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Butchers' and Deli Workers' Psychological Adaptation to Meat

Jared Piazza

Lancaster University, Department of Psychology

Gordon Hodson

Brock University, Department of Psychology

Alexandra Oakley

Lancaster University, Department of Psychology

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Author Contact Information

Jared Piazza
Department of Psychology
Fylde College
Lancaster University
LA1 4YF
j.piazza@lancaster.ac.uk
Tel: +44 (0)1524 594869

Author Note

All of our research materials can be found on Open Science Framework at https://osf.io/8qk6d. This includes a qsf (Qualtrics) file of the questionnaire, a Powerpoint slide containing the original images used in the study and corresponding weblinks, and anonymised versions of the data set (original and restructured for mixed-linear models).

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Abstract

In many societies today, the average consumer is largely removed from the earlier stages of meat production wherein meat, in many ways, resembles an animal. The present study examined the emotional and psychological consequences of recurrent meat handling. Fifty-six individuals with commercial experience handling meat (butchers and deli workers) were contrasted with 103 individuals without such experience. Participants were presented images of meat from three animals—cows, sheep, fish—that were experimentally manipulated in their degree of animal resemblance. Participants rated the images on measures of disgust, empathy for the animal, and meat-animal association. Broader beliefs and attitudes about meat and animals were also assessed. We used mixed-effect linear modelling to examine the role of time spent handling meat in participants' psychological adaptation to it. We observed significant reductions in disgust, empathy, and meat-animal association within the first year or two of meat handling for all types of meat. Time spent handling meat also predicted the degree to which a person defended and rationalized meat consumption and production, independent of a participant's gender and age. The findings have implications for understanding how people adapt to potentially aversive contexts such as handling animal parts.

Keywords: meat; disgust; adaptation; animals; butchers; dissociation; empathy

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Introduction

Meat and Disgust

Humans have an ambivalent relationship with meat. Most people enjoy meat, but animal flesh also has the potential to repulse. As omnivores, our species can exploit a wide variety of foods, yet this simultaneously exposes us to many toxins and pathogens (Rozin, 1976). Meat in particular has long provided humans with a source of nutrition and pleasure, while also acting as a potential threat of infection (Fessler, Arguello, Mekdara, & Macias, 2003; Leroy & Praet, 2015). That is, animals carry a range of bacteria and parasites that can be hazardous if not managed properly. This ambivalent relationship humans have with meat may help explain why cultures historically and universally tend to restrict their consumption of meat to a select few animals, while treating most other animals as taboo or off-limits, despite the biochemical commonalities of animal tissue (Fessler & Navarrete, 2003).

Because of its potential to contaminate, meat can be a source of disgust for many people. For some, disgust towards meat is further exacerbated by thoughts about the animal origins of meat and the harm inflicted on animals to produce meat (Hamilton, 2006; Kunst & Hohle, 2016; Loughnan, Bastian, & Haslam, 2014; Rozin & Fallon, 1987; Tian, Hilton, & Becker, 2016; Rozin, Markwith, & Stroess, 1997). Certain sensory aspects of meat, for example, the appearance of red meat or the sight or smell of blood, can elicit disgust for many people (Fessler et al., 2003; Kubberød, Ueland, Risvik, & Henjesand, 2006; Nordin, Broman, Garvill, & Nyroos, 2004; Ruby & Heine, 2012). Studies show that these features often serve as reminders that a person is eating the flesh of something that was killed (Beardsworth & Keil, 1992; Hamilton, 2006), and this association—between meat and death, or meat and the animal—has the effect of suppressing appetites or even inducing nausea (Earle, Hodson, Dhont, & MacInnis, 2019; Kunst & Hohle, 2016; Tian et al., 2016).

Disgust towards meat is also affected by higher-level concerns about the treatment of animals and beliefs about the animal source. Thinking about meat as originating from animals that have suffered inhumanely influences the subjective experience of eating meat. Participants in one study rated meat as less pleasant to smell and taste when they believed the animal was raised on a factory farm than when the animal was thought to be raised in more humane conditions (Anderson & Barrett, 2016). Likewise, knowledge about whether a meat product comes from a baby animal, versus an adult animal, can reduce appetite for meat via feelings of sympathy (Piazza, McLatchie, & Olesen, 2018; Zickfeld, Kunst, & Hohle, 2018). Furthermore, the motivations people report for avoiding meat suggest that concerns about animal treatment plays an important role in suppressing appetite towards meat (e.g., Berndsen & van der Pligt, 2004; Haverstock & Forgays, 2012; Hoffman, Stallings, Bessinger, & Brooks, 2013; Janssen, Busch, Rödiger, & Hamm, 2016; Mooney & Walbourn, 2001; Ruby, 2012; Santos & Booth, 1996). Vegetarians and vegans who avoid consuming animal products primarily for animal-welfare reasons often report feeling greater levels of disgust towards meat than people who avoid meat for reasons having to do with health or weight loss (Fessler et al., 2003; Hamilton, 2006; Rozin et al., 1997). Moral vegetarians and vegans also tend to report having stronger associations between meat and thoughts about the animal origins of meat, compared to health-motivated vegetarians (Hamilton, 2006), which may further fuel their distaste and avoidance of meat.

Adaptation to Meat

It is clear from studies of meat avoiders that people can develop strong aversions towards the sight and smell of meat. Given the potential for animal flesh and blood to repel and repulse, it is worth considering the psychological processes that enable some individuals, for example, butchers and deli workers, to comfortably work with meat on a regular basis. Disgust can be a difficult emotion to extinguish, particularly when it involves perceptions of

contamination (Ludvik, Boschen, & Neumann, 2015). Nonetheless, studies suggest that disgust towards meat is to some extent mutable (e.g., Earle et al., 2019; Rozin et al., 1997).

In the present study, we were interested in whether prolonged experience of working directly with meat products can lead to an up-regulation of one's hedonic relationship with meat such that a person may become more comfortable with meat even when it contains strong reminders of its animal origins. We addressed this question by examining people's reactions to meat products that were experimentally varied in their degree of animal resemblance. Here we use the term *adaptation* to refer to the process whereby an object or circumstance that has the potential to elicit strong emotion (e.g., a dead animal causing disgust) ceases to elicit that emotion to the same degree (see Frederick & Loewenstein, 1999; Rozin, 2008). Research shows that adaptation can occur for a variety of reasons, including repeated exposure to the eliciting object or via emotion regulation processes such as reappraisal (Ludvik et al., 2015).

In a pioneering study, Rozin (2008) investigated adaptation within the context of medical students' interactions with human cadavers. Rozin found some evidence that medical students experienced less disgust towards handling a dead body 2-3 months following their medical training, which involved cadaver dissection. Interestingly, their reduction in disgust appeared to be specific to contact with dead bodies; their levels of disgust towards other disgust elicitors (e.g., watching blood removed from a person's body) remained unchanged.

