercept)	4.71	0.00***	
AFFT	-0.17	0.01**	Awareness of AFFT decreases AFO.
Preference for naturalness	0.24	0.00***	Preference for naturalness is correlated with higher AFO.
Distrust in science	-0.03	0.50	
Speciesism	-0.59	0.00***	Lower speciesism is correlated with higher AFO.
Food neophobia	0.07	0.02**	Higher food neophobia is correlated with higher AFO.
SDRS	0.03	0.23	
Attribution of mental capabilities to animals	0.11	0.00***	Higher attribution of mental capacities to animals is correlated with higher AFO.
Income	0.00	0.07*	Lower income is correlated with higher AFO.
Gender (male)	-0.12	0.10*	Male gender is correlated with lower AFO.
Ethnicity (Asian)	-0.17	0.21	
Ethnicity (black)	-0.04	0.76	
Ethnicity (Hispanic)	-0.07	0.72	
Ethnicity (Native American)	0.49	0.21	
Ethnicity (other)	-0.53	0.10*	Ethnicity (other) is correlated with lower AFO.
Age	0.00	0.32	
Conservatism	-0.17	0.00***	Conservatism is correlated with lower AFO.

<sup>52</sup> As exploratory analysis, the regression was carried out using a version of the AFO score where the component questions were standardized to have a mean of 0 and standard deviation of 1. In this regression, the coefficient for the AFFT variable was -0.08, which is smaller than the threshold for what is conventionally interpreted as a “small” effect size, following J. E. Cohen, *Statistical Power Analysis for the Behavioral Sciences* (Hillsdale, NJ: Lawrence Erlbaum Associates Inc., 1988), 79.

Education	0.03	0.07*	Education is correlated with higher AFO.
Region (Midwest)	0.02	0.80	
Region (Northeast)	0.13	0.18	
Region (West)	0.02	0.80	

Multiple R-squared: 0.5081, Adjusted R-squared: 0.5014

\*  $p < 0.10$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

## Exploratory analysis

Variations of the regression with fewer predictors were carried out.<sup>53</sup> The full results are visible in the [results spreadsheet](#). Participants' speciesism, food neophobia, preference for naturalness, attribution of mental capabilities to animals, and conservatism are significant predictors of AFO in each regression in which they are included. Whether the participant read an article about AFFT or not is a significant predictor of AFO in all models except for the model including interaction terms between AFFT and food neophobia and between AFFT and preferences for naturalness. Participants' distrust in science, SDRS, gender, income, ethnicity (other), ethnicity (black), age, education, and region (Northeast) are significant predictors in one or more of the regressions but not in all of the regressions in which they are included. Ethnicity (Asian), ethnicity (Hispanic), ethnicity (Native American), region (Midwest), and region (West) are not significant predictors in any of the models.

When prior familiarity with AFFT was added to the main model, it was significantly positively correlated with AFO. At first glance, this appears to have opposite implications to the main model. However, it seems likely that individuals who have high AFO are more likely to have sought out information about animal-free foods in general, including AFFT, or otherwise have been exposed to this information. Therefore, it seems plausible that high AFO causes higher AFFT awareness, rather than the reverse. As evidence of this hypothesis, awareness of "plant-based foods in general (i.e. vegetarian or vegan food)" was also added to the model. This predictor was found to significantly positively correlate with AFO and awareness of AFFT was no longer significant as a predictor.

When terms are added for the interaction between whether the participant read an article about AFFT or not and food neophobia and between whether the participant read an article about AFFT or not and preferences for naturalness, these interaction terms are not significant.

---

<sup>53</sup> We conducted analysis of: 1) a model testing only the effect of varying the treatment group, 2) a model that also incorporates demographic variables, 3) the full model minus the psychological measures that seem intuitively most similar to the AFO outcome measure — speciesism and the attribution of mental capabilities to animals, 4) the full model plus a variable that accounts for familiarity with AFFT, 5) the full model plus variables that account for both familiarity with AFFT and familiarity with plant-based foods" in general.

Additional variations of the regression were carried out that compared more directly between different combinations of treatment groups, as summarized in table 2 below. The full results are visible on the [results spreadsheet](#).

Table 3: Exploratory analysis: Data subsets

Included data	Coefficient	FDR-adjusted p-value	Interpretation
Mobile data control (referent) and AFFT	-0.15	0.07*	Those viewing articles about AFFT had significantly lower AFO than those viewing the mobile data control article.
Low-tech plant-based meat (referent) and AFFT	-0.18	0.03**	Those viewing articles about AFFT had significantly lower AFO than those viewing the article about low-tech plant-based meat.
Cultured meat (referent) and high-tech plant-based meat only	-0.03	0.84	There are no significant differences in AFO between those viewing the article about high-tech plant-based meat and those viewing the article about cultured meat.
Low-tech plant-based meat (referent) and high-tech plant-based meat only	-0.20	0.04**	Those viewing articles about high-tech plant-based meat had significantly lower AFO than those viewing the article about low-tech plant-based meat
Mobile data control (referent) and low-tech plant-based meat only	0.01	0.95	There are no significant differences in AFO between those viewing the article about low-tech plant-based meat and those viewing the mobile data control article.
Only those with scores less than 3 out of 5 for AFFT awareness	-0.19	0.29	Increased awareness of AFFT was associated with decreased AFO for those with low prior awareness of AFFT, but this effect was not significant. <sup>54</sup>

\*  $p < 0.10$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

Additional regressions were carried out that checked whether participants' speciesism, attribution of mental capacities to animals, intention to change their consumption of animal products, or discomfort with the way animals are used in the food industry (one of the five AFO questions) are affected by AFFT awareness. Exposure to the AFFT articles did not have a significant effect on any of these variables. In each of these four models, the adjusted R-squared values are substantially lower than in the main model where AFO was the dependent variable. The full results are visible on the [results spreadsheet](#).

<sup>54</sup> Although this difference was not significant, there were only 361 participants who scored lower than 3 out of 5 for their awareness of AFFT. Hence, this linear regression was underpowered to detect small differences. The regression coefficient in this model was similar to the regression coefficient in the main model.

# Discussion

Most of our [hypotheses](#) were rejected by this study or were inconclusive.

The decision of animal advocates on what information to share in their materials (e.g. online ads, op-eds, documentaries) is complex and based on a wide variety of factors. Since awareness of AFFT appears to reduce AFO, this is evidence against including such information for the purpose of encouraging attitude change, though there are other reasons to include it, such as normalizing AFFT or encouraging investment in the technologies.

Exploratory analysis suggests that increasing awareness or salience<sup>55</sup> of low-tech plant-based foods did not significantly affect AFO, although prior awareness of plant-based foods was positively correlated with AFO. This suggests that, if animal advocates want to incorporate information about animal-free foods into their materials (e.g. to show an alternative to animal products), they may want to emphasize low-tech products rather than cultured meat or high-tech plant-based products. This conclusion is also supported by Macdonald and Vivalt's (2017) findings that messaging about the harms of conventional animal farming was significantly less effective at changing "ethical beliefs" if it included information about cultured meat, but that inclusion of information about an "animal-free" meat substitute" had no significant effects on ethical beliefs.<sup>56</sup>

Exploratory analysis suggests that the effects of cultured meat and high-tech plant-based meat on AFO are similar.

