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Meet your meat: Psychological factors impacting on attitudes towards animals, their consumption, and plant-based alternatives

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Abstract

A way to address health and sustainability concerns with the current food systems is to shift away from current levels of consumption of animal-sourced products, especially meat, toward an increased intake of plant-based foods. The general aim of this work was to explore how to trigger such transitions through a set of four articles, focused on the ways people perceive: (1) animals as living beings, examining the impact of characteristics of the perceiver (e.g., gender, pet attachment) and of the target (e.g., biological category of the animals) on perceptions (e.g., edibility, moral concern); (2) animals as food products and how resemblance to the animal source impacts on appetite for meat, independently from the impact of product familiarity; (3) alternatives to meat consumption (e.g., legumes, tofu) and the impact of framing (i.e., meal vs. ingredient) as a strategy to promote more positive attitudes toward meat alternatives. Finally, the ending section of this work provides a reflection about the existent gaps in this literature, integrates the main findings of the present body of work, and outlines how they might inform audiences interested in promoting transitions toward reduced meat consumption and more sustainable, healthier, plant-based diets.

Keywords: Human-animal relations, Meat consumption, Meat alternatives; Animal resemblance, Familiarity, Meal framing.

PsycInfo Codes:
2900 Social Processes & Social Issues
3920 Consumer Attitudes & Behavior
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Resumo

Uma das formas de responder aos desafios de saúde e sustentabilidade com os sistemas alimentares atuais passa por reduzir o consumo de produtos de origem animal, particularmente de carne, para um aumento no consumo de alimentos de origem vegetal. O objetivo geral deste trabalho passou por explorar como desencadear estas transições através de um conjunto de quatro artigos, com foco na forma como as pessoas percecionam (1) os animais como seres vivos, examinando o impacto das características individuais (e.g., género, ter animais de estimação) e do alvo (e.g., categoria biológica) nestas perceções (e.g., comestibilidade, preocupação moral); (2) os animais enquanto produtos alimentares e como a semelhança desses produtos com os animais influencia o apetite por carne, independentemente do impacto da sua familiaridade; e (3) alternativas ao consumo de carne (e.g., legumes, tofu) e o impacto do enquadramento da refeição como estratégia para promover atitudes mais positivas em relação às alternativas à carne. Por fim, a seção final deste trabalho apresenta uma reflexão sobre as lacunas existentes nesta literatura, integra os resultados mais relevantes do presente corpo de trabalho e descreve como estes podem informar audiências interessadas na promoção de transições rumo à redução do consumo de carne e à adoção de dietas mais sustentáveis, saudáveis e mais baseadas em alimentos de origem vegetal.

Palavras-chave: Relações humanos-animais; Consumo de carne; Alternativas à carne; Semelhança com o animal; Familiaridade; Enquadramento de refeição.

Códigos PsycInfo:
2900 Processos sociais e questões sociais
3920 Atitudes e comportamentos do consumidor
4070 Questões ambientais e atitudes

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CHAPTER 1

Background and Introduction

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Background and Introduction

1.1. General Introduction

There is increasing scientific evidence suggesting that a large-scale transition away from animal-sourced proteins towards greater use of plant-based foods can be an efficient solution to improve the sustainability of the current food systems, promoting manifold benefits on the environment, public health, and animal ethics (Aiking & de Boer, 2018; Clark & Tilman, 2017; Godfray et al., 2018; Poore & Nemecek, 2018, 2018; Röös et al., 2017; Shepon et al., 2018; Springmann et al., 2016; Tilman & Clark, 2014; Willett et al., 2019). However, shifting human diets away from meat-centered eating will likely require a profound societal transition (Dagevos & Voordouw, 2013; Schösler et al., 2012). Meat has been invested with a special socially constructed meaning in western societies (Schösler et al., 2012), and most consumers are not willing to change their meat consumption (Latvala et al., 2012), even when acknowledging the benefits of more plant-based diets (Hoek et al., 2011; Lea et al., 2006).

Therefore, with the general aim of contributing to more knowledge on how to trigger transitions towards healthier, more sustainable, and more plant-based diets, this work addresses the complex processes of eating animals. In a first approach, we examined how people perceive the source of meat, that is, individuals' perceptions towards animals, not transformed into food products, but as living beings. Secondly, we examined perceptions towards animals actually transformed into meat products. Lastly, in a perspective of meat substitution, we analyzed individuals' perceptions towards several alternative products to meat consumption.

1.1.1. Food systems and the climate emergency

Global concern is increasing about the alarming threats posed by the rapidly changing climate and a climate emergency has recently been declared (Gropp & Verdier, 2020). Food systems are one of the areas that are progressively acknowledged as a path of action that must be addressed to help tackle the negative impacts of climate change and achieve the UN Sustainable Development Goals, that aim to reshape the global food system to make it efficient, climate resilient, sustainable, healthy, and business friendly (IFPRI, 2016).

While the current systems provide nourishment and support human life on our planet, they also contribute to depleting the natural resources (e.g., land; water; energy), biodiversity loss, push towards eating habits that are not optimal for human health and raises ethical challenges

related to animal welfare and social inequalities in food distribution and availability (Aiking, 2014; Campbell et al., 2017; Clark & Tilman, 2017; Garnett, 2016; Ritchie et al., 2018; Rockström et al., 2009; Springmann et al., 2016).

Within the forecast of a growing population, the profound impacts of the current food systems will likely increase globally and raise even more complex challenges concerning food production and distribution structures that would make food available, accessible, and plentiful for the thriving of individuals and societies. This problem has captured the increased attention of the public. Nonetheless, government and policy responses to these warnings from scientists have been regrettably inadequate (Clark & Tilman, 2017; Tilman et al., 2011).

1.1.2. From meat to beets: The benefits of adopting more plant-based diets

The benefits of transitioning from meat-based to more plant-based diets are threefold, including environmental, health, and animal welfare promotion. First, this transition has been called for to reduce the ecological footprint of food systems and to meet the regulatory capacity of the Earth (Machovina et al., 2015; Schösler et al., 2015). Animal agriculture has a negative impact on the environment in several aspects (Aiking, 2011; Godfray et al., 2018; Poore & Nemecek, 2018; Willett et al., 2019). For instance, waste products from this industry are released into the ground, air, and water, contaminating them with harmful chemicals (e.g., nitrogen, phosphorus) that can be detrimental not only to the environment but to people's health (Westhoek et al., 2014). Additionally, animal agriculture implicates significantly more limited resources compared to plant agriculture (Mekonnen & Hoekstra, 2012). Previous findings revealed that meat production is a substantial contributor to climate change, considering their substantial greenhouse gas emissions (GHG), land, water, and energy use (Gerber, 2013; McMichael et al., 2007). Presently, meat production requires 33% of arable land and is responsible for 10% of global greenhouse gas emissions (FAO, 2020; Gerber, 2013). In terms of gas emissions and land use, beef production generates 50 kg of GHG, and 100 g of protein requires 164 m^2 of land. These resources tend to be 20 to 100 times higher than other protein sources such as tofu, peas, and nuts (Poore et al., 2018). Specialists estimated that a meat-free diet generates about 2.5 times less greenhouse gas emissions in comparison to a diet of 100 g of meat daily (Scarborough et al., 2014). If the population halved the consumption of animal products in the European Union, namely, meat, dairy, and eggs, the estimated reduction of greenhouse gas emissions would be approximately 25 to 40%, also reducing the cropland required for food production per capita by 23% (Westhoek et al., 2014). Regarding crop usage, to produce 1 kg of meat (e.g., poultry, pork, or beef) 2 to 7 kg of crops are needed. Considering this data, specialists started

proposing that redirecting these crops to humans, as a direct food source, could be a more efficient distribution of resources (FAO, 2020; Neville et al., 2017). Moreover, life-cycle analyses revealed that meat products need 11 times more fossil energy than analogous plant-based meat alternatives (McClements, 2020; Pimentel & Pimentel, 2003). The production of the Beyond Burger, for instance, generates approximately 90% fewer greenhouse gases, needs 93% less land, 46% less energy, and 9% less water than around 113 pounds of U.S. beef (Heller & Keoleain, 2018).

In addition to environmental benefits, the increased intake of whole-food plant-based products may also present advantages for human health. For instance, animal products are a less efficient source of protein and energy compared to plant-based products. Alternative proteins such as plants and algae are associated with health benefits, including favorable changes in cardiovascular biomarkers (Guasch-Ferré et al., 2019), lower risks of chronic diseases and mortality (Zheng et al., 2019), and are still high in protein content, bioactive compounds, and antioxidants (Tso et al., 2021). For example, compared to meat patties, alternative protein burgers generally had similar energy, no cholesterol, lower fat, and higher fiber (Cotas et al., 2020). On the other hand, several studies have been pointing out the potential health risks associated with meat consumption (Tilman & Clark, 2014; Willett et al., 2019). Red meats and processed meats, in particular, have been linked with the risk of certain cancers including colorectal, colon, and rectal cancer (Chan et al., 2011). A meta-analysis of prospective cohort studies by Wang et al. (2016) revealed that total red and processed meat consumption significantly increased the risk of cancer deaths. Accordingly, meat was classified as carcinogenic to humans by the International Agency for Research on Cancer (IARC), a subsector of the World Health Organization (WHO), supporting the link between red meat and cancer (WHO-IARC, 2015). Furthermore, meat intake has also been linked with an increased risk of Type 2 diabetes mellitus, obesity, and cardiovascular disease (Rouhani et al., 2014; Wang et al., 2016; Wolk, 2017).

Furthermore, the production, distribution, and consumption of animal-based products (e.g., meat, dairy, eggs) constitutes a major risk for zoonotic transmission, with an estimated 75% of new and emerging diseases affecting humans suspected to have animal origins (e.g., COVID-19). Present patterns of animal product consumption are considered unsustainable and may hasten consequences for environmental and human health. Considering the global pandemic that the world is facing, the WHO thus suggests that plant-based diets are a promising pathway to shift consumers away from unsustainable animal-based consumption and to help tackle global health threats such as pandemics and climate change (Sandhu et al., 2021).

Despite these concerning findings, global meat production has more than quadrupled since 1961, from 71 million tons to 346 million tons, in 2018 (FAO, 2020). Accordingly, per capita meat consumption per year, as a global average, has also increased fourfold since 1961, increasing by approximately 20 kg. In 2014, the average person in the world already consumed around 43 kg of meat per year, exceeding the ambitious limit of 40 g a day, the equivalent of 14.6 kg per year (OECD, 2022). Therefore, the current global patterns of meat consumption are way above the recommended levels. Data from 2017, showed that in some countries (e.g., US and Australia), meat consumption surpassed 100 kg per capita. Moreover, per capita consumption in China has grown approximately 15 times since 1961 (from around 4 kg to 61 kg), and in Brazil consumption has nearly quadrupled (from 28 kg to 100 kg). The average European consumes nearly 80 kilograms per year, almost doubling the amount consumed in 1961 (i.e., 48 kg). In Portugal, meat consumption has more than quadrupled in the same period, from 20 kg to 94 kg (FAO, 2020). Furthermore, evidence consistently shows that there are substantial nutritional deviations in the food patterns of the general Portuguese population, with the intake of the group "Meat, fish, and eggs" above recommended levels, and fruits, vegetables, and plant-based proteins below recommended levels (Instituto Nacional de Estatística, 2016). Taken together, these factors exponentially increase the risk for Non-Communicable Diseases (e.g., cardiovascular diseases, cancer, diabetes), which in turn are the main cause of premature death worldwide (Direção-Geral da Saúde, 2010, 2015).

Additionally, moving away from the current consumption of animal-sourced products is a necessary (but not a self-standing) solution to develop a more sufficient and ethical global food supply. A study found that if substantial changes to the dietary choices and the socio-economic conditions of the majority of the population occurred, including replacing most meat and dairy with plant-based alternatives and greater inclusion of crops presently given to animals directly to humans, especially maize, the current production of crops would be adequate to offer enough healthy food for the expected worldwide population of 9.7 billion in 2050, and ensuring access to the global food supply. However, if consumers maintain their current dietary patterns, edible crops will have to grow 119% by 2050 (Berners-Lee et al., 2018).

Besides the positive outcomes for the environment, human health, social and ethical challenges associated with a more plant-based diet, animal welfare is also mentioned as a key motivator for consumers who decide to reduce or eliminate animal products from their diets (De Backer & Hudders, 2015; Hagmann et al., 2019). Factory farming constitutes a large-scale system of violence and exploitation of sentient species for human purposes. In 2018 alone, over 772 billion vertebrate animals were killed for human consumption (most of which were fish –

around 88%, (FAO, 2020). Still, this is likely an underestimate, since this number does not include the number of animals who have died due to indirect causes brought about by the animal agriculture industry or killed in the animal agriculture supply chain (e.g., male chicks killed in the egg industry, or animals killed to feed other animals). Based on these data, it has been estimated that by eating a plant-based diet a single person could potentially save the lives of approximately 105 animals per year (Animal Charity Evaluators, 2021).

1.1.3. We still need 50 more shades of green

Meat-free diets are therefore becoming increasingly more popular due to innovation in the plant-based products industry, as a response to rising awareness of animal ethics, as well as heightened consumer interest in healthy-focused and sustainable products (Good Food Institute, 2021). Google data shows that searches related to veganism increased by 47% in 2020, meaning that it was almost twice as popular as it was five years ago (Google, 2022). Besides the concerns about personal health, planetary sustainability, and the ethical treatment of animals, the coronavirus pandemic has only contributed to the boost of this trend and has increased the attention towards plant-based diets (Proagrica, 2021).

In the US, the number of vegans grew by 600% from 4 million in 2014 to 20 million in 2018 (Global Data, 2017). Similarly, in the UK, the number of vegans has quadrupled over the last few years, from 150,000 in 2014, to 600,000 in 2019 (Food Standards Agency, 2021). In Portugal, the number of vegetarians quadrupled between 2007 and 2017, with now approximately 0.9% of vegetarians and 0.7% following a vegan diet (Lantern, 2020; Nielson, 2017). Despite these growth trends, the total number of vegans worldwide in 2021 amounts to approximately 79 million, which only corresponds to 1% of the world population (Statista, 2021). Therefore, despite the increasing adoption of more plant-based diets, and some consumers already making dietary shifts, it is still an extremely minor portion of the population.

Changing food habits might be a difficult task, since food is not only a physiological requirement for human survival but also involves choices that are immensely predominant in human behavior and influenced by many interacting factors (Köster, 2009). When the scenario is to replace a product that is highly appreciated and extremely present in the daily lives of several segments of consumers, like meat, that could become even more challenging (Graça, Calheiros, et al., 2015; Wansink et al., 2005). Meat has always been a meaningful element in human lives since prehistoric times (Leroy & Praet, 2015), not only as a fundamental dietary element and source of nourishment in most societies, but also representing a source of pleasure and attachment (Graça, Calheiros, et al., 2015; Graça, Oliveira, et al., 2015), and an enduring

symbol of status and masculinity (Cawthorn & Hoffman, 2016; De Backer et al., 2020; Rothgerber, 2013; Ruby & Heine, 2011; Schösler et al., 2015; Sobal, 2005). In Portugal, meat has also been perceived as a meaningful symbol of wellbeing within eating practices and food habits, particularly during the dictatorship of Estado Novo (1933-1974). However, due to recent scientific evidence about the negative impact of meat, meat consumption is now inversely perceived and decreased abruptly among the wealthiest and most educated people (Branco, 2021). Nevertheless, a more expressive dietary shift from all socioeconomic classes is required, since to counteract farming's impact on climate breakdown, meat consumption in the European Union should decrease by 71% by 2030, and by 81% by 2050, according to an analysis by Greenpeace European Unit (2020).

A systematic review found that only 13 to 26% of consumers were willing to eliminate or significantly decrease their meat intake for environmental motivations or have already changed their meat consumption for environmental reasons (Sanchez-Sabate & Sabaté, 2019). Animal welfare ranks even lower than other factors such as health as a consumer driver for meat-eaters to reduce their intake of meat (Bryant, 2019). With global meat consumption continuing to rise annually (FAO, 2020) and large segments of consumers not willing to change their meat-eating habits (Hartmann & Siegrist, 2017), fundamental shifts are required in the current food systems, to create a culture in which healthful, sustainable and ethical food choices are the norm (Tso et al., 2020).

To address these concerns with the current food systems, it is relevant to further examine the psychology of eating animals, and examine how individuals perceive animals, meat, and meat alternatives, to help expand knowledge on how to design effective interventions to trigger large-scale and consumer-level transitions towards reduced meat consumption and more plant-based diets.

1.2. Pathways to Better Understand How to Trigger Transitions Towards more Plant-Based Diets

1.2.1. How people perceive animals as living beings

If one of the areas of action that must be addressed to fight the current climate emergency, promote healthier and more ethical food choices, is to eat less meat, a first step would be to better understand human-animal relationships, given that animals are the central object of consumption in the current food systems. However, people tend to develop different and complex attitudes, emotions, and perceptions toward non-human animals (Herzog, 2010; Loughnan et al., 2014). Since ancient societies, the role of animals has ranged from subsistence and economic to social and spiritual dimensions. Until current days, certain animals are perceived as pets, whereas others are perceived as objects of entertainment, labor, or food. More recently, studies have been focusing on further understanding the complex topic of human-animal relationships. Examining how people perceive animals and their characteristics may provide valuable insights into the evolutionary trajectory of human behaviors, since these perceptions affect the way we treat them. Importantly, evidence shows that the way people evaluate animals might affect their willingness to change eating habits (Bastian et al., 2012; Tian et al., 2016). For instance, it might affect the individuals' perceived edibility of the animal, as animals perceived as intelligent or categorized as pets are not perceived as edible. In fact, the simple idea of consuming certain animals is perceived with disgust, whereas others are considered extremely appetizing (Rozin & Fallon, 1987; Ruby & Heine, 2012).

Therefore, examining how people perceive animals is an important topic on promoting reduced meat consumption, as they are the object of consumption. Greater knowledge of human-animal relationships might be a way to better understand how people can perceive animals as sentient beings, in a more emphatic way, and therefore explore and develop strategies that will make people leave animals off their plates.

1.2.2. How people perceive animals as food products

In recent years, researchers have been interested in understanding how people morally care for animals but at the same time eat them (Rothgerber & Rosenfeld, 2021). Inevitably, eating meat involves the process of killing animals for food, which is upsetting for some consumers. Therefore, some meat-eaters encounter a conflict between their enjoyment of meat and their affection toward animals – an experience of cognitive dissonance (Festinger, 1957). This state of conflict about meat has been called the "meat paradox" which states that consumers can simultaneously enjoy meat and care about animals and their welfare (Loughnan et al., 2010). Because dissonance is experienced as a negative state, meat-eaters may engage in efforts to either prevent or reduce this form of dissonance. An extensive literature review by Rothgerber and Rosenfeld (2021) found that there are three mechanisms used to prevent meat-related cognitive dissonance (MRCD), including:

(a) *avoidance*, by refraining from acknowledging animal ethics, environmental, or health concerns with meat consumption, to therefore avoid situations and information that increase dissonance;

(b) *willful ignorance*, by deliberately not wanting to be exposed to information about animal slaughter and farming practices, also underestimating the degree of suffering inflicted on livestock;

(c) *dissociation*, by disconnecting the animal from the food product, by changing the language about them (e.g., replacing names of the animals like "cow" or "pig" for words like "beef" or "bacon"), or by showing less willingness to eat animals that clearly remind the consumer about the living animal (e.g., body parts, blood). Therefore, a pertinent way to deal with the meat paradox is to dissociate the meat on our plate from the living animal that originated that meat. Accordingly, studies showed that individuals tend to dissociate meat from its origin, not only because the more the meat resembled the living animal (e.g., meat with visible animal body parts) more likely it was to evoke disgust, to induce avoidance to eat it. Additionally, meat with animal resemblance also increases empathy for the animal and promotes the willingness to choose a vegetarian alternative dish (Kubberød et al., 2006; Kunst & Haugestad, 2018; Shimp & Stuart, 2004; Tian et al., 2016).

However, these prevention mechanisms are more helpful when individuals are entering into a dissonance state and less useful once MRCD has been activated. According to the classical dissonance theory (Festinger, 1957), it is possible to resolve the dissonance in two ways: by decreasing discrepant cognitions and therefore eliminating the dissonant behavior (i.e., stop eating meat) to be consistent with their pro-animal beliefs, or by increasing consonant

cognitions to maintain the consumption of animals. However, the first option is less likely to happen because of the abovementioned mechanisms. Therefore, instead of changing behavior, individuals tend to reduce MRCD through cognitive change by adding consonant cognitions in the form of motivated justifications, rationalizations, and other strategic attitudes that explain away the troubling nature of eating animals and other dissonance reduction strategies (Rothgerber & Rosenfeld, 2021). For instance, justifying meat consumption as something natural, necessary, normal, or nice (Piazza et al., 2015). Bastian and Loughnan (2017) referred to these approaches as "active" dissonance reduction strategies, accounting for harm, responsibility, and identity as the key triggers of dissonance. The first strategy would consist in minimizing harm, by denying animal minds, so that harming them seems less morally troublesome (Bastian et al., 2012; Gray et al., 2021; Loughnan et al., 2010). This can be achieved by dichotomizing animals into those "we love and care" about versus those "we eat and explore" or categorizing animals as "food" versus "non-food". The second one would be refusing responsibility, by blaming other parties and viewing their behavior as dictated by authorities (e.g., the food system itself, the government) or diffused through collective action, (e.g., most people eat meat; Joy, 2010; Piazza et al., 2015). Endorsement of these justifications helps individuals feel less conflicted about eating meat, therefore enabling its consumption (Piazza et al., 2020). Finally, dispersing the identity-relevant implications of eating meat, is a strategy that involves removing oneself from the meat-eating behavior. For example, convincing oneself and others that the person does not eat a big quantity of meat or referring that they are limiting their meat intake by hiding the frequency with which particular behavior occurs. Overall, strategies that imply separating themself from the moral implications of consuming meat and therefore reducing MRCD and defending themselves from their morally troubling behavior (Bastian & Loughnan, 2017; Rothgerber & Rosenfeld, 2021).

Moreover, familiarity with the food product is another relevant dimension that may shape consumers' attitudes toward meat and that affect their appraisals and consumption. Familiarity promotes more positive associations and appraisals, encourages a sense of knowledge and comfort, positively affects consumers' acceptance, expectations, appetite towards the products (Aldridge et al., 2009; Borgogno et al., 2015; Cooke & Wardle, 2005). On the contrary, novel foods are associated with a sense of unknowing, which generates uncertainty, strangeness, fear, and distrust. For instance, less familiar foods, such as insects in Western cultures, are usually perceived as more negative, as less appetizing, inedible, or dangerous for human health (Hartmann & Siegrist, 2017; Wendin & Nyberg, 2021).

1.2.3. How people perceive alternatives to meat consumption

Considering the goal of promoting transitions towards reduced meat consumption and more plant-based diets, it is also crucial to further examine consumers' perceptions and acceptance towards these more sustainable alternatives. Meat substitutes are receiving increased global attention (Changing Markets Foundation, 2018). This growing interest in protein alternatives, such as soy, seitan and tofu has been accredited to either their reported lower environmental impact, health benefits, or improved animal welfare in comparison to conventional animal-based meat (Tziva et al., 2020). Interested entities are encouraging the acceptance of these products, using different strategies, promoting the idea of a desirable and novel sensory experience, or advocating their advantages in terms of nutritional, environmental, and ethical aspects.

Previous literature proposed that emotional responses such as avoidance and disgust are likely to vary across different alternative protein sources (e.g., tofu), whereas insect-based or cultured meat proteins (e.g., meat produced by in vitro cell cultures of animal cells) are more likely to consistently evoke disgust (Hartmann & Siegrist, 2017; Siegrist & Hartmann, 2020). The consumption context of a product will also significantly influence its perceptual appeal, as evidenced by recent research. For instance, cultural context plays a significant role in cultured meat perception and acceptance (Gómez-Luciano et al., 2019; Siegrist & Hartmann, 2020). Additionally, social context also affects the willingness to try novel/unfamiliar proteins. For example, eating with friends at food festivals may positively affect the anticipated acceptance of insect-based foods and cultured meats (Motoki et al., 2020). Moreover, the Grounded-Cognition Theory of Desire (Papies et al., 2020) proposes that food stimuli might be perceived more positively when presented in familiar contexts, for instance, meat substitutes that resemble meat, than when abstracted from such contexts.

Research has shown that consumer familiarity increases the liking for novel products and may diminish the effect of neophobia over time (Pliner et al., 1993). Therefore, there is a need to consider approaches that reduce disgust and promote familiarity and sensory appeal, and therefore acceptance for alternative proteins (Hartmann & Siegrist, 2017). Accordingly, global fast-food franchises (e.g., Burger King) are increasingly offering plant-based alternatives of trendy meat-based burgers alongside their vegetarian options, to capture the trend towards the plant-based category (Popper, 2019).

However, large segments of consumers are still not willing to change their meat-eating habits, and there is currently a lack of detailed evidence on what may shape the acceptance of novel alternative protein sources. Therefore, it is fundamental to better comprehend the

psychological, contextual, and emotional elements that might affect consumer acceptance of meat alternatives (Tso et al., 2020).

1.3. Aims and Overview

To help facilitate transitions towards more plant-based diets, the present thesis comprises four scientific articles that examine three aspects related with meat consumption (Figure 1.1). Specifically, we aimed to analyze the way people perceive: (1) the origin of meat, that is, the living animals, as sentient beings (Articles 1-2); (2) animals as meat products, not as living creatures, but as food (Article 3); and finally (3) the consumption of different meat products, as well as several meat alternatives, which allowed to identify barriers and strategies to promote consumers' acceptance towards these alternatives (Article 4).

Article 1 had three main goals. First, we aimed to develop normative ratings for a comprehensive group of animals, from different species and biological classifications. Our database included a total of 120 animal images spanning a total of 12 biological classifications, including amphibians (e.g., frog), arachnids (e.g., thick), birds (e.g., parrot), bivalves (e.g., mussel), cephalopod (e.g., squid), clitellates (e.g., leech), gastropods (e.g., snail), insects (e.g., fly), malacostrans (e.g., lobster), mammals (e.g., lion), fish (e.g., sardine) and reptiles (e.g., snake). These materials can thus be used in several researcher fields (e.g., human-animal relationships, eating behavior).

Second, we aimed to examine how each animal was perceived and assessed on 11 evaluative dimensions, including affective, aesthetic, and moral concern variables. Furthermore, we also examined which characteristics predicted were people's moral concern for animals, namely feelings of care and protection and acceptability to kill the animal for human consumption.

Third, we aimed to investigate how individual characteristics of the perceiver, namely gender, age, living area, diet, and companion animal ownership, affected their perceptions towards different animals. Previous studies pointed out the impact that these individual characteristics might have on animal perception, with women (vs. men), vegetarians (vs. omnivores), and pet-owners (vs. non pet-owners) usually reporting more favorable attitudes towards animals (Marsa-Sambola et al., 2016; Piazza et al., 2018; Randler et al., 2021).

Therefore, one of the outputs of this work was the development of a database of 120 open-source color images of animals, spanning a total of 12 biological categories, each one rated on 11 evaluative dimensions, namely valence, arousal, familiarity, cuteness, dangerousness, edibility, similarity to humans, capacity to think, capacity to feel and feelings of care and

protection and acceptability to kill the animal for human consumption. For the selection of our animal set, we attempted to provide a balanced range of biological categories, also considering animal categories usually less present in human-animal studies (e.g., malacostrans, bivalves). We presented not only item-level data for each biological category, but also presented correlations between the 11 evaluative dimensions. Additionally, we also presented animal ratings for each evaluative dimension considering the characteristics of the perceiver (e.g., gender, diet), and by biological classification.

Article 2 aimed to further explore the data from our first article and to extend the scope of the pets as ambassadors hypothesis. Our rationale was based upon the four animal categories previously identified by animal attribution literature, namely (1) companion animals (e.g., dog), (2) predators (e.g., lion), (3) farmed animals (e.g., cow), and (4) pests (e.g., cockroach). We aimed to examine how pet attachment was related to the appraisals attributed to each one of these animal categories. Previous studies found that pet attachment might encourage a wider concern for animals by increasing the perceptions individuals have about animals' mental and emotional capacities (e.g., Auger & Amiot, 2017; Hawkins & Williams, 2016). Moreover, fostering a relationship with a pet might decrease concerns related to the threat evoked by some animals, as proposed by Prokop and Tunnicliffe (2010), who found an expressive larger liking for less desirable animals among children who owned pets. Moreover, pet-owners are more likely to admire the visual characteristics of animals more promptly. In fact, appearance is a relevant predictor of concern for animals. For example, dogs with cute or baby-like characteristics increases their probability of being picked as pets (Weiss et al., 2012). Additionally, aesthetics might also affect the concern attributed to animals that are killed for food (Piazza et al., 2018; Zickfeld et al., 2018). Pet attachment might also develop the perception that animals share similar characteristics with humans. For instance, previous studies proposed that judgments of similarity to humans may encourage concern for farmed animal lives (Bastian et al., 2012). Therefore, we examined in the second article the hypothesis that pets might act as ambassadors by promoting more positive assessments towards animals, including similarity to humans.

We used ratings from our first article's database – Animal.ID database (Possidónio et al., 2019), to provide a richer examination. Aligned with previous findings (e.g., Auger & Amiot, 2017; 2019), we thus postulated that pet attachment would be associated to more favorable attitudes towards animals in general. Additionally, we hypothesized that the advantages of pet attachment would vary across animal categories. Particularly, we expected that farmed animals and predators would be more benefited by individuals' pet attachment, considering of their

mixed attributional profile. Contrarily, we speculated that pests would not benefit as much from pet attachment, considering that this animal category is overall perceived as negative and undesirable. Furthermore, we also investigated how pet attachment predicted moral concern attributed to each animal category.

Lastly, we examined how individual characteristics, such as gender, diet and pet attachment, relate with animal appraisal. Considering previous research (e.g., Graça et al., 2018; Herzog et al., 1991; Knight & Barnett, 2008; Knight et al., 2004; Piazza et al., 2015), we anticipated that women and vegetarians would reveal more positive attitudes toward animals than men and meat consumers.

Article 3 examined two key factors influencing appetite towards meat: familiarity and animal resemblance. Because past research has often failed to disentangle these factors as co-occurring inputs (e.g., Kunst & Hohle, 2016), we developed a methodological approach to separate them and examine their independent influence on meat appetite. We were interested in understanding how animal resemblance (i.e., visible animal body parts) impacts appetite for meat as previous work suggested it is an important variable. However, these studies have not dealt with the issue that consumers do not frequently encounter/consume meat that highly resembles animals. Thus, familiarity is a potential confound of animal resemblance that needs to be examined to figure out how these two variables relate and whether their influence on appetite may be disentangled. This article presents three studies.

In Study 1, we asked participants to provide spontaneous associations (e.g., "tasty") about naturally occurring meat products (e.g., "whole roasted chicken" or "fried snake") hypothesized to fall along with one of four quadrants of the familiarity with animal resemblance circumplex, to explore the extent to which different meat products elicit thoughts of the animal source. Subsequently, to further produce a two-dimensional circumplex of the meat products and investigate the independent contribution of each dimension on meat appetite, we asked participants to rate the products on familiarity, animal resemblance, and appetite. In Studies 2a and 2b (pre-registered) we aimed to test the independent contribution of each dimension in a 2 x 2 - crossed experimental design. Therefore, we selected four product exemplars from Study 1 to represent each category emerged from the four circumplex quadrants (i.e., high vs. low; familiarity x animal resemblance) and then we asked participants, that were randomly assigned to one of the four product conditions, to rate them on the same dimensions (i.e., familiarity, animal resemblance, and appeal).

We aimed to examine a different perspective of meat-animal association that took into consideration the way animal resemblance might be conditioned upon familiarity. Previous

research may have overvalued the degree in which meat-animal associations affect appetite for meat, since animal resemblance and familiarity were not commonly de-confound. Therefore, we theorized that animal resemblance would probably impact on appetite for meat particularly when meat products are less familiar, but not so expressively when a meat product is familiar. Based on past results (e.g., Piazza et al., 2020), we postulated that when meat products are highly familiar, appetites might be dominated by its perceived familiarity since familiarity produces a higher level of psychological adaptation. Inversely, when the meat product is not familiar, and there was not been an adequate exposure for psychological adaptation to happen, the psychological impact of an animal reminder is likely to be greater. Therefore, we anticipated that familiarity would produce higher appetite for meat regardless of a product's level of animal resemblance. Conversely, we did not anticipate that animal resemblance would affect the impact of familiarity on appetite.

Article 4 comprises two studies seeking to expand knowledge about people's perceptions towards meat and meat substitutes, with the aim of building insights on how to promote a shift toward more sustainable and healthier food choices. Study 1 examined the free-associations people make of a group of conventional (i.e., red meat, white meat, fish and seafood) and alternative sources of protein (i.e., insects, legumes, tofu, seitan, and lab-grown meat), using an integrative bottom-up approach. We sought to provide a diverse group of protein sources, not only including more familiar and conventional animal and plant-based products (e.g., red meat, legumes), as well as more unfamiliar and less available options (e.g., insects, cultured meat). Subsequently, we examined the emerging patterns of associations derived from the different protein sources, both conventional animal proteins and meat alternatives. Therefore, instead of trying to examine perceptions toward an individual product or evaluating meat alternatives separately from other sources of animal-sourced proteins, we aimed to produce a comprehensive and integrative depiction of the way people perceive all protein sources.

In Study 2, we built our approach in light of the dimensions that emerged in Study 1, to experimentally examine the way people perceived the same group of meat alternatives presented through different framings. Additionally, we added some dimensions considering past studies on food behavior (e.g., Blechert et al., 2014; Bryant et al., 2019; Prada et al., 2017). The food products were rated on nine evaluative dimensions, namely, taste, edibility, healthiness, caloric content, naturalness, degree of processing, expensiveness, ethics, and sustainability. The goal of this study was to investigate the impact of two framings on the perception towards meat alternatives. Particularly, we examined the impact of meat alternatives framed as a stand-alone food (individual frame) in comparison with it being incorporated into

a meal (meal frame). Considering that presenting a less familiar product (e.g., seitan) inserted in a meal may offer a richer illustration of how it might be prepared and introduced in a meal, we hypothesized that framing meat alternatives in a meal context (e.g., seitan with potatoes), in comparison when framing them as individual products (e.g., seitan), would generate more positive appraisals (Elzerman et al., 2011, 2015; Papies et al., 2020).