Whereas much research has uncovered critical differences in the level of disgust people experience towards meat (see earlier discussion), little research to date has investigated the process of adaptation to meat. People who work with meat on a regular basis as an occupation make for a natural test case of adaptation. Butchers, for example, interact repeatedly with dead animals in various stages of meat production, from the early stages of meat processing, which may involve dismemberment, the removal of skin, offal and body

parts, to the cutting of the muscle tissue into smaller units to be sold to consumers. Deli workers, likewise, engage regularly with meat products, though their work is focused more on the handling, cutting, and packaging of meat for customers and less likely to involve dismemberment. Thus, relative to most people in modern societies, butchers and deli workers interact more frequently with meat and, in particular, with products that more visibly resemble parts of the animal.

As noted earlier, thinking about the animal origins of meat and the harm caused to animals for meat production can be psychologically distressing for many people. Presumably, the constant handling of meat requires people to adapt to their environment. After all, it would be terribly disruptive to the task of preparing meat if butchers and deli workers were continually thinking of the animals that were slaughtered. We might speculate then that butchers and deli workers undergo a process of adaptation that enables them to interact with animal flesh without constantly being reminded of its origins. We theorize that recurrent handling of meat over time engenders a kind of psychological numbing such that aspects of meat that would otherwise serve to remind a person of its animal origins and evoke strong feelings of disgust loses its potency as a reminder and disgust-elicitor, akin to the adaptive process described by Rozin (2008). If recurrent working with meat engenders psychological adaptation, this should be observable within butchers' and deli workers' emotional reactions to meat, such that their feelings of disgust at seeing meat products may be tempered compared to those without such experiences.

Such theorizing may at first blush appear counterintuitive. One might just as easily surmise that butchers and deli workers should be among those with the greatest awareness of meat's animal origins on account of their direct involvement in meat production. By contrast, the average consumer today who has a great deal of distance—both physical and psychological—from the act of animal slaughter and the early stages of meat production

(Bastian & Loughnan, 2017; Earle et al., 2019; Hoogland, de Boer, & Boersema, 2005; Kunst & Hohle, 2016). Meat products sold to consumers in modern food markets and restaurants tend to be "ready to eat" / "ready to cook" with most or all of the defining features of the animal (e.g., eyes, tongue, limbs, head) already removed (Leroy & Degreef, 2015). As a result, surveys of Western grocery shoppers, for example in the Netherlands, have shown that people rarely report thinking about the animal when buying meat (Hoogland et al., 2005).

The process of outsourcing animal slaughter and meat production to institutions or a select group of people has been defined as "institutionalization" (Bastian & Loughnan, 2017). Institutionalization has the effect of shielding most people from the strong reality of animal slaughter. But, arguably, this distance from the earlier stages of meat production may have the psychological consequence of making most people *more* (not less) emotionally sensitive to meat, at least in comparison with those who regularly work with meat. This may be the case because most meat consumers today, at least in the Western world, have been spared the need to psychologically adapt to the sights and smells experienced recurrently by those who work commercially with meat. Thus, although institutionalization may serve to keep consumers from actively dwelling on the animal origins of meat during the course of their everyday life, it may also have the side-effect of preserving the potency of meat as an animal reminder, particularly when encountering meat that still contains visible features of the animal.

Some potential, existing support for this idea comes from a recent study by Kunst and Haugestad (2018), which contrasted reactions to meat with varied levels of animal reminders among participants from Ecuador and the United States. Compared to participants from the United States, the participants from Ecuador reported more frequently seeing meat products with visible reminders of the animal, such as the animal's head still attached. Consistent with our theorizing, the authors found that the Ecuadorian participants were *less*

sensitive than the North American participants to the presence (*vs*. absence) of explicit animal reminders in the meat products they evaluated, that is, they rated the meat that highly resembled the animal as less disgusting than the American participants rated it. One interpretation of these findings is that the Ecuadorian participants had adapted, to a greater extent than the American participants, to the sight of meat with visible animal reminders. In a similar vein, in the present study, we sought to test whether butchers and deli workers might display greater characteristics of psychological adaptation to meat relative to the average consumer lacking such direct experiences.

Rationalizing Meat Production

In addition to examining the emotional aspects of psychological adaptation, we also aimed to investigate whether butchers and deli workers had adapted to meat production by way of their beliefs about the benefits that meat provides society and the harm animals experience when reared and slaughtered for meat. In a Western context, discourse around the ethics of meat production and meat consumption is a frequent topic in popular media (Leroy, Brengman, Ryckbosch, & Scholliers, 2018). It has become increasingly difficult for meat consumers to remain unaware or insensitive to the public debates around meat. This has placed pressure on modern meat consumers to have ready-to-present justifications for eating meat. Research by Piazza et al. (2015) has found that meat eaters tend to rely on four primary arguments in defence of meat: that meat is *Necessary* (meat is needed for health, growing muscles, and nutrition), *Natural* (the anatomy of humans enable them to hunt and dominate animals, and to digest and extract nutrients from meat), *Normal* (eating meat has historical precedence and is widespread), and *Nice* (meat is enjoyable and tastes good) (see also Joy, 2010). Beyond these “four Ns” of meat justification, studies show that people also defend meat eating by minimizing the harm done to animals, for example, by arguing that farmed

animals are treated humanely or do not suffer much in the production of meat (Rothgerber, 2013), and by endorsing that humans have supremacy over animals (Dhont & Hodson, 2014).

Unsurprisingly, people who consume meat are more likely to endorse the four Ns than people who reject it (Piazza et al., 2015). Piazza et al. argue that this "my side bias" reflects a process of motivated cognition (e.g., see Kunda, 1990) whereby individuals will put more effort into defending the practice of meat consumption when they are personally invested in such behavior. Applying a perspective on motivated cognition to the subject of meat production offers a window in which to consider whether we might expect to observe stronger endorsements of the positive qualities of meat among individuals who work within the meat industry than those considering meat production and consumption from outside.

Main Hypotheses and the Present Study

Here we examine whether people who work closely with meat, at the post-slaughter stages of production, experience psychological adaptation on account of their repeated contact with meat. By "psychological adaptation" in this context we mean a reduced emotional response to meat and the slaughtered animal, for example, reduced disgust at meat and reduced empathy for the animal. To the extent that butchers and deli workers might experience adaptation, we consider whether part of this process is a reduction in the psychological association between meat and its animal origins. Inspired by work by Kunst and Hohle (2016), we also sought to test whether frequent contact with meat results in a decrease in empathy towards the animals slaughtered for the production of meat. If empathy for animals works to intensify disgust towards meat (see Kunst & Hohle, 2016), then we would expect butchers and deli workers to report lower levels of empathy for animals used in meat production, compared to individuals lacking such experiences. Finally, in line with our theorizing about motivated cognition, we investigated whether butchers and deli workers

possess more supportive beliefs about meat production and meat consumption, compared to the average person who does not work with meat products on a regular basis.

Our research was guided by four principal hypotheses:

Hypothesis 1 (Time spent handling meat and adaptation): In our study, we collected data on the length of time our participants had been working with meat. We predicted that time spent working with meat products would be *negatively* related to levels of disgust towards meat and empathy towards the slaughtered animals, such that greater time spent handling meat would promote reduced disgust and empathy. We sought to test this hypothesis by examining correlations between time spent working and our dependent measures, and, in a richer, more nuanced way, using a linear mixed-effect model (e.g., Baayen, Davidson, & Bates, 2008) that could identify critical time points in participants' experiences with meat in which reductions in disgust and empathy might occur as individuals move from having no experience handling meat to greater experience. This latter approach provided us a window into the timing in which psychological adaptation might occur for participants.