Exploratory analysis suggests that information about AFFT has negative effects on AFO regardless of whether it displaces unrelated information or information about low-tech plant-based meat.

As discussed above,<sup>57</sup> there are numerous psychological mechanisms through which AFFT might influence AFO. Exploratory analysis suggests that exposure to the AFFT articles has no significant effect on participants' speciesism or attribution of mental capacities to animals, suggesting that participants do not change their underlying beliefs about animals in order to reduce any cognitive dissonance that they might experience as a result of reading the AFFT articles. There are several psychological mechanisms that remain plausible explanations for why awareness of AFFT decreased AFO:

- The AFFT articles could encourage perceptions of the end of animal farming as inevitable, making people more likely to dismiss actions to help animals as unnecessary. This could encourage participants to reduce their cognitive dissonance by adjusting their political views instead of their views about animals. The present study provides some support for this hypothesis. Four out of five of the questions used in the AFO scale assess willingness to support actions to help animals, while the fifth — asking whether participants have "some discomfort with the way animals are used in the

---

<sup>55</sup> Because most U.S. are already aware of low-tech plant-based food options (e.g. beans), this is a different sort of "awareness" than the message texts that brought up foods that most U.S. adults presumably know little about. However, the message texts still seem to approximate the real-world inclusion of information in advocacy materials.

<sup>56</sup> See footnote 18.

<sup>57</sup> See the section on "The effects of AFFT on Animal Farming Opposition."

food industry” — does not. Exploratory analysis using only this discomfort question as the dependent variable finds no significant effect of increased awareness of AFFT.

- If the AFFT articles encourage the view that animal-free alternatives are unnatural, they could strengthen one of the key justifications for animal product consumption.
- If the AFFT articles encourage a perception that AFFT is currently of low quality, they could make animal farming seem relatively more appealing.
- The AFFT articles could increase the association of animals with food by emphasizing that many food products currently contain animals. This could make animal farming seem like a more necessary part of food production.

Further studies could explore which of these mechanisms best explains why AFFT decreased AFO. Further studies could also test whether the findings of the present study hold in different contexts (e.g. with respondents from outside the US) and with different messaging conditions (e.g. more comparable to those that animal advocates would use).

Sentience Institute’s 2017 and 2019 US surveys identified an increase in AFO between those two years.<sup>58</sup> The present study provides evidence that this increase is unlikely to have been caused by increases in awareness of AFFT and weak evidence that it could have been caused by increases in awareness and salience of plant-based foods more generally.<sup>59</sup> An alternative explanation, consistent with other available evidence,<sup>60</sup> is that awareness of animal welfare reforms such as California’s Proposition 12 (passed in 2018) caused increases in AFO.<sup>61</sup> Numerous other actions of animal protection, environmental, or public health advocates, as well as broader social trends encouraging moral progress, could also lead to increased AFO over time.

This was the first study to test whether certain psychological characteristics predict AFO. As shown in table 4, the results suggest differences between these characteristics’ correlations with AFO, interest in cultured meat, and vegetarianism.

Table 4: psychological characteristics and their correlations with animal farming opposition, interest in cultured meat, and vegetarianism.<sup>62</sup>

Predictor	Correlation with AFO (this study)	Correlation with interest in cultured meat	Correlation with vegetarianism
Preference for naturalness	Positive	Negative	Not significant
Distrust in science	Not significant	Negative	Untested, to our knowledge

<sup>58</sup> Jacy Reese, “Survey of US Attitudes Towards Animal Farming and Animal-Free Food October 2017” (November 2017), <https://www.sentienceinstitute.org/animal-farming-attitudes-survey-2017> and Jacy Reese, “Animals, Food, and Technology Survey 2019” (forthcoming).

<sup>59</sup> Exploratory analysis suggests that increasing awareness of low-tech plant-based meat did not significantly affect AFO, but prior awareness of plant-based foods was positively correlated with AFO.

<sup>60</sup> See the paragraph above beginning “Food companies and researchers...”

<sup>61</sup> See “California Proposition 12, Farm Animal Confinement Initiative (2018),” Ballotpedia, accessed May 30, 2020, [https://ballotpedia.org/California\\_Proposition\\_12,\\_Farm\\_Animal\\_Confinement\\_Initiative\\_\(2018\)](https://ballotpedia.org/California_Proposition_12,_Farm_Animal_Confinement_Initiative_(2018)).

<sup>62</sup> The latter two columns are based on information cited in footnote 26.

Speciesism	Positive	Not significant	Positive
Food neophobia	Positive	Negative	Negative
Attribution of mental capabilities to animals	Positive	Untested, to our knowledge	Positive
Conservatism	Negative	Negative	Negative

Given the surprising results, this study encouraged us to update our beliefs on the foundational questions in effective animal advocacy slightly more than expected. For this reason, we also slightly increased our expectations of the value of conducting additional randomized controlled trials and surveys for answering these questions, though running this experiment also took slightly longer than we expected.<sup>63</sup>

## Appendix

### Message Texts

---



---

#### Cultured: the future of food?

*PUBLISHED: 20 January 2020*




---

Dr. Lewis Anderson, a researcher at the University of Stockholm, recently served up a new cultured meat product for taste testing to a panel of chefs.

Cultured meat involves painlessly taking tissue from a live animal, extracting cells from the tissue, and feeding and nurturing them until they multiply many times. Eventually, the cells come together into small strips of muscle about a centimeter long and a few millimeters thick. Thousands of these strips are then layered together to form a meat product. From one tiny piece of tissue can come 45,000 pounds of meat. Researchers like Anderson are confident that cultured products will soon look, taste, and feel exactly like conventional meat.

“We’ve come a long way since cultured foods were first developed and tested,” said Dr. Anderson in a recent interview in his office in Stockholm University. “The costs have come down and the taste and texture have improved.”

“I think really the most important driver is the realization that livestock production has serious issues,” he said. “There are increasing concerns about animal welfare, such as animals being kept in close confinement that prevents them from engaging in natural behaviors. And of course, there are growing concerns about the consequences of industrial farming for the environment and our health.”

---

<sup>63</sup> For discussion, see the paragraph beginning “Therefore, the market effects...” and the section “Value for further research” above. For the updates to our views, see the “Value of research” tab in [this spreadsheet](#).

As public awareness of cultured meat grows, proponents like Anderson seem hopeful that their products will one day become just as popular as meat grown on animals — perhaps even more so.

---

Share or comment on this article




---

## Plant-based: the future of food?

*PUBLISHED: 20 January 2020*



Dr. Lewis Anderson, a researcher at the University of Stockholm, recently served up a new plant-based meat product for taste testing to a panel of chefs.