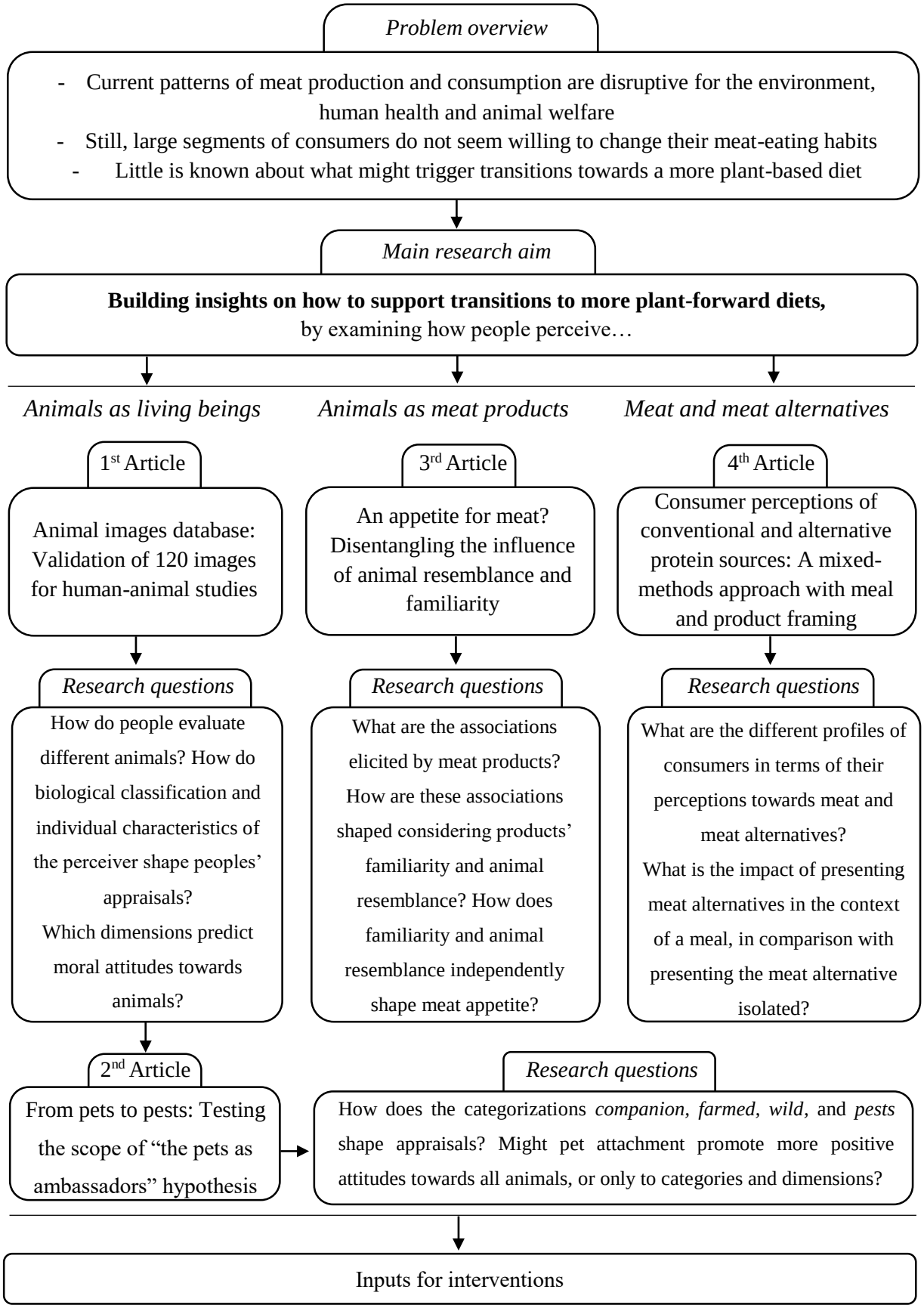

Figure 1.1. Outline of the problem, research questions, and articles.

1.4. References

Aiking, H. (2011). Future protein supply. *Trends in Food Science & Technology*, *22*(2–3), 112–120. https://doi.org/10.1016/j.tifs.2010.04.005

Aiking, H. (2014). Protein production: Planet, profit, plus people? *The American Journal of Clinical Nutrition*, *100*(suppl_1), 483S-489S. https://doi.org/10.3945/ajcn.113.071209

Aiking, H., & de Boer, J. (2018). The next protein transition. *Trends in Food Science & Technology*, *105*, 515–522. https://doi.org/10.1016/j.tifs.2018.07.008

Aldridge, V., Dovey, T. M., & Halford, J. C. G. (2009). The role of familiarity in dietary development. *Developmental Review*, *29*(1), 32–44. https://doi.org/10.1016/j.dr.2008.11.001

Animal Charity Evaluators. (2021). *The Effects of Diet Choices*. https://animalcharityevaluators.org/research/dietary-impacts/effects-of-diet-choices/#results

Auger, B., & Amiot, C. (2017). Testing and extending the pets as ambassadors hypothesis: The role of contact with pets and recategorization processes in predicting positive attitudes toward animals. *Human–Animal Interaction Bulletin*, *5*, 1–25.

Auger, B., & Amiot, C. E. (2019). Testing the roles of intergroup anxiety and inclusion of animals in the self as mechanisms that underpin the "pets as ambassadors" effect. *Anthrozoös*, *32*(1), 5–21. https://doi.org/10.1080/08927936.2019.1550277

Bastian, B., Costello, K., Loughnan, S., & Hodson, G. (2012). When closing the human–animal divide expands moral concern: The importance of framing. *Social Psychological and Personality Science*, *3*(4), 421–429. https://doi.org/10.1177/1948550611425106

Bastian, B., & Loughnan, S. (2017). Resolving the meat-paradox: A motivational account of morally troublesome behavior and its maintenance. *Personality and Social Psychology Review*, *21*(3), 278–299. https://doi.org/10.1177/1088868316647562

Berners-Lee, M., Kennelly, C., Watson, R., & Hewitt, C. N. (2018). Current global food production is sufficient to meet human nutritional needs in 2050 provided there is radical societal adaptation. *Elementa: Science of the Anthropocene*, *6*, 52. https://doi.org/10.1525/elementa.310

Blechert, J., Meule, A., Busch, N. A., & Ohla, K. (2014). Food-pics: An image database for experimental research on eating and appetite. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.00617

Borgogno, M., Favotto, S., Corazzin, M., Cardello, A. V., & Piasentier, E. (2015). The role of product familiarity and consumer involvement on liking and perceptions of fresh meat. *Food Quality and Preference*, *Complete* (44), 139–147. https://doi.org/10.1016/j.foodqual.2015.04.010

Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., Guha, N., Mattock, H., & Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology*, *16*(16), 1599–1600. https://doi.org/10.1016/S1470-2045(15)00444-1

Branco. (2021). Hábitos e práticas alimentares na sociedade portuguesa. Mudanças e reconfigurações. *SOCIOLOGIA ON LINE*, *26*, 56–81. https://doi.org/10.30553/sociologiaonline.2021.26.3

Bryant, C. J. (2019). We can't keep meating like this: Attitudes towards vegetarian and vegan diets in the United Kingdom. *Sustainability*, *11*(23), 6844. https://doi.org/10.3390/su11236844

Bryant, C., Szejda, K., Parekh, N., Desphande, V., & Tse, B. (2019). A survey of consumer perceptions of plant-based and clean meat in the USA, India, and China. *Frontiers in Sustainable Food Systems*, *3*, 11. https://doi.org/10.3389/fsufs.2019.00011

Campbell, B. M., Beare, D. J., Bennett, E. M., Hall-Spencer, J. M., Ingram, J. S. I., Jaramillo, F., Ortiz, R., Ramankutty, N., Sayer, J. A., & Shindell, D. (2017). Agriculture production as a major driver of the Earth system exceeding planetary boundaries. *Ecology and Society*, *22*(4), art8. https://doi.org/10.5751/ES-09595-220408

Cawthorn, D.-M., & Hoffman, L. C. (2016). Controversial cuisine: A global account of the demand, supply and acceptance of "unconventional" and "exotic" meats. *Meat Science*, *120*, 19–36. https://doi.org/10.1016/j.meatsci.2016.04.017

Chan, D. S. M., Lau, R., Aune, D., Vieira, R., Greenwood, D. C., Kampman, E., & Norat, T. (2011). Red and processed meat and colorectal cancer incidence: Meta-analysis of prospective studies. *PLoS ONE*, *6*(6), e20456. https://doi.org/10.1371/journal.pone.0020456

Changing Markets Foundation. (2018). *Growing the Good: The Case for Low-Carbon Transition in the Food Sector*. http://changingmarkets.org/wp-content/uploads/2019/02/Growing_the_Good-The_Case_for_Low-Carbon_Transition_in_the_Food_Sector.pdf

Clark, M., & Tilman, D. (2017). Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. *Environmental Research Letters*, *12*(6), 064016. https://doi.org/10.1088/1748-9326/aa6cd5

Cooke, L. J., & Wardle, J. (2005). Age and gender differences in children's food preferences. *The British Journal of Nutrition*, *93*(5), 741–746. https://doi.org/10.1079/bjn20051389

Cotas, J., Leandro, A., Pacheco, D., Gonçalves, A. M. M., & Pereira, L. (2020). A comprehensive review of the nutraceutical and therapeutic: Applications of red seaweeds (Rhodophyta). *Life*, *10*(3), 19. https://doi.org/10.3390/life10030019

Dagevos, H., & Voordouw, J. (2013). Sustainability and meat consumption: Is reduction realistic? *Sustainability: Science, Practice and Policy*, *9*(2), 60–69. https://doi.org/10.1080/15487733.2013.11908115

De Backer, C., Erreygers, S., De Cort, C., Vandermoere, F., Dhoest, A., Vrinten, J., & Van Bauwel, S. (2020). Meat and masculinities. Can differences in masculinity predict meat consumption, intentions to reduce meat and attitudes towards vegetarians? *Appetite*, *147*, 104559. https://doi.org/10.1016/j.appet.2019.104559

De Backer, C. J. S., & Hudders, L. (2015). Meat morals: Relationship between meat consumption consumer attitudes towards human and animal welfare and moral behavior. *Meat Science*, *99*, 68–74. https://doi.org/10.1016/j.meatsci.2014.08.011

Elzerman, J. E., Hoek, A. C., van Boekel, M. A. J. S., & Luning, P. A. (2011). Consumer acceptance and appropriateness of meat substitutes in a meal context. *Food Quality and Preference*, *22*(3), 233–240. https://doi.org/10.1016/j.foodqual.2010.10.006

Elzerman, J. E., Hoek, A. C., van Boekel, M. J. A. S., & Luning, P. A. (2015). Appropriateness, acceptance and sensory preferences based on visual information: A web-based survey on meat substitutes in a meal context. *Food Quality and Preference*, *42*, 56–65. https://doi.org/10.1016/j.foodqual.2015.01.010

FAO (2020). *Global meat production, 1961 to 2018*. http://www.fao.org/faostat/en/?#data/

Festinger, L. (1957). *A theory of cognitive dissonance* (Stanford University Press).

Food Standards Agency, & TNS-BMRB. (2021). *Food and You Survey: Wave 3Food and You Surveys, 2010-2018, and Food and You 2, 2020-Food and You Survey, 2014* (1st Edition) [Data set]. UK Data Service. https://doi.org/10.5255/UKDA-SN-7576-1

Garnett, T. (2016). Plating up solutions. *Science*, *353*(6305), 1202–1204. https://doi.org/10.1126/science.aah4765

Gerber, P. J. (2013). *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities*. Food and Agriculture Organization of the United Nations.

Global Data. (2017). *Top Trends in Prepared Foods 2017: Exploring trends in meat, fish and seafood; pasta, noodles and rice; prepared meals; savory deli food; soup; and meat substitutes*.

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., Pierrehumbert, R. T., Scarborough, P., Springmann, M., & Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science*, *361*(6399), eaam5324. https://doi.org/10.1126/science.aam5324

Gómez-Luciano, C. A., de Aguiar, L. K., Vriesekoop, F., & Urbano, B. (2019). Consumers' willingness to purchase three alternatives to meat proteins in the United Kingdom, Spain, Brazil and the Dominican Republic. *Food Quality and Preference*, *78*, 103732. https://doi.org/10.1016/j.foodqual.2019.103732

Good Food Institute. (2021). *Plant-based food retail sales reach $7 billion*. Good Food Institute, SPINS. https://gfi.org/blog/spins-data-release-2021/

Google. (2022). https://google.com/trends

Graça, J., Calheiros, M., & Oliveira, A. (2015). Attached to meat? (Un)Willingness and intentions to adopt a more plant-based diet. *Appetite*, *95*, 113–125. https://doi.org/10.1016/j.appet.2015.06.024

Graça, J., Oliveira, A., & Calheiros, M. M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, *90*, 80–90. https://doi.org/10.1016/j.appet.2015.02.037

Gray, H. M., Louderback, E. R., LaPlante, D. A., Abarbanel, B., Kraus, S. W., & Bernhard, B. J. (2021). Who holds a shared responsibility view of minimizing gambling harm? Results from a multiwave survey of casino gamblers. *Psychology of Addictive Behaviors*. https://doi.org/10.1037/adb0000767

Greenpeace European Unit. (2020). *EU climate diet: 71% less meat by 2030*. https://www.greenpeace.org/eu-unit/issues/nature-food/2664/eu-climate-diet-71-less-meat-by-2030/

Gropp, R. E., & Verdier, J. M. (2020). From climate emergency to climate response. *BioScience*, *70*(1), 3–3. https://doi.org/10.1093/biosci/biz156

Guasch-Ferré, M., Satija, A., Blondin, S. A., Janiszewski, M., Emlen, E., O'Connor, L. E., Campbell, W. W., Hu, F. B., Willett, W. C., & Stampfer, M. J. (2019). Meta-analysis of randomized controlled trials of red meat consumption in comparison with various comparison diets on cardiovascular risk factors. *Circulation*, *139*(15), 1828–1845. https://doi.org/10.1161/CIRCULATIONAHA.118.035225

Hagmann, D., Siegrist, M., & Hartmann, C. (2019). Meat avoidance: Motives, alternative proteins and diet quality in a sample of Swiss consumers. *Public Health Nutrition*, *22*(13), 2448–2459. https://doi.org/10.1017/S1368980019001277

Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology*, *61*, 11–25. https://doi.org/10.1016/j.tifs.2016.12.006

Hawkins, R. D., & Williams, J. M. (2016). Children's beliefs about animal minds (Child-BAM): Associations with positive and negative child–animal interactions. *Anthrozoös*, *29*(3), 503–519. https://doi.org/10.1080/08927936.2016.1189749

Heller, M., & Keoleain, G. (2018). *Beyond Meat's Beyond Burger Life Cycle Assessment: A detailed comparison between a plantbased and an animal-based protein source*. Center for Sustainable Systems, University of Michigan; Ann Arbor, MI, USA.

Herzog, H. (2010). *Some we love, some we hate, some we eat: Why it's so hard to think straight about animals* (1st ed). Harper.

Hoek, A. C., Luning, P. A., Weijzen, P., Engels, W., Kok, F. J., & de Graaf, C. (2011). Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance. *Appetite*, *56*(3), 662–673. https://doi.org/10.1016/j.appet.2011.02.001

Joy, M. (2010). *Why we love dogs, eat pigs, and wear cows: An introduction to carnism: the belief system that enables us to eat some animals and not others*. Conari Press.

Knight, S., & Barnett, L. (2008). Justifying attitudes toward animal use: A qualitative study of people's views and beliefs. *Anthrozoös*, *21*(1), 31–42. https://doi.org/10.2752/089279308X274047

Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference*, *20*(2), 70–82. https://doi.org/10.1016/j.foodqual.2007.11.002

Kubberød, E., Dingstad, G. I., Ueland, Ø., & Risvik, E. (2006). The effect of animality on disgust response at the prospect of meat preparation—An experimental approach from Norway. *Food Quality and Preference*, *17*(3–4), 199–208. https://doi.org/10.1016/j.foodqual.2005.04.004

Kunst, J. R., & Haugestad, C. A. (2018). The effects of dissociation on willingness to eat meat are moderated by exposure to unprocessed meat: A cross-cultural demonstration. *Appetite*, *120*, 356–366. https://doi.org/10.1016/j.appet.2017.09.016

Kunst, J. R., & Hohle, S. M. (2016). Meat eaters by dissociation: How we present, prepare and talk about meat increases willingness to eat meat by reducing empathy and disgust. *Appetite*, *105*, 758–774. https://doi.org/10.1016/j.appet.2016.07.009

Lantern. (2020). *The Green Revolution Portugal*. https://uploads-ssl.webflow.com/5a6862c39aae84000168e863/5fbd3c27ce689acc9c90399a_2020%20Estudo%20The%20Green%20Revolution%20Portugal%20Lantern_compressed.pdf

Latvala, T., Niva, M., Mäkelä, J., Pouta, E., Heikkilä, J., Kotro, J., & Forsman-Hugg, S. (2012). Diversifying meat consumption patterns: Consumers' self-reported past behaviour and intentions for change. *Meat Science*, *92*(1), 71–77. https://doi.org/10.1016/j.meatsci.2012.04.014

Lea, E., Crawford, D., & Worsley, A. (2006). Public views of the benefits and barriers to the consumption of a plant-based diet. *European Journal of Clinical Nutrition*, *60*(7), 828–837. https://doi.org/10.1038/sj.ejcn.1602387

Leroy, F., & Praet, I. (2015). Meat traditions. The co-evolution of humans and meat. *Appetite*, *90*, 200–211. https://doi.org/10.1016/j.appet.2015.03.014

Loughnan, S., Bastian, B., & Haslam, N. (2014). The psychology of eating animals. *Current Directions in Psychological Science*, *23*(2), 104–108. https://doi.org/10.1177/0963721414525781

Loughnan, S., Haslam, N., Murnane, T., Vaes, J., Reynolds, C., & Suitner, C. (2010). Objectification leads to depersonalization: The denial of mind and moral concern to objectified others. *European Journal of Social Psychology*, n/a-n/a. https://doi.org/10.1002/ejsp.755

Machovina, B., Feeley, K. J., & Ripple, W. J. (2015). Biodiversity conservation: The key is reducing meat consumption. *Science of The Total Environment*, *536*, 419–431. https://doi.org/10.1016/j.scitotenv.2015.07.022

Marsa-Sambola, F., Muldoon, J., Williams, J., Lawrence, A., Connor, M., & Currie, C. (2016). The short attachment to pets scale (SAPS) for children and young people: Development, psychometric qualities and semographic and health associations. *Child Indicators Research*, *9*(1), 111–131. https://doi.org/10.1007/s12187-015-9303-9

McClements, D. J. (2020). Future foods: Is it possible to design a healthier and more sustainable food supply? *Nutrition Bulletin*, *45*(3), 341–354. https://doi.org/10.1111/nbu.12457

McMichael, A. J., Powles, J. W., Butler, C. D., & Uauy, R. (2007). Food, livestock production, energy, climate change, and health. *The Lancet*, *370*(9594), 1253–1263. https://doi.org/10.1016/S0140-6736(07)61256-2

Mekonnen, M. M., & Hoekstra, A. Y. (2012). A global assessment of the water footprint of farm animal products. *Ecosystems*, *15*(3), 401–415. https://doi.org/10.1007/s10021-011-9517-8

Motoki, K., Ishikawa, S., Spence, C., & Velasco, C. (2020). Contextual acceptance of insect-based foods. *Food Quality and Preference*, *85*, 103982. https://doi.org/10.1016/j.foodqual.2020.103982

Neville, M., Tarrega, A., Hewson, L., & Foster, T. (2017). Consumer-orientated development of hybrid beef burger and sausage analogues. *Food Science & Nutrition*, *5*(4), 852–864. https://doi.org/10.1002/fsn3.466

Nielson. (2017). *120 000 vegetarianos—Número quadruplica em 10 anos*. http://www.centrovegetariano.org/Article-620-Numero-vegetarianos-quadruplica-10anos-Portugal.html

OECD. (2022). *Meat consumption*. https://data.oecd.org/agroutput/meat-consumption.htm

Papies, E. K., Barsalou, L. W., & Rusz, D. (2020). Understanding desire for food and drink: A grounded-cognition approach. *Current Directions in Psychological Science*, *29*(2), 193–198. https://doi.org/10.1177/0963721420904958

Piazza, J., Hodson, G., & Oakley, A. (2020). Butchers' and deli workers' psychological adaptation to meat. *Emotion*, No Pagination Specified-No Pagination Specified. https://doi.org/10.1037/emo0000738

Piazza, J., McLatchie, N., & Olesen, C. (2018). Are baby animals less appetizing? Tenderness toward baby animals and appetite for meat. *Anthrozoös*, *31*(3), 319–335. https://doi.org/10.1080/08927936.2018.1455456

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite*, *91*, 114–128. https://doi.org/10.1016/j.appet.2015.04.011

Pimentel, D., & Pimentel, M. (2003). Sustainability of meat-based and plant-based diets and the environment. *The American Journal of Clinical Nutrition*, *78*(3), 660S-663S. https://doi.org/10.1093/ajcn/78.3.660S

Pliner, P., Pelchat, M., & Grabski, M. (1993). Reduction of neophobia in humans by exposure to novel foods. *Appetite*, *20*(2), 111–123. https://doi.org/10.1006/appe.1993.1013

Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Popper, N. (2019). *You Call That Meat? Not So Fast, Cattle Ranchers Say.* The New York Times. https://www.nytimes.com/2019/02/09/technology/meat-veggie-burgers-lab-produced.html

Possidónio, C., Graça, J., Piazza, J., & Prada, M. (2019). Animal images database: Validation of 120 images for human-animal studies. *Animals*, *9*(8), 475. https://doi.org/10.3390/ani9080475

Prada, M., Garrido, M. V., & Rodrigues, D. (2017). Lost in processing? Perceived healthfulness, taste and caloric content of whole and processed organic food. *Appetite*, *114*, 175–186. https://doi.org/10.1016/j.appet.2017.03.031

Proagrica. (2021). *Pandemic fuels rise of plant-based diets, finds new Proagrica study*. https://www.prnewswire.com/news-releases/pandemic-fuels-rise-of-plant-based-diets-finds-new-proagrica-study-301234533.html

Prokop, P., & Tunnicliffe, S. D. (2010). Effects of having pets at home on children's attitudes toward popular and unpopular animals. *Anthrozoös*, *23*(1), 21–35. https://doi.org/10.2752/175303710X12627079939107

Randler, C., Adan, A., Antofie, M.-M., Arrona-Palacios, A., Candido, M., Boeve-de Pauw, J., Chandrakar, P., Demirhan, E., Detsis, V., Di Milia, L., Fančovičová, J., Gericke, N., Haldar, P., Heidari, Z., Jankowski, K. S., Lehto, J. E., Lundell-Creagh, R., Medina-Jerez, W., Meule, A., … Vollmer, C. (2021). Animal welfare attitudes: Effects of gender and diet in university samples from 22 countries. *Animals*, *11*(7), 1893. https://doi.org/10.3390/ani11071893

Research Institute (IFPRI), I. F. P. (2016). *2016 Annual report* (0 ed.). International Food Policy Research Institute. https://doi.org/10.2499/9780896292628

Ritchie, H., Reay, D. S., & Higgins, P. (2018). The impact of global dietary guidelines on climate change. *Global Environmental Change*, *49*, 46–55. https://doi.org/10.1016/j.gloenvcha.2018.02.005

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., … Foley, J. A. (2009). A safe operating space for humanity. *Nature*, *461*(7263), 472–475. https://doi.org/10.1038/461472a

Röös, E., Bajželj, B., Smith, P., Patel, M., Little, D., & Garnett, T. (2017). Greedy or needy? Land use and climate impacts of food in 2050 under different livestock futures. *Global Environmental Change*, *47*, 1–12. https://doi.org/10.1016/j.gloenvcha.2017.09.001

Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: Masculinity and the justification of meat consumption. *Psychology of Men & Masculinity*, *14*(4), 363–375. https://doi.org/10.1037/a0030379

Rothgerber, H., & Rosenfeld, D. L. (2021). Meat-related cognitive dissonance: The social psychology of eating animals. *Social and Personality Psychology Compass*, *15*(5). https://doi.org/10.1111/spc3.12592

Rouhani, F., Kumasaka, N., de Brito, M. C., Bradley, A., Vallier, L., & Gaffney, D. (2014). Genetic background drives transcriptional variation in human induced pluripotent stem cells. *PLoS Genetics*, *10*(6), e1004432. https://doi.org/10.1371/journal.pgen.1004432

Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review*, *94*(1), 23–41. https://doi.org/10.1037/0033-295X.94.1.23

Ruby, M. B., & Heine, S. J. (2011). Meat, morals, and masculinity. *Appetite*, *56*(2), 447–450. https://doi.org/10.1016/j.appet.2011.01.018

Ruby, M. B., & Heine, S. J. (2012). Too close to home. Factors predicting meat avoidance. *Appetite*, *59*(1), 47–52. https://doi.org/10.1016/j.appet.2012.03.020

Sanchez-Sabate, R., & Sabaté, J. (2019). Consumer attitudes towards environmental concerns of meat consumption: A systematic review. *International Journal of Environmental Research and Public Health*, *16*(7), 1220. https://doi.org/10.3390/ijerph16071220

Sandhu, H., Arora, A., Sarker, S., Shah, B., Sivendra, A., Winsor, E., & Luthra, A. (2021). *Pandemic prevention and unsustainable animal-based consumption*. WHO Press. https://doi.org/10.2471/blt.20.276238

Scarborough, P., Appleby, P. N., Mizdrak, A., Briggs, A. D. M., Travis, R. C., Bradbury, K. E., & Key, T. J. (2014). Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK. *Climatic Change*, *125*(2), 179–192. https://doi.org/10.1007/s10584-014-1169-1

Schösler, H., Boer, J. de, & Boersema, J. J. (2012). Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution. *Appetite*, *58*(1), 39–47. https://doi.org/10.1016/j.appet.2011.09.009

Schösler, H., de Boer, J., Boersema, J. J., & Aiking, H. (2015). Meat and masculinity among young Chinese, Turkish and Dutch adults in the Netherlands. *Appetite*, *89*, 152–159. https://doi.org/10.1016/j.appet.2015.02.013

Shepon, A., Eshel, G., Noor, E., & Milo, R. (2018). The opportunity cost of animal based diets exceeds all food losses. *Proceedings of the National Academy of Sciences*, *115*(15), 3804–3809. https://doi.org/10.1073/pnas.1713820115

Shimp, T. A., & Stuart, E. W. (2004). The role of disgust as an emotional mediator of advertising effects. *Journal of Advertising*, *33*(1), 43–53. https://doi.org/10.1080/00913367.2004.10639150

Siegrist, M., & Hartmann, C. (2020). Consumer acceptance of novel food technologies. *Nature Food*, *1*(6), 343–350. https://doi.org/10.1038/s43016-020-0094-x

Sobal, J. (2005). Men, meat, and marriage: Models of masculinity. *Food and Foodways*, *13*(1–2), 135–158. https://doi.org/10.1080/07409710590915409

Springmann, M., Godfray, H. C. J., Rayner, M., & Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proceedings of the National Academy of Sciences*, *113*(15), 4146–4151. https://doi.org/10.1073/pnas.1523119113

Statista. (2021). *Veganism and vegetarianism worldwide - Statistics & facts*.

Tian, Q., Hilton, D., & Becker, M. (2016). Confronting the meat paradox in different cultural contexts: Reactions among Chinese and French participants. *Appetite*, *96*, 187–194. https://doi.org/10.1016/j.appet.2015.09.009

Tilman, D., Balzer, C., Hill, J., & Befort, B. L. (2011). Global food demand and the sustainable intensification of agriculture. *Proceedings of the National Academy of Sciences*, *108*(50), 20260–20264. https://doi.org/10.1073/pnas.1116437108

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518–522. https://doi.org/10.1038/nature13959

Tso, R., Lim, A. J., & Forde, C. G. (2020). A critical appraisal of the evidence supporting consumer motivations for alternative proteins. *Foods*, *10*(1), 24. https://doi.org/10.3390/foods10010024

Tziva, M., Negro, S. O., Kalfagianni, A., & Hekkert, M. P. (2020). Understanding the protein transition: The rise of plant-based meat substitutes. *Environmental Innovation and Societal Transitions*, *35*, 217–231. https://doi.org/10.1016/j.eist.2019.09.004

Wang, X., Lin, X., Ouyang, Y. Y., Liu, J., Zhao, G., Pan, A., & Hu, F. B. (2016). Red and processed meat consumption and mortality: Dose–response meta-analysis of prospective cohort studies. *Public Health Nutrition*, *19*(5), 893–905. https://doi.org/10.1017/S1368980015002062

Wansink, B., Sonka, S., Goldsmith, P., Chiriboga, J., & Eren, N. (2005). Increasing the acceptance of soy-based foods. *Journal of International Food & Agribusiness Marketing*, *17*(1), 35–55. https://doi.org/10.1300/J047v17n01_03

Weiss, E., Miller, K., Mohan-Gibbons, H., & Vela, C. (2012). Why did you choose this pet?: Adopters and pet selection preferences in five animal shelters in the United States. *Animals*, *2*(2), 144–159. https://doi.org/10.3390/ani2020144

Wendin, K. M., & Nyberg, M. E. (2021). Factors influencing consumer perception and acceptability of insect-based foods. *Current Opinion in Food Science*, *40*, 67–71. https://doi.org/10.1016/j.cofs.2021.01.007

Westhoek, H., Lesschen, J. P., Rood, T., Wagner, S., De Marco, A., Murphy-Bokern, D., Leip, A., van Grinsven, H., Sutton, M. A., & Oenema, O. (2014). Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. *Global Environmental Change*, *26*, 196–205. https://doi.org/10.1016/j.gloenvcha.2014.02.004

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., … Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

Wolk, A. (2017). Potential health hazards of eating red meat. *Journal of Internal Medicine*, *281*(2), 106–122. https://doi.org/10.1111/joim.12543

Zheng, Y., Li, Y., Satija, A., Pan, A., Sotos-Prieto, M., Rimm, E., Willett, W. C., & Hu, F. B. (2019). Association of changes in red meat consumption with total and cause specific mortality among US women and men: Two prospective cohort studies. *BMJ*, l2110. https://doi.org/10.1136/bmj.l2110

Zickfeld, J. H., Kunst, J. R., & Hohle, S. M. (2018). Too sweet to eat: Exploring the effects of cuteness on meat consumption. *Appetite*, *120*, 181–195. https://doi.org/10.1016/j.appet.2017.08.038

CHAPTER 2

Animal Images Database: Validation of 120 Images for Human-Animal Studies

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CHAPTER 2

Animal Images Database: Validation of 120 Images for Human-Animal Studies

2.1. Abstract

There has been increasing interest in the study of human-animal relations. This contrasts with the lack of normative resources and materials for research purposes. We present subjective norms for a set of 120 open-source color images of animals spanning a total of 12 biological categories (e.g., mammals, insects, reptiles, arachnids). Participants (N = 509, 55.2% female, M_{age} = 28.05, SD = 9.84) were asked to evaluate a randomly selected sub-set of 12 animals on valence, arousal, familiarity, cuteness, dangerousness, edibility, similarity to humans, capacity to think, capacity to feel, acceptability to kill for human consumption and feelings of care and protection. Animal evaluations were affected by individual characteristics of the perceiver, particularly gender, diet and companion animal ownership. Moral attitudes towards animals were predominantly predicted by ratings of cuteness, edibility, capacity to feel and familiarity. The Animal Images Database (Animal.ID) is the largest open-source database of rated images of animals.

Keywords: Human-animal relations, Normative data, Subjective ratings, Diet, Meat consumption, Animal images.

2.2. Introduction

Non-human animals have been ever-present as evolutionary partners with whom humans share the planet. We may care for some species, while perceiving others as inconsequential. The mere thought of eating some animals is disgusting, whereas others are deemed highly appetizing. Animals are treated in varied ways within and across cultures. Some animals are kept as companions, whereas others are used for a myriad of purposes such as work, clothing, entertainment and nourishment. Some are protected, while others are met largely with indifference. People's perceptions, emotions and attitudes toward non-human animals tend to be diverse, complex and sometimes even paradoxical (Herzog, 2010; Loughnan et al., 2014). Researchers have recently been interested in better understanding this complexity, since the way we think about animals and their features has direct consequences for how we treat them.

Interest in addressing such questions is ever increasing among both lay and academic audiences. Progress on these topics will depend partly on the availability of resources for reliable comparisons of results across studies and samples. The publication of norms for sets of stimuli is increasingly important for the scientific community. Particularly, in areas such as affective and moral science, large, diverse and systematically validated stimulus sets have contributed for considerable scientific progress. For instance, it is possible to find normative data for a wide range of visual stimuli, including symbols (e.g., Mcdougall et al., 1999; Prada et al., 2016), emojis (e.g., Rodrigues et al., 2018), as well as real life pictures (e.g., Lang et al., 2005). Some of the pictures datasets are content-specific (e.g., food, Blechert et al., 2014; Foroni et al., 2013; Prada et al., 2017; or faces, Ebner et al., 2010; Garrido et al., 2017). To our knowledge and in spite of increasing research interest in topics which address our relations with animals, there are no databases providing a comprehensive and systematic depiction of a wide range of different animal species. A recent study produced ratings for fear, disgust and aesthetic preferences for a set of standardized images of reptiles (Janovcová et al., 2019) but no other animals were included.

Researchers doing work on use of animals as food often include photos of animals in their materials to study psychological processes such as meat-animal dissociation (Kunst & Hohle, 2016; Tian et al., 2016), appetite for animal products (e.g., Anderson & Barrett, 2016; Piazza et al., 2018; Zickfeld et al., 2018) and mind attribution (e.g., Bastian et al., 2012; Loughnan et al., 2010; Piazza & Loughnan, 2016). Likewise, researchers doing work on the psychology of animal treatment often make use of animal images in their experimental designs (e.g., Borgi &

Cirulli, 2015; Laham, 2009; Piazza et al., 2014, 2018). Arguably, studies of this sort could benefit greatly from having access to a versatile set of animal images.