Hypothesis 2 (Interaction between meat handling and level of animal reminder): We speculated that adaptation to meat may occur at all stages of meat production for individuals who work with meat, whereas those without commercial meat-preparation experience will have adapted primarily to the later stages of meat preparation, such as cooking already-processed meat for consumption, wherein much of the resemblance of the animal has been removed from the product. Thus, we hypothesized that differences in meat-elicited disgust and empathy between those with commercial meat-handling experience and those without will be most observable when there are high degrees of animal reminders present in the animal product. In other words, we expected to find a two-way interaction

between time spent handling meat and animal-reminder level, with time having a larger effect on reported disgust and empathy at higher rather than lower levels of animal reminder.

Hypothesis 3 (Dissociating animals from meat): Actively dwelling on the animal origins of meat is likely to disrupt a butcher's/deli worker's ability to perform the task of preparing meat for consumption. For this reason, we hypothesized that people who work with meat over time cultivate the capacity to dissociate meat from their animal origins, such that when they encounter meat products, including products with ostensible cues to the animal source, these cues lose their potency to serve as animal reminders. By contrast, meat should remain a fairly potent reminder of the animal for individuals lacking such direct experiences working with meat. This led us to predict that time spent handling meat will *attenuate* the degree of psychological association between meat and animals at the sight of meat. Stated differently, we expected images of meat products to be *less potent* at generating thoughts of the animal source for individuals who have worked at greater lengths with meat products.

Hypothesis 4 (Beliefs about animals and meat): Compared to individuals without meat-handling experience, individuals who have worked commercially with meat were expected to report more positive views of meat. Specifically, expect experience handling with meat to be associated with stronger endorsement of (a) the 4Ns, (b) that farmed animals are treated and slaughtered humanely, and (c) that humans have supremacy over animals. Such supportive beliefs about meat should aid butchers and deli workers in justifying their involvement in meat production.

To test our hypotheses, we recruited individuals who have worked for varying lengths of time in commercial meat production, as butchers or deli-counter workers, at locations in Lancashire, England. As our comparison sample, we sought to draw individuals from roughly the same geographical region but who had no direct commercial experience working with meat. The overall aim was to recruit a minimum of 150 individuals who varied in their level

of experience working with meat products, particularly the earlier stages of meat preparation in which the meat still possesses some resemblance of its animal origins. A sample size of 150 gives us 90% power to detect a medium size effect ($f = .20$) within a mixed-measures design with 4x3 repeated measurements, two groups and an alpha error probability set at .05 (G*Power 3.1; Faul, Erdfelder, Buchner, & Lang, 2009). Our recruitment strategy enabled us to capture a range of experiences with meat—as little as zero to a few months experience to over 20-years-experience working with meat. This variability in experience could then be utilized within a linear mixed-effect model to test our hypotheses about psychological adaptation. Thus, although we classified participants into "butcher/deli worker" and "community" samples, this categorical division into groups was less relevant for our analytical strategy, which utilized the duration of meat-work experience as the primary fixed-factor within a mixed linear model.

To investigate participants' psychological reactions to meat products, we presented them with images of meat products from three different animals (cow, sheep, fish), and experimentally manipulated the degree to which the products resembled the animal source. For each image, participants rated how strongly that they felt *disgust* towards the meat product, had *empathy* for the animal slaughtered, and were *reminded of the animal* slaughtered. Participants were also assessed on their beliefs about meat (the 4Ns), the humane treatment and slaughter of farmed animals, the supremacy of humans over animals, their moral concern for animals (broadly construed), their previous experiences working with meat products, and their dietary habits with regards to animal products.

A qsf (Qualtrics) file of the study materials and questionnaire, meat images, and anonymised versions of the data set (original and restructured for mixed-linear models) are available on Open Science Framework at https://osf.io/8qk6d.

Methods

Participants

The study was approved by Lancaster University's Department of Psychology Ethics Committee. In an effort to identify and recruit individuals with experience working with meat, we recruited from several locations within Lancashire, UK, including two supermarkets and several butchers and fishmongers in Lancaster and Morecambe. The third author visited each location to describe the general study. Those who provided their verbal consent to participate completed the questionnaire either on a tablet or phone, and, in some cases, were sent a link to the survey via a messaging application. Participants also provided their written consent via an electronic consent form prior to starting the survey. Additionally, a few participants were also recruited via survey links advertised within online message boards for butchers and deli workers. Fifty-six individuals (28 male, 27 female, 1 other/non-binary) completed the survey. Participants' background experiences with meat ranged from directly assisting with animal slaughter (n = 1), to working in a butcher's shop or meat market (n = 15), deli counter (n = 30) or kitchen/food services (n = 10). Six participants did not indicate their place of employment. Time spent working with meat was measured using seven ordinal categories that ranged from 0-6 months (3.6%) to over 20 years (7.1%), with most participants falling somewhere in between: 6-11 months (12.5%), 1-2 years (23.2%), 2-4 years (19.6%), 5-10 years (17.8%), 10-20 years (16.1%).[1]

The community sample was recruited on a voluntary basis via convenience sampling (e.g., requests on Facebook or twitter, printed advertisements posted around Lancaster University) (n = 192) and another 15 participants were recruited via Lancaster University's psychology undergraduate participant pool in exchange for course credit. If anyone recruited

[1] We had the intuition that differences within shorter timeframes working with meat (e.g., 6 months vs. 2 years) would be psychologically more meaningful than differences at longer timeframes (e.g., 10 years vs. 20 years). Thus, we designed the categories to offer greater nuance in differentiating shorter than longer time lengths. An alternative approach would have participants estimate, in an open-ended fashion, the length of time (months and years) they have been working with meat.

via convenience sampling reported having experience in the meat industry they were classified along with the other butchers/deli workers. Among those participants who reported no experience in the meat industry, 207 started the survey, but only 103 (37 male, 65 female, 1 other/non-binary) completed the survey in its entirety. The rest completed it partially or did not advance beyond the consent page, and thus were removed.

All participants, regardless of group classification, received the same information about the study prior to participating. The mean age of the community sample (M = 23.01, SD = 7.36) was significantly lower than that of the deli workers (M = 29.48, SD = 9.57), $t(157) = 4.75$, $p < .001$, $d = 0.76$, 95% CI = [3.78, 9.16]. Because the two groups differed significantly in age, and because age correlated with many of our outcome variables (see below), where relevant we treated age as a covariate in our analyses to statistically control for it as a potential confound between the two groups (in the group comparisons) and time spent working with meat (in the mixed-effect model). The nationality of the butchers/deli workers was 55% British and 45% other (e.g., American, Canadian, German), which was somewhat more diverse than the community sample (90% British, 10% other).

Table 1

Dietary classifications of the two samples: Count and percentage.