Plant-based meat involves using heme from soy plants, which is what gives it its distinctly meaty flavor. The heme is made using yeast. First, yeast is grown via fermentation. Then, soy leghemoglobin (containing heme) is isolated from the yeast, and added to the other ingredients. Researchers like Anderson are confident that plant-based products will soon look, taste, and feel exactly like conventional meat.

“We’ve come a long way since plant-based foods were first developed and tested,” said Dr. Anderson in a recent interview in his office in Stockholm University. “The costs have come down and the taste and texture have improved.”

“I think really the most important driver is the realization that livestock production has serious issues,” he said. “There are increasing concerns about animal welfare, such as animals being kept in close confinement that prevents them from engaging in natural behaviors. And of course, there are growing concerns about the consequences of industrial farming for the environment and our health.”

As public awareness of plant-based meat grows, proponents like Anderson seem hopeful that their products will one day become just as popular as meat grown on animals — perhaps even more so.

---

Share or comment on this article




---

## Plant-based: the future of food?

*PUBLISHED: 20 January 2020*



---

Dr. Lewis Anderson, a chef in Stockholm, recently served up some plant-based dishes for taste testing to a panel of chefs.

Plant-based products sometimes use ingredients like pulses, grains, or mushrooms to fill the same role that meat often plays in a meal. These products add variety to the available plant-based food options, which also include more traditional dishes, like vegetable soups, or meals focused on beans and rice. Though plant-based foods look, taste, and feel different to conventional meat, culinary professionals like Anderson are confident that they can create food that is just as enjoyable, if not more so.

“We’ve continued to develop and improve plant-based foods,” said Dr. Anderson in a recent interview in his office in Stockholm. “There is now a large range of tasty and affordable products available.”

“I think really the most important driver is the realization that livestock production has serious issues,” he said. “There are increasing concerns about animal welfare, such as animals being kept in close confinement that prevents them from engaging in natural behaviors. And of course, there are growing concerns about the consequences of industrial farming for the environment and our health.”

As public awareness of plant-based food grows, proponents like Anderson seem hopeful that their products will one day become just as popular as meat — perhaps even more so.

---

Share or comment on this article




---

## Use of mobile data can reduce traffic jams

*PUBLISHED: 20 January 2020*



Dr. Lewis Anderson, a researcher at the University of Stockholm, recently conducted a study seeking to use data to achieve reductions in traffic jams.

The study found that using data from mobile phone networks to track the movement of people across the country can help predict where traffic jams are likely to occur, enabling authorities to take preventative measures. The phones provide information via the Global Positioning System (GPS), a network of satellites orbiting the Earth. Signals are intercepted by GPS receivers, which calculate how far away each satellite is based on how long it took for the messages to arrive.

“This is the first time we are using the mobile data to address the regular movements of people within a country, such as on their daily commute,” says Dr. Anderson. “This kind of big data will help with the reduction of traffic jams.”

“I think really the most important motivation for this sort of research is the realization that traffic jams contribute to serious issues,” he said. “Last year, drivers lost an average of just under one week’s worth of time, dealing with



slow-moving traffic. This wasted time has financial costs through lost productivity. And of course, this traffic contributes to unnecessary pollution.”

As understanding of movement patterns grows, proponents like Anderson seem hopeful that their work will one day be a part of the solution to the traffic jam problem.

---

Share or comment on this article




---

## Guided Track code

Thank you for participating in this survey. Please note that you cannot go back in this survey, so please take your time before clicking on an answer.

Definition:

A /\*factory farm\*/ is a large industrialized farm, especially one on which a large number of animals are kept indoors in conditions intended to maximize production at minimal cost.

\*wait: 4.seconds

\*button:I'm ready!

\*experiment: main intervention variation

\*group: cultured meat

\*page

\*Please read carefully. There will be a short delay before you can proceed and you will need to answer comprehension questions to make sure you read and understood the article.\*

\*image:

[https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226211/SI%20RCT/Cultured\\_rejj5l.png](https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226211/SI%20RCT/Cultured_rejj5l.png)

\*wait: 20.seconds

\*button: I have read the article and am ready to continue the survey!

\*question: \*Which of the following best describes the topic of the article that you just read?\*

\*shuffle

Foods that could replace conventional animal products

Vacuum cleaners

Courses to improve writing skills

Participation in sports and physical activity

\*group: high-tech plant-based meat

\*page

\*Please read carefully. There will be a short delay before you can proceed and you will need to answer comprehension questions to make sure you read and understood the article.\*

\*image:

[https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226252/SI%20RCT/HT\\_PB\\_ti2aev.png](https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226252/SI%20RCT/HT_PB_ti2aev.png)

\*wait: 20.seconds

\*button: I have read the article and am ready to continue the survey!

\*question: \*Which of the following best describes the topic of the article that you just read?\*

\*shuffle

Foods that could replace conventional animal products

Vacuum cleaners

Courses to improve writing skills

Participation in sports and physical activity

\*group: low-tech plant-based meat

\*page

\*Please read carefully. There will be a short delay before you can proceed and you will need to answer comprehension questions to make sure you read and understood the article.\*

\*image:

[https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226287/SI%20RCT/LT\\_PB\\_mg5hml.png](https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226287/SI%20RCT/LT_PB_mg5hml.png)

\*wait: 20.seconds

\*button: I have read the article and am ready to continue the survey!

\*question: \*Which of the following best describes the topic of the article that you just read?\*

\*shuffle

Foods that could replace conventional animal products

Vacuum cleaners

Courses to improve writing skills

Participation in sports and physical activity

\*group: control

\*page

\*Please read carefully. There will be a short delay before you can proceed and you will need to answer comprehension questions to make sure you read and understood the article.\*

\*image:

[https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226326/SI%20RCT/Mobile\\_data\\_uhmi6o.png](https://res.cloudinary.com/dfvw2kzwa/image/upload/v1580226326/SI%20RCT/Mobile_data_uhmi6o.png)

\*wait: 20.seconds

\*button: I have read the article and am ready to continue the survey!