To address this limitation, the present study presents 120 open-source color animal pictures, from several biological classes, with normative ratings in multiple domains, including affective dimensions (valence, arousal), animal characteristics (both physical and psychological) and attitudes related to the treatment of animals.

2.2.1. Diversity in how we perceive and categorize animals

Humans tend to classify and evaluate non-human animals differently, based on several factors. One criterion is to consider their biological classification. This type of classification aims to describe species, their genetic variability and relationships between animals, according to a predetermined system (Schuh & Brower, 2000). Biological classification has been shown to impact on the treatment of animals. Humans have more positive attitudes toward mammals and birds than species from other classifications (Czech et al., 1998). For example, humans are more likely to support conservation efforts directed at birds and mammals than for reptiles and invertebrates (Batt, 2009; Colléony et al., 2017; Czech et al., 1998). Another criterion is to classify animals based on their utility or relationship to humans, with certain categorizations (e.g., companions) generating more positive outcomes than others (e.g., pests, see Amiot et al., 2019).

Characteristics of the perceiver also play a role in how we evaluate different animals. Such characteristics include gender, age, residential area (urban vs. rural), dietary patterns (e.g., meat avoidance) and childhood contact with animals. For instance, compared to men, women tend to report more positive and compassionate attitudes toward animals (Driscoll, 1995; Herzog et al., 1991; Piazza et al., 2018) and are more concerned with animal protection (Herzog et al., 2015; Martens et al., 2019). In contrast, meat consumption is often related to masculinity (e.g., Rothgerber, 2013; Ruby & Heine, 2011) and men are usually more attached to meat (Graça et al., 2015). Furthermore, compared to women, men are more likely to endorse "speciesist" attitudes such as believing that humans have the right to use or control animals because of their inferior moral standing (Caviola et al., 2018). Diet is an important moderator of animal-directed attitudes and judgments, as is childhood experiences with animals. Omnivores tend to attribute animals with less mental and emotional complexity than do vegetarians (Bilewicz et al., 2011) and several studies have found links between forming an attachment to pets in childhood and levels of empathic concern for animals in adulthood (Grandgeorge & Hausberger, 2011; Marsa-Sambola et al., 2016; Rothgerber & Mican, 2014).

2.2.2. Relevant evaluative dimensions in how humans perceive non-human animals

The current work aims to provide an extensive set of animal images—the Animal Images Database or Animal.ID—to researchers working in the field of human-animal interactions. We thought an extensive database of animal images, with established ratings on a range of perceptual and evaluative characteristics, would be of particular value to researchers interested in lay judgments of animals of various sorts. To this end, we sought to identify a set of evaluative dimensions that researchers would benefit from, based on previous studies within the field. This review of the literature led us to 11 dimensions, which we describe more fully below.

2.2.2.1. Valence

Valence can be described as the inherent positivity-negativity/ attractiveness-aversiveness of a stimulus (e.g., Frijda & Scherer, 2009). It is one of the most relevant dimensions of affect (Charland, 2005). The valence generated by an animal is likely to influence our emotional and behavioral responses toward them. For instance, animals such as spiders and snakes are generally negatively evaluated and often evoke an avoidance response (Dan-Glauser & Scherer, 2011; Prada et al., 2014). In contrast, companion animals, such as dogs and cats, generally induce more positive evaluations and attachments (Czech et al., 1998; Kellert, 1996; Kidd & Kidd, 1987).

2.2.2.2. Arousal

This measure is defined as the level of activation or, conversely, emotional calmness, a person experiences (Osgood et al., 1957). Similar to valence, arousal is a central dimension of affect. Research examining how individuals perceive the arousal of different animals is scarce (for an exception, see Kurdi et al., 2017) and interplay between arousal and valence is complex. Some studies have shown that negatively evaluated animals (e.g., spiders, snakes) elicit high arousing levels (Dan-Glauser & Scherer, 2011). On the other hand, valence ratings and levels of arousal can positively correlate. For example, studies have shown that pictures representing species with more infantile characteristics generate more positive valence and also higher arousal than pictures of species without these characteristics (Brosch et al., 2007). Thus, it is important to measure valence and arousal independently to better understand how people evaluate different animals along these dimensions and how these dimensions can interact within such evaluations.

2.2.2.3. Familiarity

This measure refers to the level or frequency of contact one has with a particular animal in daily life, whether physical or virtual (e.g., via media). Companion animals such as dogs are highly familiar (GfK, 2015), as are many domesticated animals used for food (e.g., pigs) and some well-known wild animals (e.g., lions). Nonetheless, many animals may vary widely in their familiarity. Thus, familiarity may be a highly individualized dimension. Evaluations of animals along this dimension are likely to depend on individual characteristics that would modulate one's contact with animals. For instance, it is likely that a person who lives in a rural area encounters chickens and cows more often that someone from an urban area.

2.2.2.4. Similarity to humans

Animals differ in the extent to which they are perceived to share characteristics in common with humans. Research suggests that similarity influences the evaluation of animals in a number of important ways: from an early age, people tend to prefer animals they consider to be more similar to humans, for example, preferring mammals to birds, birds to herptiles (reptiles, amphibians) and herptiles to invertebrates (Batt, 2009; Borgi & Cirulli, 2015; Serpell, 2004). People also report being more likely to "save" animals that share similarities with humans (e.g., Czech et al., 1998; Plous, 1993). For example, a study examining lay decisions about which endangered animals should be prioritized within animal conservation efforts in Australia revealed that 'similarity to humans' was the predominate predictor of how participants prioritized different species (Tisdell et al., 2006).

2.2.2.5. Dangerousness

The perceived threat from a species is a relevant measure that affects our perception and treatment of animals (Piazza et al., 2014). Animals such as snakes, spiders and bats are commonly evaluated as dangerous and associated with phobias and feelings of disgust (Knight, 2008; Purkis & Lipp, 2009; Shuman et al., 2013). Piazza et al. (2014) showed, both with measures and experimental manipulations, that the perceived harmfulness of an animal is predictive of its moral standing, that is, the extent to which it is seen as deserving rights and protections. Importantly, the authors found that the perceived harmfulness of an animal influences its moral standing independent of other morally relevant characteristics, such as the animal's perceived intelligence or emotional sensitivity.

2.2.2.6. Cuteness

Cuteness is a perceptual judgment linked to the possession of physical qualities characteristic of infants of many species. These qualities include a large, rounded head, chubby cheeks, and, proportionate to head size, small nose and big eyes—the so-called "baby schema" (Lorenz, 1943). Judgments of "cuteness" have been shown to motivate propensities to respond to the subject with care and affection (Glocker et al., 2009; Lobmaier et al., 2010; Lorenz, 1943). An animal's relative cuteness is an important predictor in how it is treated. Cute features may give certain dogs an advantage to be selected as pets (Weiss et al., 2012). Baby features have been linked to judgments that an animal is vulnerable and in need of protection. For example, Piazza et al. (2018) found that baby farmed animals evoked more feelings of tenderness than their adult counterpart and this increase in tenderness was linked to reduced appetite for meat products associated with the animal. Baby animals appear to be particularly persuasive in promoting animal welfare and intentions to support environmental campaigns (Huddy & Gunnthorsdottir, 2000; Miesler et al., 2011).

2.2.2.7. Capacity to think and capacity to feel

Capacity to think refers to the animal's cognitive capacities, such as their capacity to think, imagine and remember (Bastian et al., 2012), whereas capacity to feel refers to the animal's capacity of feeling and experiencing sensations, such as pleasure and pain. Gray and colleagues (2007) subdivide "minds" into two aspects: agency and patiency or higher cognitive abilities (e.g., planning, memory, imagination) and experiential states (e.g., pain, fear, joy). Despite this conceptual distinction, empirical work by Piazza et al. (2014) has shown that "thinking" and "feeling" traits tend to be perceived as positively correlated in animals (see also Bastian et al., 2012). Critically, when orthogonally manipulated, both dimensions of "mind having" have been found to promote judgments that an animal is worthy of moral consideration (Piazza et al., 2014). Conversely, when motivated to eat animals, people often deny animals the capacity to think and feel, relative to how these traits are attributed to animals when consumer motivations are removed (Bastian et al., 2012). As noted earlier, attributions of animal mind are influenced by a number of moderators, including dietary lifestyle (Bilewicz et al., 2011; Piazza et al., 2015) and familiarity with animals (Morris et al., 2012). For example, individuals that live with and care for companion animals report animals of this sort as having richer mental lives than individuals who do not live with companion animals (Morris et al., 2012).

2.2.2.8. Edibility

Several factors impact on the perceived edibility of an animal, that is, their judged suitability for human consumption. Cuteness, as previously mentioned, predicts reduced appetite towards meat derived from an animal (Miesler et al., 2011; Piazza et al., 2018). Likewise, animals ascribed higher degrees of mental capacity are deemed less edible than animals attributed lesser capacities (Bastian et al., 2012; Bratanova et al., 2011). In most Western countries, farmed animals, including cows, pigs and chickens are usually perceived as food sources and highly edible. In contrast, the idea of eating companion animals, such as a dog or cat, is deemed as unthinkable and disgusting (Fallon & Rozin, 1983). Thus, the way we categorize animals affects their perceived edibility and edibility, in turn, can influence how we attribute characteristics to animals. For example, Bilewicz et al. (2011) showed that pigs are denied secondary emotions, compared to dogs, yet this was only true for people who eat meat. Recently, other species have been introduced as sustainable food source alternatives (e.g., crickets, grasshoppers). Additionally, there are some consumers interested in "exotic meat," including kangaroo or crocodile meat (Drury, 2011; Hoffman & Cawthorn, 2012). Thus, judgments of edibility are vital for better understanding people's attitudes towards animals and their use as food products.

2.2.2.9. Acceptability to kill for human consumption and feelings of care and protection

We included two measures of the judged moral worth of an animal: the extent to which individuals consider it acceptable to harm and kill the animal for human consumption (e.g., food, clothing) and the extent which people desire to care for or protect an animal, items adapted from Piazza et al. (2014). These items, which could be classed as outcome variables, were included to enable us to explore which characteristics, perceived across a vast range of animal targets, are independently predictive of the moral value we place on different animals. Based on the research reviewed earlier (Bastian et al., 2012; Bratanova et al., 2011; Piazza et al., 2014, 2018; Plous, 1993; Tisdell et al., 2006), we had reason to believe that the dimensions of human similarity, cuteness, "mind having" (i.e., capacity for thought and feeling), dangerousness and edibility, would each contribute to such moral judgments of animals. However, since all of these dimensions have yet to be tested simultaneously, within a single predictive model, using an extensive set of targets, we reserved judgment with regards to which of the dimensions would emerge as the most predictive and which dimensions might fail to contribute predictive value when controlling for their relationship with other dimensions. Because this aim was exploratory and secondary to our larger goal of validating a large set of animal images, we allowed the zero-

order correlations between variables to guide our decision about which variables to include as predictors within our models (see below).

2.2.3. The current study

The goals of the present study are threefold: (1) to provide normative ratings for a broad set of animals that can be used by researchers from different areas; (2) to explore how different animals and their characteristics are perceived and evaluated, paying particular attention to which characteristics are independently predictive of people's moral concern for animals; and (3) to examine how individual differences of the perceiver, including gender, age, diet, living area, companion animal ownership, influence the way animals are perceived and evaluated.

To this end, we developed a database of 120 open-source color images of animals, spanning a total of 12 biological categories and had each image rated on 11 evaluative dimensions. In selecting our set of animals, we tried to strike a balance between providing a range of biological types, while recognizing that much research, for example, on preferences for animals and their treatment, utilizes mammals more so than other animal categories (e.g., Borgi & Cirulli, 2015; Laham, 2009; Piazza et al., 2014; Piazza & Loughnan, 2016). Thus, we paid particular attention to mammals as a class, while also putting effort into populating other categories often underrepresented in human-animal studies. Furthermore, we also faced pragmatic constraints in our selection process. Certain animal categories, such as mammals and birds, were more abundant within open-source databases than other categories (e.g., arachnids, clitellates). In our analysis, we sought to provide item-level data for each biological category. At the macro-level, we examined associations between the 11 evaluative dimensions across the entire set of animals and contrasted rater evaluations as a function of perceiver characteristics (e.g., gender, diet) and biological classification.

2.3. Materials and Methods

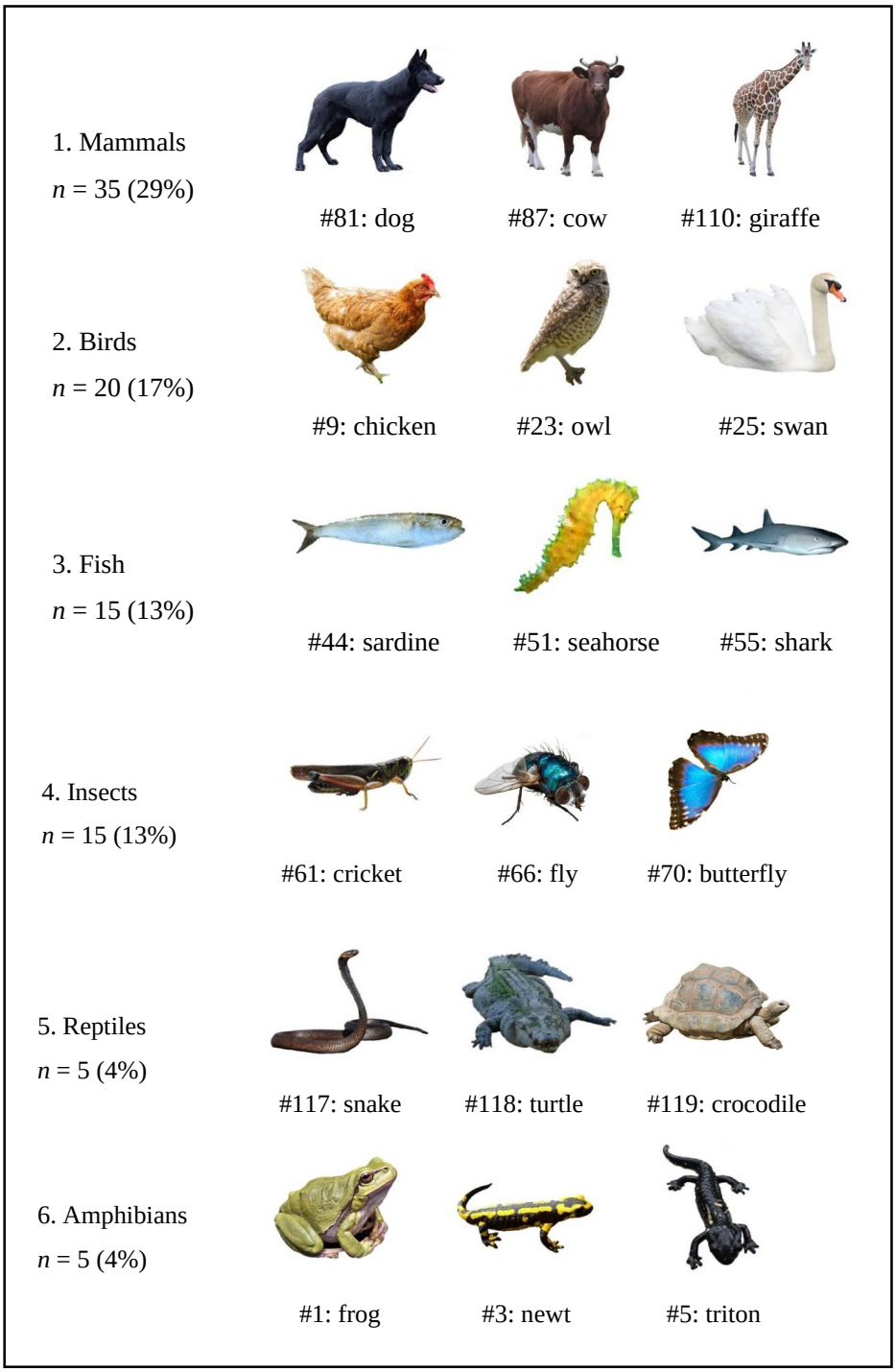
2.3.1. Participants

We aimed to collect at least 500 participants to have a minimum of 50 evaluations per stimulus. Our target sample size was guided by previous studies that have developed normative data and stimulus sets for research purposes (e.g., Blechert et al., 2014; Prada et al., 2016, 2017, 2018; Rodrigues et al., 2018). Five-hundred and seventeen participants completed the survey. After exclusions (see Results section), the final sample included 509 Portuguese participants (55.2% female) aged between 18 and 71 years old (M_{age} = 28.05, SD = 9.84). More than half of our sample (52.5%) had a higher education degree (Bachelor's, Master's or doctorate degree), 41.1% completed secondary education and 6.5% completed primary education. Most participants were students (49.7%) or were employed (42%). The remaining were unemployed (4.7%), retired (0.8%) or reported to have "other" occupational status. Most participants included animals (meat or fish) in their diets (93%), whereas 4.6% followed a vegetarian diet and 2.4% followed a vegan diet. Furthermore, participants reported living in predominantly urban areas (M = 5.10, SD = 1.93), t = 12.87, p < 0.001. Although they reported having frequent contact with farmed animals during childhood (M = 4.69, SD = 2.04), t = 7.64, p < 0.001, current contact with these animals was less frequent (M = 3.09, SD = 1.94), t = −10.55, p < 0.001 (t-tests performed against scales midpoint, 4.00). Most participants reported to have had a companion animal during childhood (87.4%), specifically dogs (49.7%), cats (23.3%), fishes (11.3%), hamsters (7.5%) and birds (5.7%). Similarly, most participants reported to currently have a companion animal (72%). Once again, dogs (51.5%) and cats (35.2%) were the most frequent animals, followed by fishes (5.5%) and birds (5.2%). The remaining participants (2.6%) reported having other companion animals (e.g., rabbits, Guinea pigs, horses, goats, chickens, turtles, lizards).

2.3.2. Development of the stimulus set

Our database includes 120 open-source color animal images (see Appendix, Table A1) and is available at https://osf.io/mdpt6/. To develop the stimulus set, animal pictures were retrieved from open-source online databases (e.g., Pixabay; Pexels; Pxhere). The final selection was independently done by four judges, taking the following criteria in consideration: the image was (a) in color, (b) depicted a single animal and (c) the full body of the animal was visible. Each image depicts a single animal against a white background. The original background of the

images was removed to focus attention on the stimulus and to provide images more versatile research uses. Additionally, to standardize stimuli orientation, images were rotated so that, whenever possible, the head of the animal was positioned to the right with a 300 × 225 pixels, PNG format. Furthermore, the images were categorized attending the biological classification of the animal depicted (12 categories, see Figure 2.1).



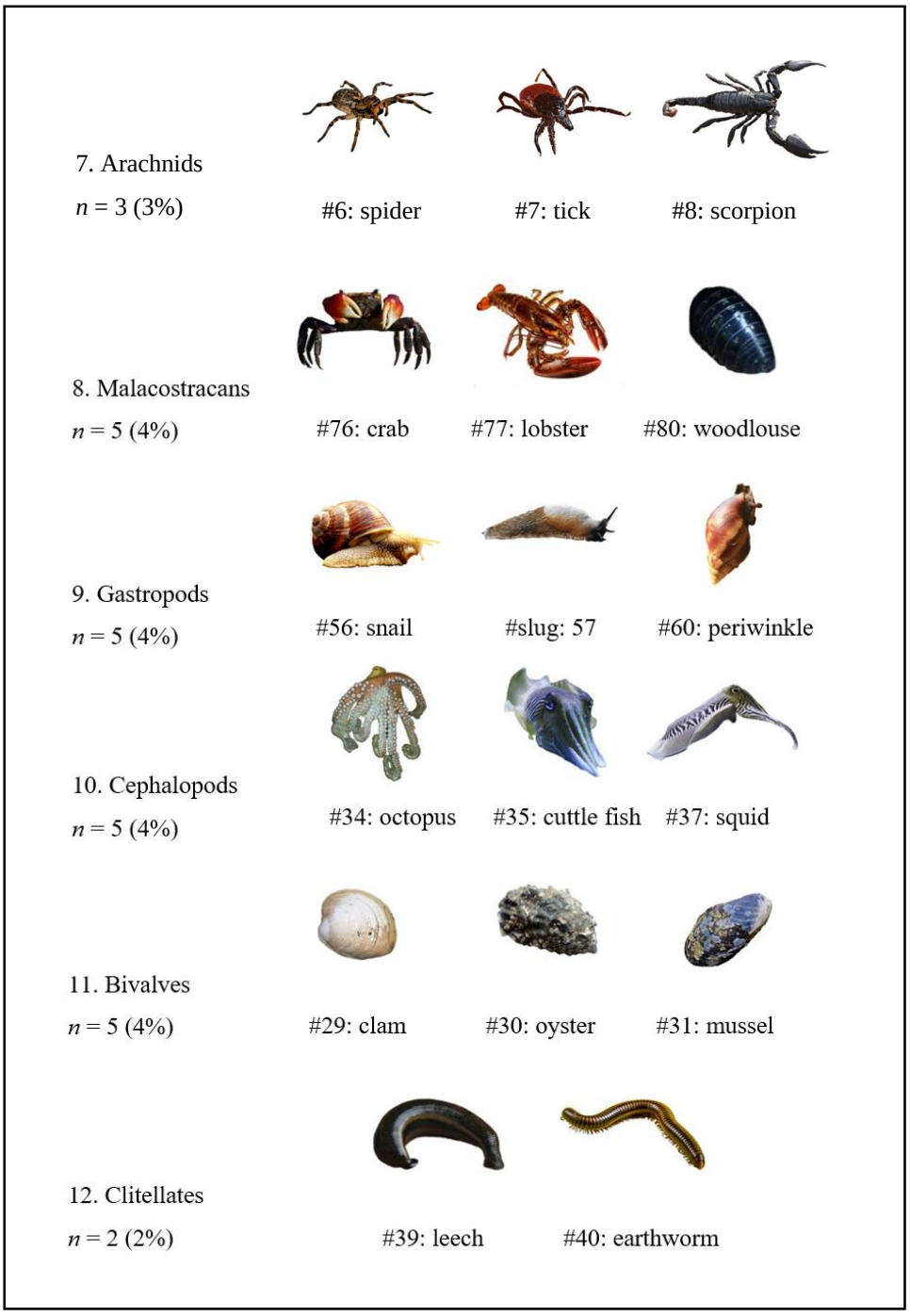


Figure 2.1. Distribution of the 120 images (*n*; %) according to category and examples of animals included in the stimulus set.

2.3.3. Procedure and measures

Participants were invited via social networking websites and institutional e-mail to collaborate on a web survey aimed at testing stimuli for future research. The language of the survey was in Portuguese. By clicking on a hyperlink, participants were directed to a secure webpage (hosted at Qualtrics©). The opening page informed participants they were taking part in a study on the

"perception and evaluation of animal pictures." They were informed about the study's expected duration and ethical considerations. After consenting to participate, participants were asked to provide sociodemographic information: age, sex, nationality, educational level and current occupational status. General instructions stated that the task consisted in evaluating each animal on 11 subjective dimensions using 7-point rating scales (for detailed instructions for each dimension, see Table 2.1). Participants were informed that there were no right or wrong answers. A practice trial was included to familiarize participants with the task (the practice stimulus was not included in the final set of images). To prevent fatigue, participants were asked to rate a subset of 12 animal pictures which were randomly selected from the 120 available. Each trial corresponded to the evaluation of one photograph, with the image centered on the page and the rating scales below it. Upon completion of the evaluative task, we asked participants to indicate their previous and current area of residence (1 = *Predominantly rural*; 7 = *Predominantly urban*), as well as their previous and current contact with both companion animals and farmed animals, using 7-point rating scale (1 = *Not often*; 7 = *Very often*). Next, we asked about participants' diet and consumption frequency of foods (e.g., red meat, white meat, fruits and vegetables). Finally, participants were thanked and offered the possibility to register for a raffle to win a tablet as compensation for their participation.

Table 2.1. Instructions and scale anchors for each evaluative dimension.

Dimension	Instruction: Indicate to What Extent	Scale
1. Valence (e.g., Foroni et al., 2013)	… this animal is negative or positive.	1 = *Very negative* to 7 = *Very positive*
2. Arousal (e.g., Foroni et al., 2013)	… this animal makes you feel activated or excited.	1 = *Does not at all make me feel activated* to 7 = *Makes me feel very activated*
3. Familiarity (e.g., Foroni et al., 2013)	… this animal is familiar.	1 = *Not at all familiar* to 7 = *Extremely familiar*
4. Similarity to humans (Serpell, 2004; Tisdell et al., 2006)	… this animal is similar to humans.	*1 = Not at all similar to humans* to 7 = *Extremely similar to humans*
5. Cuteness (Borgi & Cirulli, 2016; Piazza et al., 2018)	… this animal is cute.	1 = *Not at all cute* to 7 = *Extremely cute*
6. Dangerousness (Piazza et al., 2014)	… this animal is dangerous or harmful to humans.	1 = *Not at all dangerous* to 7 = *Extremely dangerous*
7. Edibility (Bastian et al., 2012)	… you find meat from this animal edible.	1 = *Not at all edible* to 7 = *Extremely edible*
8. Capacity to think (Bastian et al., 2012)	… this animal has cognitive capacities, such as thought, imagination and memory.	1 = *Not at all capable of thinking, imagining, remembering* to 7 = *Very capable of thinking, imagining, remembering*
9. Capacity to feel (Bastian et al., 2012)	… this animal is capable of feeling and experiencing sensations, such as pleasure and pain.	1 = *Not at all capable of experiencing sensations, such as pleasure and pain.* to 7 = *Very capable of experiencing sensations, such as pleasure and pain.*

10. Acceptability to kill for human consumption (Bastian et al., 2012)	… it is acceptable or unacceptable to kill this animal for human consumption	1 = *Completely unacceptable to kill the animal for human consumption* to 7 = *Completely acceptable to kill the animal for human consumption.*
11. Feelings of care and protection (Piazza et al., 2014)	… you desire to care for or protect this animal.	1 = *I do not at all desire to care for/protect the animal* to 7 = *I strongly desire to care for/protect the animal*

2.3.4. Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics v.23. Zero-order correlations were calculated to examine relationships between the evaluative dimensions. Analysis of variance was used to test for differences in evaluations as a function of our demographic variables (e.g., gender, age, diet) and biological classification. When conducting follow-up comparisons, we used Tukey's HSD tests to contrast evaluations based on diet and Bonferroni correction to contrast evaluations for comparisons involving biological classification. Linear regressions were conducted to examine which dimensions best predicted our moral outcome variables.

2.4. Results

Only participants that completed the animal pictures evaluation task were retained for analyses (N = 517). A preliminary data analysis showed evidence of systematic responding (i.e., same value of the response scales used in 80% of the ratings), which lead to the exclusion of eight participants (final sample = 509). Results reported a small percentage of outliers (1.33%—identified considering the criterion of 2.50 *SD*s above or below the mean evaluation of each stimulus in a given dimension). Therefore, no further responses were excluded.

Each photograph was evaluated, on average, by 51 participants (range: min. = 42, max. = 60), which is within an acceptable range for developing normative data (e.g., Blechert et al., 2014; Prada et al., 2016, 2017, 2018; Rodrigues et al., 2018). Item-level data (means, *SD*s and confidence intervals for each stimulus across evaluative dimensions) is available online at https://osf.io/mdpt6/and as Supplementary Data (see Appendix, Table A2).

2.4.1. Frequency distribution

We computed means, standard deviations and confidence intervals for each image on each dimension (see Supplementary Data). Based on the confidence interval, images were categorized as low, moderate or high on each dimension. Animal images were categorized as moderate when the confidence interval included the response scale midpoint of 4.00; as low when the upper bound of the confidence interval was below the scale midpoint; and as high

when the lower bound of the confidence interval was above the scale midpoint (for similar procedure, see References (Garrido et al., 2017; Prada et al., 2016, 2018). Figure 2.2 represents the frequency distribution of animal images, rated low, moderate and high, on each of the 11 rated dimensions (i.e., valence, arousal, etc.). In the text below, we also provide some examples of animals that fell within each grouping (low, moderate, high).

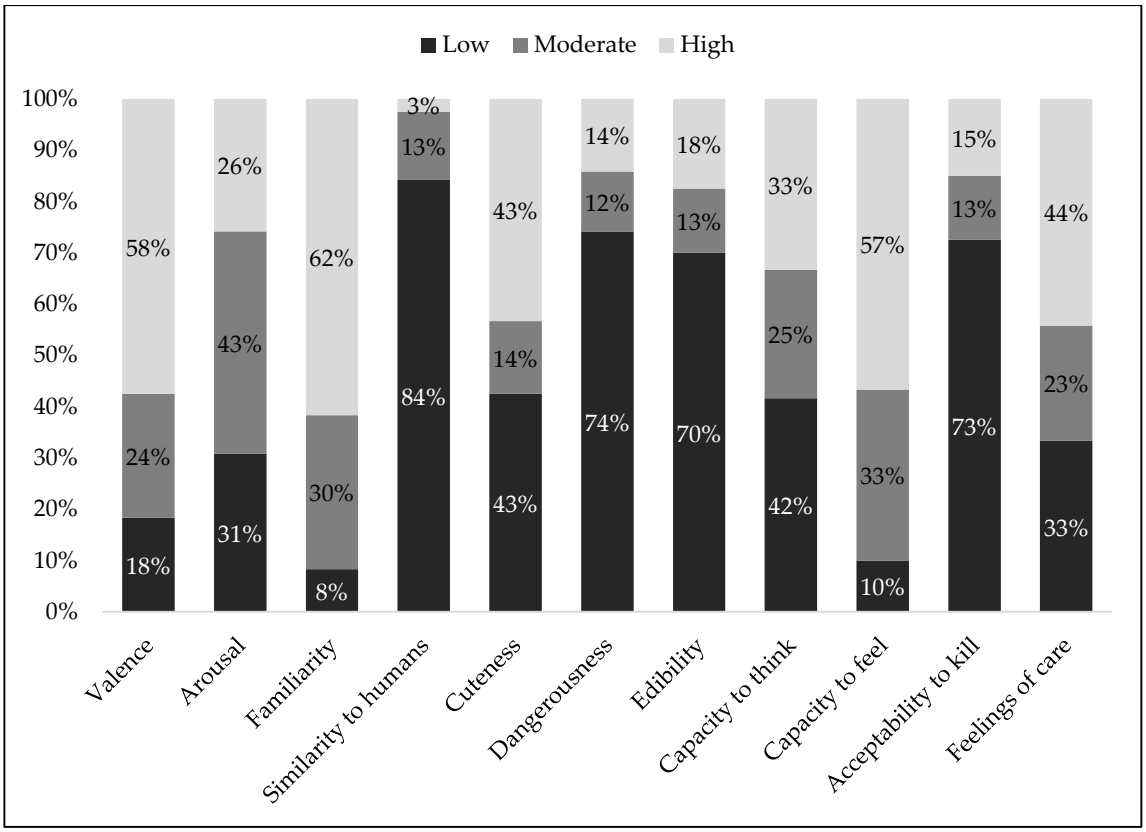


Figure 2.2. Distribution of animal images with low, medium and high rating on each evaluative dimension.

As shown in Figure 2.2, most animals were rated as positive (58%, e.g., dolphin, penguin), as familiar (62%, e.g., cat, rabbit) and as having high capacity to feel (57%, e.g., gorilla, dolphin). A smaller percentage was categorized as negative (18%, e.g., mosquito, fly) or with moderate valence (24%, e.g., cricket, squid), low on familiarity (8%, e.g., leech, krill) or as moderately familiar (30%, e.g., frog, shrimp) and has having lower (10%, e.g., clam, sea snail) or moderate capacity to feel (33%, e.g., scorpion, seahorse). Furthermore, most animals were rated as low on the remaining dimensions, namely similarity to humans (84%, e.g., sea snail, fly), dangerousness (74%, e.g., clam, snail), edibility (70%, e.g., fly, mosquito, koala), acceptability to kill for human consumption (73%, lion, dog). A small percentage was perceived as highly (3%, e.g., gorilla, chimp) or moderately (13%, e.g., elephant, horse) similar to

humans, highly (14%, e.g., tiger, crocodile) or moderately dangerous (12%, e.g., kangaroo, panda), highly (18%, e.g., sardine, sea bass) or moderately (13%, e.g., rabbit, guppy) edible and highly (15%, e.g., codfish, lobster) or moderately (13%, e.g., goose, squid) acceptable to kill for human consumption.

In the remaining dimensions, the images were distributed across the three levels. For example, ratings for the cuteness dimension show that animals were judged as low (43%, e.g., fly, cockroach) or high (43%, e.g., dolphin, cat) on this dimension, with a smaller percentage of animals categorized a moderately cute (14%, e.g., seagull, cow). Most animals received high feelings of care (44%, e.g., cat, dolphin), with similar distributions across low (33%, e.g., mosquito, fly) and a smaller percentage rated as moderate (23%, e.g., turkey, frog) on feelings of care. Concerning capacity to think, animals were evenly categorized across low (42%, sea snail, mussel, clam), moderate (25%, e.g., swan, chameleon) and high capacities (33%, dolphin, chimp). Moreover, most animals received moderate arousal scores (43%, e.g., ladybug, pig), with similar distributions across low (31%, e.g., sea snail, woodlouse) and high arousal (26%, e.g., lion, cat).

2.4.2. Correlations between the evaluative dimensions

Correlations between the evaluative dimensions can be seen in Table 2.2. Taking the strength of the correlation as our criterion (Evans, 1996), we only discuss in the text correlations that were at least moderate (Pearson's $r \geq .40$). For example, valence was positively correlated with arousal, familiarity, cuteness, feelings of care, capacity to feel and capacity to think ratings. Arousal was positively correlated with familiarity, cuteness, feelings of care, capacity to feel and capacity to think. We observed moderate positive correlations between ratings of similarity to humans and capacity to think. Cuteness ratings were positively correlated with feelings of care, capacity to feel and capacity to think. Edibility was strongly and positively correlated with moral concern, such that animals perceived as edible were also deemed as more acceptable to kill for human consumption. The ratings for feelings of care were positively correlated with both capacity to feel and to think. Capacity to think and to feel were also strongly, positively correlated.