Dietary Category	Definition Provided to Participants	Butchers/Deli Workers	Community
Meat lover	I prefer to have meat in all or most of my meals.	16 (28.6%)	21 (20.4%)
Omnivore	I eat meat and other animal products like dairy and/or eggs.	28 (50.0%)	50 (48.5%)
Semi-vegetarian or reducitarian	I eat meat, but only on rare occasions or only certain types of meat.	6 (10.7%)	13 (12.6%)
Pescatarian	I eat fish and/or seafood, as well as dairy products and eggs, but no other meat.	1 (1.8%)	7 (6.8%)
Lacto- or Ovo-vegetarian	I eat dairy products and/or eggs, but no meat or fish.	3 (5.4%)	8 (7.8%)
Strict vegetarian	I eat no animal products, including diary and eggs, but would not consider myself “vegan”.	0 (0.0%)	1 (1.0%)

Dietary vegan	I eat no animal products, including dairy, eggs, honey, gelatine, etc.	1 (1.8%)	1 (1.0%)
Lifestyle vegan	I never consume any animal products, and avoid all non-food animal products, including leather, silk, wool, cosmetics containing animal ingredients, etc.	1 (1.8%)	2 (1.9%)

It was important to compare the dietary profile of our two groups to ensure that differences in their reactions to meat cannot be reduced to differences in diet. Table 1 shows the breakdown of dietary classifications for each group. As can be seen, the distribution of dietary categories were quite similar between groups, with the majority of participants reporting being omnivore, meat lover, or semi-vegetarian (89% of deli workers *vs*. 82% community). One slight difference between the samples was that there were relatively more pescatarians in the community sample than the butcher/deli-worker sample. Nonetheless, a Chi-square analysis of the two groups and eight categories revealed that overall the two groups were reasonably matched in their dietary orientations, $\chi(7) = 4.02$, $p = .777$.

Materials and Procedures

Meat images. We developed a set of 12 images of meat products, four images each for the three animals of study (cow, sheep, fish). The four images for each animal, varied in the degree to which the meat contained features of the once-living animal. The highest animal-reminder image contained the whole carcass of the animal (or most of it) after slaughter. The lowest level of animal reminder presented the carcass after having been "processed" (i.e., stripped of its animal resemblance), cooked and prepared to be eaten. The low-medium and medium-high images presented the carcass in intermediate stages of being processed (the original 12 images can be found at https://osf.io/8qk6d; see Figure 1 for an approximate set of images). Thus, taken together, the twelve images represented two crossed repeated-measures variables: *animal type* (cow, sheep, fish) x *animal-reminder level* (low,

low-medium, medium-high, high). Six of the images were photographed by the experimenter. The remaining six photos were taken from online image directories.

[Insert Figure 1 about here]

Participants were presented the 12 images in a randomised order, one at a time, and rated each on three measures assessing: (a) feeling of *disgust* towards the meat ("I feel disgusted when looking at this image."); (b) *empathy* towards the animal source ("When I see the image [above], I feel sorry for the animal that was slaughtered."); and (c) perceptions of *meat-animal association* ("The first thing I thought about when I saw the picture [above] was a living being."). All three measures were assessed in terms of level of agreement/disagreement on a 7-point Likert scale (1 = *Strongly disagree*; 7 = *Strongly agree*). All three measures were adapted from Kunst and Hohle (2016).

Moral circle task. Following the animal reminder image questions, participants completed the Moral Circle task (Laham, 2009), which is an assessment of general moral concern for animals, across a wide range of species. Participants were shown a list of 27 animals, which also included humans. They were then asked to complete the following task: "When we think about entities in the world, we might feel a moral obligation to show concern for the welfare and interests of some of those entities. Below is a list of entities. Select those that you feel morally obligated to show concern for." Participants could select as many or as few of these entities as they deemed appropriate to fully answer the question. A score from this task was generated by summing the total number of animals selected.

Meat justification. Next, we assessed endorsement of meat consumption using Piazza et al.'s (2015) 4N Scale. The scale contains 16 items, with four items used to measure each of the four different justification categories for eating meat: these are natural (e.g., "Human beings are natural meat-eaters—we naturally crave meat"), normal (e.g., "It is normal to eat meat"), necessary (e.g., "It is necessary to eat meat in order to be healthy"), and nice (e.g.,

"Meals without meat would just be bland and boring"). All 16 items were answered in terms of level of agreement/disagreement using a 7-point Likert scale. The 4N scale had a strong internal reliability aggregating across the four subscales (Cronbach's $\alpha = .94$).

Belief in humane treatment of farmed animals. An individual item assessed the degree to which participants believe that farmed animals are reared humanely: "When being reared for their meat, animals are treated humanely." Participants provided their level of agreement/disagreement using the same 7-point Likert scale as before.

Belief in humane slaughter. Participants provided their level agreement/ disagreement with one additional item: "Animals slaughtered for their meat are slaughtered humanely", again on a 7-point Likert scale.

Human supremacy beliefs. Next, participants answered the 6-item Human Supremacy Belief scale, taken from Dhont and Hodson (2014) (e.g., "In an ideal world, humans and animals would be treated on an equal basis [reversed]"; "There is nothing unusual at all in the fact that humans dominate other species"). The same 7-point scale was used as before to assess level of agreement/disagreement. This scale measures the extent to which participants believe humans are superior to animals and therefore have the right to rule over them. Half of the items are reverse scored; a scale average was calculated, with higher scores representing greater endorsement of human supremacy. The scale had high reliability ($\alpha = .90$).

Experiences with meat and demographic questions. The questionnaire ended with a few items to assess participants' experiences with meat. The first Yes/No item was used to sort our participants into the deli-worker versus community categories: "Are you currently/have you previously worked in an environment which required you to handle raw meat? (e.g., butchers, deli counter, etc.)?" If participants answered "Yes" to this first question, next they were asked: "Please list the names of each establishment (e.g. Sainsbury's

Lancaster) or butcher's shop where you work or have worked. This could be more than one." They were also asked to provide the length of time they have been working with animal products: "How many months/years have you collectively worked in a role requiring you to handle/prepare raw meat?" Participants selected from a range of options: 0-6 months, 6-11 months, 1-2 years, 2-4 years, 5-10 years, 10-20 years, over 20 years. This was used as our measure of *time spent* working with meat. Finally, all participants answered questions about their age, gender, nationality, and dietary classification. At the end, all participants were debriefed about the study and thanked for their participation.

Results

Analysis Plan

Age correlated positively with 4N endorsement, $r(158) = .18$, $p = .022$, human supremacy beliefs, $r(158) = .25$, $p = .002$, belief in humane treatment, $r(158) = .37$, $p < .001$, and humane slaughter of farmed animals, $r(158) = .36$, $p < .001$, but not with the size of participants' moral circles, $r(158) = -.05$, $p = .570$. Age also tended to correlate with our dependent measures (disgust, empathy, meat-animal association) across the twelve unique trials, with older participants tending to report less disgust, empathy, and meat-animal association compared to younger participants. Thus, we treated age as a covariate in our mixed-effects analysis for all relevant outcome variables. Since the gender profiles of our two groups differed somewhat (i.e., a greater proportion of females in the community sample relative to butchers/deli workers), and previous research has shown reliable gender differences in attitudes towards meat (e.g., Ruby, 2012), we included gender as a fixed effect in all of our analyses to rule out gender as a potential confound of meat experience.