\*question: \*Which of the following best describes the topic of the article that you just read?\*

\*shuffle

The use of mobile data to prevent traffic jams

Vacuum cleaners

Courses to improve writing skills

Participation in sports and physical activity

>>AFOAgreementScale=[["Strongly agree", 7], ["Agree", 6], ["Somewhat agree", 5], ["Somewhat disagree", 3], ["Disagree", 2], ["Strongly disagree", 1], ["No opinion", 4]]

>>AFOLikelyScale=[["Very likely", 7], ["Likely", 6], ["Somewhat likely", 5], ["Somewhat unlikely", 3], ["Unlikely", 2], ["Very unlikely", 1], ["No opinion", 4]]

>>DietIntentions=[["Very likely to increase", 1], ["Likely to increase", 2], ["Somewhat likely to increase", 3], ["Somewhat likely to decrease", 5], ["Likely to decrease", 6], ["Very likely to decrease", 7], ["No opinion", 4]]

>>AgreementScale=[["Strongly agree", 7], ["Agree", 6], ["Somewhat agree", 5], ["Neither agree nor disagree", 4], ["Somewhat disagree", 3], ["Disagree", 2], ["Strongly disagree", 1]]

>>ReverseAgreementScale=[["Strongly agree", 1], ["Agree", 2], ["Somewhat agree", 3], ["Neither agree nor disagree", 4], ["Somewhat disagree", 5], ["Disagree", 6], ["Strongly disagree", 7]]

>>CapacitiesScale=[["1 - animals definitely do not possess", 1], ["2", 2], ["3", 3], ["4", 4], ["5", 5], ["6", 6], ["7 - animals definitely do possess", 7]]

>>FamiliarityScale=[["Not familiar at all", 1], ["Slightly familiar", 2], ["Moderately familiar", 3], ["Very familiar", 4], ["Extremely familiar", 5]]

>>TrueOrFalse=[["Definitely true", 1], ["Mostly true", 0], ["Don't know", 0], ["Mostly false", 0], ["Definitely false", 0]]

>>ReverseTrueOrFalse=[["Definitely true", 0], ["Mostly true", 0], ["Don't know", 0], ["Mostly false", 0], ["Definitely false", 1]]

>>Education=[["Grade 4 or less", 1], ["Grade 5 to 8", 2], ["Grade 9 to 11", 3], ["Grade 12 (no diploma)", 4], ["High school graduate", 5], ["GED or Alternative Credential", 6], ["Some college credit, but less than 1 year of college credit", 7], ["1 or more years of college credit, no degree", 8], ["Associate's degree (for example: AA, AS)", 9], ["Bachelor's degree (for example: BA, BS)", 10], ["Master's degree (for example: MA, MS, MEng, MEd, MBA)", 11], ["Professional degree beyond Bachelor's degree (for example: MD, DDS, DVM, LIB, JD)", 12], ["Doctorate degree (for example: PhD, EdD)", 13]]

>>Income=[["Less than \$5,000", 2500], ["\$5,000-\$9,999", 7500], ["\$10,000-\$14,999", 12500], ["\$15,000-\$19,999", 17500], ["\$20,000-\$24,999", 22500], ["\$25,000-\$29,999", 27500], ["\$30,000-\$34,999", 32500], ["\$35,000-\$39,999", 37500], ["\$40,000-\$44,999", 42500], ["\$45,000-\$49,999", 47500], ["\$50,000-\$54,999", 52500], ["\$55,000-\$59,999", 57500], ["\$60,000-\$64,999", 62500], ["\$65,000-\$69,999", 67500], ["\$70,000-\$74,999", 72500], ["\$75,000-\$79,999", 77500], ["\$80,000-\$89,999", 85000], ["\$90,000-\$99,999", 95000], ["\$100,000-\$124,999", 112500], ["\$125,000-\$149,999", 137500], ["\$150,000-\$199,999", 175000], ["\$200,000-\$249,999", 225000], ["\$250,000 or more", 300000]]

\*randomize: all

\*page

\*randomize: all

\*question: \*Please rate your level of agreement with the following statement: I have some discomfort with the way animals are used in the food industry.\*

\*answers: AFOAgreementScale

\*question: \*Please rate your level of agreement with the following statement: I support a ban on the factory farming of animals.\*

\*answers: AFOAgreementScale

\*question: \*Please rate your level of agreement with the following statement: I support a ban on slaughterhouses.\*

\*answers: AFOAgreementScale

\*question: \*Please rate your level of agreement with the following statement: I support a ban on animal farming.\*

\*answers: AFOAgreementScale

\*question: \*Suppose a public demonstration against the problems of factory farming occurred near where you live and your friend asked you to come demonstrate with her. If this demonstration fit into your schedule, how likely would you be to join and help demonstrate?\*

\*answers: AFOLikelyScale

Definition:

A /*factory farm*/ is a large industrialized farm, especially one on which a large number of animals are kept indoors in conditions intended to maximize production at minimal cost.

\*randomize: all

\*page

\*Listed below are a few statements about your relationships with others. How much is /each/ statement TRUE or FALSE for you?\*

\*randomize: all

\*question: \*I am always courteous, even to people who are disagreeable.\*

\*answers: TrueOrFalse

\*question: \*There have been occasions when I took advantage of someone.\*

\*answers: ReverseTrueOrFalse

\*question: \*I sometimes try to get even rather than forgive and forget.\*

\*answers: ReverseTrueOrFalse

\*question: \*I sometimes feel resentful when I don't get my way.\*

\*answers: ReverseTrueOrFalse

\*question: \*No matter who I'm talking to, I'm always a good listener.\*

\*answers: TrueOrFalse

\*page

\*To what extent do you agree with the following statements?\*

\*randomize: all

\*question: \*Morally, animals always count for less than humans.\*

\*answers: AgreementScale

\*question: \*Humans have the right to use animals however they want to.\*

\*answers: AgreementScale

\*question: \*It is morally acceptable to keep animals in circuses for human entertainment.\*

\*answers: AgreementScale

\*question: \*It is morally acceptable to trade animals like possessions.\*

\*answers: AgreementScale

\*question: \*Chimpanzees should have basic legal rights such as a right to life or a prohibition of torture.\*

\*answers: ReverseAgreementScale

\*question: \*It is morally acceptable to perform medical experiments on animals that we would not perform on any human.\*

\*answers: AgreementScale

\*page

\*To what extent do you believe that animals and humans have the following mental capacities to the same degree as humans?\*

\*randomize: all

\*question: \*Self-control?\*

\*answers: CapacitiesScale

\*question: \*Morality?\*

\*answers: CapacitiesScale

\*question: \*Memory?\*

\*answers: CapacitiesScale

\*question: \*Planning?\*

\*answers: CapacitiesScale

\*page

\*Please rate your level of agreement with the following statements:\*

\*randomize: all

\*question: \*I am constantly sampling new and different foods.\*

\*answers: ReverseAgreementScale

\*question: \*I don't trust new foods.\*

\*answers: AgreementScale

\*question: \*If I don't know what is in a food, I won't try it.\*

\*answers: AgreementScale

\*question: \*I like foods from different countries.\*

\*answers: ReverseAgreementScale

\*question: \*Ethnic food looks too weird to eat.\*

\*answers: AgreementScale

\*question: \*At dinner parties, I will try a new food.\*

\*answers: ReverseAgreementScale

\*question: \*I am afraid to eat things I have never had before.\*

\*answers: AgreementScale

\*question: \*I am very particular about the foods I will eat.\*

\*answers: AgreementScale

\*question: \*I will eat almost anything.\*

\*answers: ReverseAgreementScale

\*question: \*I like to try new ethnic restaurants.\*

\*answers: ReverseAgreementScale

\*page

\*Please rate your level of agreement with the following statements:\*

\*randomize: all

\*question: \*More often than not, human intervention causes damage to nature.\*

\*answers: AgreementScale

than people expect.\*

\*answers: AgreementScale

\*question: \*Natural things tend to be healthier than non-natural things.\*

\*answers: AgreementScale

\*question: \*Natural medicine is more effective than medicine made in a lab.\*

\*answers: AgreementScale

\*question: \*Natural food tastes better than processed food.\*

\*answers: AgreementScale

\*question: \*Natural food is safer than processed food.\*

\*answers: AgreementScale

\*question: \*Natural medicine is safer than medicine made in a lab.\*

\*answers: AgreementScale

natural.\*

\*answers: AgreementScale

\*page

\*Please rate your level of agreement with the following statements:\*

\*randomize: all

from the public.\*

\*answers: AgreementScale

\*question: \*Information about food-related hazards from scientists is distorted.\*