Table 2.2. Correlations between the 11 evaluative dimensions (Pearson's *r*).

		1	2	3	4	5	6	7	8	9	10
1.	Valence	-									
2.	Arousal	.59 ***	-								
3.	Familiarity	.46 ***	.42 ***	-							
4.	Similarity to humans	.26 ***	.39 ***	.14 ***	-						
5.	Cuteness	.67 ***	.61 ***	.39 ***	.39 ***	-					
6.	Dangerousness	− .25 ***	.01	− .16 ***	.10 **	− .10 **	-				
7.	Edibility	− .04	.02	.07	.08	− .03	.23 ***	-			
8.	Capacity to feel	.50 ***	.48 ***	.31 ***	.28 ***	.45 ***	− .06	− .05	-		
9.	Capacity to think	.45 ***	.52 ***	.22 ***	.48 ***	.48 ***	.01	− .07	.66 ***	-	
10.	Acceptability to kill	−.14 ***	−.10 **	.04	.03	− .15 ***	.19 ***	.83 ***	− .16 ***	.17 ***	-
11.	Feelings of care	.63 ***	.59 ***	.32 ***	.34 ***	.72 ***	− .14 ***	−.12 ***	.44 ***	.47 ***	.28 ***

Note. $N = 509$. **Correlation is significant at the .05 level (two-tailed). ***Correlation is significant at the .001 level (two-tailed).

2.4.3. Differences in ratings: Individual characteristics

Table 2.3 presents a summary of the mean evaluations across dimensions, for the entire sample and separately by gender. Overall, participants evaluated the animal images above the scale midpoint in valence, familiarity, feelings of care and capacity to feel, all *p*-values ≤. 004 and below the scale midpoint in the remaining measures, all *p*-values ≤ .043. Mean ratings for cuteness, $p = .609$ and capacity to think, $p = .583$, did not differ significantly from scale midpoint.

Table 2.3. Mean evaluations across dimensions: The full sample and by gender.

	Full Sample (*n* = 509)		**Men (*n* = 228)**		**Women (*n* = 281)**	
	M	**(*SD*)**	***M***	***SD***	***M***	***SD***
Valence	4.43 *	(0.96)	4.35 [a]	(0.93)	4.51 [a]	(0.99)
Arousal	3.90 *	(1.10)	3.88 [a]	(1.02)	3.91 [a]	(1.17)
Familiarity	4.73 *	(1.31)	4.60 [a]	(1.31)	4.84 [b]	(1.29)
Similarity to humans	2.51 *	(1.08)	2.54 [a]	(1.00)	2.49 [a]	(1.14)
Cuteness	4.02	(1.05)	3.98 [a]	(0.99)	4.06 [a]	(1.09)
Dangerousness	3.09 *	(0.82)	3.12 [a]	(0.82)	3.08 [a]	(0.82)
Edibility	2.99 *	(1.28)	3.37 [a]	(1.32)	2.69 [b]	(1.15)
Capacity to feel	4.76 *	(1.33)	4.58 [a]	(1.32)	4.90 [b]	(1.32)
Capacity to think	3.97	(1.31)	3.94 [a]	(1.17)	3.99 [a]	(1.42)
Acceptability to kill	2.93 *	(1.36)	3.29 [a]	(1.44)	2.63 [b]	(1.21)
Feelings of care	4.17 *	(1.30)	4.15 [a]	(1.18)	4.18 [a]	(1.39)

Note. * Different from scale midpoint (i.e., 4). Different superscripts indicate significant differences due to gender, all *p*-values ≤ .035 (i.e., values labelled with [a] are statistically different from [b]).

2.4.3.1. Gender

Differences according to participants' gender in these overall evaluations were only found for a few dimensions. As shown in Table 2.3, women (vs. men) evaluated the animals as more familiar, $t(507) = -2.11$, $p = .035$, Cohen's $d = .18$, more capable to feel, $t(507) = -2.78$, $p = .006$, Cohen's $d = .24$, less edible, $t(454.229) = 6.17$, $p < .001$, Cohen's $d = .55$ and less acceptable to kill for human consumption, $t(444.681) = 5.47$, $p < .001$, Cohen's $d = .50$.

2.4.3.2. Age

Overall, animal ratings did not differ much according to participants' age. However, results showed that age correlated with valence, $r = .15$, $p = .001$, cuteness, $r = .13$, $p = .003$ and feelings of care ratings, $r = .11$, $p = .014$. Specifically, the older the participant, the higher were the valence, cuteness and feelings of care ratings of animals.

2.4.3.3. Diet

To examine the impact of dietary habits on animal evaluation we recoded the type of diet reported by the participant according to the meat ingestion: omnivores (i.e., people who included meat in their diets in an unrestricted manner; 81.4%), restricted omnivores (i.e., pescatarian and flexitarian diets; 11.4%) and meat avoiders (i.e., vegetarians or vegans; 7.2%). As expected, results showed significant mean differences on most of the ratings, except familiarity, as a function of diet (see Table 2.4). Step-wise differences generally emerged, with the largest mean differences observed between omnivores and meat avoiders, with values for restricted omnivores generally falling between the two. Meat avoiders evaluated animals higher on valence, arousal, cuteness, similarity to humans, capacity to feel, capacity to think, feelings of care and with lower edibility and acceptability to kill, in comparison with omnivores and meat reducers, all p-values $\leq .022$, $\eta_p^2 = 0.03$ to 0.09. Meat avoiders also evaluated animals as less dangerous than omnivores, $p < .001$, $\eta_p^2 = 0.03$. Furthermore, compared to omnivores, meat reducers evaluated animals as less acceptable to kill for human consumption, $p < .001$, $\eta_p^2 = 0.09$ and displayed higher feelings of care for them, $p = .022$, $\eta_p^2 = 0.09$.

Table 2.4. Mean scores for evaluative dimensions by dietary category (level of meat restriction).

	Omnivores (*n* = 394)		**Restricted Omnivores (*n* = 55)**		**Meat Avoiders (*n* = 35)**	
	M	***SD***	***M***	***SD***	***M***	***SD***
Valence	4.36 [a]	(0.86)	4.58 [a]	(1.11)	5.25 [b]	(1.09)
Arousal	3.83 [a]	(1.06)	3.96 [a]	(0.92)	4.86 [b]	(1.11)
Familiarity	4.74 [a]	(1.30)	4.62 [a]	(1.35)	5.22 [a]	(1.14)
Similarity to humans	2.41 [a]	(0.99)	2.54 [a]	(1.07)	3.20 [b]	(1.39)
Cuteness	3.94 [a]	(0.97)	4.11 [a]	(1.15)	4.69 [b]	(1.26)
Dangerousness	3.14 [a]	(0.80)	2.95 [a,b]	(0.83)	2.58 [b]	(0.80)
Edibility	3.11 [a]	(1.25)	2.95 [a]	(1.19)	2.02 [b]	(1.29)
Capacity to feel	4.72 [a]	(1.30)	4.73 [a]	(1.40)	5.63 [b]	(1.29)
Capacity to think	3.90 [a]	(1.29)	3.88 [a]	(1.14)	4.87 [b]	(1.43)
Acceptability to kill	3.11 [a]	(1.35)	2.64 [b]	(1.00)	1.60 [c]	(1.06)
Feelings of care	4.02 [a]	(1.20)	4.49 [b]	(1.40)	5.42 [c]	(1.28)

Note. Different superscripts indicate significant differences due to dietary category, all *p*-values ≤ .022. Tukey's HSD tests were used for step-wise comparisons of dietary category.

2.4.3.4. Living area

Overall, animal ratings did not differ much according to participants' living area. The only exception was for ratings of animals' capacity to feel, $r = .09$, $p = .057$, with marginally greater attributed capacity to feel to animals among those participants from urban areas.

2.4.3.5. Companion animal ownership

Results showed differences between participants who currently had a companion animal and participants who had not in animal ratings. Particularly, participants who reported currently owning (vs. not owning) a companion animal rated animals higher in the following dimensions: valence, $t(313.558) = -2.37$, $p = .019$, Cohen's $d = .22$, arousal, $t(506) = -2.79$, $p = .031$, Cohen's $d = .28$, cuteness, $t(506) = -3.10$, $p = .002$, Cohen's $d = .31$, feelings of care, $t(506) = -3.38$, $p = .001$, Cohen's $d = .34$, capacity to feel, $t(282.615) = -2.81$, $p = .005$, Cohen's $d = .27$, capacity to think, $t(308.101) = -3.51$, $p = .001$, Cohen's $d = .33$. Moreover, those who currently had a companion animal also rated animals lower in dangerousness, $t(506) = 2.90$, $p = .004$, Cohen's $d = .28$, edibility, $t(506) = 2.57$, $p = .011$, Cohen's $d = .25$ and acceptability to kill for human consumption, $t(506) = 2.84$, $p = .005$, Cohen's $d = .28$ (see Table 2.5).

Table 2.5. Mean scores for evaluative dimensions by current companion animal ownership.

	Current Companion Animal Ownership			
	No (*n* = 142)		Yes (*n* = 366)	
	M	***SD***	***M***	***SD***
Valence	4.29 [a]	(0.82)	4.49 [b]	(1.01)
Arousal	3.68 [a]	(1.01)	3.98 [b]	(1.13)
Familiarity	4.75 [a]	(1.38)	4.73 [a]	(1.28)
Similarity to humans	2.48 [a]	(1.06)	2.52 [a]	(1.09)
Cuteness	3.79 [a]	(0.97)	4.11 [b]	(1.06)
Dangerousness	3.26 [a]	(0.82)	3.03 [b]	(0.81)
Edibility	3.22 [a]	(1.24)	2.90 [b]	(1.28)
Capacity to feel	4.51 [a]	(1.23)	4.86 [b]	(1.36)
Capacity to think	3.67 [a]	(1.13)	4.08 [b]	(1.36)
Acceptability to kill	3.20 [a]	(1.34)	2.82 [a]	(1.35)
Feelings of care	3.86 [a]	(1.18)	4.29 [b]	(1.32)

Note. Different superscripts indicate significant differences due to companion animal ownership, all *p*-values ≤ .031.

Similarly, results also showed differences in animal ratings between participants who had a companion animal during childhood and participants who had not. Particularly, participants who reported to own a companion animal during childhood rated animals higher in the following dimensions: valence, $t(506) = -2.32$, $p = .021$, Cohen's $d = .33$, arousal, $t(506) = -2.61$, $p = .009$, Cohen's $d = .35$, cuteness, $t(506) = -3.03$, $p = .003$, Cohen's $d = .43$, feelings of care, $t(506) = -2.96$, $p = .003$, Cohen's $d = .40$ and capacity to think, $t(506) = -2.28$, $p = .023$, Cohen's $d = .30$ (see Table 2.6).

Table 2.6. Mean scores for evaluative dimensions by companion animal ownership in childhood.

	Companion Animal Ownership in Childhood			
	No (*n* = 64)		Yes (*n* = 444)	
	M	***SD***	***M***	***SD***
Valence	4.17 [a]	(0.84)	4.47 [b]	(0.98)
Arousal	3.57 [a]	(1.05)	3.95 [b]	(1.11)
Familiarity	4.63 [a]	(1.43)	4.75 [a]	(1.29)
Similarity to humans	2.45 [a]	(1.11)	2.52 [a]	(1.06)
Cuteness	3.65 [a]	(0.95)	4.08 [b]	(1.05)
Dangerousness	3.24 [a]	(0.70)	3.07 [a]	(0.84)
Edibility	3.19 [a]	(1.25)	2.96 [a]	(1.28)
Capacity to feel	4.59 [a]	(1.22)	4.78 [a]	(1.35)
Capacity to think	3.62 [a]	(1.32)	4.02 [b]	(1.31)
Acceptability to kill	3.18 [a]	(1.41)	2.89 [a]	(1.34)
Feelings of care	3.72 [a]	(1.22)	4.23 [b]	(1.30)

Note. Different superscripts indicate companion animal ownership differences, all *p*-values ≤ .023.

2.4.4. Differences in ratings: Animals' biological categories

We categorized the animal images according to their biological category and compared mean ratings across each category (see Figure 2.1), using a repeated measures ANOVA for each evaluative dimension (with Huynh-Feldt correction as sphericity assumption was not verified). Based on post hoc comparisons with Bonferroni correction, we identified categories with the highest and lowest score in each dimension (see Table 2.7).

Overall, ratings were highly affected by animal categories in all dimensions (all *p*-values < .001, .34 < η_p^2 < 0.75; see Table 2.7). Mammals were rated as the most positive animal category (all other comparisons with mammals, *p*-values < .001). Arachnids were the most negative category, though the means were not significantly different in comparison to clitellates (all other comparisons with arachnids, *p*-values ≤ .003). Mammals were also the most arousing category and clitellates were rated as the least arousing category, all *p*-values < .001. Likewise, mammals were rated the most familiar category and clitellates were the least familiar category, all *p*-values ≤ .001. The same pattern was observed for cuteness, such that mammals were rated as the cutest category, all *p*-values < .001; and clitellates were the least cute, though not significantly less cute than arachnids and bivalves, all *p*-values ≥ .628 (all other comparisons with clitellates, *p*-values ≤ .001). Expectedly, mammals were the category rated as more similar to humans from all the categories, all *p*-values < .001. Bivalves were the category with lowest similarity to humans.

Arachnids were rated the most dangerous animal category, all *p*-values < .001. Bivalves were rated the least dangerous, along with gastropods (all other comparisons with bivalves and gastropods, all *p*-values ≤ .001). Bivalves were the most edible category, though not significantly more edible than cephalopods, fish and malacostrans (all other comparisons with bivalves, *p*-values ≤ .033). Clitellates were the category with the lowest edibility.

Mammals were attributed, by far, the highest capacity to think (all comparisons with mammals, *p*-values < .001) and the highest capacity to feel, all *p*-values < .001. The lowest thinking capacity was attributed to bivalves, clitellates, gastropods, insects and malacostrans. The lowest capacity to feel was attributed to bivalves and clitellates, all *p*-values ≤ .037. Bivalves were rated the most acceptable category to kill for human consumption, though not significantly more acceptable to kill than cephalopods, fish, gastropods and malacostrans, *p*-values ≥ .331 (all other comparisons with bivalves, *p*-values < .001). Amphibians were rated the least acceptable to kill for human consumption. Finally, mammals were the category that elicited the highest feelings of care and protection, all *p*-values < .001. Arachnids received the

lowest feelings of care and protection, along with bivalves and clitellates (all other comparisons with bivalves, all *p*-values ≤ .016).

2.4.5. Evaluative dimensions predicting moral attitudes towards animals

Two multiple linear regression were conducted to predict our two moral outcome variables: (1) acceptability to kill form human consumption and (2) feelings of care and protection. Using the raw correlations to guide us, the following predictor variables were included in the model because they correlated to a significant degree with at least one of the outcome variables: familiarity, cuteness, dangerousness, edibility, similarity to humans, capacity to feel and capacity to think. Multicollinearity analysis showed no concerns on this assumption (*Tolerance* = 0.45 to 0.92, *Variance Inflation Factor* = 1.09 to 2.24).

For acceptability to kill form human consumption, results showed a significant regression equation, $F(7,501) = 175.37$, $p < .001$, with the predictor variables explaining 71.0% of acceptability to kill for human consumption. Familiarity ($\beta = 0.054$), cuteness ($\beta = -0.110$), edibility ($\beta = 0.813$) and capacity to feel ($\beta = -0.072$) contributed at statistically significant levels to the prediction of acceptability to kill, all *p*-values ≤ 0.045. The remaining variables did not statistically contribute to the model ($\beta \leq -0.046$), all *p*-values ≥ 0.196. Regarding feelings of care and protection, results also showed a significant regression equation, $F(7,501) = 88.32$, $p < 0.001$, with the predictor variables explaining 55.2% of feelings of care and protection. Similar to the first model, cuteness ($\beta = 0.602$), edibility ($\beta = -0.087$) and capacity to feel ($\beta = 0.082$) made statistically significant contributions to the prediction of feelings of care, all *p*-values ≤ 0.050. The remaining variables did not significantly contribute to the model ($\beta \leq 0.083$), all *p*-values ≥ 0.063.

Table 2.7. Means and standard deviations for each evaluative dimension by animal category.

Dimensions	Animal Category												
	Amphibians	Arachnids	Birds	Bivalves	Cephalopods	Clitellates	Gastropods	Insects	Malacostrans	Mammals	Fish	Reptiles	*F* ***
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	
Valence	3.43 (0.47)	2.65 (0.26)	4.73 (0.61)	4.23 (0.38)	4.29 (0.23)	2.76 (0.19)	4.10 (0.45)	3.49 (1.04)	3.99 (0.46)	5.27 (0.57)	4.49 (0.59)	3.95 (1.34)	$F(8.35,409.29) = 69.35$, $\eta_p^2 = 0.59$
Arousal	3.33 (0.47)	3.48 (0.30)	4.03 (0.39)	2.76 (0.13)	3.58 (0.40)	2.71 (0.13)	2.84 (0.47)	3.43 (0.52)	3.30 (0.52)	4.75 (0.54)	3.67 (0.41)	4.01 (0.38)	$F(7.25,355.30) = 24.77$, $\eta_p^2 = 0.34$
Familiarity	3.84 (0.46)	3.95 (0.79)	5.07 (0.55)	4.18 (0.79)	3.97 (0.91)	2.89 (0.64)	4.44 (0.98)	4.54 (0.61)	3.82 (1.16)	5.41 (0.59)	4.48 (0.69)	4.56 (0.55)	$F(8.28,405.51) = 28.52$, $\eta_p^2 = 0.37$
Cuteness	2.94 (0.82)	2.01 (0.07)	4.62 (0.94)	2.30 (0.34)	3.62 (0.44)	1.87 (0.04)	2.71 (0.71)	2.72 (1.27)	2.78 (0.39)	5.50 (0.79)	3.80 (1.07)	3.67 (1.28)	$F(9.34,457.55) = 125.56$, $\eta_p^2 = 0.72$
Similarity humans	1.76 (0.21)	1.76 (0.11)	2.56 (0.38)	1.43 (0.15)	2.10 (0.24)	1.50 (0.00)	1.59 (0.26)	1.71 (0.24)	1.70 (0.07)	3.72 (0.86)	2.15 (0.22)	2.17 (0.37)	$F(8.38,410.61) = 69.38$ $\eta_p^2 = 0.59$
Dangerousness	3.59 (0.56)	5.32 (0.46)	2.81 (0.74)	1.60 (0.30)	3.24 (0.56)	3.01 (0.32)	1.58 (0.22)	2.85 (1.15)	2.83 (0.65)	3.62 (1.25)	2.59 (1.24)	4.03 (2.08)	$F(6.45,316.15) = 120.40$, $\eta_p^2 = 0.71$
Edibility	1.85 (0.25)	1.93 (0.09)	3.10 (1.09)	4.38 (0.91)	4.19 (0.79)	1.61 (0.04)	3.66 (0.97)	1.82 (0.35)	4.12 (1.63)	2.71 (1.27)	4.20 (1.45)	2.21 (0.71)	$F(9.06,443.98) = 103.15$, $\eta_p^2 = 0.68$
Capacity to think	3.08 (0.49)	3.10 (0.12)	4.37 (0.41)	2.17 (0.25)	3.78 (0.69)	2.52 (0.06)	2.66 (0.44)	2.95 (0.36)	3.07 (0.08)	5.26 (0.58)	3.46 (0.45)	4.16 (0.40)	$F(7.65,374.80) = 64.25$, $\eta_p^2 = 0.57$
Capacity to feel	4.17 (0.42)	3.89 (0.31)	5.26 (0.27)	2.85 (0.31)	4.49 (0.50)	3.28 (0.0)	3.60 (0.50)	3.85 (0.42)	3.98 (0.15)	5.83 (0.43)	4.41 (0.39)	4.86 (0.59)	$F(8.12,397.68) = 49.70$, $\eta_p^2 = 0.50$
Acceptability kill	2.09 (0.17)	2.52 (0.17)	2.96 (0.90)	4.39 (0.69)	3.94 (0.67)	2.35 (0.36)	3.87 (0.68)	2.38 (0.29)	3.98 (1.14)	2.38 (1.07)	3.83 (1.20)	2.21 (0.66)	$F(7.88,385.95) = 47.241$ $\eta_p^2 = 0.49$
Feelings of care	3.20 (0.54)	2.44 (0.13)	4.65 (0.63)	2.89 (0.18)	3.72 (0.27)	2.45 (0.24)	3.23 (0.33)	3.0 (0.97)	3.32 (0.29)	5.34 (0.62)	4.07 (0.52)	4.0 (1.12)	$F(8.79,439.64) = 59.00$, $\eta_p^2 = 0.55$

Note. *** All *p*-values < .001.

2.5. Discussion

The present study aimed to increase knowledge on how individuals perceive and evaluate different animals and provide normative data on an extensive set of animal images. The publication of norms for sets of stimuli is important for the advancement of scientific research. Here we provide ready-to-use experimental materials for reliable comparisons of animal evaluations across a range of key demographic variables (e.g., gender, diet, animal ownership) and biological classification. The Animal.ID is the first database that includes a vast array of species along with standardized evaluative dimensions beyond valence and arousal. Importantly, this new database of images is completely open-source. Despite it being possible to find a plethora of animal images online, most of them are copyrighted or require payment, which is a barrier to many researchers. Given the recent increase of interest in the study of human-animal relationships and the psychology of animal treatment (for recent reviews, see References Bastian & Loughnan, 2017; Borgi & Cirulli, 2016; Loughnan & Piazza, 2018), we believe that the time is ripe to offer the field a set of validated resources to help support progress in this area.

The present database includes 120 open-source color pictures depicting animals from 12 biological categories, with normative data on 11 measures. Many of the subjective dimensions assessed correlated at low to moderate levels. Valence was correlated with familiarity, which is in line with previous studies supporting the idea that we have more positive attitudes toward familiar stimuli (Colman et al., 2011). Our findings also showed that animal category highly affected ratings. Mammals and birds were the biological categories perceived as most positive, cute and familiar. Across all species, cuter animals were perceived as less dangerous, more capable to feel and to think, less acceptable to kill for human consumption and evoked more feelings of care and protection. The link between cuteness and moral concern extends past work by Piazza et al. (2018), which focused on evaluations of farmed animals. The relationship between cuteness and mind attribution is consistent with Sherman and Haidt's (2011) mentalizing theory of cuteness, which asserts that cute features enhance social engagement with and mentalizing of the target agent. Our results are also consistent more broadly with the literature on baby schemas, which tends to find more positive outcomes and evaluations of targets, human and nonhuman, that display high levels of cute features (Glocker et al., 2009; Lobmaier et al., 2010; Thorn et al., 2015; Zickfeld et al., 2018). It is interesting to notice that cuteness was unrelated with edibility, which, on the surface, is in tension with Piazza et al. (2018), who found that images of baby animals reduced appetite for meat, particularly for

women. Since Piazza et al. focused mainly on farmed animals, it may be that the negative relationship between cuteness and edibility does not extend beyond this sub-group of animals.

Our results were furthermore in line with research that suggests that animals perceived to be similar to humans are evaluated more positively (e.g., Batt, 2009; Borgi & Cirulli, 2015; Czech et al., 1998). Accordingly, mammals (e.g., gorilla, dolphin) were perceived as most similar to humans and likewise were perceived as the most arousing, cuter, thinking, emotional capable and evoked the highest feelings of care and protection from among all of the animal categories. Such findings parallel those within the literature on inter-group relations. Humans tend to display more favorable attitudes towards targets perceived to share similarities with themselves (Allen et al., 2002; Alvarez & Jaffe, 2004; Balliet et al., 2014; Everett et al., 2015; Stephan & Finlay, 1999). Interestingly and unexpectedly, we found that similarity to humans had no relationship with acceptability to kill for human consumption. This might be because the majority of animals humans typically eat are mammals, while at the same time some of the most cherished and protected animals are mammals. These competing forces might partly explain the absence of a correlation.

Also of note was the finding that dangerousness was positively correlated with judgments of acceptability to kill for human consumption and edibility. This finding might relate to the psychology of hunting. A study that analyzed photos of hunters posing with their prey found that levels of achievement satisfaction displayed by the hunter were greater when posing with larger and more dangerous prey (Child & Darimont, 2015). Humans may believe it is more acceptable—and satisfactory—to kill species that are more dangerous, possibly because of the potential threat they pose to humans. Indeed, Piazza et al. (2014) found that perceptions of harmfulness tend to reduce judgments that animals deserve moral protections. Independent of this, people may find the meat of dangerous animals to be highly edible by virtue of these animals being common targets of human hunting.

Moreover, animals perceived as more acceptable to kill for human consumption were also evaluated as less capable to think and feel. Findings from previous studies have suggested that categorizing specific groups of animals as food tends to reduce the amount of mind ascribed to them, which in turn helps justify their use for consumption (Bastian et al., 2012; Bratanova et al., 2011). Nonetheless, in our study, edibility was unrelated to capacity to feel and think. This is somewhat in tension with the findings of Bastian et al. (2012), who found a moderately sized negative relationship between mind attribution and edibility. There are several differences between our study and theirs, most of all the scope of animals that we used in our study was much larger. Because of this wide scope, the vast majority of the animals in our sample (70%)

were rated quite low on edibility, which may has reduced the possibility of observing a relationship between animal edibility and attributions of thought/feelings.

Our two measures of possessing mind—the capacity to feel and think—were positively correlated, which is consistent with past findings (e.g., Bastian et al., 2012; Piazza et al., 2014). As argued by Piazza et al. (2014), the capacity for thought (e.g., to imagine and remember things, to reflect on the self) may be perceived as essential to having a rich emotional life, such that species with a greater capacity for thought are seen as more capable of sophisticated emotions. Future work, of course, is needed to test this hypothesis more directly.

2.5.1. Individual differences in the evaluation of animals

In line with past research (e.g., Knight et al., 2004; Morris et al., 2012), the ratings our participants made of animals were influenced by a number of individual differences. We found small to medium effects of gender on animal evaluations. Overall, women reported more favorable perceptions and attitudes toward animals than men. For instance, women considered animals in general less edible, more capable of feeling and less acceptable to kill for human consumption than men. This is consistent with several studies which have shown that women, compared to men, tend to report more positive attitudes toward animals (Caviola et al., 2018; Driscoll, 1995; Herzog et al., 1991; Piazza et al., 2018), are more concerned with animal protection (Herzog et al., 2015), are less likely to support animal exploitation (Graça et al., 2018) and are more likely to oppose meat consumption (e.g., Graça et al., 2015; Kubberød et al., 2002; Rothgerber, 2013; Ruby & Heine, 2011; Schösler et al., 2015).

Consistent with past studies (e.g., Bilewicz et al., 2011), we found small to medium effects of diet on evaluations of animals. Meat avoiders in our sample had more positive attitudes towards animals and attributed them greater cognitive and emotional capacities. Additionally, meat avoiders were more aroused by animals, found them cuter, less dangerous and more similar to humans than meat eaters. We found that age and living area played a limited role on the way individuals perceived animals (see also Knight et al., 2004). Our findings indicated that participants living in predominantly urban areas were marginally more likely to experience higher feelings of care and protection toward animals. Older participants were somewhat more positive towards animals and found them overall cuter than younger participants and they expressed greater feelings of care and protection for animals than younger participants as well.

Finally, our data revealed a small positive effect of companion animal ownership on animal evaluations. Specifically, participants that owned a companion animal during childhood and participants that currently owned one, evaluated animals more positively, as cuter, as more

capable of thought and expressed more feelings of care for animals than non-owners. Furthermore, participants currently owning a companion animal also evaluated animals as more capable to feel, less dangerous, less edible and less acceptable to kill for human consumption. These results are in line with a recent study showing that participants who reported more contact with animals had more positive attitudes toward animals (Martens et al., 2019). These findings support the "pets as ambassadors' hypothesis", which posits that pet-keeping in childhood may lead to a more general, positive disposition towards animals and environmental conservation later in life (Auger & Amiot, 2019; Marsa-Sambola et al., 2016).

2.5.2. Characteristics predicting moral attitudes

Across the entire set of 120 animals, we found that cuter animals, animals judged less edible and more capable of feeling, tended to be treated with greater moral concern, that is, they elicited greater feelings of care and protection and were deemed less acceptable to kill for human consumption. Less familiar animals were also deemed less acceptable to kill for human consumption. Overall, our findings highlight the importance of several factors in predicting the moral attitudes people hold of animals. These factors predominantly related to: (a) the types of minds animals are thought to possess (e.g., Bastian et al., 2012; Knight et al., 2004); (b) the aesthetic qualities an animal possesses relating to a "babylike" appearance (e.g., Borgi & Cirulli, 2015; Piazza et al., 2018); and (c) the utilitarian motivations people have when relating to animals as consumer products (e.g., Piazza & Loughnan, 2016; Serpell, 2004).

2.5.3. Limitations and future directions

Future research into the evaluations people make of animals should of course continue to expound upon our initial investigation here. For example, there may be some benefit to expanding certain aspects of the stimulus set. For instance, the clitellata category only contained two animals—leeches and earthworms. Likewise, we only included one picture of each animal but for some species (e.g., dogs) there may exist great variability in the attitudes people form towards different exemplars within the species. Thus, future research could expand on our database to include more than one exemplar of each animal to provide a larger representation of the category. Furthermore, the images in our photo set depict the entire animal, yet much research suggests that faces—the eyes in particular—are important for emotion recognition and empathic engagement (Cowan et al., 2014; Hall et al., 2010). Future work on animals would benefit from developing a normative set of facial images of animals that could be fitted for such face-directed research. Lastly, the present study relied on a convenience sample of Portuguese

Internet users. Our sampling methods may have attracted people with a greater interest in and affinity with animals than the average Portuguese person drawn using alternative methods. Future studies should aim to contrast our findings with other, more targeted and diverse samples to assess for convergence and variation when considering different cultural and demographic contexts.

2.6. Conclusions

Animal.ID – found here: https://osf.io/mdpt6/ – offers an open-source database of 120 color images of animals spanning a total of 12 biological categories, each normed on 11 evaluative dimensions. Researchers can use this free resource to help advance knowledge into the many different ways we relate to animals.

2.7. References

Allen, M. W., Hunstone, M., Waerstad, J., Foy, E., Hobbins, T., Wikner, B., & Wirrel, J. (2002). Human-to-animal similarity and participant mood influence punishment recommendations for animal abusers. *Society & Animals*, *10*(3), 267–284. https://doi.org/10.1163/156853002320770074

Alvarez, L., & Jaffe, K. (2004). Narcissism guides mate selection: Humans mate assortatively, as revealed by facial resemblance, following an algorithm of "self seeking like." *Evolutionary Psychology*, *2*(1), 177–194. https://doi.org/10.1177/147470490400200123

Amiot, C. E., Lépine, O., & Zaky, J. (2019). Compartmentalization of animals: Toward an understanding of how we create cognitive distinctions between animals and their implications. *Analyses of Social Issues and Public Policy*. https://doi.org/10.1111/asap.12177

Anderson, E. C., & Barrett, L. F. (2016). Affective beliefs influence the experience of eating meat. *PLoS ONE*, *11*(8), e0160424. https://doi.org/10.1371/journal.pone.0160424

Auger, B., & Amiot, C. E. (2019). Testing the roles of intergroup anxiety and inclusion of animals in the self as mechanisms that underpin the "pets as ambassadors" effect. *Anthrozoös*, *32*(1), 5–21. https://doi.org/10.1080/08927936.2019.1550277

Balliet, D., Wu, J., & De Dreu, C. K. W. (2014). Ingroup favoritism in cooperation: A meta-analysis. *Psychological Bulletin*, *140*(6), 1556–1581. https://doi.org/10.1037/a0037737

Bastian, B., & Loughnan, S. (2017). Resolving the meat-paradox: A motivational account of morally troublesome behavior and its maintenance. *Personality and Social Psychology Review*, *21*(3), 278–299. https://doi.org/10.1177/1088868316647562

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

Batt, S. (2009). Human attitudes towards animals in relation to species similarity to humans: A multivariate approach. *Bioscience Horizons*, *2*(2), 180–190. https://doi.org/10.1093/biohorizons/hzp021

Bilewicz, M., Imhoff, R., & Drogosz, M. (2011). The humanity of what we eat: Conceptions of human uniqueness among vegetarians and omnivores. *European Journal of Social Psychology*, *41*(2), 201–209. https://doi.org/10.1002/ejsp.766

Blechert, J., Meule, A., Busch, N. A., & Ohla, K. (2014). Food-pics: An image database for experimental research on eating and appetite. *Frontiers in Psychology*, *5*(JUN). https://doi.org/10.3389/fpsyg.2014.00617

Borgi, M., & Cirulli, F. (2015). Attitudes toward animals among kindergarten children: Species preferences. *Anthrozoös*, *28*(1), 45–59.
https://doi.org/10.2752/089279315X14129350721939

Borgi, M., & Cirulli, F. (2016). Pet Face: Mechanisms underlying human-animal relationships. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.00298

Bratanova, B., Loughnan, S., & Bastian, B. (2011). The effect of categorization as food on the perceived moral standing of animals. *Appetite*, *57*(1), 193–196. https://doi.org/10.1016/j.appet.2011.04.020

Brosch, T., Sander, D., & Scherer, K. R. (2007). That baby caught my eye... Attention capture by infant faces. *Emotion*, *7*(3), 685–689. https://doi.org/10.1037/1528-3542.7.3.685

Caviola, L., Everett, J. A. C., & Faber, N. S. (2018). The moral standing of animals: Towards a psychology of speciesism. *Journal of Personality and Social Psychology*, *116*(6), 1011–1029. https://doi.org/10.1037/pspp0000182

Charland, L. (2005). The heat of emotion: Valence and the demarcation problem. *Journal of Consciousness Studies*, *12*(8–10), 82–102.