For all of our analyses, we use time spent working with meat—an ordinal variable with eight levels ranging from 0 = "no experience" to 7 = "over 20 years"—as our variable of interest, in lieu of a categorical grouping variable (e.g., butchers/deli workers vs. community

sample). Time spent handling meat provides richer information about the degree of participants' experience with meat, as opposed to treating butcher/deli workers as a single, homogenous group. By comparing each ordinal increase in time spent handling meat, relative to a reference point of zero experience (i.e., the community sample), we could identify significant differences in participants' reactions to meat products as a function of their time spent handling meat.

For our three measures of psychological adaptation—disgust, empathy, and meat-animal association—we constructed a linear mixed-effect model in IBM SPSS (v. 25) that treated time spent handling meat, gender, and age as separate fixed effects, and participants as a random effect. We also included in the model the repeated-measures variables animal type and animal-reminder level as independent, categorical[2] fixed effects, as well as the two-way interaction of time x animal type, the two-way interaction of time x animal reminder (to test Hypothesis 2), and the two-way interaction of animal type x animal reminder. Below, we report Type III Tests of the fixed effects in our model. We used time handling meat (zero to over 20 years) in our analysis, as opposed to a binary grouping variable, to capitalise on participants' varied experiences with handling meat. As parameter estimates, we used pairwise comparisons, with zero as our reference, to identify significant step-level mean differences as a function of meat-handling experience (*p*-values are reported using Least Significant Difference). For our five measures of meat justification and animal attitudes (4N, human supremacy, humane treatment, humane slaughter, moral circles) we used a linear mixed-effect model that treated time spent handling meat, gender, and age as separate fixed effects, and participants as a random effect.

Hypotheses 1-2: Adaptation to meat

[2] Animal-reminder level can also be conceptualized as an ordinal variable. For the purpose of our mixed-effect model, we treated it as categorical.

Figure 2 presents mean disgust and empathy scores (and standard errors) for our two groups of participants (butchers/deli workers vs. community sample) as a function of animal type and level of animal reminder. Although we did not use the binary grouping variable within our mixed-effect analyses, we present the means as a function of group simply as a heuristic way to visualize the data. Table S1 in Supplemental Materials provides a breakdown of means and standard deviations for all three measures (disgust, empathy, meat-animal association) by group, animal type, and animal-reminder level. With few exceptions, group mean comparisons at each level of animal reminder were significant at $p < .0125$ (Bonferroni correction of .05/4) with effect sizes (Cohen's *d*) ranging from .30 to .99—see Table S1.

[Insert Figure 2 about here]

Disgust. Consistent with Hypothesis 1, time spent handling meat was a significant fixed effect of disgust towards meat, $F(7,1850) = 20.98$, $p < .001$, independent of the significant effect of gender, $F(2,1850) = 84.40$, $p < .001$ ($M_{women} = 3.18$, $SE = .092$ vs. $M_{men} = 1.97$, $SE = .096$), and the non-significant effect of age, $F(1,1850) = 1.73$, $p = .188$. Pairwise comparisons of the seven levels of meat-handling experience, contrasted with zero (no experience), showed that significant decreases in disgust tended to emerge with participants who had at least 1-2 years of experience handling meat or higher, *MD*s ranged -1.08 to -1.50, *p*s < .001, 95% $CI_{1\text{-}2years}$ = [-1.39, -.76], whereas there were no significant reductions in disgust scores for participants with 0-6 months, $MD = -.56$, $SE = .40$, $p = .238$, 95% CI = [-1.33, .21] or 6-11 months experience, $MD = .17$, $SE = .21$, $p = .430$, 95% CI = [-.25, .58].

There was no main effect of animal type, $F(2,1850) = 0.01$, $p = .988$, but a significant effect of animal-reminder level, $F(3,1850) = 4.78$, $p = .003$, with higher disgust reported at higher levels of animal reminder—a finding consistent with previous research (e.g., Earle et al., 2019; Kunst & Hohle, 2016). Contrary to Hypothesis 2, the two-way interaction between time and animal-reminder level was not significant, $F(21,1850) = 0.36$, $p = .997$. There was

also no two-way interaction of time and animal type, $F(14,1850) = 0.66$, $p = .813$. However, there was a significant two-way interaction of animal type x animal-reminder level, $F(6,1850) = 42.69$, $p < .001$, that may be explained by the different pattern of disgust ratings for fish compared to cow and sheep (see Figure 2). Whereas disgust levels tended to rise with each step-increase of animal reminder (lowest to highest) for cow and sheep, this incremental rise in disgust levels reverses for fish at the highest level of animal reminder (i.e., viewing the whole dead fish).

Empathy. Consistent with the results for disgust, and consistent with Hypothesis 1, there was a significant fixed effect of time spent handling meat on empathy scores, $F(7,1843) = 17.55$, $p < .001$, such that participants exhibited comparatively less empathy towards the animal slaughtered as they worked with meat. This finding was independent of a significant effect of gender, $F(2,1843) = 93.80$, $p < .001$ ($M_{women} = 3.78$, $SE = .094$ vs. $M_{men} = 2.45$, $SE = .098$), and marginal effect of age, $F(1,1843) = 3.19$, $p = .074$. Examination of the pairwise comparisons of the seven levels of meat-handling experience, contrasted with 0 (no experience), revealed that empathy towards the slaughtered animal dropped significantly at 1-2 years of working with meat, $MD = -1.10$, $SE = .16$, 95% CI = [-1.42, -.78] or higher, MDs ranged from -.79 to -1.87, ps < .001. By contrast, participants who had worked less than 1 year did not differ in their empathy towards the slaughtered animal, $MD_{0\text{-}6months} = -.41$, $SE = .40$, $p = .302$, 95% CI = [-1.19, .37], or displayed more empathy than those with zero experience, $MD_{6\text{-}11months} = .59$, $SE = .22$, $p = .007$, 95% CI = [.16, 1.01].

There was no effect of animal type on empathy, $F(2,1843) = 0.38$, $p = .680$, but there was a significant effect of animal-reminder level, $F(3,1843) = 2.95$, $p = .032$. That is, consistent with studies by Kunst and Hohle (2016), participants felt more empathy for the animal slaughtered as the level of animal reminders increased (see Figure 2). Again, contrary to Hypothesis 2, there was no two-way interaction of time and animal-reminder level,

$F(21,1843) = 0.17$, $p = .999$, no interaction of time and animal type, $F(14,1843) = 0.56$, $p = .894$, but a large two-way interaction between animal type and animal-reminder level, $F(6,1843) = 19.60$, $p < .001$, which, again, may be explained by a slightly different pattern of empathy scores for fish than for cows and sheep—see Figure 2 (bottom panel). Empathy for fish appeared to plateau at the medium-high level, whereas empathy for cows and sheep tended to increase at each animal-reminder level and accelerate between the medium-high and highest step.

Correlations. See Supplemental Materials and Table S2, for further discussion and test of Hypothesis 1, which examined zero-order correlations (Spearman's ρ) between time spent handling meat and levels of disgust and empathy. In brief, time spent handling meat correlated negatively and significantly with disgust towards meat and empathy towards the slaughtered animal at every level of animal reminder, for all three animals. See Table S3 for Pearson correlations between disgust, empathy, and meat-animal association across the experimental conditions.