\*answers: AgreementScale

to the public.\*

\*answers: ReverseAgreementScale

made in the food-related information provided.\*

\*answers: ReverseAgreementScale

\*page

\*Please ignore the question below and all of the personality items listed; instead select the second option listed (introversion and thinking).\*

\*question: \*Which of these personality traits best describe you and your personality?\*

Prefer extraversion, prefer thinking

Prefer introversion, prefer thinking

Prefer extraversion, prefer feeling

Prefer introversion, prefer feeling  
Other

\*page

\*question: \*Over the next month, how is your consumption of animal products (meat, dairy, and/or eggs) likely to change?\*

\*answers: DietIntentions

\*page

\*randomize: all

\*question: \*Prior to this survey, how familiar were you with "cultured meat" (also known as "clean meat," "cultivated meat," or "in-vitro meat")?\*

\*answers: FamiliarityScale

\*question: \*Prior to this survey, how familiar were you with "plant-based meats" that use heme and other ingredients to mimic the taste of regular meat ("bleeding burgers")?\*

\*answers: FamiliarityScale

\*question: \*Prior to this survey, how familiar were you with "plant-based foods" in general (i.e. vegetarian or vegan food)?\*

\*answers: FamiliarityScale

\*randomize: all

\*question: \*Please state your age (in years).\*

\*type: number

\*question: \*Please indicate your annual household income before taxes.\*

\*answers: Income

\*question: \*What is the highest degree or level of school you have completed? If currently enrolled, select the previous grade or highest degree received.\*

\*answers: Education

\*question: \*Which of the following best describes you?\*

White or Caucasian (not Hispanic or Latino)  
Black or African-American (not hispanic or Latino)  
Asian or Pacific Islander  
Native American, Alaska Native, or Aleutian  
Hispanic or Latino (White or Caucasian)  
Hispanic or Latino (Black or African-American)  
Hispanic or Latino (All other races/multiple races)  
Other

\*question: \*What is your gender?\*



Male

Female

\*question: \*Which state do you live in?\*

Alabama

Alaska

Arizona

Arkansas

California

Colorado

Connecticut

Delaware

Florida

Georgia

Hawaii

Idaho

Illinois

Indiana

Iowa

Kansas

Kentucky

Louisiana

Maine

Maryland

Massachusetts

Michigan

Minnesota

Mississippi

Missouri

Montana

Nebraska

Nevada

New Hampshire

New Jersey

New Mexico

New York

North Carolina

North Dakota

Ohio

Oklahoma

Oregon

Pennsylvania

Rhode Island

South Carolina  
 South Dakota  
 Tennessee  
 Texas  
 Utah  
 Vermont  
 Virginia  
 Washington  
 West Virginia  
 Wisconsin  
 Wyoming

\*page

\*randomize

\*group: politicscons

\*question: \*How would you describe your political views?\*

\*confirm

\*name: politicsconservative

\*type: choice

Very liberal

Liberal

Moderate

Conservative

Very conservative

No opinion

\*group: politicslib

\*question: \*How would you describe your political views?\*

\*confirm

\*name: politicsliberal

\*type: choice

Very conservative

Conservative

Moderate

Liberal

Very liberal

No opinion

\*page

Thank you for taking part in this study!

The purpose of this study was to examine people's reactions to information about new types of animal-free foods and how this affects their attitudes towards animal farming. We are also interested in how

these attitudes are affected by a variety of other beliefs and attitudes. This survey was distributed to US residents only.

Depending on which article you were randomly allocated to receive at the start of this survey, the quotes and characters used in the article may have been fabricated for the purposes of this study.

This project was conducted by a researcher at Sentience Institute, a think tank that researches moral circle expansion.

Your participation is greatly appreciated. If you are interested in learning the results of the study once it is completed and the data analysed, or if you have any other concerns or queries, please feel free to contact me at [jamie@sentienceinstitute.org](mailto:jamie@sentienceinstitute.org). Otherwise, please click the

\*program: EndOfActivityButton

## R code

```
> dat <- read.csv(<file>) # file location here
library(dplyr)

> dat <- mutate(dat, AFO = rowMeans(select(dat, AFOdemo:AFObanAF)))

> dat <- mutate(dat, nature = rowMeans(select(dat, natSafe:natDamage)))

> dat <- mutate(dat, science = rowMeans(select(dat, sciWithhold:sciAccount)))

> dat <- mutate(dat, speciesism = rowMeans(select(dat, specHumans:specExper)))

> dat <- mutate(dat, neophobia = rowMeans(select(dat, neoSampling:neoCountries)))

> dat <- mutate(dat, SDRS = rowSums(select(dat, SDRStook:SDRSeven)))

> dat <- mutate(dat, mentalCap = rowMeans(select(dat, MCcontrol:MCmemory)))

> dat[["compCul"]][is.na(dat[["compCul"]])] <- 0
> dat[["compHT"]][is.na(dat[["compHT"]])] <- 0
> dat[["compLT"]][is.na(dat[["compLT"]])] <- 0
> dat[["compCon"]][is.na(dat[["compCon"]])] <- 0

> dat[["politicscons"]][is.na(dat[["politicscons"]])] <- 0
> dat[["politicslib"]][is.na(dat[["politicslib"]])] <- 0

> dat <- mutate(dat, politics = rowSums(select(dat, politicscons:politicslib)))
```

```

> dat <- mutate(dat, AFFT = rowSums(select(dat, compCul:compHT)))
> dat <- mutate(dat, comprehension = rowSums(select(dat, compCul:compCon)))

> dat <- data.frame(dat, stringsAsFactors=TRUE)
> dat <- mutate(dat, AFFT = as.factor(dat$AFFT))

#relevel categorical demographic variables for largest group, substituting "Group" with the categorical
demographic variable and "1" with the appropriate category
> dat <- within(dat, group<- relevel(group,ref=1))

#data cleaning
> dat <- filter(dat, comprehension == 1)

> dat <- filter(dat, attention == 1)

> dat <- na.omit(dat, AFOdemo:finished)

#Multiple regression
> fit <- lm(data=dat, AFO ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)

> p.adjust(summary(fit)$coefficients[,4], "fdr")