Child, K. R., & Darimont, C. T. (2015). Hunting for trophies: Online hunting photographs reveal achievement satisfaction with large and dangerous prey. *Human Dimensions of Wildlife*, *20*(6), 531–541. https://doi.org/10.1080/10871209.2015.1046533

Colléony, A., Clayton, S., Couvet, D., Saint Jalme, M., & Prévot, A.-C. (2017). Human preferences for species conservation: Animal charisma trumps endangered status. *Biological Conservation*, *206*, 263–269. https://doi.org/10.1016/j.biocon.2016.11.035

Colman, A. M., Best, W. M., & Austen, A. J. (2011). Familiarity and liking: Direct tests of the preference -feedback hypothesis. *Psychological Reports*, *58*(3), 931–938. https://doi.org/10.2466/pr0.1986.58.3.931

Cowan, D. G., Vanman, E. J., & Nielsen, M. (2014). Motivated empathy: The mechanics of the empathic gaze. *Cognition and Emotion*, *28*(8), 1522–1530. https://doi.org/10.1080/02699931.2014.890563

Czech, B., Krausman, P. R., & Borkhataria, R. (1998). Social Construction, Political Power, and the Allocation of Benefits to Endangered Species. *Conservation Biology*, *12*(5), 1103–1112. https://doi.org/10.1046/j.1523-1739.1998.97253.x

Dan-Glauser, E. S., & Scherer, K. R. (2011). The Geneva affective picture database (GAPED): A new 730-picture database focusing on valence and normative significance. *Behavior Research Methods*, *43*(2), 468–477. https://doi.org/10.3758/s13428-011-0064-1

Driscoll, J. W. (1995). Attitudes toward Animals: Species ratings. *Society & Animals*, *3*(2), 139–150. https://doi.org/10.1163/156853095X00125

Drury, R. (2011). Hungry for success: Urban consumer demand for wild animal products in Vietnam. *Conservation and Society*, *9*(3), 247. https://doi.org/10.4103/0972-4923.86995

Ebner, N. C., Riediger, M., & Lindenberger, U. (2010). FACES-a database of facial expressions in young, middle-aged, and older women and men: Development and validation. *Behavior Research Methods*, *42*(1), 351–362. https://doi.org/10.3758/BRM.42.1.351

Evans, J. D. (1996). *Straightforward statistics for the behavioral sciences*. Brooks/Cole Pub. Co.

Everett, J. A. C., Faber, N. S., & Crockett, M. (2015). Preferences and beliefs in ingroup favoritism. *Frontiers in Behavioral Neuroscience*, *9*. https://doi.org/10.3389/fnbeh.2015.00015

Fallon, A. E., & Rozin, P. (1983). The psychological bases of food rejections by humans. *Ecology of Food and Nutrition*, *13*(1), 15–26. https://doi.org/10.1080/03670244.1983.9990728

Foroni, F., Pergola, G., Argiris, G., & Rumiati, R. I. (2013). The FoodCast research image database (FRIDa). *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00051

Frijda, N. H., & Scherer, K. R. (2009). Emotion definitions (psychological perspectives). In D. Sander & K. R. Scherer (Eds.), *The Oxford Companion to Emotion and the Affective Sciences* (pp. 142–144). Oxford University Press.

Garrido, M. V., Lopes, D., Prada, M., Rodrigues, D., Jerónimo, R., & Mourão, R. P. (2017). The many faces of a face: Comparing stills and videos of facial expressions in eight dimensions (SAVE database). *Behavior Research Methods*, *49*(4), 1343–1360. https://doi.org/10.3758/s13428-016-0790-5

Glocker, M. L., Langleben, D. D., Ruparel, K., Loughead, J. W., Gur, R. C., & Sachser, N. (2009). Baby schema in infant faces induces cuteness perception and motivation for caretaking in adults. *Ethology*, *115*(3), 257–263. https://doi.org/10.1111/j.1439-0310.2008.01603.x

Graça, J., Calheiros, M. M., & Oliveira, A. (2015). Attached to meat? (Un)Willingness and intentions to adopt a more plant-based diet. *Appetite*, *95*, 113–125. https://doi.org/10.1016/j.appet.2015.06.024

Graça, J., Calheiros, M. M., Oliveira, A., & Milfont, T. L. (2018). Why are women less likely to support animal exploitation than men? The mediating roles of social dominance orientation and empathy. *Personality and Individual Differences*, *129*, 66–69. https://doi.org/10.1016/j.paid.2018.03.007

Grandgeorge, M., & Hausberger, M. (2011). Human-animal relationships: From daily life to animal-assisted therapies. *Annali Dell'Istituto Superiore Di Sanita*, *47*(4), 397–408. https://doi.org/10.4415/ANN_11_04_12

Gray, H. M., Gray, K., & Wegner, D. M. (2007). Dimensions of mind perception. *Science*, *315*(5812), 619. https://doi.org/10.1126/science.1134475

Hall, J. K., Hutton, S. B., & Morgan, M. J. (2010). Sex differences in scanning faces: Does attention to the eyes explain female superiority in facial expression recognition? *Cognition & Emotion*, *24*(4), 629–637. https://doi.org/10.1080/02699930902906882

Herzog, H. (2010). *Some We Love, Some We Hate, Some We Eat: Why It's So Hard to Think Straight About Animals*. Harper Perennial.

Herzog, H. A., Betchart, N. S., & Pittman, R. B. (1991). Gender, sex role orientation, and attitudes toward animals. *Anthrozoös*, *4*(3), 184–191. https://doi.org/10.2752/089279391787057170

Herzog, H., Grayson, S., & McCord, D. (2015). Brief measures of the animal attitude scale. *Anthrozoös*, *28*(1), 145–152. https://doi.org/10.2752/089279315X14129350721894

Hoffman, L. C., & Cawthorn, D. M. (2012). What is the role and contribution of meat from wildlife in providing high quality protein for consumption? *Animal Frontiers*, *2*(4), 40–53. https://doi.org/10.2527/af.2012-0061

Huddy, L., & Gunnthorsdottir, A. H. (2000). The persuasive effects of emotive visual imagery: Superficial manipulation or the product of passionate reason? *Political Psychology*, *21*(4), 745–778. https://doi.org/10.1111/0162-895X.00215

Janovcová, M., Rádlová, S., Polák, J., Sedláčková, K., Peléšková, Š., Žampachová, B., Frynta, D., & Landová, E. (2019). Human attitude toward reptiles: A relationship between fear, disgust, and aesthetic preferences. *Animals*, *9*(5), 238. https://doi.org/10.3390/ani9050238

Kellert, S. R. (1996). *The value of life: Biological diversity and human society*. Island Press.

Kidd, A. H., & Kidd, R. M. (1987). Seeking a theory of the human/companion animal bond. *Anthrozoös*, *1*(3), 140–145. https://doi.org/10.2752/089279388787058489

Knight, A. J. (2008). “Bats, snakes and spiders, oh my!” How aesthetic and negativistic attitudes, and other concepts predict support for species protection. *Journal of Environmental Psychology*, *28*(1), 94–103. https://doi.org/10.1016/j.jenvp.2007.10.001

Knight, S., Vrij, A., Cherryman, J., & Nunkoosing, K. (2004). Attitudes towards animal use and animal mind. *Anthrozoos*, *17*(1 DOI-10.2752/089279304786991945 SRC-BaiduScholar FG-0), 43–62. https://doi.org/10.2752/089279304786991945

Kubberød, E., Ueland, Ø., Rødbotten, M., Westad, F., & Risvik, E. (2002). Gender specific preferences and attitudes towards meat. *Food Quality and Preference*, *13*(5), 285–294. https://doi.org/10.1016/S0950-3293(02)00041-1

Kunst, J. R., & Hohle, S. M. (2016). Meat eaters by dissociation: How we present, prepare and talk about meat increases willingness to eat meat by reducing empathy and disgust. *Appetite*, *105*, 758–774. https://doi.org/10.1016/j.appet.2016.07.009

Kurdi, B., Lozano, S., & Banaji, M. R. (2017). Introducing the open affective standardized image set (OASIS). *Behavior Research Methods*, *49*(2), 457–470. https://doi.org/10.3758/s13428-016-0715-3

Laham, S. M. (2009). Expanding the moral circle: Inclusion and exclusion mindsets and the circle of moral regard. *Journal of Experimental Social Psychology*, *45*(1), 250–253. https://doi.org/10.1016/j.jesp.2008.08.012

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2005). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8. In *Media*. University of Florida.

Lobmaier, J. S., Sprengelmeyer, R., Wiffen, B., & Perrett, D. I. (2010). Female and male responses to cuteness, age and emotion in infant faces. *Evolution and Human Behavior*, *31*(1), 16–21. https://doi.org/10.1016/j.evolhumbehav.2009.05.004

Lorenz, K. (1943). Innate forms of potential experience. *Zeitschrift Für Tierpsychologie*, *5*(2), 235–409.

Loughnan, S., Bastian, B., & Haslam, N. (2014). The psychology of eating animals. *Current Directions in Psychological Science*, *23*(2), 104–108. https://doi.org/10.1177/0963721414525781

Loughnan, S., Haslam, N., & Bastian, B. (2010). The role of meat consumption in the denial of moral status and mind to meat animals. *Appetite*, *55*(1), 156–159. https://doi.org/10.1016/j.appet.2010.05.043

Loughnan, S., & Piazza, J. (2018). Thinking morally about animals. In *Atlas of moral psychology* (pp. 165–174). The Guilford Press.

Marsa-Sambola, F., Muldoon, J., Williams, J., Lawrence, A., Connor, M., & Currie, C. (2016). The short attachment to pets scale (SAPS) for children and young people: Development, psychometric qualities and demographic and health associations. *Child Indicators Research*, *9*(1), 111–131. https://doi.org/10.1007/s12187-015-9303-9

Martens, P., Hansart, C., & Su, B. (2019). Attitudes of young adults toward animals—The Case of high school students in Belgium and the Netherlands. *Animals*, *9*(3), 88. https://doi.org/10.3390/ani9030088

Mcdougall, S. J. P., Curry, M. B., & de Bruijn, O. (1999). Measuring symbol and icon characteristics: Norms for concreteness, complexity, meaningfulness, familiarity, and semantic distance for 239 symbols. *Behavior Research Methods, Instruments, & Computers*, *31*(3), 487–519. https://doi.org/10.3758/BF03200730

Miesler, L., Leder, H., & Herrmann, A. (2011). Isn't it cute: An evolutionary perspective of baby-schema effects in visual product designs. *International Journal of Design*, *5*, 17–30.

Morris, P., Knight, S., & Lesley, S. (2012). Belief in animal mind: Does familiarity with animals influence beliefs about animal emotions? *Society and Animals*, *20*(3), 211–224. https://doi.org/10.1163/15685306-12341234

Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). The measurement of meaning. In *The measurement of meaning.* Univer. Illinois Press.

Piazza, J., Landy, J. F., & Goodwin, G. P. (2014). Cruel nature: Harmfulness as an important, overlooked dimension in judgments of moral standing. *Cognition*, *131*(1), 108–124. https://doi.org/10.1016/j.cognition.2013.12.013

Piazza, J., & Loughnan, S. (2016). When meat gets personal, animals' minds matter less: Motivated use of intelligence information in judgments of moral standing. *Social Psychological and Personality Science*, *7*(8), 867–874. https://doi.org/10.1177/1948550616660159

Piazza, J., McLatchie, N., & Olesen, C. (2018). Are baby animals less appetizing? Tenderness toward baby animals and appetite for meat. *Anthrozoos*, *31*(3), 319–335. https://doi.org/10.1080/08927936.2018.1455456

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite*, *91*, 114–128. https://doi.org/10.1016/j.appet.2015.04.011

Plous, S. (1993). Psychological mechanisms in the human use of animals. *Journal of Social Issues*, *49*(I), 11–52.

GfK (2015). *Portugal é um país pet-friendly. https://www.gfk.com/press/portugal-e-um-pais-pet-friendly*. http://www.gfk.com/pt/insights/press-release/portugal-e-um-pais-petfriendly/

Prada, M., Fonseca, R., Garcia-Marques, T., & Fernandes, A. (2014). Se correr o bicho pega... Normas de avaliação de imagens de animais negativos. *Laboratório de Psicologia*, *12*(1). https://doi.org/10.14417/lp.851

Prada, M., Garrido, M. V., Camilo, C., & Rodrigues, D. L. (2018). Subjective ratings and emotional recognition of children's facial expressions from the CAFE set. *PLoS ONE*, *13*(12), e0209644. https://doi.org/10.1371/journal.pone.0209644

Prada, M., Rodrigues, D., Garrido, M. V., & Lopes, J. (2017). Food-pics-PT: Portuguese validation of food images in 10 subjective evaluative dimensions. *Food Quality and Preference*, *61*(April), 15–25. https://doi.org/10.1016/j.foodqual.2017.04.015

Prada, M., Rodrigues, D., Silva, R. R., & Garrido, M. V. (2016). Lisbon symbol database (LSD): Subjective norms for 600 symbols. *Behavior Research Methods*, *48*(4), 1370–1382. https://doi.org/10.3758/s13428-015-0643-7

Purkis, H. M., & Lipp, O. V. (2009). Are snakes and spiders special? Acquisition of negative valence and modified attentional processing by non-fear-relevant animal stimuli. *Cognition and Emotion*, *23*(3), 430–452. https://doi.org/10.1080/02699930801993973

Rodrigues, D., Prada, M., Gaspar, R., Garrido, M. V., & Lopes, D. (2018). Lisbon Emoji and Emoticon Database (LEED): Norms for emoji and emoticons in seven evaluative dimensions. *Behavior Research Methods*, *50*(1), 392–405. https://doi.org/10.3758/s13428-017-0878-6

Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: Masculinity and the justification of meat consumption. *Psychology of Men & Masculinity*, *14*(4), 363–375.

Rothgerber, H., & Mican, F. (2014). Childhood pet ownership, attachment to pets, and subsequent meat avoidance. The mediating role of empathy toward animals. *Appetite*, *79*, 11–17. https://doi.org/10.1016/j.appet.2014.03.032

Ruby, M. B., & Heine, S. J. (2011). Meat, morals, and masculinity. *Appetite*, *56*(2), 447–450. https://doi.org/10.1016/j.appet.2011.01.018

Schösler, H., de Boer, J., Boersema, J. J., & Aiking, H. (2015). Meat and masculinity among young Chinese, Turkish and Dutch adults in the Netherlands. *Appetite*, *89*, 152–159. https://doi.org/10.1016/j.appet.2015.02.013

Schuh, R. T., & Brower, A. V. Z. (2000). *Biological Systematics. Principles and applications* (1st ed.). Cornell University Press.

Serpell, J. A. (2004). Factors influencing human attitudes to animals and their welfare. *Animal Welfare*, *13*(1), 145–151.

Sherman, G. D., & Haidt, J. (2011). Cuteness and disgust: The humanizing and dehumanizing effects of emotion. *Emotion Review*, *3*(3), 245–251. https://doi.org/10.1177/1754073911402396

Shuman, V., Sander, D., & Scherer, K. R. (2013). Levels of valence. *Frontiers in Psychology*, *4*, 261.

Stephan, W. G., & Finlay, K. (1999). The role of empathy in improving intergroup relations. *Journal of Social Issues*, *55*(4), 729–743. https://doi.org/10.1111/0022-4537.00144

Thorn, P., Howell, T. J., Brown, C., & Bennett, P. C. (2015). The canine cuteness effect: Owner-perceived cuteness as a predictor of human–dog relationship quality. *Anthrozoos*, *28*(4), 569–585. https://doi.org/10.1080/08927936.2015.1069992

Tian, Q., Hilton, D., & Becker, M. (2016). Confronting the meat paradox in different cultural contexts: Reactions among Chinese and French participants. *Appetite*, *96*, 187–194. https://doi.org/10.1016/j.appet.2015.09.009

Tisdell, C., Wilson, C., & Swarna Nantha, H. (2006). Public choice of species for the "Ark": Phylogenetic similarity and preferred wildlife species for survival. *Journal for Nature Conservation*, *14*(2), 97–105. https://doi.org/10.1016/j.jnc.2005.11.001

Weiss, E., Miller, K., Mohan-Gibbons, H., & Vela, C. (2012). Why did you choose this pet? Adopters and pet selection preferences in five animal shelters in the United States. *Animals*, *2*(2), 144–159. https://doi.org/10.3390/ani2020144

Zickfeld, J. H., Kunst, J. R., & Hohle, S. M. (2018). Too sweet to eat: Exploring the effects of cuteness on meat consumption. *Appetite*, *120*, 181–195. https://doi.org/10.1016/j.appet.2017.08.038

CHAPTER 3

From Pets to Pests: Testing the Scope of the 'Pets as Ambassadors' Hypothesis

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CHAPTER 3

From Pets to Pests: Testing the Scope of the ‘Pets as Ambassadors’ Hypothesis

3.1. Abstract

Positive relationships with pets can sometimes foster more positive judgments of other animals. The present study sought to examine the scope of this ‘Pets as Ambassadors’ effect in relation to four meaningful animal categories (companion, farmed, predators, and pests) derived from the Animal Images Database (Animal.ID). The Animal.ID contains ratings from 376 Portuguese individuals on pet attachment and several dimensions related to animal attributes and moral concern for 120 different animals, which offered insights into the scope and nature of the pets as ambassadors effect. Pet attachment was related positively to ethical concern for animals and lower levels of speciesism. The relationship between pet attachment and animal attributions was expressed, beyond companion animals, most consistently for predators and farmed animals, and least of all pests. The benefits of pet attachment centered mostly on aesthetic judgments and benevolent feelings towards predators and farmed animals, sentience attributions for pests, and concerns about the killing of all animal groups for human consumption. Pet attachment did not reliably relate to the attributions individuals made about the intelligence or dangerousness of animals, or their similarity to humans. The findings help clarify how pets might serve as ambassadors for other animals.

Keywords: Pet attachment, Human-animal relationships, Human-animal interaction; Pets as ambassadors, Attitudes toward animals.

3.2. Introduction

Several lines of research have converged on the finding that prolonged contact with an animal in one's care has the potential to engender and expand concern for other animals more generally (Auger & Amiot, 2017; Paul & Serpell, 1992, 1993). This is sometimes referred to as the Pets as Ambassadors hypothesis (Serpell & Paul, 1994). Studies into this phenomenon have at times yielded mixed findings. Some studies have demonstrated positive benefits of owning a pet on, for example, attributions of sentience and emotion to animals (Hawkins & Williams, 2016; Morris et al., 2012) or concern for their treatment (Prokop & Tunnicliffe, 2010). However, other studies have observed little to no effects of owning a pet on such measures (Knight et al., 2004; Taylor & Signal, 2005).

Arguably, the most far-reaching outcomes of owning a pet seem to occur for individuals who have formed emotional attachments with their pets (Budge et al., 1998; Hawkins et al., 2017; Poresky & Hendrix, 1990). For instance, Rothgerber and Mican (2014) observed among an adult sample that owning a pet was unrelated to meat avoidance (arguably, a measure of concern for farmed animals), yet pet attachment did predict meat avoidance via empathy for animals. Likewise, Hawkins and Williams (2016) found that belief in animal minds was particularly great among children who formed deep bonds with their pets.

The emotional bond people experience towards their pets might generalize to other animals by way of *animal identification*, whereby individuals come to identify more deeply with 'animals' as a broader, relational category (Auger & Amiot, 2017, 2019a, 2019b). For instance, Auger and Amiot (2019a) found that individuals who reported frequent contact with pets reported lower anxiety about interacting with animals and were more likely to see animals as an organizing feature of their own identity. Perceiving a common identity with animals, in turn, predicted feeling positively about animals as a general category (see also Auger & Amiot, 2017).

3.2.1. Exploring the scope of the pet as ambassadors hypothesis

It is thus becoming increasingly clear that forming an emotional bond with a companion animal can have several generalizing benefits for other animals. Here we sought to explore in a more nuanced way how pet attachment might shape the attributions individuals form of other animals and the scope of the animals affected.

As alluded to above, most studies interested in pets as ambassadors have examined the impact of pet contact or attachment with the aim of determining whether contact with a

particular animal or class of animals might foster positive attitudes with 'animals' as a superordinate category. For example, Auger and Amiot (2019b) examined the role of imagined contact in fostering a greater level of identification with 'animals' in this broad sense. Participants who imagined a positive interaction with a dog or cow, relative to a neutral task, were more likely to include the target animal class (i.e., companion or farmed animals) within the self (i.e., they viewed themselves as sharing an identity or overlapping properties with these animals) and they displayed more positive attitudes towards animals in general.

What remains unclear about the pets as ambassadors hypothesis is whether all animals might benefit equally from the conceptual and emotional spill-over that occurs when forming an attachment to a pet. It is possible that the generalization effects observed in past studies are limited to certain animal categories. At present, no systematic test of the scope of the hypothesis has been made, though several notable studies have utilized measures that extend beyond evaluations of 'animals' as a general category.

Paul and Serpell (1993) collected attitude ratings from UK-based university students using a treatment of animals questionnaire with subscales pertaining to the treatment of farmed, wild, and laboratory animals. They found positive relationships between the number of "important pets" a person reported and greater concern for the treatment of all three categories of animals. More extensively, Prokop and Tunnicliffe (2010) examined the knowledge and attitudes of Slovakian children towards three animal categories: pests, predators, and "disgusting animals" (associated with disease). They used a single animal exemplar for each category (potato beetle, wolf, and mouse, respectively), and contrasted children's knowledge and attitudes of these animals with that of animal counterparts for each target (i.e., ladybug for potato beetle, rabbit for wolf, squirrel for mouse). Children who owned pets tended to rate the animal targets more favorably, across all three animal comparisons than children without pets. Finally, Bjerke et al. (2003) surveyed Norwegian pet owners and non-pet owners about their like or dislike for 24 different urban animal species. Pet owners tended to report greater liking for each animal than non-pet owners, but this did not hold true for certain animals, such as mosquitoes, snails, and wasps, that were rated as highly "problematic" species.

3.2.2. The present study and hypotheses

The present study sought to add to the current understanding of the scope of the Pets as Ambassadors Hypothesis. We capitalized on a large, pre-existing set of animal image ratings from the Animal Image Database (Animal.ID; Possidónio et al., 2019), and we allowed findings from the animal attribution literature to guide our thinking about which animals exemplify four

psychologically meaningful and distinctive categories of animals: (1) companion animals, (2) predators, (3) farmed animals, and (4) pests. We sought to investigate the relationship pet attachment has with attributions made of these four categories of animals, each of which elicit a mixture of emotions and attributions.

Research shows that conceptions of animals often fall into four categories. For instance, Sevillano and Fiske (2016) had participants rate sets of animals on traits relating to warmth (e.g., friendly, good-natured) and competence (e.g., intelligent, skillful), and via hierarchical cluster analysis observed four emergent categories that related to animals treated as companions (e.g., dog), that are farmed (e.g., cow), wild predatory animals (e.g., bear), and pests (e.g., rat). Similarly, Leite et al. (2019) had participants rate their moral concern for a set of 20 animals, and via factor analysis observed a four-factor solution that corresponded closely to that of Sevillano and Fiske. Both research teams found that companion animals tended to receive the most flattering attributions. These animals were attributed traits related to both warmth and competence and were met with feelings of delight, tenderness, and high moral concern (see also Amiot et al., 2019; Piazza et al., 2014). By contrast, predators—animals such as lions and wolves—were viewed as highly competent, but low on warmth (Sevillano & Fiske, 2016). Predators tended to evoke ambivalent emotions, a mixture of fear and awe, on account of the potential threat they pose to others and their considerable strength and ability. Farmed animals, such as cows, sheep, and pigs, tended to be rated in the middle on both warmth and competence, and the emotions they evoked were neutral. The least desirable category of animals was pests—animals such as spiders and cockroaches—who tended to be seen as low in competence and warmth. These animals are often the objects of disgust, fear and loathing, likely due to their association with disease and physical harm (Curtis et al., 2004; Serpell, 2004). Because predators, farmed animals, and pests have been shown to attract relatively lower ratings of moral concern, and generate either mixed or negative emotions, they make suitable candidates to test the scope of pets as ambassadors hypothesis.

In the current study, we also sought to explore how pet attachment might shape the *kinds of attributions* individuals make of different animals. Pet attachment might promote broader concern for animals by enhancing the views people have about the richness of animals' mental and emotional lives, as has been found in some studies of children with pets (e.g., Hawkins & Williams, 2016). Pet attachment might further operate by reducing fears about the threat posed by different animals, as suggested by Prokop and Tunnicliffe (2010) who observed a relatively greater liking for "undesirable" animals among pet-owning children. Additionally, individuals with pets might come to appreciate the aesthetic qualities of animals more readily. Aesthetics

is an important predictor of concern for animals – for instance, having cute or baby-like features enhances the likelihood of certain dogs being selected as pets (Weiss et al., 2012) and the concern felt towards animals slaughtered for food (Piazza et al., 2018; Zickfeld et al., 2018). Finally, cultivating a bond with a pet might enhance the perception that animals share some overlapping properties with humans. Research suggests that appraisals of human similarity can promote concern for, for example, farmed animal lives (Bastian et al., 2012). Thus, it is possible that pets might operate as ambassadors by enhancing judgments of human-animal similarity.

To offer a rich, nuanced investigation into the hypothesis, we utilized ratings from Animal.ID database (Possidónio et al., 2019), which provides measurements of 120 animals on several attributional dimensions, including the extent to which an animal is thought to possess (a) thoughts and feelings (i.e., "mind"), (b) is similar to humans, (c) edible, (d) harmful, and (e) cute. The Animal.ID also provides ratings of the moral standing of animals connected to (f) the perceived acceptability of killing animals for human consumption, and (g) feelings of care and protection, and it offers basic affective ratings related to (h) valence and (i) arousal, and (j) familiarity.

We hypothesized, consistent with past research (e.g., Auger & Amiot, 2017; 2019a) that pet attachment would relate to more positive attitudes towards animals in general. However, moving beyond more general measures, we expected that the benefits of pet attachment would apply differentially across animal categories. We speculated that predators and farmed animals would be the main beneficiaries of generalized pet attachment, as a function of their mixed attributional profile, whereas we did not expect pests to benefit as much from pet attachment, given their largely negative profile as an undesirable animal group. We made no predictions about what *form* the generalization effect would take for each animal category. Instead, we sought, in an exploratory manner, to elucidate which attributional dimensions are significantly related to pet attachment for each animal group. Central to this aim was exploring the extent to which pet attachment predicts the moral attitudes people hold of different animals. If pets are to be ambassadors for other animals, ultimately, this should be observable in the way animals are treated and held in regard (e.g., Paul & Serpell, 1993). Here, we considered whether pet attachment might relate to moral concern for certain animals more than others. To this end, the aforementioned items (f) and (g), related to the acceptability of killing animals and feelings of care, were of particular significance, and therefore, in our main analysis, were treated as our principal outcome variables.

Finally, as ancillary concerns, we tested the role of individual characteristics such as gender and diet alongside pet attachment. We expected women and meat avoiders (e.g., vegetarians)

to overall exhibit more positive attitudes toward animals than men and meat consumers since past research has consistently found that, women and meat avoiders hold more empathic attitudes towards animals (e.g., Graça et al., 2018; Herzog et al., 1991; Knight & Barnett, 2008; Knight et al., 2004; Piazza et al., 2015).

3.3. Method

3.3.1. Participants

The present study was considered by the host institution to be exempt from ethical review from the IRB. The sample was taken from Possidónio et al. (2019). The original report did not make use of pet attachment data. Therefore, the present study provides a new use of the data with four sub-groups of animal ratings. Our data includes a sub-set of 376 Portuguese participants (54% female), aged between 18 and 71 years old (M = 28.23, SD = 10.09). More than half of our sample (52.1%) had a higher education degree. Most participants reported including animals (meat or fish) in their diets (84.6%; *meat eaters*), whereas 5.4% followed a vegetarian diet and 2.2% followed a vegan diet (*meat avoiders*). Furthermore, participants reported living in predominantly urban areas (M = 5.08, SD = 1.95), $t(372) = 10.63$, $p < .001$. Participants reported having fairly frequent contact with farmed animals during childhood (M = 4.74, SD = 2.02), $t(374) = 7.19$, $p < .001$, though current contact with these animals was less frequent (M = 3.07, SD = 1.91), $t(374) = -9.40$, $p < .001$ (t-tests performed against scale midpoint, 4.00). Most participants reported having had a companion animal during childhood (87.5%), including dogs (49.1%), cats (24.2 %), and Guinea pigs (1.6%). Similarly, most participants reported to currently have a companion animal (73.1%). Once again, dogs (49.8%) and cats (36.3%) were the most frequent animals. Guinea pigs were also mentioned (1.1%).

3.3.2. Procedure and instruments

The research was conducted in compliance with all APA Ethical Guidelines for the treatment of human participants. Participants were invited via social networking websites and institutional e-mail to take part in a web survey (hosted at Qualtrics©) on the "perception and evaluation of animal pictures". In addition to providing sociodemographic information, participants evaluated a subset of animals on 11 subjective dimensions using 7-point rating scales (for detailed instructions for each dimension, see Table 3.1). A practice trial was included to familiarize participants with the task. To prevent fatigue, participants were asked to rate a subset

of 12 animal pictures which were randomly selected from the 120 available. Each trial corresponded to the evaluation of one animal photograph, with each image centered on the page and the rating scales below it. After the animal evaluation task, participants completed three trait measures: the Animal Attitudes Scale—short form (Herzog et al., 2015), the Speciesism Scale (Caviola et al., 2019), and an adapted version of Attachment to Pets Scale—short form (Marsa-Sambola et al., 2016), in that order.

Table 3.1. Instructions and scale anchors for each evaluative dimension (Possidónio et al., 2019).

Dimension	Instruction: Indicate to What Extent	Scale
Valence	… this animal is negative or positive.	*1 = Very negative* to *7 = Very positive*
Arousal	… this animal makes you feel activated or excited.	1 = *Does not at all make me feel activated* to 7 = *Makes me feel very activated*
Familiarity	… this animal is familiar.	1 = *Not at all familiar* to 7 = *Extremely familiar*
Similarity to humans	… this animal is similar to humans.	*1 = Not at all similar to humans* to 7 = *Extremely similar to humans*
Cuteness	… this animal is cute.	1 = *Not at all cute* to 7 = *Extremely cute*
Dangerousness	… this animal is dangerous or harmful to humans.	1 = *Not at all dangerous* to 7 = *Extremely dangerous*
Edibility	… you find meat from this animal edible.	1 = *Not at all edible* to 7 = *Extremely edible*
Capacity to think	… this animal has cognitive capacities, such as thought, imagination and memory.	1 = *Not at all capable of thinking, imagining, remembering* to 7 = *Very capable of thinking, imagining, remembering*
Capacity to feel	… this animal is capable of feeling and experiencing sensations, such as pleasure and pain.	1 = *Not at all capable of experiencing sensations, such as pleasure and pain* to 7 = *Very capable of experiencing sensations, such as pleasure and pain.*
Acceptability to kill for human consumption	… it is acceptable or unacceptable to kill this animal for human consumption.	1 = *Completely unacceptable to kill the animal for human consumption* to 7 = *Completely acceptable to kill the animal for human consumption.*
Feelings of care and protection	… you desire to care for or protect this animal.	1 = *I do not at all desire to care for/protect the animal* to 7 = *I strongly desire to care for/protect the animal*

The Short Attachment to Pets Scale constituted our primary measure of the extent to which participants had formed an emotional attachment to a pet, whether this was in the past or present. The scale includes nine items aimed at measuring an individual's emotional connection to a specific, meaningful companion animal. Participants were instructed to think of a specific pet that in some manner participants had meaningful contact, in their past or present. They were instructed that this could be their own pet or a family pet. Participants answered items concerning the particular animal they had in mind (e.g., "I consider this pet to be a friend") and used 7-point rating scales to provide their level of agreement/disagreement (1 = *Completely disagree*; 7 = *Completely agree*). In the current sample, the scale had high internal reliability (α = .93). The full scale can be viewed at https://osf.io/mdpt6/.

The Animal Attitudes Scale—short form is composed of five items (e.g., "It is morally wrong to hunt wild animals just for sport") that were assessed in terms of the level of agreement or disagreement using a 7-point rating scales (1 = *Completely disagree*; 7 = *Completely agree*). This scale provides a measure of people's attitudes regarding how different animals are treated within society, where higher scores indicate greater levels of ethical concern for animals. The scale's internal consistency was adequate (α = .69).

The Speciesism Scale consists of six items designed to measure beliefs about the right to treat animals differently or inferior to humans based on species membership (e.g., "Humans have the right to use animals however they want to"). The items were assessed in terms of the level of agreement/disagreement (1 = *Completely disagree*; 7 = *Completely agree*), with higher scores representing greater endorsement of speciesism. The scale had good reliability (α = .79).

Additional details of the recruitment procedures and a full description of methods are reported in Possidónio et al. (2019).

3.3.3. Animal selection

For the present study, we utilized ratings of a subset of exemplars derived from the Animal Images Database (Animal.ID). This database includes 120 open-source color animal images, that were collected from open-source online databases (e.g., Pixabay; Pxhere) and then edited to depict a single animal, with the full-body visible, against a white background, with 300 x 225 pixels. The selection of exemplars to compose the animal categories for the present study was guided by Sevillano and Fiske's (2016) findings. Our four categories coincided with their four clusters of animals, based on measures of warmth and competence: (1) companion animals (dog, cat, Guinea pig), (2) farmed animals (pig, cow, sheep), (3) predators (tiger, bear, lion) and (4) pests (cockroach, spider, tick). The criteria we used to select the animals for each category

were as follows: (a) we selected animals that belong *predominantly* to a single category with respect to the cultural background of our sample. For example, rabbits can be companion animals, but they are also widely farmed to use as food, therefore, they were excluded. By contrast, we selected Guinea pigs as companion animals because they are not farmed or eaten in Portugal. Likewise, although spiders could be considered companion animals for some people, we reasoned that most Portuguese adults would classify them more as pests; (b) we created categories with animals from the same biological class if possible (e.g., pests were all invertebrate); (c) we aimed to have the same number of animals in each category. Since we only could obtain three ostensible companion animals from the Animal.ID, all categories were populated with three animals.

3.3.4. Analysis plan

Our main analysis involved correlating our measure of pet attachment with the eleven evaluative dimensions for all four categories of animals. This was followed up with a more targeted regression analysis, which focused on the two moral standing measures as outcome variables and included pet attachment, gender, and diet as predictors.