Hypothesis 3: Dissociating meat from animals

The results for meat-animal dissociation scores were comparable to those for disgust and empathy (see Figure 3 for means and standard errors by group, animal type and animal-reminder level). Consistent with Hypothesis 3, there was a significant fixed effect of time spent handling meat on meat-animal association scores, $F(7,1850) = 21.89$, $p < .001$, independent of a significant effect of gender $F(2,1850) = 16.51$, $p < .001$ ($M_{women} = 3.32$, $SE = .095$ vs. $M_{men} = 2.88$, $SE = .099$), and a non-significant effect of age $F(1,1850) = 1.22$, $p = .269$. As before, we examined pairwise comparisons of the seven levels of meat-handling experience, contrasting them with no experience. We observed significantly lower levels of meat-animal association as early as 0-6 months working with meat, $MD = -1.55$, $SE = .40$, $p < .001$, 95% CI = [-2.33, -.77]. Although most level-comparisons with zero were significant,

there were two exceptions: the mean comparison between level 0 (no experience) and level 7 (> 20 years) was directionally as expected but non-significant, MD = -.45, SE = .33, p = .177, 95% CI = [-1.11, .20], and the comparison between level 0 and level 2 (6-11 months) was in the slight reverse direction and non-significant, MD = .38, SE = .22, p = .078, 95% CI = [-0.43, .810], all other comparisons, MDs ranged from -.46 to -1.72, ps < .02. In short, lower levels of meat-animal association were observed among participants within the first few months of working with meat and sustained at most later time points as well, though there were some exceptions to this trend.

[Insert Figure 3 about here]

There was no fixed effect of animal type on meat-animal association, $F(2,1850) = 1.55$, $p = .212$, but a sizable effect of animal-reminder level, $F(3,1850) = 6.27$, $p < .001$, with lower levels of meat-animal association at lower levels of animal resemblance (see Figure 3). The two-way interaction between time and animal-reminder level was not significant, $F(21,1850) = 0.34$, $p = .998$, neither was the interaction of time and animal type, $F(14,1850) = 0.47$, $p = .948$; however, the interaction of animal type and animal-reminder level was significant, $F(6,1850) = 46.52$, $p < .001$, with meat-animal associations for fish increasing incrementally at each step-increase of animal resemblance, whereas the meat-animal association means for cow and sheep rose more sharply between the medium-high and high animal-reminder step (see Figure 3).

Correlations. See Supplemental Materials and Table S2, for Spearman's correlations of time spent handling meat and meat-animal association scores. The negative correlations between time and meat-animal association were significant for nine of the twelve instances.

Hypothesis 4: Beliefs about animals and meat

Table 2 displays the descriptive statistics at the group-level for our belief measures. Our linear mixed-effects analysis revealed that time spent handling meat was associated with

greater endorsement of the 4Ns, $F(7, 1897) = 32.12$, $p < .001$, independent of gender, $F(2, 1897) = 24.44$, $p < .001$, and age, $F(1, 1897) = 0.21$, $p = .650$. Compared to participants with no experience, meat-handling experience led to greater endorsement of the 4Ns for all levels of experience, *MD*s ranged from .36 to 1.51, *p*s < .002, except 0-6 months, $MD = -.42$, $SE = .26$, $p = .112$, 95% CI = [-.93, .10] and 6-11 months, where the difference reversed, $MD = -.75$, $SE = .14$, $p < .001$, 95% CI = [-1.03, -.47]. Time spent handling meat was also associated with human supremacy endorsement, $F(7, 1897) = 15.18$, $p < .001$, independent of gender, $F(2, 1897) = 110.81$, $p < .001$, and age, $F(1, 1897) = 8.87$, $p = .003$. Compared to participants with no experience handling meat, participants with 1-2 years of experience or more showed significantly higher levels of human supremacy endorsement, *MD*s ranged from .30 to 1.09, *p*s < .05 (other *p*s > .22).

Table 2

Means (and standard deviations) of belief measures by group.

	Butchers/Deli workers	Community
4Ns of meat justification	4.53 (1.48)	3.89 (1.29)
Human supremacy beliefs	4.22 (1.47)	3.38 (1.40)
Humane treatment of farmed animals	3.95 (1.86)	2.99 (1.66)
Humane slaughter of farmed animals	4.09 (1.89)	3.00 (1.67)
Moral circle size	16.68 (7.70)	19.22 (7.07)

Experience handling meat was also associated with greater endorsement of humane treatment, $F(7, 1897) = 12.27$, $p < .001$, and slaughter of farmed animals, $F(7, 1897) = 13.95$, $p < .001$, independent of gender, $F_{treatment}(2, 1897) = 29.50$, $p < .001$, $F_{slaughter}(2, 1897) =$

44.51, $p < .001$, and age, $F_{treatment}(1, 1897) = 155.16$, $p < .001$, $F_{slaughter}(1, 1897) = 88.28$, $p < .001$. Endorsement of humane treatment was greater at all levels of experience, compared to zero experience, with a few exceptions (2-4 years, *MD* = -.26, *SE* = .15, $p = .082$, 95% CI = [-.56, .03]; 10-20 years, *MD* = .29, *SE* = .18, $p = .102$, 95% CI = [-.06, .63]), all other *MD*s ranged from .53 to 1.79, *p*s < .05. Endorsement of human slaughter was greater at all levels of experience, compared to zero, with few exceptions (6-11 months, *MD* = .00, *SE* = .18, $p = .96$, 95% CI = [-.35, 0.37]; 2-4 years, *MD* = .20, *SE* = .15, $p = .201$, 95% CI = [-.10, .50]), all other *MD*s ranged from .78 to 1.33, *p*s < .006. Lastly, experience handling meat was associated with more restricted moral circles, $F(7, 1897) = 14.20$, $p < .001$, independent of the effects of gender, $F(7, 1897) = 44.79$, $p < .001$, and age, $F(1, 1897) = 16.54$, $p < .001$. Significant differences emerged at all levels above 6-11 months experience, *MDs* ranged from -1.35 to -7.54, *p*s < .05 (0-6 months, *MD* = -1.95, *SE* = 1.44, $p = .175$, 95% CI = [-4.76, .87]; 6-11months, *MD* = -.39, *SE* = .78, $p = .621$, 95% CI = [-1.92, 1.15]).

Thus, consistent with Hypothesis 4, commercial experience handling meat was associate with more defensive views of meat, belief in human supremacy, and, to a certain extent, beliefs about humane slaughter and rearing practices. Additionally, meat handling was associated with more restricted circles of moral concern.

General Discussion

Although most people eat meat, few of us, at least in modern society, play a direct role in the preparation of meat from living animal to grocer. The present study contrasted the psychological experiences of people who work commercially with meat production with general consumers whose experiences preparing and handling meat are limited. We observed a number of findings that suggest that our sample of butchers and deli workers from Lancashire, UK, had adapted, in many ways, to the meat products they repeatedly encountered in their work.