```

## Exploratory analysis

```

#Full dataset, new models
> fitAFFTonly <- lm(data=dat, AFO ~ AFFT)
> summary(fitAFFTonly)
> p.adjust(summary(fitAFFTonly)$coefficients[,4], "fdr")

> fitDemographics <- lm(data=dat, AFO ~
AFFT+income+gender+ethnicity+age+politics+education+region)
> summary(fitDemographics)
> p.adjust(summary(fitDemographics)$coefficients[,4], "fdr")

> dat <- mutate(dat, famAFFT = rowMeans(select(dat, famHT:famCul)))

> fitMinusSimilar <- lm(data=dat, AFO ~
AFFT+nature+science+neophobia+SDRS+income+gender+ethnicity+age+politics+education+region)
> summary(fitMinusSimilar)
> p.adjust(summary(fitMinusSimilar)$coefficients[,4], "fdr")

```

```

> dat <- mutate(dat, famAFFT = rowMeans(select(dat, famHT:famCul)))
> fitWithFam <- lm(data=dat, AFO ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region+famAFFT)
> summary(fitWithFam)
> p.adjust(summary(fitWithFam)$coefficients[,4], "fdr")

> fitWithBothFams <- lm(data=dat, AFO ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region+famAFFT+famLT)
> summary(fitWithBothFams)
> p.adjust(summary(fitWithBothFams)$coefficients[,4], "fdr")

> fitInteractions <- lm(data=dat, AFO ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region+AFFT:nature+AFFT:neophobia)
> p.adjust(summary(fitInteractions)$coefficients[,4], "fdr")

#Data subsets: creating the data subsets
> dat <- mutate(dat, noLT = rowSums(cbind(dat$compCul, dat$compHT, dat$compCon)))
> dat <- mutate(dat, noCon = rowSums(select(dat, compCul:compLT)))
> dat <- mutate(dat, culHTonly = rowSums(cbind(dat$compCul, dat$compHT)))
> dat <- mutate(dat, HTLTonly = rowSums(cbind(dat$compHT, dat$compLT)))
> dat <- mutate(dat, conLTonly = rowSums(cbind(dat$compCon, dat$compLT)))

> dat <- mutate(dat, noLT = as.factor(dat$noLT))
> dat <- mutate(dat, noCon = as.factor(dat$noCon))
> dat <- mutate(dat, culHTonly = as.factor(dat$culHTonly))
> dat <- mutate(dat, HTLTonly = as.factor(dat$HTLTonly))
> dat <- mutate(dat, conLTonly = as.factor(dat$conLTonly))

> datNoLT <- filter(dat, noLT == 1)
> datNoCon <- filter(dat, noCon == 1)
> datCulHTonly <- filter(dat, culHTonly == 1)
> datHTLTonly <- filter(dat, HTLTonly == 1)
> datConLTonly <- filter(dat, conLTonly == 1)
> datLowAFFTfam <- filter(dat, famAFFT < 2)

```

#Data subsets: analyzing the data subsets

```

> fitNoLT <- lm(data=datNoLT, AFO ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> summary(fitNoLT)
> p.adjust(summary(fitNoLT)$coefficients[,4], "fdr")

> fitNoCon <- lm(data=datNoCon, AFO ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> summary(fitNoCon)
> p.adjust(summary(fitNoCon)$coefficients[,4], "fdr")

> fitCulHTonly <- lm(data=datCulHTonly, AFO ~
group+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> summary(fitCulHTonly)
> p.adjust(summary(fitCulHTonly)$coefficients[,4], "fdr")

> datHTLTonly <- within(datHTLTonly, group<- relevel(group,ref="low-tech plant-based meat"))
> fitHTLTonly <- lm(data=datHTLTonly, AFO ~
group+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> summary(fitHTLTonly)
> p.adjust(summary(fitHTLTonly)$coefficients[,4], "fdr")

> fitConLTonly <- lm(data=datConLTonly, AFO ~
group+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> summary(fitConLTonly)
> p.adjust(summary(fitConLTonly)$coefficients[,4], "fdr")

> fitLowAFFTfam <- lm(data=datLowAFFTfam, AFO ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> summary(fitLowAFFTfam)
> p.adjust(summary(fitLowAFFTfam)$coefficients[,4], "fdr")

#Exploratory analysis: Altered dependent variable
> fitSpeciesism <- lm(data=dat, speciesism ~
AFFT+nature+science+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics+education
+region)
> p.adjust(summary(fitSpeciesism)$coefficients[,4], "fdr")

```

```

> fitMentalCap <- lm(data=dat, mentalCap ~
AFFT+nature+science+speciesism+neophobia+SDRS+income+gender+ethnicity+age+politics+education
+region)
> p.adjust(summary(fitMentalCap)$coefficients[,4], "fdr")

> fitDiet <- lm(data=dat, diet ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> p.adjust(summary(fitDiet)$coefficients[,4], "fdr")

> fitDiscomfort <- lm(data=dat, AFODiscomfort ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> p.adjust(summary(fitDiscomfort)$coefficients[,4], "fdr")

#standardizing the AFO questions for analysis of a standardized version of the AFO score
> dat <- dat %>%
  mutate(AFOdemoS = scale(AFOdemo))
dat <- dat %>%
  mutate(AFObanFFS = scale(AFObanFF))
> dat <- dat %>%
  mutate(AFOdiscomfortS = scale(AFOdiscomfort))
> dat <- dat %>%
  mutate(AFObanSS = scale(AFObanS))
> dat <- dat %>%
  mutate(AFObanAFS = scale(AFObanAF))
> dat <- mutate(dat, AFOS = rowMeans(select(dat, AFOdemoS:AFObanAFS)))
> fitS <- lm(data=dat, AFOS ~
AFFT+nature+science+speciesism+neophobia+SDRS+mentalCap+income+gender+ethnicity+age+politics
+education+region)
> p.adjust(summary(fitS)$coefficients[,4], "fdr")

```

## Information visible to participants on Positly's advert

Participants were given 5 days to join the pilot study and will be given 20 days to join the main experiment.

### Activity title for participants:

“Quick survey”

### Activity description for participants:

“Participants will be asked to read a short article, then answer some questions about a variety of attitudes and preferences.”