3.4. Results

3.4.1. Pet attachment: Descriptive results

Overall, participants reported moderately high levels of pet attachment (M = 5.84, SD = 1.32), one-sample $t(369) = 26.84$, $p < .001$, $d = 1.4$, 95% CI [1.71, 1.98] and moderately high, ethical concern for animals (M = 5.38, SD = 1.10), one-sample $t(372) = 24.12$, $p < .001$, $d = 1.25$, 95% CI [1.27, 1.49], based on scale midpoint comparisons. Moreover, on average, participants reported fairly low levels of speciesism (M = 2.34; SD = 1.10), one-sample $t(362) = -27.20$, $p < .001$, $d = -1.4$, 95% CI [-1.78, -1.54].

3.4.2. Gender, diet and attitudes toward animals

Table 3.2 presents descriptive and inferential statistics for the animal attitude measures by gender and diet. As can be seen, women reported significantly higher pet attachment than men, as well as greater ethical concerns for animals, and lower levels of speciesism. Regarding diet, meat avoiders reported lower levels of speciesism when compared to meat eaters, and greater ethical concern for animals. However, no significant differences were found between meat

avoiders and meat eaters with regards to pet attachment. Thus, different from gender, diet was not included in our main analysis as a covariate of pet attachment.

Table 3.2. Descriptive and inferential statistics: attitudes toward animals by gender and diet.

	Gender	*N*	*M*	*SD*	Inferential Statistics
Pet Attachment	Men	172	5.60	1.29	$t(368) = -3.38$, $p = .001$
	Women	198	6.06	1.32	$d = 0.35$, 95% CI [-0.73, -0.19]
Animal Attitudes	Men	172	5.05	1.09	$t(371) = -5.54$, $p < .001$
	Women	201	5.66	1.04	$d = 0.57$, 95% CI [-0.83, -0.39]
Speciesism	Men	167	2.69	1.21	$t(361) = 5.56$, $p < .001$
	Women	196	2.03	1.04	$d = 0.58$, 95% CI [0.42, 0.89]
	Diet	*N*	*M*	*SD*	Inferential Statistics
Pet Attachment	Meat eaters	341	5.82	1.32	$t(367) = -1.52$, $p = .129$
	Meat avoiders	28	6.21	1.33	$d = 0.30$, 95% CI [-0.91, 0.12]
Animal Attitudes	Meat eaters	342	5.30	1.05	$t(33{,}616) = -5.90$, $p < .001$
	Meat avoiders	28	6.50	0.88	$d = 1.24$, 95% CI [-1.56, -0.85]
Speciesism	Meat eaters	335	2.43	1.16	$t(58{,}446) = -10.54$, $p < .001$
	Meat avoiders	27	1.28	0.46	$d = 1.30$, 95%, CI [0.93, 1.37]

3.4.3. Correlations between pet attachment and general animal attitudes

As expected, pet attachment and ethical concern for animals were positively correlated, $r(499) = .33$, $p < 001$, and pet attachment and speciesism were negatively correlated, $r(487) = -.42$, $p < 001$. Thus, consistent with pets as ambassadors, people who reported stronger emotional bonds with pets also reported overall greater concern for how animals are treated in society and endorsed speciesism less.

The Animal Attitudes Scale and the Speciesism Scale were highly negatively correlated, $r(490) = -.70$, $p < .001$; that is, greater ethical concern for animals was associated with lower levels of speciesism.

3.4.4. Animal attributions: Descriptive results by animal category

Table 3.3 presents the mean attribution ratings by animal category. Companion animals were rated highly positive, familiar, and cute, they elicited great feelings of care and were rated highly unacceptable to kill for human consumption. Farmed animals were perceived as quite familiar, not very dangerous, highly edible, quite acceptable to kill for human consumption, and elicited moderate feelings of care. Predators were perceived as highly dangerous, rated quite high on the capacity to think, elicited moderate feelings of care, and were perceived as

unacceptable to kill for human consumption. Finally, pests were rated as highly negative, moderately familiar and dangerous, not edible, cute, or similar to humans, having a low capacity to think and feel, and evoked low feelings of care.

Table 3.3. Means and standard deviations of the attribution ratings by animal category.

	Companion		Farmed		Predators		Pest	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Evaluative Dimensions								
Valence	5.55	1.58	5.21	1.43	4.88	1.54	2.40	1.48
Arousal	4.97	1.91	4.53	1.50	4.92	1.76	3.67	2.18
Familiarity	5.95	1.62	5.90	1.52	5.00	1.86	4.22	2.20
Edibility	1.93	1.65	5.56	1.83	2.14	1.71	1.82	1.39
Cuteness	5.95	1.35	4.73	1.59	5.85	1.27	1.82	1.47
Dangerousness	2.83	1.56	2.63	1.52	6.12	1.23	4.35	2.00
Similarity to humans	3.64	1.84	3.71	1.83	3.64	1.67	1.61	1.10
Capacity to feel	5.75	1.58	5.81	1.42	5.85	1.54	3.68	1.97
Capacity to think	5.19	1.84	4.81	1.66	5.26	1.59	2.83	1.73
Acceptability to kill	1.64	1.24	4.77	2.02	1.70	1.37	2.58	2.04
Feelings of care	5.76	1.55	4.72	1.70	5.38	1.70	2.25	1.67

*Note. N*s ranged from 129 (companion animals) to 147 (predators).

3.4.5. Pet attachment and animal attributions

Zero-order correlations between pet attachment and the attributions participants made of the four animal categories can be seen in Table 3.4.

Table 3.4. Correlations between pet attachment and animal ratings for each animal category.

	Evaluative Dimensions										
Animal Category	Valence	Arousal	Familiarity	Edibility	Cuteness	Dangerous-ness	Similarity to humans	Capacity to feel	Capacity to think	Acceptabi-lity to kill	Feelings of care
Companion	.31***	.34***	.28**	-.27**	.35***	-.22*	.12	.18*	.27**	-.32***	.29***
Farmed	.18*	.17*	.24**	-.25**	.29***	-.02	.04	.05	.12	-.35***	.20*
Predators	.15	.23**	-.02	-.26**	.26**	-.01	.04	.14	.19*	-.37***	.19*
Pests	.06	.03	.01	-.19*	.01	-.01	-.05	.21*	.07	-.37***	.15

*Note. N*s ranged from 123 (companion animals) to 143 (predators).
*p < .050; **p < .010; ***p < .001.

3.4.5.1. Companion animals

As one would expect, pet attachment most consistently related to participants' attributions of companion animals. Companion animals are the central focus of pet attachment, thus, it is not surprising that pet attachment correlated with valence, arousal, familiarity, feelings of care and protection for companion animals, disapproval of killing companion animals for consumer purposes, attributions of mind (thoughts and feelings), benevolence, cuteness, and the belief that companion animals are not edible. Pet attachment was unrelated to the perception that companion animals share similarities with humans.

3.4.5.2. Predators and farmed animals

Relative to companion animals, pet attachment was less consistently associated with attributions made of predators and farmed animals. As with companion animals, pet attachment correlated with arousal, greater feelings of care and protection for these animals, and disapproval of killing predators and farmed animals for consumer purposes. Like companion animals, pet attachment was associated with aesthetic attributions of cuteness and judgments of the inedibility of predators and farmed animals. However, unlike companion animals, pet attachment was unrelated to judgments that predators and farmed animals are not dangerous or can feel. Pet attachment was weakly associated with attributions of cognitive ability in predators, but unrelated to mind attributions for farmed animals. Like companion animals, pet attachment was related to positive valence and familiarity towards farmed animals, but unrelated to judgments of the similarities between humans and predators, and humans and farmed animals. Thus, we observed some evidence of an ambassador effect within predatory and farmed animals, and the nature of this effect was largely connected to aesthetic judgments and moral concern for these animals.

3.4.5.3. Pests

As expected, pet attachment was related to judgments of pests in a limited manner. Pet attachment was not related to feelings of care or protection for pests, but it did relate to judgments that it was unacceptable to kill pests for consumer purposes and that pests are an inedible animal group. The only other judgment that linked pet attachment with pests was the attribution that pests have the capacity to feel. Participants who formed strong bonds with their pets tended to see such animals as having a greater capacity for sentience.

3.4.6. Pet attachment (and gender and diet) predicting moral attitudes towards animals

We performed two step-wise regression analyses with the two moral standing measures for each animal category: (1) acceptability to kill animals for human consumption and (2) feelings of care and protection. In the first model, we included pet attachment as the sole predictor of moral attitudes. In the second model, we included pet attachment along with gender and diet as predictors. Because Model 2 included three predictors, we applied an adjustment of alpha of $p = .05/3 = .017$, to reduce concerns about type I error. The results of these analyses can be viewed in Tables 3.5 and 3.6. As can be seen, when accounting for gender and diet, pet attachment remained an independent, negative predictor of judgments that it is acceptable to kill animals, for all animal groups. When accounting for gender and diet, pet attachment remained a significant, positive predictor of feelings of care towards companion animals, but not for the other, non-companion animal groups. Diet emerged as a significant negative predictor of care for farmed animals and pests, with meat eaters reporting less concern for these animals than meat avoiders. No single predictor in Model 2 emerged as an independent predictor of care towards predators, at least not at the $p < .017$ level.

Table 3.5. Step-wise regression models with acceptability to kill for human consumption as the outcome measure.

	Model 1	Model 2
Animal Category	Pet attachment	Pet attachment, gender, diet
Companion	$R^2_{adj} = .09$, $F = 14.19$, $p < .001$ $\beta_{pet\ attachment} = -0.32$, $t = -3.77$, $p < .001$	$R^2_{adj} = .13$, $F = 7.11$, $p < .001$ $\beta_{pet\ attachment} = -0.29$, $t = -3.45$, $p = .001$ $\beta_{gender} = -0.19$, $t = -2.23$, $p = .028$ $\beta_{diet} = -0.09$, $t = -1.05$, $p = .296$
Farmed	$R^2_{adj} = .11$, $F = 19.13$, $p < .001$ $\beta_{pet\ attachment} = -0.35$, $t = -4.47$, $p < .001$	$R^2_{adj} = .29$, $F = 19.96$, $p < .001$ $\beta_{pet\ attachment} = -0.29$, $t = -3.97$, $p < .001$ $\beta_{gender} = -0.24$, $t = -3.31$, $p = .001$ $\beta_{diet} = -0.33$, $t = -4.62$, $p < .001$
Predators	$R^2_{adj} = .13$, $F = 22.95$, $p < .001$ $\beta_{pet\ attachment} = -0.37$, $t = -4.70$, $p < .001$	$R^2_{adj} = .15$, $F = 9.18$, $p < .001$ $\beta_{pet\ attachment} = -0.34$, $t = -4.28$, $p = .001$ $\beta_{gender} = -0.17$, $t = -2.16$, $p = .032$ $\beta_{diet} = -0.03$, $t = -.36$, $p = .721$
Pests	$R^2_{adj} = .13$, $F = 21.83$, $p < .001$ $\beta_{pet\ attachment} = -0.37$, $t = -4.67$, $p < .001$	$R^2_{adj} = .13$, $F = 7.85$, $p < .001$ $\beta_{pet\ attachment} = -0.34$, $t = -4.10$, $p = .001$ $\beta_{gender} = -0.05$, $t = -0.56$, $p = .574$ $\beta_{diet} = -0.09$, $t = -1.09$, $p = .278$

Table 3.6. Step-wise regression models with feelings of care and protection as the outcome measure.

	Model 1	Model 2
Animal Category	Pet attachment	Pet attachment, gender, diet
Companion	R^2_{adj} = .08, F = 11.44, p = .001 $\beta_{pet\ attachment}$ = 0.29, t = 3.38, p = .001	R^2_{adj} = .83, F = 4.78, p = .004 $\beta_{pet\ attachment}$ = 0.30, t = 3.42, p = .001 β_{gender} = -0.12, t = -1.39, p = .167 β_{diet} = 0.09, t = 1.07, p = .285
Farmed	R^2_{adj} = .03, F = 5.92, p = .016 $\beta_{pet\ attachment}$ = 0.20, t = 2.43, p = .016	R^2_{adj} = .10, F = 6.01, p = .001 $\beta_{pet\ attachment}$ = 0.17, t = 2.10, p = .037 β_{gender} = 0.10, t = 1.27, p = .205 β_{diet} = 0.24, t = 3.02, p = .003
Predators	R^2_{adj} = .03., F = 4.98, p = .027 $\beta_{pet\ attachment}$ = 0.18, t = 2.23, p = .027	R^2_{adj} = .03, F = 2.27, p = .083 $\beta_{pet\ attachment}$ = 0.19, t = 2.21, p = .029 β_{gender} = 0.01, t = 0.09, p = .931 β_{diet} = 0.11, t = 1.34, p = .184
Pests	R^2_{adj} = .01, F = 2.94, p = .088 $\beta_{pet\ attachment}$ = 0.15, t = 1.70, p = .088	R^2_{adj} = .18, F = 10.70, p < .001 $\beta_{pet\ attachment}$ = 0.12, t = 1.48, p = .141 β_{gender} = -0.18, t = -2.21, p = .029 β_{diet} = 0.41, t = 5.17, p < .001

3.5. Discussion

The present study examined how different classes of animals benefit from a person forming an attachment with a pet, to test the scope of the Pets as Ambassadors hypothesis. Previous work has demonstrated that individuals who interact frequently with pets, and develop attachments with them, often exhibit more positive attitudes towards animals in general (e.g., Amiot & Bastian, 2017, 2019a, 2019b; Hawkins & Williams, 2016; Paul & Serpell, 1993; Prokop & Tunnicliffe, 2010). Here, we wanted to advance the current understanding of the hypothesis by focusing on specific animal categories and specific attributions people make of animals, moving beyond assessments of general attitudes towards "animals" as a basic category. Using the Animal.ID database (Possidónio et al., 2019), we identified four meaningful categories of animals to serve as suitable targets. We probed evaluations of these four animal groups along eleven dimensions and examined how these evaluations related to pet attachment. Our findings both replicate and extend past research into the idea that pets can serve as ambassadors.

First, we replicated past findings that individuals who report higher pet attachment also report more positive attitudes toward animals in general and lower levels of speciesism (e.g., Auger & Amiot, 2017; Auger & Amiot, 2019a; Paul & Serpell, 1993; Serpell & Paul, 1994). Second, we replicated several gender and dietary-based findings regarding animal attitudes. Consistent with prior observations, women and meat avoiders in our sample reported lower

levels of speciesism and greater concern for the ethical treatment of animals, compared with men and meat eaters, respectively (e.g., Herzog et al., 1991; Knight & Barnett, 2008; Piazza et al., 2015). In our study, women also reported greater levels of pet attachment than men. A previous review of gender differences in human-animal interactions found negligible to small effect sizes with regards to gender and pet attachment (Herzog, 2007). However, whenever differences were found, they were usually in the direction of females reporting higher pet attachment than males (e.g., see Vidović et al., 1999).

More critically, the present study advances work on pets as ambassadors hypothesis by exploring which types of animals benefit from pet attachment and *in what ways* they benefit. Our findings highlight the importance of considering both the targets of the hypothesis and the variety of attributions people engage in. Unsurprisingly, attributions of companion animals had the most consistent relationship with pet attachment. Except for one attribution dimension (human-animal similarity), pet attachment correlated significantly with all attributions made of companion animals. This observation aligns with the main premise of the phenomenon: companion animals provide a base for expanding outward concerns for other animals.

The animals that benefitted most from pet attachment, beyond companion animals, were farmed animals and predators. The benefits conferred by pet attachment related mostly to enhanced aesthetic judgments of these animals—specifically, viewing farmed animals and predators as cute. These findings highlight a potential benefit of pet attachment for these animal groups insofar as previous research has shown that appraisals of cuteness are an important predictor of how animals are treated (e.g., Piazza et al., 2018; Weiss et al., 2012; Zickfeld et al., 2018). Pet attachment was less consistently related to attributions of harmfulness, cognitive ability, and the similarities farmed animals and predators share with humans. Nonetheless, pet attachment did relate to some degree to an enhanced belief in the cognitive capacities of predators. Importantly, pet attachment correlated consistently with moral concern for the treatment of non-companion animals. However, once we accounted for covariance with gender and diet, this relationship between pet attachment and moral attitudes remained only with regards to evaluations of animal slaughter, and not feelings of care towards these animals. Diet emerged as the strongest predictor of care for farmed animals and pests.

The benefits pests conferred from pet attachment were constrained to attributions of sentience (e.g., capacity for feelings) and moral attitudes towards killing such animals. Thus, although pet attachment had the least bearing on the attributions people made of pests, even this undesirable class of animals benefitted in some ways from the positive experiences of pet owners.

That pet attachment related extensively with moral concern for animals and appraisals of their inedibility aligns with previous findings that pet ownership and attachment is associated with greater empathy towards animals in general (Paul, 2000), greater liking for both popular and unpopular animals (Prokop & Tunnicliffe, 2010), and avoidance of meat in adulthood (Paul & Serpell, 1993; Rothgerber & Mican, 2014). Pet attachment had little relationship to the attributions individuals held regarding the dangerousness of animals, the types of minds they have, or their similarity with humans. One way to interpret these results is through the lens of affective versus cognitive processes (e.g., Caviola & Capraro, 2019). Pet attachment might relate with concern for animals predominantly by enhancing people's affective evaluations of animals (e.g., by enhancing aesthetic judgments), as opposed to updating beliefs regarding the type of proclivities animals possess (e.g., the threat they pose) or their perceived similarity to humans. Nevertheless, it is important to point out that we found some exceptions to this trend: pests did benefit from pet attachment in terms of being seen as having greater sentience, and predators were also ascribed more cognitive ability among those scoring high in pet attachment. Thus, it seems likely that forming an attachment to a pet enhances a range of evaluative and attributional processes, though the aesthetic and emotional enhancements appear especially prominent, particularly towards predatory mammals and farmed animals.

3.5.1. Limitations and future directions

One of the limitations of this study is that the selection of three animal exemplars used for each animal category was guided by previous taxonomic findings (e.g., Sevillano & Fiske, 2016) rather than having participants themselves classify the animals. We believe that the animal groupings have *prima facie* validity, but future research could adopt a more bottom-up approach to animal classification when testing the scope of the hypothesis, as some animals may relate to multiple categories for some people (e.g., individuals with spiders as pets). Future studies should continue to test the scope of the phenomenon with additional, meaningful animal categories and expand the set of exemplars used for each category and the number of images per species, as there is likely to be meaningful variability in the way animals are perceived not only across species but within as well.

Additionally, our study focused exclusively on appraisals of animals, but future work should consider employing behavioral measures, particularly with regards to the moral dimensions we studied (e.g., willingness to take protective action on behalf of animals). Finally, future studies should compare our findings with those derived from other cultural samples to assess for convergence and variation in how pets can serve as ambassadors for other animals.

3.6. Conclusion

The present study reinforces previous evidence that pets can indeed be ambassadors for other animals. Forming meaningful attachments to pets appears to benefit companion animals most, yet farmed animals and predatory mammals also benefited substantially in terms of the aesthetic and moral judgments of pet owners. Animals considered ‘pests’ benefitted little. Nonetheless, even pests were ascribed somewhat richer minds by individuals who formed pet attachments, and such individuals also showed greater concern for their treatment. Thus, our findings highlight the unique and nuanced ways in which pet attachment can shape the beneficial attributions people make of different animal species.

3.7. References

Amiot, C. E., & Bastian, B. (2017). Solidarity with animals: Assessing a relevant dimension of social identification with animals. *PLoS One*, *12*(1), e0168184. https://doi.org/10.1371/journal.pone.0168184

Amiot, C. E., Lépine, O., & Zaky, J. (2019). Compartmentalization of animals: Toward an understanding of how we create cognitive distinctions between animals and their implications. *Analyses of Social Issues and Public Policy*, *19*(1), 150–176. https://doi.org/10.1111/asap.12177

Auger, B., & Amiot, C. (2017). Testing and extending the pets as ambassadors hypothesis: The role of contact with pets and recategorization processes in predicting positive attitudes toward animals. *Human–Animal Interaction Bulletin*, *5*, 1–25. https://www.apa-hai.org/haib/download-info/extending-pets-ambassadors-hypothesis-role-contact-pets-recategorization-processes-predicting-positive-attitudes-toward-animals/

Auger, B., & Amiot, C. E. (2019a). Testing the roles of intergroup anxiety and inclusion of animals in the self as mechanisms that underpin the "Pets as Ambassadors" effect. *Anthrozoös*, *32*(1), 5–21. https://doi.org/10.1080/08927936.2019.1550277

Auger, B., & Amiot, C. E. (2019b). The impact of imagined contact in the realm of human-animal relations: Investigating a superordinate generalization effect involving both valued and devalued animals. *Journal of Experimental Social Psychology*, *85*, 103872. https://doi.org/10.1016/j.jesp.2019.103872

Bastian, B., Costello, K., Loughnan, S., & Hodson, G. (2012). When closing the human–animal divide expands moral concern: The importance of framing. *Social Psychological and Personality Science*, *3*(4), 421–429. https://doi.org/10.1177/1948550611425106

Bjerke, T., Østdahl, T., & Kleiven, J. (2003). Attitudes and activities related to urban wildlife: Pet owners and non-owners. *Anthrozoös*, *16*(3), 252–262. https://doi.org/10.2752/089279303786992125

Budge, C., R., Spicer, J., Jones, B., & George, R. S. (1998). Health correlates of compatibility and attachment in human-companion animal relationships. *Society & Animals*, *6*(3), 219–234. https://doi.org/10.1163/156853098X00168

Caviola, L., & Capraro, V. (2020). Liking but devaluing animals: Emotional and deliberative paths to speciesism. *Social Psychological and Personality Science*, *11*(8), 1080–1088. https://doi.org/10.1177/1948550619893959

Caviola, L., Everett, J. A. C., & Faber, N. S. (2019). The moral standing of animals: Towards a psychology of speciesism. *Journal of Personality and Social Psychology, 116*(6), 1011–1029. https://doi.org/10.1037/pspp0000182

Curtis, V., Aunger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 271*(suppl_4). https://doi.org/10.1098/rsbl.2003.0144

Graça, J., Calheiros, M. M., Oliveira, A., & Milfont, T. L. (2018). Why are women less likely to support animal exploitation than men? The mediating roles of social dominance orientation and empathy. *Personality and Individual Differences, 129,* 66-69. https://doi.org/10.1016/j.paid.2018.03.007

Hawkins, R. D., & Williams, J. M. (2016). Children's beliefs about animal minds (Child-BAM): Associations with positive and negative child–animal interactions. *Anthrozoös, 29*(3), 503–519. https://doi.org/10.1080/08927936.2016.1189749

Hawkins, R., Williams, J., & Scottish Society for the Prevention of Cruelty to Animals (Scottish SPCA). (2017). Childhood attachment to pets: Associations between pet attachment, attitudes to animals, compassion, and humane behaviour. *International Journal of Environmental Research and Public Health, 14*(5), 490. https://doi.org/10.3390/ijerph14050490

Herzog, H. A. (2007). Gender differences in human–animal interactions: A review. *Anthrozoös, 20*(1), 7–21. https://doi.org/10.2752/089279307780216687

Herzog, H. A., Betchart, N. S., & Pittman, R. B. (1991). Gender, sex role orientation, and attitudes toward animals. *Anthrozoös, 4*(3), 184–191. https://doi.org/10.2752/089279391787057170

Herzog, H., Grayson, S., & McCord, D. (2015). Brief measures of the animal attitude scale. *Anthrozoös, 28*(1), 145–152. https://doi.org/10.2752/089279315X14129350721894

Knight, S., & Barnett, L. (2008). Justifying attitudes toward animal use: A qualitative study of people's views and beliefs. *Anthrozoös, 21*(1), 31–42. https://doi.org/10.2752/089279308X274047

Knight, S., Vrij, A., Cherryman, J., & Nunkoosing, K. (2004). Attitudes towards animal use and belief in animal mind. *Anthrozoös, 17*(1), 43–62. https://doi.org/10.2752/089279304786991945

Leite, A. C. Dhont, K., & Hodson, G. (2019). Longitudinal effects of human supremacy beliefs and vegetarianism threat on moral exclusion (vs. inclusion) of animals. *European Journal of Social Psychology, 49,* 179-189. doi: 10.1002/ejsp.2497

Marsa-Sambola, F., Muldoon, J., Williams, J., Lawrence, A., Connor, M., & Currie, C. (2016). The short attachment to pets scale (SAPS) for children and young people: Development, psychometric qualities and semographic and health associations. *Child Indicators Research, 9*(1), 111–131. https://doi.org/10.1007/s12187-015-9303-9

Morris, P., Knight, S., & Lesley, S. (2012). Belief in animal mind: Does familiarity with animals influence beliefs about animal emotions? *Society & Animals, 20,* 211-224. https://doi.org/10.1163/15685306-12341234

Paul, E. S. (2000). Empathy with animals and with humans: Are they linked? *Anthrozoös, 13*(4), 194–202. https://doi.org/10.2752/089279300786999699

Paul, E. S., & Serpell, J. (1992). Why children keep pets: The influence of child and family characteristics. *Anthrozoös, 5*(4), 231–244. https://doi.org/10.2752/089279392787011340

Paul, E. S., & Serpell, J. A. (1993). Childhood pet keeping and humane attitudes in young adulthood. *Animal Welfare, 2*(4), 321–337.

Piazza, J., Landy, J. F., & Goodwin, G. P. (2014). Cruel nature: Harmfulness as an important, overlooked dimension in judgments of moral standing. *Cognition, 131*(1), 108–124. https://doi.org/10.1016/j.cognition.2013.12.013

Piazza, J., McLatchie, N., & Olesen, C. (2018). Are baby animals less appetizing? Tenderness toward baby animals and appetite for meat. *Anthrozoös, 31*(3), 319–335. https://doi.org/10.1080/08927936.2018.1455456

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite, 91,* 114–128. https://doi.org/10.1016/j.appet.2015.04.011

Poresky, R. H., & Hendrix, C. (1990). Differential effects of pet presence and pet-bonding on young children. *Psychological Reports, 67*(1), 51–54. https://doi.org/10.2466/pr0.1990.67.1.51

Possidónio, C., Graça, J., Piazza, J., & Prada, M. (2019). Animal images database: Validation of 120 images for human-animal studies. *Animals, 9*(8), 475. https://doi.org/10.3390/ani9080475

Prokop, P., & Tunnicliffe, S. D. (2010). Effects of having pets at home on children's attitudes toward popular and unpopular animals. *Anthrozoös, 23*(1), 21–35. https://doi.org/10.2752/175303710X12627079939107

Rothgerber, H., & Mican, F. (2014). Childhood pet ownership, attachment to pets, and subsequent meat avoidance. The mediating role of empathy toward animals. *Appetite, 79,* 11–17. https://doi.org/10.1016/j.appet.2014.03.032

Serpell, J. (2004). Factors influencing human attitudes to animals and their welfare. *Animal Welfare, 13*(1), 145–151.

Serpell, J. A., & Paul, E. (1994). Pets and the development of positive attitudes to animals. In A. Manning & J. A. Serpell (Eds.), *Animals and human society: Changing perspectives* (pp. 127–144). Routledge.

Sevillano, V., & Fiske, S. T. (2016). Warmth and competence in animals: Social perception of animals. *Journal of Applied Social Psychology, 46*(5), 276–293. https://doi.org/10.1111/jasp.12361

Taylor, N., & Signal, T. D. (2005). Empathy and attitudes to animals. *Anthrozoös, 18*(1), 18–27. https://doi.org/10.2752/089279305785594342

Vidović, V. V., Štetić, V. V., & Bratko, D. (1999). Pet ownership, type of pet and socio-emotional development of school children. *Anthrozoös, 12*(4), 211–217. https://doi.org/10.2752/089279399787000129

Weiss, E., Miller, K., Mohan-Gibbons, H., & Vela, C. (2012). Why did you choose this pet?: Adopters and pet selection preferences in five animal shelters in the United States. *Animals, 2*(2), 144–159. https://doi.org/10.3390/ani2020144

Zickfeld, J. H., Kunst, J. R., & Hohle, S. M. (2018). Too sweet to eat: Exploring the effects of cuteness on meat consumption. *Appetite, 120,* 181–195. https://doi.org/10.1016/j.appet.2017.08.038

CHAPTER 4

An Appetite For Meat? Disentangling the Influence of Animal Resemblance and Familiarity

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CHAPTER 4

An Appetite for Meat? Disentangling the Influence of Animal Resemblance and Familiarity

4.1. Abstract

Consumers in modern society are often less exposed to meat that resembles the animal, and thus are less familiar with it, making it difficult to disentangle the influence of these two inputs (familiarity vs. animal resemblance) on meat appetite. Across three studies, we sought to systematically disentangle the impact of familiarity and animal resemblance on meat appetite using inductive (Study 1) and experimental (Studies 2a-2b) approaches. In Study 1 (N = 229) we separated familiarity and animal resemblance into orthogonal dimensions using 28 meat products. Participants provided free associations and rated the products on familiarity, animal resemblance, and appetitive appeal. In Studies 2a and 2b (N = 514) we experimentally examined the independent contributions of familiarity and animal resemblance, using stimuli normed in Study 1. We hypothesized that animal resemblance has its most pronounced influence on appetite when meat products are unfamiliar. Participants' free associations and ratings of the products were in line with this conditional hypothesis (Study1), as were the experimental manipulations of familiarity and animal resemblance (Studies 2a-2b), confirmed by a mini meta-analysis. In all three studies, familiarity had a pervasive influence on appetite. These findings suggest that product familiarity can attenuate the psychological impact that animal reminders have on appetite. Thus, interventions aimed at eliciting animal associations with meat should consider the familiarity of the products employed.

Keywords: Meat consumption, Animal resemblance, Familiarity, Association, Appetite.

4.2. Introduction

Meat that highly resembles the animal source can be off-putting for some consumers, possibly because it reminds people of its animal origins or triggers thoughts of animal slaughter (Benningstad & Kunst, 2020; Rothgerber, 2013; Tian et al., 2016). The modernization of meat production has aided consumers in avoiding animal reminders by providing consumers physical and psychological distance from the potentially upsetting sights and smells of animal slaughter (Bastian & Loughnan, 2017; Rozin et al., 1997; Segers, 2012). Many meat products purchased at market, particularly in Western cultures, lack a strong resemblance to the animal source (Hoogland et al., 2005). Presumably, this distance serves to preserve appetite for meat by preventing consumers from recurrently associating meat with its animal origins or, perhaps, the violence of animal slaughter (Benningstad & Kunst, 2020; Kunst & Hohle, 2016).

Indeed, several studies have shown that getting consumers to think about the animal origins of meat can disrupt the pleasure derived from meat consumption (Benningstad & Kunst, 2020). Studies have found that, all else equal, presenting raw meat reduces appetite for meat products, relative to cooked meat (Kubberød et al., 2008; Shimp & Stuart, 2004). Raw meat, arguably, resembles a living animal more than cooked meat, which might explain higher levels of distaste at raw meat (Rozin & Fallon, 1987). Red meat tends to elicit more disgust than white meat, which might be due to its greater animal resemblance, or other aspects of its appearance (e.g., a greater presence of blood; Fessler et al., 2003; KubberØd et al., 2006). Including reminders of the animal source can reduce appetite for meat, relative to suitable control conditions. For example, presenting a picture of an animal, alongside a recipe for a meat dish, reduces willingness to consume the meat (Kunst & Hohle, 2016; Tian et al., 2016). Including the head of the animal (e.g., a pig's head for roasted ham) relative to no head, or using "animal terms" instead of "food terms" to describe meat (e.g., "cow" instead of "beef"), have also been shown to reduce appetite for meat products by eliciting thoughts of and/or concern for the animal source (Earle et al., 2019; Kunst & Hohle, 2016; Kunst & Haugestad, 2018). Finally, qualitative studies of meat avoiders have documented reports that vegetarians and vegans often associate the sensorial aspects of meat (e.g., raw flesh, the smell of blood) with the animal and their slaughter (Hamilton, 2006). These studies point to an underlying psychological process whereby thinking about the animal origins of meat can disrupt appetite for meat, whereas dissociating meat from the animal source appears to sustain appetites.

Although meat-animal dissociation seems to be an effective mechanism for maintaining consumers' interest in meat, there are some reasons to question its ubiquity as a lever of meat

appetite. First, meat-animal dissociation as a self-standing theoretical framework struggles to explain why many meat products that highly resemble animals (e.g., whole roasted turkey in the United States and the UK; "pig leg" [jamon serrano] in Spain; whole cooked fish in Portugal) are highly popular dishes (Díaz-Caro et al., 2019; Einstein & Hornstein, 1970; Madsen & Chkoniya, 2019). Observing food practices across diverse cultural contexts suggests that there may be instances in which consumers find a meat product highly enjoyable despite noticing the link between a product and its animal origins.

Second, experimental manipulations of dissociation via animal reminders (e.g., presenting the head of a cooked animal) may conflate animal resemblance with familiarity. A roasted ham with the pig's head attached (Kunst & Hohle, 2016, Study 2a/b) or an uncooked, bloody steak (Kubberød et al., 2008) resemble animals more than a headless ham or well-cooked steak. Critically, however, such high-resemblance products are often less familiar to consumers—that is, they are encountered and consumed less often. Thus, experimental manipulations of meat-animal dissociation may be problematically conflating animal reminders and familiarity, obfuscating their discriminant impact on appetite. This observation is critical in light of the pervasive role familiarity has on food enjoyment, generally, and meat enjoyment, specifically (Foroni et al., 2013; Prada et al., 2017). Familiarity, or the perceived frequency of encountering a product, is a key determinant of consumer enjoyment of meat as it reduces uncertainty about the risks and taste (Cooke & Wardle, 2005; Pliner & Stallberg-White, 2000). Familiar meat products tend to be rated more favorably on measures of appearance and taste than less familiar meats (Borgogno et al., 2015), and frequent exposure to foods in childhood is directly associated with food preferences in adulthood (Wadhera et al., 2015). Conversely, the lack of familiarity with meat of a particular animal (e.g., meat alternatives, such as insect protein or cultured meat) is a principal hurdle to consumer interest (Bryant & Barnett, 2018; Hoek et al., 2011; Possidónio et al., 2019, 2021; Tan et al., 2016).