First, participants who had commercially worked with meat reported comparatively less disgust for experimentally presented meat products derived from cow, sheep, and fish, less empathy for the animals slaughtered, and were less likely to psychologically connect meat with its animal origins, relative to those who lacked such experiences (Hypotheses 1 and 3). According to our mixed-effects analysis, significant reductions in disgust and empathy emerged within the first two years of handling meat, whereas reductions in meat-animal association occurred even earlier, within the first six months. These reductions in disgust, empathy, and meat-animal association held when accounting for individual differences in age and gender of our participants, and were additionally supported by consistent, moderate-to-large negative correlations between time spent working with meat and the degree of disgust, empathy, and meat-animal association participants reported. Interestingly, and against our predictions, the psychological differences we observed across our participants were not most visible at high levels of animal resemblance (Hypothesis 2). Rather, roughly equivalent reductions in disgust and empathy, due to meat-handling, occurred across all levels of animal reminder and all types of animal meat used in our experimental materials. Thus, the psychological effects of meat handling were not limited to products with explicit animal reminders; they were more pervasive than we expected.

It is also worth pointing out that the negative relationships we observed between time working in the meat industry and ratings of disgust, empathy, and meat-animal association, work against the hypothesis that the individual differences we observed are simply due to butchers' and deli workers' self-selection into positions of meat handling. Such an explanation fails to account for the negative relationships between time and disgust, time and empathy, etc., that we observed *within* our sample of butchers and deli workers (see Table S2).

Second, our participants with commercial experience working with meat production tended to have more positive views of meat than participants who lacked such experiences (Hypothesis 4). Specifically, they tended to endorse that meat is necessary, normal, natural, and nice, that humans have supremacy over animals, and that farmed animals are reared and slaughtered humanely, to a greater extent than our participants lacking meat-handling experience. They also included fewer animals, on average, in their circle of moral concern. We interpret these findings through the lens of motivated cognition (e.g., Kunda, 1990), whereby personal involvement in the production and consumption of meat requires a fortifying of rationalizations in order to maintain a positive construal of one's involvement in the slaughter of animals (Bastian & Loughnan, 2017; Piazza & Loughnan, 2016; Piazza et al., 2015).

Connections to Previous Research

Our findings advance work into the psychology of disgust, meat and animals on a number of fronts. First, our findings advance work on disgust and adaptation (e.g., Rozin, 2008) by investigating a novel domain of disgust elicitors—dead animals and animal flesh—in which people can undergo a process of adaptation. Rozin (2008) found that medical students experienced reductions in disgust towards human cadavers after a 2-3 month exposure for dissection training. Our sample of deli workers and butchers expressed diminished feelings of disgust, and diminished empathy for the slaughtered animals, when evaluating meat products, compared to individuals who lacked such direct experiences with meat production. Furthermore, the longer our participants had worked in the meat industry, the less disgust and empathy they felt towards meat and the animals involved, and this reduced sense of empathy and disgust was observable within the first two years of work. This suggests that psychological adaptation to meat may occur over relatively short time periods.

Our study extends work on adaptation further by identifying *meat-animal dissociation* as a potential mechanism whereby adaptation to meat might occur. In line with previous work (e.g., Earle et al., 2019; Hamilton, 2006; Kunst & Hohle, 2016; Kunst & Haugestad, 2018), our manipulation of animal-reminder level impacted on the degree of disgust reported by our participants and the degree of empathy they expressed towards the slaughtered animal, with lower disgust and empathy at lower levels of animal resemblance. This suggests a potential causal link between meat-animal dissociation and adaptation to meat. Further, indirect support for this idea comes from the observation that participants with greater degrees of meat-handling experience were less likely to connect the animal product to the animal source when viewing it, compared to participants without commercial meat-handling experience. These reductions in meat-animal association were observed among participants within the first few months of working with meat. This early onset of meat-animal dissociation that we observed is suggestive that meat-animal dissociation may temporally precede the emotional dimensions of meat adaptation. We might speculate that routine interaction with meat products results in a quieting of the meat-animal association, which in turn may attenuate people's emotional response to meat. Of course, further work is needed to test this interpretation.

Second, our findings extend the application of motivated cognition to the psychology of meat consumption. Piazza et al. (2015) found that meat eaters and meat avoiders largely disagree in their beliefs about whether meat is necessary, normal, natural, and nice (the four Ns). Piazza and Loughnan (2016) showed how consumers often fail to incorporate relevant information into their moral concern for animals when they are personally invested in the dilemma of eating animals. In the present investigation, we found that individuals who work frequently with meat more strongly endorsed the four Ns of meat justification than individuals not working in the meat industry. They also had more positive beliefs about the

treatment of farmed animals, thought humans are more justified in having dominion over animals, and placed fewer animals within their moral circle, compared to those with no commercial experience with meat. In short, we uncovered evidence that would suggest that working with meat production fosters beliefs about meat and the treatment of farmed animals that aids in the rationalization of animal slaughter. Although our research design cannot entirely isolate whether beliefs about meat and animals precede work with meat, as opposed to being shaped directly by one's involvement in meat production, we observed significant fixed effects of time spent handling meat for all of our measures of meat justification and animal treatment, which goes some distance in addressing this concern.

Limitations and Constraints on Generalization

Like all investigations, our study had limitations. First, we limited our recruitment to Lancashire, UK. It would be useful to replicate our findings in other regions and countries where aspects of meat production may differ in important ways. Second, we elicited reactions towards meat via a single sensory modality: sight. Third, we assessed time spent handling meat with a series of ordinal time-length categories. Future studies could aim to assess time by asking participants to estimate the months/years they have been working. It would also be useful to assess participants' qualitative experiences with meat, as certain experiences (e.g., removing offal vs. cutting muscle tissue) may be more relevant for adaptation than others. Finally, there was a small number of butchers and deli-workers (n = 2) that reported less than 6 months experience handling meat, which limits the conclusions that can be drawn about this group even with our repeated-measures design. Future efforts to examine this group would provide richer insights into this early phase of adaptation.

Potential Mechanisms of Adaptation

What might account for the lower levels of disgust and empathy experienced by butchers and deli workers in our study? There are at least three possibilities: (a) *repeated*

exposure to meat products may promote adaptation; (b) people who handle meat may experience *counterconditioning* (see e.g., Ludvik et al., 2015) whereby their working with animal products is made more positive by virtue of the compensation they receive for their work (e.g., salary, imagined consumer gratitude); (c) people who work with meat may *reappraise* the potential negative aspects of meat, for example, by reassuring themselves that people need meat to flourish or that animals are treated humanely when they are slaughtered.

We found consistent relationships between time spent working with animal products and the amount of adaptation deli workers exhibited towards meat, which we take as preliminary evidence for repeated exposure as a mechanism of adaptation. We also observed significantly more positive beliefs about the value of meat and the humane treatment of animals slaughtered for meat among our meat-industry workers, which suggests a possible process of reappraisal. We have no direct evidence for counterconditioning, and it is possible that other mechanisms await discovery. Future studies should continue to investigate the factors contributing to meat adaptation, as there are likely several.

Conclusion

As we have seen here, individuals who have frequent contact with meat adapt to their circumstances. They experience less disgust than the average consumer when confronted with meat products, express less empathy for animals slaughtered, and are less likely to think about the animal when interacting with meat of various sorts. Rather than being horrified by the incessant pall of animal slaughter, it would seem that repeatedly interacting with meat at various stages of production results in a tuning down, rather than ratcheting up, of one's disgust towards meat.