## References

- Allen, Mary, “Beyond Meat Goes Public, Raises \$241 Million” (May 2019), <https://www.gfi.org/beyond-meat-ipo>.
- Allès, Benjamin, Julia Baudry, Caroline Méjean, Mathilde Touvier, Sandrine Péneau, Serge Hercberg, and Emmanuelle Kesse-Guyot, “Comparison of Sociodemographic and Nutritional Characteristics between Self-Reported Vegetarians, Vegans, and Meat-Eaters from the NutriNet-Santé Study,” *Nutrients* 9, no. 9 (September 2017), 1023.
- Anderson, Jo, and Linda Tyler, “Attitudes Toward Farmed Animals in the BRIC Countries,” (September 2018), <https://faunalytics.org/attitudes-towards-farmed-animals-bric-countries/>.
- “Clean’ Meat or ‘Cultured’ Meat: A Randomized Trial Evaluating the Impact on Self-Reported Purchasing Preferences,” Animal Charity Evaluators (March 2017), <https://animalcharityevaluators.org/blog/clean-meat-or-cultured-meat-a-randomized-trial-evaluating-the-impact-on-self-reported-purchasing-preferences/>.
- “Models of Media Influence on Demand for Animal Products,” Animal Charity Evaluators, last edited June 2016, <https://animalcharityevaluators.org/research/other-topics/models-of-media/>.
- “How Will Cultured Meat and Meat Alternatives Disrupt the Agricultural and Food Industry,” ATKearney (2019).
- “California Proposition 12, Farm Animal Confinement Initiative (2018),” Ballotpedia, accessed May 30, 2020, [https://ballotpedia.org/California\\_Proposition\\_12,\\_Farm\\_Animal\\_Confinement\\_Initiative\\_\(2018\)](https://ballotpedia.org/California_Proposition_12,_Farm_Animal_Confinement_Initiative_(2018)).
- Bartels, Daniel M., and Russell C. Burnett, “A Group Construal Account of Drop-in-the-Bucket Thinking in Policy Preference and Moral Judgment,” *Journal of Experimental Social Psychology* 47, no. 1 (2011), 50-7.
- Bastian, Brock, Steve Loughnan, Nick Haslam, and Helena R. M. Radke, “Don’t Mind Meat? The Denial of Mind to Animals Used for Human Consumption,” *Personality and Social Psychology Bulletin* 38, no. 2 (2012), 247-56.
- Benjamini, Yoav, and Yosef Hochberg, “Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing,” *Journal of the Royal Statistical Society: Series B (Methodological)* 57, no. 1 (1995), 289-300.
- Bratanova, Boyka, Steve Loughnan, and Brock Bastian, “The Effect of Categorization as Food on the Perceived Moral Standing of Animals,” *Appetite* 57, no. 1 (2011), 193–6.
- Briggs, Helen, “Artificial meat: UK scientists growing ‘bacon’ in labs” (19 March, 2019), <https://www.bbc.co.uk/news/science-environment-47611026>.
- Brown, Mike, “Lab-Grown Meat: Beyond Burgers, the 7 In-Vitro Foods Coming to Plates” (September 10, 2019), <https://www.inverse.com/article/58515-lab-grown-meat-beyond-burgers-the-7-in-vitro-foods-coming-to-plates>.
- Bryant, Christopher John, “We Can’t Keep Meating Like This: Attitudes towards Vegetarian and Vegan Diets in the United Kingdom,” *Sustainability* 11, no. 23 (December 2, 2019), <https://www.mdpi.com/2071-1050/11/23/6844/html>.
- Bryant, Christopher John, Keri Szejda, Varun Deshpande, Nishant Parekh, and Brian Tse, “A Survey of Consumer Perceptions of Plant-Based and Clean Meat in the USA, India, and China,” *Frontiers in Sustainable Food Systems* 3 (2019).



- Caldwell, Krystal, "Welfare Reforms and Meat Consumption" (November 14, 2016), <https://mercyforanimals.org/welfare-reforms-survey>.
- Cameron, C. Daryl, and B. Keith Payne, "Escaping Affect: How Motivated Emotion Regulation Creates Insensitivity to Mass Suffering," *Journal of Personality and Social Psychology* 100, no. 1 (2011), 1-15.
- Caviola, Lucius, Jim A. C. Everett, and Nadira S. Faber, "The Moral Standing of Animals: Towards a Psychology of Speciesism," *Journal of Personality and Social Psychology* (2018).
- Cohen, Jacob, "A Power Primer," *Psychological Bulletin* 112, no. 1 (1992), 155-9.
- Cohen, J. E., *Statistical Power Analysis for the Behavioral Sciences* (Hillsdale, NJ: Lawrence Erlbaum Associates Inc., 1988).
- "Animal Cruelty," Compassion In World Farming, accessed September 9, 2019, <https://www.ciwf.org.uk/factory-farming/animal-cruelty/>.
- Conner, Mark, and Paul Norman (eds.), *Predicting and Changing Health Behaviour: Research and Practice with Social Cognition Models* (Maidenhead: Open University Press, 2015; first published 1995).
- Cooney, Nick, "Do Online Videos of Farmed Animal Cruelty Change People's Diets and Attitudes?" (March 2016), <https://mercyforanimals.org/impact-study>.
- Cooney, Nick, "Report: What Elements Make a Vegetarian Leaflet More Effective?" (May 20, 2014), <http://www.humaneleagueulabs.org/blog/2014-05-20-what-elements-make-vegetarian-leaflet-more-effective/>.
- Dhont, Kristof, Gordon Hodson, Ana C. Leite, and Alina Salmen, "The Psychology of Speciesism," in Kristof Dhont and Gordon Hodson (eds.) *Why We Love and Exploit Animals: Bridging Insights from Academia and Advocacy* (Abingdon: Routledge, 2019), 29-49.
- Faul, Franz, Edgar Erdfelder, Albert-Georg Lang, and Axel Buchner, "G\* Power 3: A Flexible Statistical Power Analysis Program for the Social, Behavioral, and Biomedical Sciences," *Behavior Research Methods* 39, no. 2 (2007), 175-91.
- Festinger, Leon, *A Theory of Cognitive Dissonance* (Stanford: Stanford University Press, 1957).
- Forestell, Catherine A., and John B. Nezlek, "Vegetarianism, Depression, and the Five Factor Model of Personality," *Ecology of Food and Nutrition* 57, no. 3 (2018), 246-59.
- Frewer, Lynn J., Joachim Scholderer, and Lone Bredahl, "Communicating about the Risks and Benefits of Genetically Modified Foods: The Mediating Role of Trust," *Risk Analysis: An International Journal* 23, no. 6 (2003), 1117-33.
- Graça, João, Maria Manuela Calheiros, and Abílio Oliveira, "Attached to Meat? (Un) Willingness and Intentions to Adopt a More Plant-Based Diet," *Appetite* 95 (2015), 113-25.
- Harris, Jamie, "Health Behavior Interventions Literature Review" (forthcoming).
- Harris, Jamie, and Jacy Reese, "The Effects of Animal-Free Food Technology Awareness on Animal Farming Opposition" (April 2, 2020), <https://osf.io/xq86b>.
- Hauser, David J., and Norbert Schwarz, "Attentive Turkers: MTurk Participants Perform Better on Online Attention Checks than do Subject Pool Participants," *Behavior Research Methods* 48, no. 1 (2016), 400-7.
- Hays, Ron D., Toshi Hayashi, and Anita L. Stewart, "A Five-item Measure of Socially Desirable Response Set," *Educational and Psychological Measurement* 49, no. 3 (1989), 629-36.