The status of meat as a potential pathogen vector may explain the strong link between familiarity and appetite—familiarity likely serves as a proximal signal to consumers that a given product is safe to consume, increasing its appeal (Aldridge et al., 2009; Fessler et al., 2003; Navarrete & Fessler, 2003). People who work in the meat industry (e.g., butchers) tend to adapt fairly quickly to the sight and smells of meat products (Piazza et al., 2021). This familiarization or habituation process tends to reduce a person's concern for the animals slaughtered and sustains the appeal of meat, even when it highly resembles the animal source (Piazza et al., 2021). Likewise, individuals from societies that frequently consume meat products with visible reminders of the animal (e.g., the head or limbs intact) tend to show reduced effects of animal

reminders on their appetite for meat, relative to consumers from societies where exposure to such images are less common (Kunst & Haugestad, 2018).

In short, familiarity with meat products increases their appeal, and it is possible that familiarity may attenuate the psychological impact that animal reminders have on appetite.

4.2.1. Overview of the present research and hypotheses

Since many instances of meat-animal association naturalistically coincide with lower levels of food familiarity, methodological efforts to separate the constructs of animal resemblance and familiarity would offer useful insights into how animal resemblance impacts meat appetite. In the current research we conducted three studies designed to disentangle animal resemblance and meat familiarity in a more systematic manner than in previous studies of meat-animal dissociation.

Study 1 used an inductive or "bottom-up" method for separating the two dimensions using participant ratings of a large set of meat products. We presented participants with 28 naturalistic meat products that putatively differed along the two dimensions of interest: familiarity and animal resemblance. Participants provided spontaneous associations to the products and, subsequently, rated each product on measures of familiarity, animal resemblance, and appeal as food. The free association task allowed us to unobtrusively explore the extent to which different meat products elicit thoughts of the animal source. The rating task was used to generate a two-dimensional circumplex of the products and examine how each dimension independently contributes to appetite for meat. Study 1 provided a basis for identifying products unconfounded along the dimensions of interest that could then be used experimentally. In two subsequent pre-registered studies (Studies 2a and 2b), we utilized four products from Study 1 that were normed to represent exemplars from each of the four circumplex quadrants (i.e., high vs. low; familiarity x animal resemblance). Participants were randomly assigned to one of the four products and rated them on familiarity, animal resemblance, and appeal. This enabled us to test the independent contribution of each dimension in a 2 x 2-crossed experimental design. The images used for Study 2a were based solely on the normed ratings from Study 1, whereas images used for Study 2b had the additional strength of providing some control over the animal source.

We theorized that previous work, by often not de-confounding animal resemblance and familiarity, may have overestimated the extent to which meat-animal associations impact on appetite for meat. Here, we tested an alternative view of meat-animal association that considers how animal resemblance might be conditioned upon familiarity. Specifically, we hypothesized that animal resemblance is likely to exert an influence on appetite for meat primarily when meat

products are unfamiliar, but less so when a meat product is familiar. We reasoned that familiar meat products involve high levels of psychological adaptation (e.g., Piazza et al., 2021), thus, when meat products are highly familiar, appetites are likely dominated by this familiarity. Conversely, when meat is unfamiliar, the psychological impact of an animal reminder is likely to be greater, since there has not been sufficient exposure for psychological adaptation to occur. By contrast, we did not expect that the impact of familiarity on appetite would be conditioned on animal resemblance. Rather, we expected that familiarity would enhance appetite for meat independent of a product's level of animal resemblance.

All research materials and datasets for the studies are available at https://osf.io/6z9sk/?view_only=ced9d396f349447ca8fbe27351b076dc. The studies obtained ethics approval from the Faculty of Science and Technology Ethics Committee at Lancaster University (FSTREC).

4.3. Study 1

4.3.1. Method

4.3.1.1. Participants

Participants were recruited via Prolific Academic (Peer et al., 2017). Participation was restricted to individuals living in the United Kingdom. Vegetarian and vegan participants were removed from the analyses (n = 20) since they were likely to exhibit extremely low appetite ratings toward the target products. The final sample included 229 UK participants (65.9% female) aged between 18 and 75 years old (M_{age} = 38.32, SD = 12.75). Most participants self-identified as meat lovers or omnivores (i.e., individuals who included meat, fish, and/or seafood in their diets - 74.7%); 20.1% followed a semi-vegetarian diet (restricted meat or certain meats from their diet), whereas 5.2% were pescatarians (i.e., individuals who included fish and/or seafood in their diets, but no other meats).

4.3.1.2. Procedure

Data collection took place on 17th December 2020. Participants were invited to take part in a study on the "perception of meat products." Participants were provided a hyperlink to the study on Prolific Academic and were asked to tick a captcha box to screen out bots. After providing informed consent, participants were directed to the survey hosted by Qualtrics, which involved

a free-association task, followed by an image rating task. After providing demographic information, participants were debriefed, thanked, and paid.

4.3.1.3. Measures and materials

4.3.1.3.1. Image selection

The images were retrieved from open-source online databases (e.g., Pexels; Pixabay). The selection criteria were to select images (1) depicting a single meat product, (2) presenting the meat product as it would be eaten, (3) without people or other foods visible (e.g., hands; garnishes). The images were resized (371 × 309 pixels), edited to eliminate or blur other elements besides the meat product, and edited on contrast and brightness. The goal was to select images depicting naturally occurring meat products hypothesized to fall into one of the four quadrants of the familiarity with animal resemblance circumplex, and therefore to cover these four quadrants with images varying on these two dimensions.

Each image was given a brief descriptive caption that identified: (a) the name of the meat product (e.g., "chicken liver pate"), (b) its geographic origins and prevalence (e.g., "Northern and central European cuisines"), and (c) how it is typically prepared, cooked and/or eaten (e.g., "Chicken livers are ground down and mixed with butter, spices and herbs"). This was done to increase participants' capacity to identify the product beyond what they could discern from the image alone. See Appendix B (Table B1) for all 28 images and their descriptive captions. Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2021.105875.

4.3.1.3.2. Free association task

First, we presented the 28 images, without the descriptive caption, one at a time, in a randomized order. Participants were asked to write in a text box what was the first thing that came to their minds when viewing the image.

4.3.1.3.3. Image rating task

Participants viewed the same 28 images a second time, in a new randomized order, this time with the corresponding descriptive caption. For each image, participants were asked to evaluate the product on three dimensions, measured on 7-point rating scales: (1) familiarity - "How often do you encounter this product in your everyday life?" (1 = Never, 4 = On occasion, 7 = Very frequently); (2) animal resemblance - "How much does this product resemble an animal?" (1 = Not at all, 4 = Moderately like an animal, 7 = Very much like an animal); and (3) appetite -

"Hypothetically speaking, how positive or negative would you feel about eating the meat depicted in the photo?" (1 = Very negative, 4 = Neutral, 7 = Very positive). The measures were presented below the image/caption.

4.3.1.4. Data analysis plan

4.3.1.4.1. Free associations

The data retrieved from the word association task were analyzed based on the procedure used in Graça, Oliveira, et al. (2015) and Possidónio et al. (2021). A total of 6412 associations were retrieved (i.e., associations from 229 participants x 28 products). Separate association lists were generated for each meat product. To ensure that the meanings expressed by the participants were maintained, associations with the same meaning were grouped (e.g., "nice" with "delicious"), and related words/concepts were merged into semantic categories (e.g., "unappealing" with "odd" to create a category of negatively valenced associations). Conceptually relevant categories that were mentioned by at least 10% of the participants were retained for the analysis and interpretation of themes and clusters (i.e., 81 categories that were mentioned 6128 times; see Appendix, Table B2).

4.3.1.4.2. Clustering of products defined by animal resemblance and familiarity

All analyses were performed using SPSS Statistics (version 23, IBM©). To group and organize the meat products within the two-dimensional space (circumplex) organized by the key variables, a hierarchical cluster analysis (HCA) was performed with the ratings of familiarity and animal resemblance as the organizing dimensions. Next, a k-means cluster analysis was conducted to obtain the cluster membership of each product and its distance from the cluster center.

4.3.1.4.3. Dimensions predicting appetite

Correlations were calculated to explore the relationship between the three measured variables. To analyze how strongly each dimension independently predicts appetite for meat, a regression was conducted with familiarity and animal resemblance as simultaneous predictors of appetite ratings. This analysis modeled the contribution of each dimension at the level of the different meat products to capture variability in the perception of familiarity and animal resemblance between the different products. We also ran a second regression analysis using the participant-level ratings to examine the contribution of each dimension at the level of individual (participant) tendencies to perceive familiarity and animal resemblance across all 28 products.

4.3.2. Results

4.3.2.1. Free associations

4.3.2.1.1. Categories identified across the meat products

Based on the pattern of participants' association responses across the 28 meat products, we identified six main categories (in order of prevalence): negatively valenced associations, which referred to negative sensorial and emotional responses (e.g., "unappealing", "odd"; emerging in 82.1% of the products, 37.6% of associations); positively valenced associations, comprised of positive hedonic and emotional responses (e.g., "nice", "appealing", "appetizing"; 67.9% of the products, 27.6% of associations); associations about the identification/naming of the animal (64.3% of the products, 22% of associations); associations concerning sensory attributes of the meat (50% of products, 8.2% of associations); associations related to the category ethics and health issues (e.g., "nutritious", "diseases"; <15% of products, 2.5% and 2.1% of associations, respectively). In short, the most common associations referred to sensorial and affective features in response to the meat products. Animal-related associations were also common (see Table 4.1).

Table 4.1. Frequencies and percentage of mentions (%) of the categories identified in the free-association task across clusters.

		Low Familiarity				High Familiarity				Total			
		n	*%*	*f*	*% f*	*n*	*%*	*f*	*% f*	*n*	*%*	*f*	*% f*
High Resemblance	Negative valence	10	100.0	1406	53.1	3	75.0	182	18.3	13	92.9	1588	25.9
	Positive valence	4	40.0	204	7.7	4	100.0	402	40.4	8	57.1	606	9.9
	Animal identification	10	100.0	699	26.4	4	100.0	360	36.2	14	100.0	1059	17.3
	Ethics	3	30.0	153	5.8	0	0.0	0	0.0	3	21.4	153	2.5
	Sensory attributes	4	40.0	186	7.0	2	50.0	51	5.1	6	42.9	237	3.9
	Health	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Low Resemblance	Negative valence	5	83.3	419	47.1	5	62.5	297	18.6	10	71.4	716	11.7
	Positive valence	3	50.0	214	24.1	8	100.0	870	54.5	11	78.6	1084	17.7
	Animal identification	0	0.0	0	0.0	4	50.0	291	18.2	4	28.6	291	4.7
	Ethics	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Sensory attributes	4	66.7	156	17.5	4	50.0	112	7.0	8	57.1	268	4.4
	Health	3	50.0	100	11.2	1	12.5	26	1.6	4	28.6	126	2.1
Total	Negative valence	15	93.8	1825	51.6	8	66.7	479	18.5	23	82.1	2304	37.6
	Positive valence	7	43.8	418	11.8	12	100.0	1272	49.1	19	67.9	1690	27.6
	Animal identification	10	62.5	699	19.8	8	66.7	651	25.1	18	64.3	1350	22.0
	Ethics	3	18.8	153	4.3	0	0.0	0	0.0	3	10.7	153	2.5
	Sensory attributes	8	50.0	342	9.7	6	50.0	163	6.3	14	50.0	505	8.2
	Health	3	18.8	100	2.8	1	8.3	26	1.0	4	14.3	126	2.1

Note. *n* – number of products where the category emerged; *%* - proportion in which the category is presented in the quadrant; *f* – number of associations related with that category mentioned in the quadrant; *% f* - proportion in which the associations related with that category were mentioned in the quadrant.

4.3.2.1.2. Hierarchical cluster analysis of the familiarity and animal resemblance ratings and categories identified across clusters

The two predictive dimensions, familiarity and animal resemblance, were not significantly correlated but had a largely orthogonal relationship, $r(27) = -.16$, $p = .422$, which ruled out any concerns about multicollinearity. Figure 4.1 presents the results of the hierarchical cluster analysis using familiarity and animal resemblance ratings as the organizing dimensions.

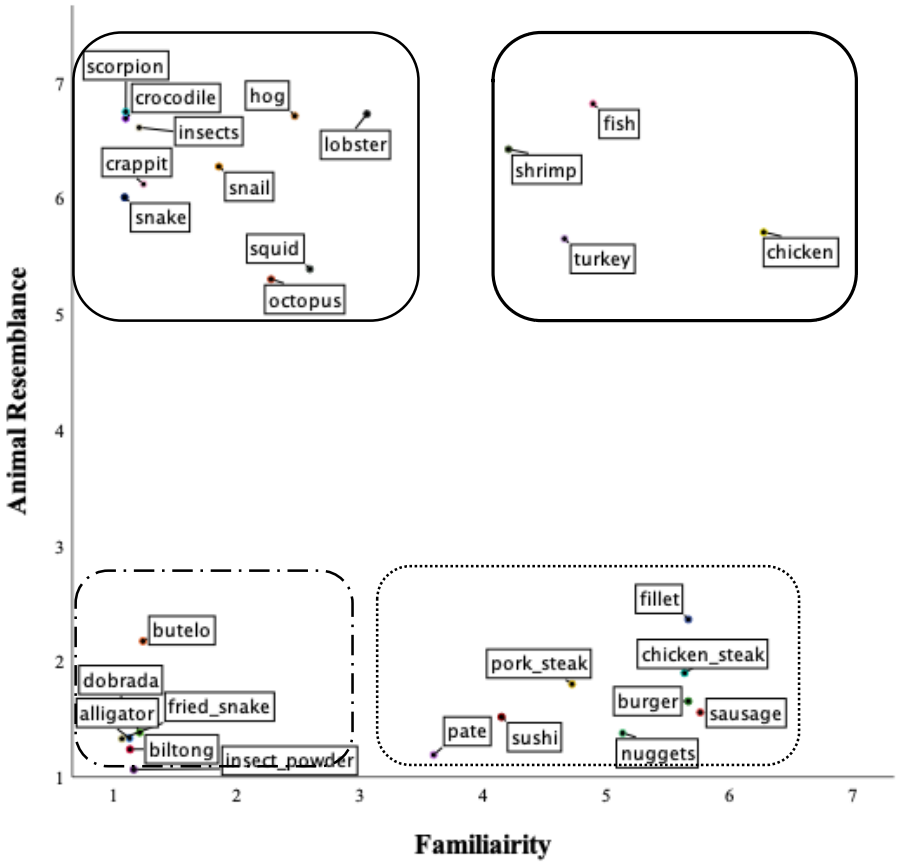

Figure 4.1. Projection of the four clusters on the circumplex between animal resemblance and familiarity. *Note.* Each cluster represents a group of products grouped by the circumplex between animal resemblance and familiarity. The border of each group is represented by a specific pattern: Cluster 1 ── (*n* = 10); Cluster 2 --- (*n* = 4); Cluster 3 -·-·- (*n* = 6); Cluster 4 ···· (*n* = 8).

Cluster 1 contained products categorized with high resemblance and low familiarity. It included animals not conventionally used as food in the local food practices (e.g., scorpion, crocodile, octopus), often presented whole. This cluster showed the biggest presence of negatively valenced associations from all the clusters. As expected, this set of products also produced a high level of identification and naming of the animal, emerging in 100% of its products (see Table 4.1).

Cluster 2 contained products categorized with high resemblance and high familiarity. This included four whole-cooked animals, conventionally used as food in the local food practices (e.g., turkey, chicken, fish). Positively valenced associations dominated this cluster, emerging in all four products. This cluster also had high levels of identification and naming of the animal, among 100% of the products.

Cluster 3 contained products categorized with low resemblance and low familiarity. It included less conventional products, where the identification of the animal was less apparent (e.g., insect powder, kangaroo biltong, fried snake). Negatively valenced associations dominated this cluster. Associations related with sensory attributes and health were also common.

Finally, cluster 4 contained products with low resemblance and high familiarity. This included meat products conventionally used in the local food practices, again where the identification of the animal was less apparent (e.g., nuggets, burger, sausage). This cluster, like cluster 2, tended to elicit positively valenced associations. Half of the products also induced associations related with sensory attributes.

4.3.2.2. Familiarity and animal resemblance as predictors of appetite

4.3.2.2.1. Rating dimensions of the four clusters

Table 4.2 presents the mean ratings of familiarity, animal resemblance, and appetite for the four clusters. Ratings for each meat product are available as Supplementary Material (see Appendix, Table B3). Repeated-measures comparisons of the mean appetite scores showed that clusters 2 and 4, defined by high familiarity, did not differ in their level of appeal, $MD = -0.07$, $SE = 0.06$, $p = 1.000$, 95% CI [-0.24, −0.10]. Both clusters revealed higher appetite ratings in comparison with clusters 1 and 3, defined by low familiarity (all comparisons, ps $< .001$). Cluster 1, defined by high resemblance and low familiarity, as expected, had the lowest appetite score (see Table 4.2; all comparisons, ps $< .001$). This is consistent with the conditional hypothesis that we test further in Studies 2a-2b: variation in animal resemblance did not significantly impact on appetite within clusters where familiarity

was high. However, when familiarity was low (clusters 1 and 3), high animal resemblance was associated with lower appetites than when animal resemblance was low, *MD* = −0.29, *SE* = 0.06, *p* = <.001, 95% CI [-0.46, −0.13] (see Table 4.2).

Table 4.2. Mean familiarity, animal resemblance, and appetite scores by cluster.

	Familiarity				Animal resemblance				Appetite			
	M	*SD*	*95% IC for Mean*		*M*	*SD*	*95% IC for Mean*		*M*	*SD*	*95% IC for Mean*	
			LB	*UP*			*LB*	*UP*			*LB*	*UP*
Cluster 1	1.80	0.60	1.72	1.88	6.26	0.80	6.15	6.36	2.54[a]	1.08	2.40	2.68
Cluster 2	5.01	1.06	4.87	5.15	6.15	0.74	6.05	6.25	5.15[b]	1.27	4.98	5.31
Cluster 3	1.16	0.34	1.11	1.20	1.42	0.56	1.35	1.49	2.83[c]	1.24	2.67	2.99
Cluster 4	5.04	1.06	4.90	5.18	1.67	0.86	1.56	1.78	5.22[b]	1.08	5.08	5.36

Note. Different superscripts ([a,b]) indicate mean differences between clusters on appetite ratings.

4.3.2.2.2. Product-level analysis

Correlations at the level of the 28 meat products revealed that familiarity and appetite ratings were highly positively correlated, $r(27) = .95$, $p < .001$, such that the more familiar the meat product, the greater its appeal. Although marginal, animal resemblance and appetite revealed a weak to moderate, negative relationship, $r(27) = -.30$, $p = .062$.

When familiarity and animal resemblance were entered together into a regression model predicting appetite ratings across the 28 meat products, this analysis revealed familiarity to be a strong independent predictor of appetite, $\beta = 0.93$, $t(25) = 16.48$, $p < .001$. Animal resemblance was also a significant independent predictor in this analysis, with greater animal resemblance associated with lower appetite ratings, $\beta = -0.15$, $t(25) = -2.69$, $p = .013$. The overall model was significant, $F(2, 25) = 150.19$, $p < .001$, and explained 92.3% of the variation in appetite. A Fisher's Z test revealed that the relative size of the relationships with appetite differed significantly, $Z = 7.52$, $p < .001$. The tighter fit between familiarity and appetite, than between animal resemblance and appetite, can be visually observed through the pattern of means displayed in Figure 4.2.

4.3.2.2.3. Participant-level analysis

We conducted a secondary analysis, using the participant-level ratings to examine the contribution of each dimension at the level of individual tendencies. The results were quite consistent with the product-level analysis and can be found in Supplementary Materials (see Appendix B4).

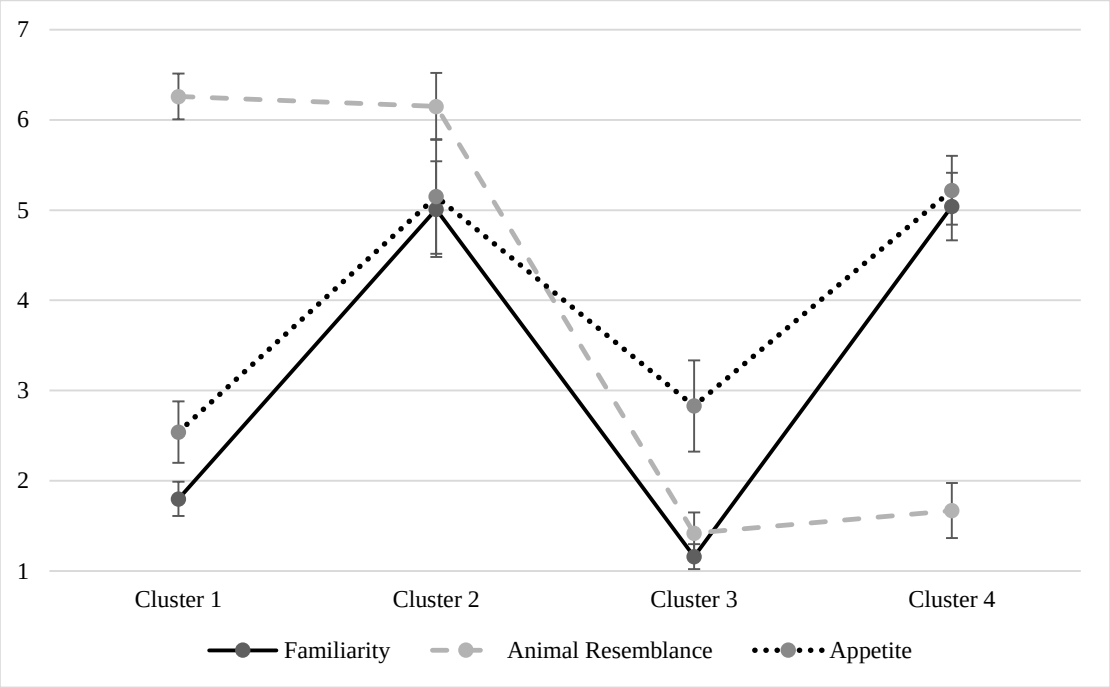

Figure 4.2. Mean familiarity, animal resemblance, and appetite scores by cluster (N = 28 meat products). *Note.* Error-bars represent ±1 standard error from the mean.

4.3.3. Discussion

Study 1 revealed that familiar meat products tended to elicit more positive associations than less familiar meat products. By contrast, the relationship between animal resemblance and appetite for meat was weak. Nonetheless, animal resemblance did significantly reduce appetite ratings, when focused on unfamiliar meat products, and high-resemblance meat products elicited more animal associations than low-resemblance products. These initial findings suggest that animal resemblance does generate animal associations, but its impact on appetite may be more noticeable when the meat is unfamiliar.

Study 1 generated a set of meat products normed on the two dimensions, which allowed us to subsequently test the conditional hypothesis more directly in Studies 2a-2b by testing for interaction effects between the familiarity and animal resemblance within a targeted 2 × 2 design. In these studies, we switched to a between-subjects design, to help reduce the possibility that participants might infer the aims of the study and modify their ratings accordingly. Finally, we included a direct measure of meat-animal association alongside our measure of animal resemblance from Study 1 to further confirm that the perception of animal resemblance and meat-animal association co-occur.

For Studies 2a and 2b, we preregistered the conditional hypothesis that animal resemblance would have a stronger impact on appetite for unfamiliar meat products than for products that are familiar. Specifically, we expected to observe a significant interaction of Familiarity x Animal Resemblance, with animal resemblance consistently reducing appetite ratings for unfamiliar meat products. However, when meat products were familiar, we expected appetite ratings to be less swayed by the level of animal resemblance and dominated by their appraised familiarity. By contrast, we predicted that familiarity would enhance appetite ratings, independent of animal resemblance.

4.4. Study 2a

4.4.1. Method

4.4.1.1. Participants

Recruitment occurred again on Prolific so that we could target a similar population as in Study 1. Again, participation was restricted to individuals living in the UK. However, this time we used Prolific's prescreening questions to recruit only those who followed "no specific diet" (omnivores) or a "pescatarian diet", to avoid recruiting vegetarian and vegan participants who did not eat meat and/or fish. Pescatarians were eligible since at least one of the meat products involved fish (whole fish). Individuals who had participated in Study 1 were not eligible. Most participants self-identified as meat-lover or omnivore (89.5%), 8.2% semi-vegetarian and 2.3% pescatarian. Two vegetarian participants who slipped through the prescreening were removed from the analysis. The final sample included 257 UK-based participants (61.9% female) aged between 18 and 70 years old (*M*age = 36.03, *SD* = 13.50).

4.4.1.2. Procedures, measures, and materials

Data collection took place on 29th March 2021. Participants took part in a study on "perceptions of meat products" with similar procedures as Study 1. A 2 × 2 between-subjects design was used, such that participants were randomly assigned to one of four conditions: familiarity (low; high) x animal resemblance (low; high). Participants were equally distributed across conditions (samples varying between 63 and 65 participants per condition).

Participants were asked to evaluate one of four meat images from Study 1. The images were selected based on the ratings derived from Study 1, normed on the two dimensions of interest. For example, high familiarity image ratings did not differ from each other but were significantly

higher than the low familiarity images (see Table 4.3 for the relevant comparisons). This led to the selection of the following images: (1) whole crocodile (high resemblance; low familiarity), (2) whole fish (high resemblance; high familiarity), (3) alligator bites (low resemblance; low familiarity), and (4) chicken nuggets (low resemblance; high familiarity).

The images were presented with the same descriptive caption from Study 1 (i.e., product label, its origin, and preparation/cooking information). Participants evaluated each product on three measures: the familiarity and animal resemblance items from Study 1, plus one additional measure of animal resemblance, derived from Kunst and Hohle (2016). This measure relates more directly to the *psychological state* of meat-animal association that animal resemblance has been empirically linked to: "How much does the picture above remind you of a living being?" (1 = *not at all* to 7 = *very much*). On a separate page, participants rated their appetite for the product, as in Study 1. Participants provided demographic information, were debriefed, thanked, and paid.

Table 4.3. Multiple comparisons between the images used to represent the conditions defined by familiarity and animal resemblance for Study 2a.

Familiarity		Low Whole crocodile *M* = 1.10; *SD* = 0.43	High Whole fish *M* = *4.89*; *SD* = 1.69
Low	Alligator bites *M* = 1.13; *SD* = 0.53	$p = 1.00$	$p < .001$
High	Chicken nuggets *M* = 5.13; *SD* = 1.60	$p < .001$	$p = .524$

Animal resemblance		Low Alligator bites *M* = 1.34; *SD* = 0.86	High Whole crocodile *M* = 6.69; *SD* = 1.07
Low	Chicken nuggets *M* = 1.38; *SD* = 1.02	$p = 1.00$	$p < .001$
High	Whole fish *M* = 6.82; *SD* = 0.50	$p < .001$	$p = .376$

Note. Comparisons based on means derived from Study 1.

4.4.1.3. Preregistered analysis plan

The analysis plan for Study 2a can be viewed here: https://aspredicted.org/9gf63.pdf. The animal resemblance and meat-animal association items were highly correlated, $r(255) = .78$, $p < .001$. Thus, as preregistered, we aggregated the items to form an index of animal resemblance and conducted a 2 × 2 ANOVA on appetite scores, with follow-up contrasts (Tukey's HSD tests).

4.4.2. Results

Examining the familiarity and animal resemblance means for each condition (Table 4.4) revealed that our manipulation of animal resemblance was successful, though the whole crocodile was rated as resembling the animal at significantly higher levels than the whole fish. By contrast, the manipulation of familiarity was not as successful as we expected, based on the prior ratings observed in Study 1. Specifically, the whole fish was not perceived as familiar as the chicken nuggets, and its rated familiarity was quite low (M = 2.84). This somewhat limits the conclusions we might infer from the manipulation. Thus, in our analysis, we also sought to compare the *degree* of familiarity and animal resemblance perceived within this (intended) "High x High" condition in predicting appetite ratings.

Table 4.4. Mean scores for familiarity, animal resemblance, and appetite by condition (Study 2a).

Familiarity	Animal resemblance	Familiarity		Animal resemblance		Appetite	
		M	*SD*	*M*	*SD*	*M*	*SD*
Low	Low (Alligator bites)	1.22^{a}	0.78	2.22^{a}	1.17	3.91^{b}	1.71
	High (Whole crocodile)	1.10^{a}	0.43	6.44^{d}	0.95	2.67^{a}	1.46
High	Low (Chicken nuggets)	4.08^{c}	1.54	1.70^{b}	0.74	4.95^{c}	1.39
	High (Whole fish)	2.84^{b}	1.66	5.88^{c}	1.11	4.19^{b}	1.77

Note. N = 257; Different superscripts (^{a,b,c,d}) within a given column indicate mean differences on ratings between products.

A two-way ANOVA 2 (familiarity: low; high) x 2 (animal resemblance: low; high) was conducted. As expected, it revealed a main effect of familiarity on appetite, $F(1,253) = 41.83$, $p < .001$, $\eta_p^2 = 0.14$, with participants in high familiar conditions reporting higher appetite means in comparison with low familiar conditions, and a main effect of animal resemblance on appetite, $F(1,253) = 25.58$, $p = .001$, $\eta_p^2 = 0.09$, with participants in low resemblance conditions reporting higher appetite means in comparison with high resemblance conditions. Against predictions, the interaction of familiarity and animal resemblance was not significant, $F(1,253) = 1.43$, $p = .233$, $\eta_p^2 = 0.006$ (Figure 4.3).

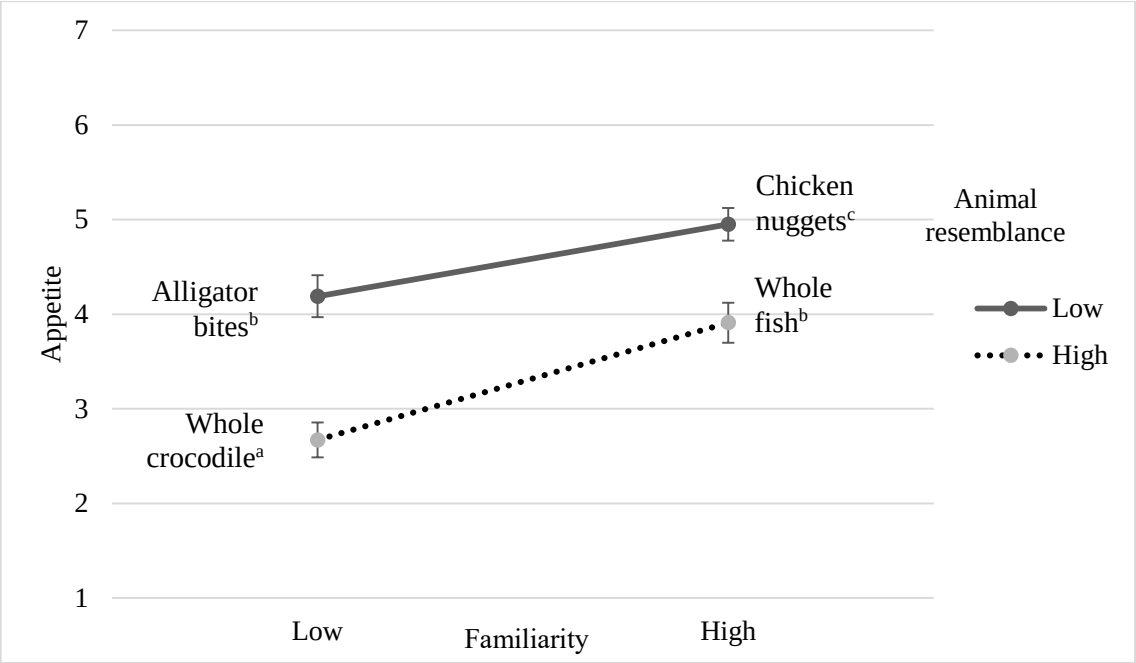

Figure 4.3. Effects of familiarity and animal resemblance on appetite (Study 2a).

Note. Different superscripts ([a,b,c]) indicate mean differences on appetite between conditions defined by animal resemblance and familiarity (interaction effect). Error-bars represent ±1 standard error from the mean.

Despite the non-significant interaction, we continued with our preregistered plan to analyze the simple effects for appetite scores (Tukey's HSD comparisons). As expected, familiarity increased appetite for meat products both when animal resemblance was high (whole meat), $t(125) = -5.28$, $p < .001$, $MD = -1.52$, $SE = 0.28$, 95% CI [−2.09, −0.95], $d = -0.936$, and when resemblance was low (bites/nuggets), $t(128) = -3.83$, $p < .001$, $MD = -1.05$, $SE = 0.28$, 95% CI [−1.59, −0.51], $d = -0.672$ (see Table 4.4). Also as expected, when familiarity was low, animal resemblance had a significant effect on meat appetite, $t(126) = -4.41$, $p < .001$, $MD = -1.24$, $SE = 0.28$, 95% CI [−1.80, −0.68], $d = -0.779$, with animal resemblance reducing appetite for unfamiliar meat (see Table 4.4). Unexpectedly, animal resemblance also significantly reduced appetite for familiar meat (whole fish), $t(127) = -2.74$, $MD = -0.77$, $SE = 0.28$, $p = .007$, 95% CI [−1.32, −0.21], $d = -0.482$. However, as noted earlier, our high familiar/high resemblance condition (whole fish) was somewhat problematic, due to its quite low familiarity ratings. Because of this issue, we also ran a focused regression for this condition, contrasting ratings of familiarity and animal resemblance as predictors of appetite. Results revealed a significant model, $F(2,61) = 10.00$, $p < .001$, with the predictors explaining 24.7% of the variation in appetite. Both familiarity,

β = 0.395, t = 3.51, p = .001, and animal resemblance, β = −0.243, t = −2.16, p = .035, were significant predictors.

4.4.3. Discussion

Study 2a provided partial, initial support for the conditional hypothesis regarding animal resemblance. Though the predicted interaction effect of familiarity and animal resemblance was not significant, animal resemblance had a relatively larger effect on appetite for unfamiliar products than familiar products. Scrutiny of the familiarity ratings for the whole fish revealed that it was not rated as familiar as in our previous study (M = 2.84 vs. 4.89), despite sampling from a population quite similar to that we based our selection criteria upon. In Study 2a, we incidentally sampled relatively fewer semi-vegetarians and pescatarians than in Study 1, which could have contributed to this difference. As a result, the whole fish was not rated as familiar as the chicken nuggets, which complicated their comparison. The whole fish was also, overall, rated as resembling an animal less than the whole crocodile (see Table 4.4), though the resemblance mean rating for whole fish was quite high and not as problematic as its familiarity rating.