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Image References

Cooked steak [Online image]. (2017). https://pixabay.com/id/photos/makanan-alam-asap-gourmet-makan-3251781/

Cows hanging in slaughterhouse [Online image]. (2016). https://pixabay.com/id/photos/daging-sapi-sapi-rumah-jagal-1884301/

Lamb butchers [Online image]. (2016). https://pixabay.com/id/photos/hewan-karkas-kamar-dingin-jagal-3324798/

Lamb cooked [Online image]. (2006). https://pixabay.com/id/photos/abstrak-amerika-latar-belakang-1238658/

Lamb steak [Online image]. (2018). https://pixabay.com/id/photos/daging-domba-t-bone-steak-hille-3359248/

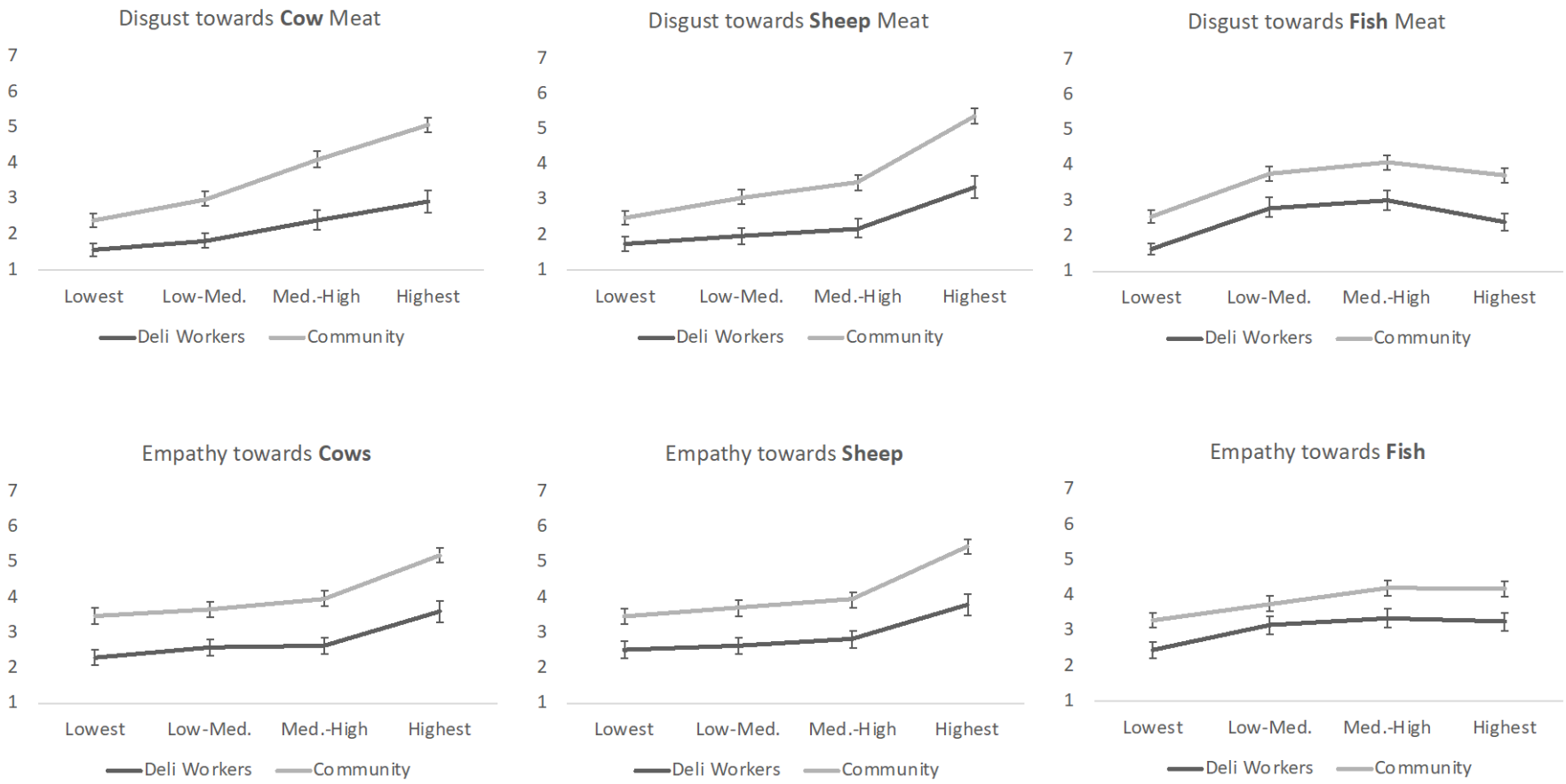
Figures and Captions

Figure 1

Experimental stimuli (meat images) by animal type and animal-reminder level. Due to copyright, several images have been replaced with approximate, open-source images from Pixabay. These include cow-lowest, sheep-lowest, sheep-low-medium, sheep-highest, and fish-lowest. Cow-highest is from Pixabay and is the original image used. See Image References. All other images, including fish-lowest, were photographed

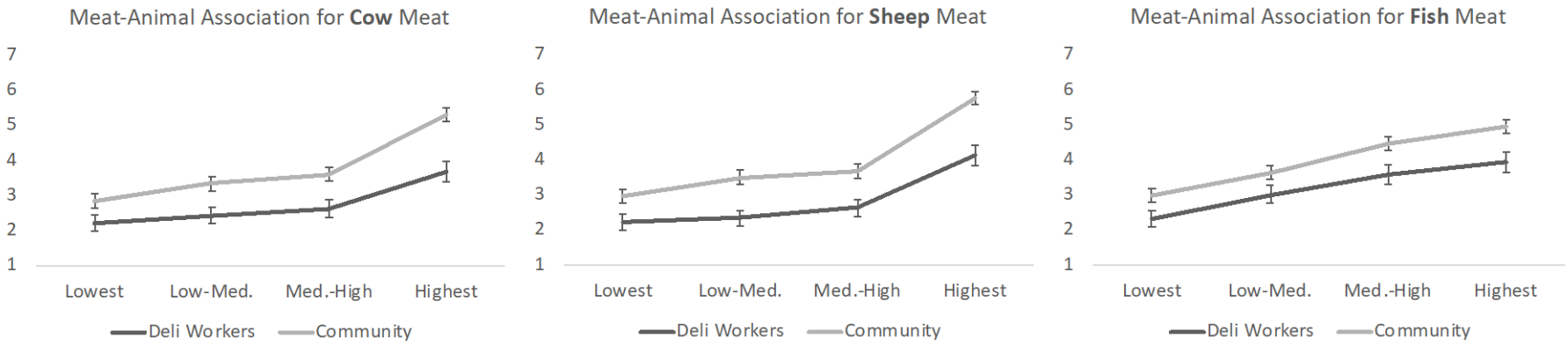
by the third author, Alexandra Oakley, and reproduced with her permission. The original images and their corresponding references can be found at https://osf.io/8qk6d.

Figure 2



Top panel: Disgust (top panel) and Empathy (bottom panel) towards cow, sheep, and fish by group and animal-reminder level. Error bars ±1 S.E.

Figure 3



Meat-animal association for cow, sheep, and fish by group and animal-reminder level. Higher scores reflect a higher degree of thinking about the animal source. Error bars ±1 S.E.