“Diet Change and Demographic Characteristics of Vegans, Vegetarians, Semi-Vegetarians, and Omnivores,” Humane League Labs (April 2014),  
<http://www.humaneleaguelabs.org/static/reports/2014/04/diet-change-and-demographic-characteristics1.pdf>.

Hurford, Peter, and Marcus A. Davis, “Animal Equality Showed that Advocating for Diet Change Works. But is it Cost-Effective?” (June 7, 2018),  
<https://www.rethinkpriorities.org/blog/2019/2/21/animal-equality-showed-that-advocating-for-diet-change-works-but-is-it-cost-effective-1>.

“Climate Change and Land,” Intergovernmental Panel on Climate Change (August 2019),  
[https://www.ipcc.ch/site/assets/uploads/2019/08/2f.-Chapter-5\\_FINAL.pdf](https://www.ipcc.ch/site/assets/uploads/2019/08/2f.-Chapter-5_FINAL.pdf).

Loughnan, Steve, Brock Bastian, and Nick Haslam, “The Psychology of Eating Animals,” *Current Directions in Psychological Science* 23, no. 2 (2014), 104-8.

Loughnan, Steve, Nick Haslam, and Brock Bastian, “The Role of Meat Consumption in the Denial of Moral Status and Mind to Meat Animals,” *Appetite* 55, no. 1 (2010), 156–9.

Lusk, Jayson, “Who are the Vegetarians?” (September 2014),  
<http://jaysonlusk.com/blog/2014/9/30/who-are-the-vegetarians>.

Macdonald, Bobbie, and Eva Vivalt, “The Impact of New Products on Ethical Beliefs” (November 8, 2017),  
<https://osf.io/4dczh/>.

McPhetres, Jonathon, Bastiaan T. Rutjens, Netta Weinstein, and Jennifer A. Brisson, “Modifying Attitudes About Modified Foods: Increased Knowledge Leads to More Positive Attitudes,” *Journal of Environmental Psychology* 64 (2019), 21-9.

Michel, Fabienne, and Michael Siegrist, “How Should Importance of Naturalness be Measured? A comparison of different scales,” *Appetite* 140 (2019), 298-304.

Mohorčich, J., “What Can Nuclear Power Teach Us About the Institutional Adoption of Clean Meat?” (November 28, 2017), <https://www.sentienceinstitute.org/nuclear-power-clean-meat>.

Mohorčich, J., “What Can the Adoption of GM Foods Teach Us About the Adoption of Other Food Technologies?” (June 20, 2018), <https://www.sentienceinstitute.org/gm-foods>.

“Launch of the world’s first cultured meat hamburger (August 5, 2013),” Mosa Meat (Jan 13, 2018),  
<https://www.youtube.com/watch?v=slsQLZL2EI>.

“Meat in your diet,” National Health Service, last edited May 24, 2018,  
<https://www.nhs.uk/live-well/eat-well/meat-nutrition/>.

Painter, James, “‘Promising the Earth’: The Coverage of Cultured Meat in the US and UK Elite Media” (forthcoming).

Paolacci, Gabriele, and Jesse Chandler, “Inside the Turk: Understanding Mechanical Turk as a Participant Pool,” *Current Directions in Psychological Science* 23, no. 3 (2014), 184-8.

Piazza, Jared, and Steve Loughnan, “When Meat Gets Personal, Animals’ Minds Matter Less: Motivated Use of Intelligence Information in Judgments of Moral Standing,” *Social Psychological and Personality Science* 7, no. 8 (2016), 867-74.

Piazza, Jared, Matthew B. Ruby, Steve Loughnan, Mischel Luong, Juliana Kulik, Hanne M. Watkins, Mirra Seigerman, “Rationalizing Meat Consumption. The 4Ns,” *Appetite* 91 (2015), 114-28.

Pliner, Patricia, and Karen Hobden, “Development of a Scale to Measure the Trait of Food Neophobia in Humans,” *Appetite* 19, no. 2 (1992), 105-20.

Pollard, Tessa M., Andrew Steptoe, and Jane Wardle, “Motives Underlying Healthy Eating: Using the Food Choice Questionnaire to Explain Variation in Dietary Intake,” *Journal of Biosocial Science* 30, no. 2 (1998), 165-79.

“What are Participant Quality filters?” Positly, last edited January 21, 2019, <https://www.positly.com/support/quality-filters/>.

Reese, Jacy, “Animals, Food, and Technology Survey 2019” (forthcoming).

Reese, Jacy, “Effective Animal Advocacy Researcher Survey June 2017” (June 2017), <https://www.sentienceinstitute.org/blog/ea-researcher-survey-june-2017>.

Reese, Jacy, “Survey of US Attitudes Towards Animal Farming and Animal-Free Food October 2017” (November 2017), <https://www.sentienceinstitute.org/animal-farming-attitudes-survey-2017>.

Rothgerber, Hank, “Efforts to Overcome Vegetarian-Induced Dissonance Among Meat Eaters,” *Appetite* 79 (2014), 32-41.

Ruby, Matthew B., “Vegetarianism. A Blossoming Field of Study,” *Appetite* 58, no. 1 (2012), 141-50.

“Summary of Evidence for Foundational Questions in Effective Animal Advocacy,” Sentience Institute, last updated December 24, 2019, <https://www.sentienceinstitute.org/foundational-questions-summaries>.

Siegrist, Michael, Bernadette Sütterlin, and Christina Hartmann, “Perceived Naturalness and Evoked Disgust Influence Acceptance of Cultured Meat,” *Meat Science* 139 (2018), 213-9.

Slade, Peter, “If You Build It, Will They Eat It? Consumer Preferences for Plant-Based and Cultured Meat Burgers,” *Appetite* 125 (2018), 428-37.

Steptoe, Andrew, Tessa M. Pollard, and Jane Wardle, “Development of a Measure of the Motives Underlying the Selection of Food: The Food Choice Questionnaire,” *Appetite* 25, no. 3 (1995), 267-84.

“Clean Meat: The Naming of Tissue-Engineered Meat,” The Good Food Institute, accessed June 11, 2019, <http://mfait.gfi.org/the-naming-of-clean-meat>.

Tonsor, Glynn T., and Nicole J. Olynk, “Impacts of Animal Well-Being and Welfare Media on Meat Demand,” *Journal of Agricultural Economics* 62, no. 1 (February 2011), 59-72.

“2018: American Community Survey 1-Year Estimates Data Profile,” United States Census Bureau, accessed January 29, 2020, <https://data.census.gov/cedsci/table?q=United%20States&table=DP05&tid=ACSDP1Y2018.DP05&g=&lastDisplayedRow=24>.

Wilks, Matti, Clive J. C. Phillips, Kelly Fielding, and Matthew J. Hornsey, “Testing Potential Psychological Predictors of Attitudes Towards Cultured Meat,” *Appetite* 136 (2019), 137-45.

Wilks, Matti, and Jacy Reese, “Consumer Acceptance,” in *Cellular Agriculture: Developing Animal Products Without Animals* (Amsterdam, Netherlands: Elsevier, 2020).