As a first step towards correcting this limitation, we explored the ratings of familiarity and animal resemblance as predictors of appetite for the whole fish condition. Both familiarity and resemblance ratings independently predicted appetite ratings in this condition. To more fully address this limitation, in Study 2b we replaced the whole fish image with a different stimulus from Study 1 (whole roasted chicken) that might better typify the high resemblance x high familiarity condition. This selection had the added advantage of standardizing the type of animal along the familiarity dimension (i.e., high familiarity = chicken vs. low familiarity = alligator), whereas Study 2a held constant animal type only within the low familiarity condition (alligator).

4.5. Study 2b

4.5.1. Method

4.5.1.1. Participants

The sample included 257 UK participants (58.4% female) aged between 18 and 88 years old (M_{age} = 36.12, SD = 14.97). Participation was restricted to individuals living in the UK who followed “no specific diet”. Vegetarians and vegans were not eligible to participate.

Pescatarians were also not eligible, as there were no seafood products in Study 2b. The invitation for this study was not shown to participants who had taken part in Studies 1 and 2a. Most participants self-identified as meat-lover or omnivore (89.5%) and 10.5% followed a semi-vegetarian diet. Two participants identified as pescatarian or vegetarian, and thus were removed from the analysis.

4.5.1.2. Procedures, measures, and materials

Data collection took place on 1st April 2021. Procedures were the same as in Study 2a. As before, participants were randomly assigned to one of four conditions, with participants equally distributed across conditions (samples varying between 63 and 65 participants per condition). The main difference was the replacement of the high familiar x high resemblance meat product (i.e., whole fish in Study 2a vs. whole chicken selected from Study 1). The rationale for this replacement was two-fold: (a) to select a product that would have suitably high familiarity and animal resemblance ratings and (b) control for the type of animal within each level of familiarity (i.e., high familiarity = chicken; low familiarity = alligator). All other materials were identical to those used in Study 2a.

4.5.1.3. Preregistered analysis plan

The analysis plan was identical to Study 2a and can be viewed here: https://aspredicted.org/eb4bq.pdf. As before, the two animal resemblance/meat-animal association items correlated highly, $r(255) = .89$, $p < .001$, and therefore were aggregated.

4.5.2. Results

The manipulation of high familiarity/high resemblance (whole chicken) was more successful in producing high familiarity ratings, compared to Study 2a (see Table 4.5), with ratings even higher than in the other High Familiarity condition (chicken nuggets). The animal resemblance ratings for the whole chicken condition were not as high as in Study 1 ($M = 4.48$ vs. 5.71) and were significantly lower than when compared with the other high resemblance condition (whole crocodile; see Table 4.5). As in Study 2a, we conducted a regression analysis, focused on the High/High condition, to contrast the contribution of familiarity and resemblance ratings on appetite in this condition.

Table 4.5. Mean scores for familiarity, animal resemblance, and appetite by condition (Study 2b).

Familiarity	Animal resemblance	Familiarity		Animal resemblance		Appetite	
		M	*SD*	*M*	*SD*	*M*	*SD*
Low	Low (Alligator bites)	1.08^{a}	0.32	2.04^{a}	1.18	3.58^{a}	1.79
	High (Whole crocodile)	1.14^{a}	0.56	6.04^{c}	1.34	3.03^{a}	1.70
High	Low (Chicken nuggets)	4.19^{b}	1.78	1.53^{a}	0.69	4.90^{c}	1.69
	High (Whole chicken)	6.00^{c}	1.10	4.48^{b}	1.40	5.69^{b}	1.31

Note. N = 257. Different superscripts (^{a,b,c}) within a given column indicate significant mean differences on ratings between products.

The two-way ANOVA revealed, as expected, a main effect of familiarity on appetite, with participants in the high familiar conditions reporting higher appetite means in comparison with low familiar conditions, $F(1,253) = 96.05$, $p < .001$, $\eta_p^2 = 0.28$. Different from Study 2a, there was no main effect of animal resemblance on appetite, $F(1,253) = 0.35$, $p = .556$, $\eta_p^2 = 0.001$. However, this time the predicted interaction effect was significant, $F(1,253) = 10.76$, $p = .001$, $\eta_p^2 = 0.04$ (see Figure 4.4).

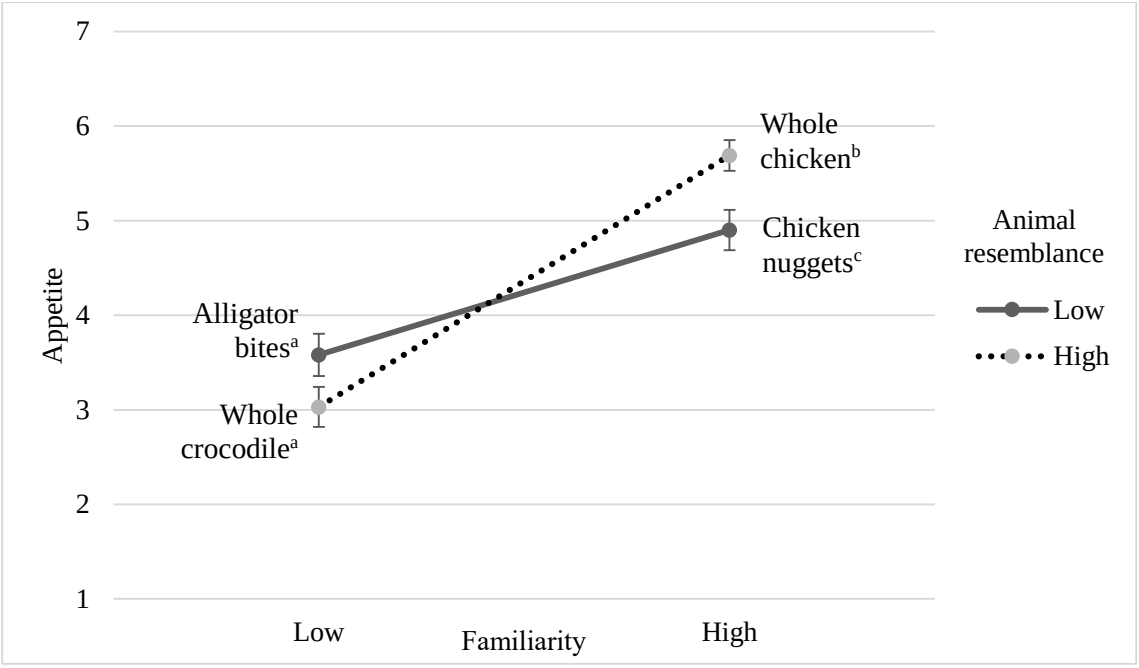

Figure 4.4. Interaction effect between familiarity and animal resemblance on appetite (Study 2b). *Note.* Different superscripts (^{a,b,c}) indicate mean differences on appetite between conditions defined by animal resemblance and familiarity (interaction effect). Error-bars represent ±1 standard error from the mean.

Simple-effects tests were carried out in accordance with the analysis plan. Animal resemblance significantly increased appetite when meat was familiar (meat from chicken, $t(126) = 2.95$, $p = .004$, $MD = 0.79$, $SE = 0.29$, 95% CI [0.30, 1.32], $d = 0.522$. This effect is opposite than what would be expected if animal resemblance exerted an effect on appetite independent of familiarity. Also different from Study 2a, when meat was unfamiliar (i.e., meat from alligator), animal resemblance did not significantly impact on appetite, $t(127) = -1.78$, $p = .077$, $MD = 0.55$, $SE = 0.31$, 95% CI [−1.15, 0.06], $d = -0.314$, though the pattern of means was in a similar direction as in Study 2a. As in Study 2a, familiarity reliably increased appetite for meat at both levels of animal resemblance – high (whole meat): $t(128) = -10.02$, $p < .001$, $MD = -2.66$, $SE = 0.27$, 95% CI [−3.19, −2.14], $d = -1.753$; low (bites/nuggets): $t(125) = -4.29$, $p < .001$, $MD = -1.33$, $SE = 0.31$, 95% CI [−1.94, −0.71], $d = -0.758$ (see Table 4.5).

A regression analysis was used to further explore the High/High (i.e., whole chicken) condition. Results revealed a significant model, $F(2,62) = 6.84$, $p = .001$, with the predictors explaining 18.1% of the variation in appetite. Familiarity ratings independently predicted appetite ratings, $\beta = 0.409$, $t = 3.56$, = .001, whereas animal resemblance did not, $\beta = -0.11$, $t = -0.96$, $p = .340$.

4.6. Mini Meta-Analysis

Studies 2a and 2b presented slightly different results for the effect of animal resemblance on appetite within the low familiarity (alligator bites vs. whole crocodile) and High Familiarity (chicken nuggets vs. whole fish/chicken) conditions. Hence, we ran a mini meta-analysis, to obtain weighted mean scores across the studies, and get a better sense of the estimated size of the effect of resemblance for these two comparisons, using procedures suggested by Goh et al. (2016). Consistent with the conditional hypothesis, animal resemblance had a moderate size, negative impact on meat appetite when familiarity was low, $r = -.26$, $p < .001$, and a non-significant effect when familiarity was high, $r = .01$, $p = .891$ (see Table 4.6). Additionally, the effect of animal resemblance on appetite was highly heterogenous when the meat products were familiar, but less heterogenous for low familiar products.

Table 4.6. Meta-analysis: Effects of animal resemblance on meat appetite at low and high levels of familiarity.

		t	*df*	*p*	*Cohen's d*	*r*
Low familiarity						
Study 2a (*N* = 257)	Whole crocodile -alligator bites	-4.41	126	< .001	-0.779	-.366
Study 2b (*N* = 257)	Whole crocodile -alligator bites	-1.78	127	.077	-0.314	-.156
M r_z						-.270
M r						-.264
Combined *Z*						-4.181***
I^2						98.03
High familiarity						
Study 2a (*N* = 257)	Whole fish - chicken nuggets	-2.74	127	.007	-0.482	-.236
Study 2b (*N* = 257)	Whole chicken - chicken nuggets	2.95	126	.004	0.522	.254
M r_z						.009
M r						.006
Combined *Z*						0.891
I^2						144.1

Note. M r_Z = weighted mean correlation (Fisher's z transformed). *M r* = weighted mean correlation (converted from r_Z to *r*). Positive Cohen's *d* and positive correlation coefficients indicate that high animal resemblance meat products have higher appetite ratings than low animal resemblance meat products. I^2 index was generated using a spreadsheet by Neyeloff, Fuchs and Moreira (2012) and should be interpreted with caution when based on few studies. ***$p < .001$, two-tailed.

4.7. General Discussion

The present studies sought to disentangle familiarity and animal resemblance as naturally co-occurring inputs into meat appetite. Our findings showed that animal resemblance had a limited role in appetite for meat once familiarity was accounted for. This suggests that product familiarity can attenuate the psychological impact that animal reminders have on appetite, and possibly account for some of the effects ostensibly attributed to animal resemblance in the psychological literature.

Study 1 had participants evaluate meat products. It was found that meat products that highly resemble the animal source tended to elicit more animal-identification associations than meat products with a low animal resemblance. This is consistent with the idea that animal resemblance is indeed a source of animal association. Though it is worth noting that the rate of animal associations, even within the high-resemblance products, was below 50%. On the one hand, this may suggest that animal associations are not very common even for high-resemblance products. On the other hand, it might also have been the case that participants were aware of

the animal association but did not report it in the free association task because other associations (e.g., hedonic sensory experiences) were more prominent.

Efforts to inductively separate the two dimensions of interest in Study 1 were largely successful. The image ratings returned a two-dimensional circumplex with images falling into one of four clusters, representing products appraised as high or low in familiarity and high or low in animal resemblance. Exploration of the features of the four clusters produced initial evidence for the conditional hypothesis: animal resemblance reduced appetite for meat products, but only when familiarity with the product was low. Appetite ratings were thus highly influenced by product familiarity, but the influence of animal resemblance was more conditional. Animal resemblance affected appetite mainly when the meat product was unfamiliar.

Studies 2a-2b drew upon the normed familiarity and animal resemblance ratings gathered in Study 1, to identify products suitably separated on the dimensions of interest and applied a 2 × 2 experimental design. In Study 2a, animal resemblance *reduced* appetite for familiar meat, whereas in Study 2b it *enhanced* appetite for familiar meat. Notably, these differences coincided with the degree of familiarity attributed to the "familiar" meat used in each study (i.e., higher levels of familiarity in 2b than in 2a). A mini meta-analysis of the two studies suggested that the effect of animal resemblance on appetite was moderate and significant for unfamiliar meat (i.e., *reducing* the appeal of unfamiliar meat), but nonsignificant for familiar meat (the weighted mean *r* was close to zero). By contrast, product familiarity consistently and robustly increased appetite for meat.

4.7.1. Implications for theory and practice

Our findings help unite and clarify two lines of research on meat appeal. The first line of research has shown that when people psychologically associate meat with its animal origins, their appetite wanes (Benningstad & Kunst, 2020; Earle et al., 2019; Kunst & Hohle, 2016; Tian et al., 2016). Yet another line of research has found that individuals can become desensitized to animal reminders with repeated exposure to them, such that when exposed to high-resembling meat products, consumers show diminished appetite disruption than consumers with less exposure to such products (Kunst & Haugestad, 2018; Piazza et al., 2021). The present findings help reconcile these two lines of research by illuminating how familiarity and animal resemblance interact to impact on appetite. Our findings suggest two novel conclusions: (1) animal resemblance has its greatest impact on appetite when familiarity with meat products is low; and (2) animal resemblance loses its influence on appetite when familiarity is high not

because animal associations are suppressed, but because they seem to be unproblematic for appetite.

That animal resemblance had its strongest influence on appetite when meat products were unfamiliar can be understood in terms of the uncertainty surrounding unfamiliar products. When a food product is familiar, consumers can trust it will meet their expectations (Borgogno et al., 2015; Tuorila et al., 1994), which are anchored on past sensory experiences. By contrast, the uncertainty caused by unfamiliar products requires consumers to use other aspects, for example, related to a product's appearance or description, to inform taste expectations. In the domain of meat, animal resemblance is one such aspect that can impact on consumer enjoyment. Indeed, as shown in our mini meta-analysis, it is when meat products were unfamiliar that animal resemblance most consistently exerted an impact on appetite.

The present findings also give insight into the mechanism by which animal resemblance loses its impact on meat appeal. We observed that high animal-resembling meat products can retain their appeal to consumers even though they remain as reminders of the animal. That is, familiarity did not dispel the meat-animal association—at least, not fully—as observed in the free associations and meat-animal association ratings of the high-resembling products. Participants in our studies appeared to be aware of which products resembled animals and which did not. Despite the animal association being active, it often failed to disrupt participants' appetite for familiar products. This finding is interesting because it suggests that familiarity softens or neutralizes the psychological power of meat-animal associations rather than preventing them from emerging.

If this view is correct, it has important implications for how researchers and advocates might approach meat-reduction interventions, particularly interventions aimed at inducing meat-animal associations (e.g., Kwasny, Dobernig & Riefler, 2021; Mathur et al., 2021). The current findings suggest that it is not enough to evoke a meat-animal association because not all meat-animal associations are problematic for meat consumers. We have seen here that, for familiar meat products, meat-animal associations are not uncommon, yet they have lost their potency to disrupt appetites. Thus, interventions aimed at inducing meat-animal associations should consider the existing relationship consumers have with the meat product. The fact that familiarity had its strongest effects when animal resemblance was high highlights the need to consider familiarity when examining the impact of animal resemblance on appetite. What, on the surface, may look like an effect of animal resemblance may often be at least partly attributed to the degree of familiarity of the animal reminder.

We would recommend that interventions utilizing animal reminders consider ways of making either the animal reminder or the meat seem less familiar or more unusual. Some animal reminders themselves are unusual (e.g., presenting a roasted ham or chicken with the head attached; Kunst & Hohle, 2016), and so their application to a product would likely reduce its appeal by making it less familiar. But such interventions may be of limited practical value since most consumers will likely avoid products that include such unfamiliar alterations. Other animal reminders are orthogonal to the meat itself (e.g., presenting a photo of a cow at the deli counter or alongside a recipe; Tian et al., 2016). The efficacy of such interventions will likely hinge on the nature of the meat product—how familiar it is to the consumer—but also the familiarity of the animal reminder in relation to the product. If the animal reminder is commonly paired with the product (e.g., commonly seeing an image of a cow at the deli counter), the inclusion of the reminder within an intervention is likely to be ineffective at lowering appetites because the consumer will be habituated to such an association. Thus, effective meat-animal association interventions will consider not only the experience the consumer has with the product but also the animal reminder in relation to the product.

4.7.2. Limitations and future directions

There were several limitations with the current methods. We struggled to find products that reliably represented the high resemblance x high familiarity quadrant. This quadrant may be empirically limited because familiarity with high-resemblance meat, such as whole fish or pig roast, may be highly variable across cultures and within. Future studies should continue to explore this dimensional space for suitable stimuli.

Another limitation is that we could not standardize the animal across all four quadrants, and, in our experimental studies, animal type covaried with familiarity (i.e., familiar meat was from a different animal than unfamiliar meat). In Study 2a, animal type was not held constant within the high-familiar condition, because the products used were based on the normative ratings from Study 1. Our approach was to select four products that had suitable distance within the "resemblance x familiarity" circumplex. This empirically-driven selection for Study 2a incidentally led to animal type being standardized for low-familiar meat, but not high-familiar meat. We did not see this as a substantive problem. Nevertheless, we recognized that it was a potential limitation which needed to be addressed in Study 2b. More generally, the coincidence of familiarity and animal type is a genuine empirical constraint that should be recognized when studying meat appetite. We did manage to observe some exceptions to this rule in Study 1 (e.g., butelo and hog roast were unfamiliar meat from pigs, whereas pork steak and pork sausage were

familiar). The broad coverage of naturalistic meat products in Study 1 provides us with some assurance that differences in animal type cannot fully account for the influence familiarity has on meat appetite. Nonetheless, continued effort is needed to identify materials that can suitably manage this issue.

Our findings are also limited to the animals that we were able to include in our methods. Many of the animals we used as unfamiliar meat (e.g., alligator, octopus, insects) are animals that individuals have little to moderate moral concern for (see Possidónio et al., 2019). It would be beneficial to extend the current findings with more dishes from mammals as they are animals individuals tend to care a lot about. We avoided using meat from unfamiliar sources that people have high concern for (e.g., dogs, chimpanzees, whales, elephants) because the meat from these animals would be likely rated at floor levels among our UK-based participants, yielding limited variability in the appetite ratings to use in the analyses. Importantly, there could also be practical barriers in finding real images of such meat that are openly available and can be used in research. We chose to use real stimuli to strengthen the ecological validity of our methods, instead of trying to convince participants they were viewing meat from legally protected animals. Given the great variability in cuisine in different cultures, care will be required to develop stimuli that are suitably anchored to the culture of interest, when determining whether our findings might generalize to populations beyond the UK-based samples we investigated.

Our conclusions are also limited to the variables we focused on. One extraneous variable that we did not consider that might impact on meat appetite is the perceived nutritional value of the product. For example, chicken nuggets would likely have been rated lower in nutritional value than the whole chicken, which might partly explain their discrepant appetite ratings. Nonetheless, there are many instances where the less healthy product (e.g., high-caloric 'junk food') is rated more desirable than the perceived healthier product (e.g., Pursey et al., 2017). Thus, future research should examine such third variables as their impact on meat appetite is far from clear.

Finally, as highlighted by Benningstad and Kunst (2020), more research is needed to better understand which aspects of meat-animal associations are problematic for consumers. Research by Kunst and Hohle (2016) suggests that meat-animal associations often elicit empathy for the slaughtered animal, and Hamilton (2006) observed that vegetarians and vegans often associate meat with violence and death. Thus, it may be that representations of slaughter and violence done to animals are particularly off-putting for consumers, as opposed to representations of the living animal. Working out which aspect of the association is particularly problematic is an important direction for better understanding how to construct the most effective interventions.

4.8. Conclusion

Connecting meat to animals can be psychologically problematic for some consumers. We have observed that this is most likely to be true when a meat dish is novel and unfamiliar. Meat products that are familiar, that consumers have habituated to, and, thus, have clear expectations about, are less likely to be disrupted by meat-animal associations. For such products, the sensory experience of the dish and its animal resemblance is psychologically integrated in a manner that the product retains its appeal despite its animal connection. This happens not because the animal origins fade from view but because, when it comes to food, “familiarity breeds contentment”, and this is true even for food with a face.

4.9. References

Aldridge, V., Dovey, T. M., & Halford, J. C. G. (2009). The role of familiarity in dietary development. *Developmental Review, 29*(1), 32–44. https://doi.org/10.1016/j.dr.2008.11.001

Bastian, B., & Loughnan, S. (2017). Resolving the meat-paradox: A motivational account of morally troublesome behavior and its maintenance. *Personality and Social Psychology Review: An Official Journal of the Society for Personality and Social Psychology, Inc, 21*(3), 278–299. https://doi.org/10.1177/1088868316647562

Benningstad, N. C. G., & Kunst, J. R. (2020). Dissociating meat from its animal origins: A systematic literature review. *Appetite, 147*, Article 104554. https://doi.org/10.1016/j.appet.2019.104554

Borgogno, M., Favotto, S., Corazzin, M., Cardello, A. V., & Piasentier, E. (2015). The role of product familiarity and consumer involvement on liking and perceptions of fresh meat. *Food Quality and Preference, Complete*, (44), 139–147. https://doi.org/10.1016/j.foodqual.2015.04.010

Bryant, C., & Barnett, J. (2018). Consumer acceptance of cultured meat: A systematic review. *Meat Science, 143*, 8–17. https://doi.org/10.1016/j.meatsci.2018.04.008

Cooke, L. J., & Wardle, J. (2005). Age and gender differences in children's food preferences. *British Journal of Nutrition, 93*(5), 741–746. https://doi.org/10.1079/bjn20051389

Díaz-Caro, C., García-Torres, S., Elghannam, A., Tejerina, D., Mesias, F. J., & Ortiz, A. (2019). Is production system a relevant attribute in consumers' food preferences? The case of Iberian dry-cured ham in Spain. *Meat Science, 158*, Article 107908. https://doi.org/10.1016/j.meatsci.2019.107908

Earle, M., Hodson, G., Dhont, K., & MacInnis, C. (2019). Eating with our eyes (closed): Effects of visually associating animals with meat on antivegan/vegetarian attitudes and meat consumption willingness. *Group Processes & Intergroup Relations, 22*(6), 818–835. https://doi.org/10.1177/1368430219861848

Einstein, M. A., & Hornstein, I. (1970). Food preferences of college students and nutritional implications. *Journal of Food Science, 35*(4), 429–436. https://doi.org/10.1111/j.1365-2621.1970.tb00950.x

Fessler, D. M. T., Arguello, A. P., Mekdara, J. M., & Macias, R. (2003). Disgust sensitivity and meat consumption: A test of an emotivist account of moral vegetarianism. *Appetite, 41*(1), 31–41. https://doi.org/10.1016/S0195-6663(03)00037-0

Foroni, F., Pergola, G., Argiris, G., & Rumiati, R. I. (2013). The FoodCast research image database (FRIDa). *Frontiers in Human Neuroscience, 7*. https://doi.org/10.3389/fnhum.2013.00051

Goh, J. X., Hall, J. A., & Rosenthal, R. (2016). Mini meta-analysis of your own studies: Some arguments on why and a primer on how: Mini Meta-Analysis. *Social and Personality Psychology Compass, 10*(10), 535–549. https://doi.org/10.1111/spc3.12267

Graça, J., Calheiros, M., & Oliveira, A. (2015). Attached to meat? (Un)Willingness and intentions to adopt a more plant-based diet. *Appetite, 95*, 113–125. https://doi.org/10.1016/j.appet.2015.06.024

Graça, J., Oliveira, A., & Calheiros, M. M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite, 90*, 80–90. https://doi.org/10.1016/j.appet.2015.02.037

Hamilton, M. (2006). Eating death: Vegetarians, meat and violence. Food, Culture and Society: *An International Journal of Multidisciplinary Research, 9*, 155–177. https://doi.org/10.2752/155280106778606053

Hoek, A. C., Luning, P. A., Weijzen, P., Engels, W., Kok, F. J., & de Graaf, C. (2011). Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance. *Appetite, 56*(3), 662–673. https://doi.org/10.1016/j.appet.2011.02.001

Hoogland, C., Boer, J., & Boersema, J. (2005). Transparency of the meat chain in the light of food culture and history. *Appetite, 45*, 15–23. https://doi.org/10.1016/j.appet.2005.01.010

KubberØd, E., Ueland, Ø., Dingstad, G. I., Risvik, E., & Henjesand, I. J. (2008). The effect of animality in the consumption experience—a Potential for disgust. *Journal of Food Products Marketing, 14*(3), 103–124. https://doi.org/10.1080/10454440801985985

KubberØd, E., Ueland, Ø., Risvik, E., & Henjesand, I. (2006). A study on the mediating role of disgust with meat in the prediction of red meat consumption among young females. *Journal of Consumer Behaviour, 5*, 281–291. https://doi.org/10.1002/cb.180

Kunst, J., & Møyner Hohle, S. (2016). Meat eaters by dissociation: How we present, prepare and talk about meat increases willingness to eat meat by reducing empathy and disgust. *Appetite, 105*. https://doi.org/10.1016/j.appet.2016.07.009

Kunst, J. R., & Palacios Haugestad, C. A. (2018). The effects of dissociation on willingness to eat meat are moderated by exposure to unprocessed meat: A cross-cultural demonstration. *Appetite, 120*, 356–366. https://doi.org/10.1016/j.appet.2017.09.016

Kwasny, T., Dobernig, K., & Riefler, P. (2021). Towards reduced meat consumption: A systematic literature review of intervention effectiveness, 2001–2019. *Appetite*. Article 105739. https://doi.org/10.1016/j.appet.2021.105739

Madsen, A. O., & Chkoniya, V. (2019). Fish consumption in the age of the information society—the Evolution of the Fish Sector in Portugal. European Journal of Social *Sciences, 2*(2), 36. https://doi.org/10.26417/ejss-2019.v2i2-63

Mathur, M. B., Peacock, J., Reichling, D. B., Nadler, J., Bain, P. A., Gardner, C. D., & Robinson, T. N. (2021). Interventions to reduce meat consumption by appealing to animal welfare: Meta-analysis and evidence-based recommendations. *Appetite, 164*, Article 105277. https://doi.org/10.1016/j.appet.2021.105277

Navarrete, C. D., & Fessler, D. (2003). Meat is good to taboo: Dietary proscriptions as a product of the interaction of psychological mechanisms and social processes. Journal of *Cognition and Culture, 3*(1), 1–40. https://doi.org/10.1163/156853703321598563

Neyeloff, J. L., Fuchs, S. C., & Moreira, L. B. (2012). Meta-analyses and forest plots using a microsoft excel spreadsheet: Step-by-step guide focusing on descriptive data analysis. *BMC Research Notes, 5*, 52. https://doi.org/10.1186/1756-0500-5-52

Peer, E., Brandimarte, L., Samat, S., & Acquisti, A. (2017). Beyond the Turk: Alternative platforms for crowdsourcing behavioral research. Journal of Experimental Social *Psychology, 70*, 153–163. https://doi.org/10.1016/j.jesp.2017.01.006

Piazza, J., Hodson, G., & Oakley, A. (2021). Butchers' and deli workers' psychological adaptation to meat. *Emotion, 21*(4), 730–741. https://doi.org/10.1037/emo0000738

Pliner, P., & Stallberg-White, C. (2000). "Pass the ketchup, please": Familiar flavors increase children's willingness to taste novel foods. *Appetite, 34*(1), 95–103. https://doi.org/10.1006/appe.1999.0290

Possidónio, C., Graça, J., Piazza, J., & Prada, M. (2019). Animal images database: Validation of 120 images for human-animal studies. *Animals, 9*(8), 475. https://doi.org/10.3390/ani9080475

Possidónio, C., Prada, M., Graça, J., & Piazza, J. (2021). Consumer perceptions of conventional and alternative protein sources: A mixed-methods approach with meal and product framing. *Appetite, 156*, Article 104860. https://doi.org/10.1016/j.appet.2020.104860

Prada, M., Rodrigues, D., Garrido, M. V., & Lopes, J. (2017). Food-pics-PT: Portuguese validation of food images in 10 subjective evaluative dimensions. *Food Quality and Preference, 61*, 15–25. https://doi.org/10.1016/j.foodqual.2017.04.015

Pursey, K. M., Davis, C., & Burrows, T. L. (2017). Nutritional aspects of food addiction. *Current Addiction Reports, 4*, 142–150.

Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: Masculinity and the justification of meat consumption. *Psychology of Men and Masculinity, 14*(4), 363–375. https://doi.org/10.1037/a0030379

Rozin, P., & Fallon, A. E. (1987). *A perspective on disgust. Psychological Review, 94*(1), 23–41. https://doi.org/10.1037/0033-295X.94.1.23

Rozin, P., Markwith, M., & Stoess, C. (1997). Moralization and becoming a vegetarian: The transformation of preferences into values and the recruitment of disgust. *Psychological Science, 8*(2), 67–73. https://doi.org/10.1111/j.1467-9280.1997.tb00685.x

Segers, Y. (2012). *Food systems in the nineteenth century*. In M. Bruegel (Ed.), A cultural history of food in the age of Empire. London, UK: Berg Publisher.

Shimp, T. A., & Stuart, E. W. (2004). The role of disgust as an emotional mediator of advertising effects. *Journal of Advertising, 33*(1), 43–53. https://doi.org/10.1080/00913367.2004.10639150

Tan, H. S. G., van den Berg, E., & Stieger, M. (2016). The influence of product preparation, familiarity and individual traits on the consumer acceptance of insects as food. *Food Quality and Preference, 52,* 222–231. https://doi.org/10.1016/j.foodqual.2016.05.003

Tian, Q., Hilton, D., & Becker, M. (2016). Confronting the meat paradox in different cultural contexts: Reactions among Chinese and French participants. *Appetite, 96*, 187–194. https://doi.org/10.1016/j.appet.2015.09.009

Tuorila, H., Meiselman, H. L., Bell, R., Cardello, A. V., & Johnson, W. (1994). Role of sensory and cognitive information in the enhancement of certainty and linking for novel and familiar foods. *Appetite, 23*(3), 231–246. https://doi.org/10.1006/appe.1994.1056

Wadhera, D., Phillips, E. D. C., Wilkie, L. M., & Boggess, M. (2015). Perceived recollection of frequent exposure to foods in childhood is associated with adulthood liking. *Appetite, 89*, 22–32. https://doi.org/10.1016/j.appet.2015.01.011

CHAPTER 5

Consumer Perceptions of Conventional and Alternative Protein Sources: A Mixed-Methods Approach with Meal and Product Framing

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CHAPTER 5

Consumer Perceptions of Conventional and Alternative Protein Sources: A Mixed-Methods Approach with Meal and Product Framing

5.1. Abstract

Understanding consumer perceptions of meat alternatives is key to facilitating a shift toward more sustainable food consumption. Importantly, these perceptions may vary according to the characteristics of the consumer (e.g., preferences, motivations), the product (e.g., sensory attributes) and the encounter (e.g., how the meat alternative is presented/framed). Qualitative and quantitative methods were applied to examine consumer perceptions of five proposed alternatives to meat: legumes, tofu, seitan, lab-grown meat, and insects. In Study 1, 138 participants provided free associations with regards to conventional animal proteins (e.g., red/white meat, fish) and the five alternatives. Three profiles of consumers were identified: (1) hedonically motivated meat eaters uninterested in meat substitutes; (2) health-oriented meat eaters open to some meat substitutes; and (3) ethically conscious meat avoiders positively oriented to most meat alternatives. In Study 2, the presentation of the product was experimentally manipulated: 285 participants evaluated the same five meat alternatives along several dimensions (e.g., edibility, healthiness), either when framed as an individual product or as part of a larger meal. Overall, most meat alternatives benefited from a meal framing, with the notable exception of legumes, which benefited from an individual framing, and insects which were evaluated quite negatively regardless of framing. The present findings suggest that there is not a single way to frame all meat alternatives that will improve their appeal to all consumers.

Keywords: Meat alternatives, Meat substitutes, Plant-based food, Meal framing, Lab-grown meat.

5.2. Introduction

Transitioning away from animal-sourced proteins towards greater use of plant-based foods may help reduce the negative impact of current food systems on the environment (Aiking, 2011; Godfray et al., 2018; Poore & Nemecek, 2018; Willett et al., 2019) and public health (Tilman & Clark, 2014; Willett et al., 2019). Despite these concerns, global meat consumption continues to rise annually (FAO, 2018), and large segments of consumers are not willing to change their meat-eating habits (Hartmann & Siegrist, 2017). One challenge to enable transitions toward healthier and more sustainable food consumption is to develop pathways (e.g., through campaigns, advertisements, public policies) that promote plant-based eating as increasingly accessible and appealing to greater numbers of consumers (de Boer & Aiking, 2017, 2018; Godfray et al., 2018; Graça et al., 2019b, 2020). To help inform these efforts, the current work: (1) explores consumers' perceptions of meat and meat alternatives; and (2) provides a test of framing as a strategy to increase the appeal of meat alternatives.

5.2.1. Alternatives to meat consumption

Meat represents an important and valued source of protein in human diets (Leroy & Praet, 2015). Consumer perceptions of meat are influenced both by psychological factors and qualities of the meat itself (Font-i-Furnols & Guerrero, 2014; Verbeke et al., 2010). Consumer attitudes towards meat are shaped by sensory aspects of meat (e.g., appearance, texture, flavour; Font-i-Furnols & Guerrero, 2014), the type of meat (e.g., red meat, white meat, fish; Clifton & Tapsell, 2013), marketing factors (e.g., price, label, brand; Font-i-Furnols et al., 2014), as well as health and ethical concerns (Berndsen & van der Pligt, 2005; Verbeke et al., 2010).

Several alternative products to meat have been proposed to reduce the current reliance on meat-based proteins (Alexander et al., 2017; Kumar et al., 2017; Smetana et al., 2015). These products differ in terms of their nutritional value, the technological challenges required for production, and their current acceptance as alternatives to meat (van der Weele et al., 2019). These products also differ in terms of their origins: they can be sourced from plants, such as legumes (i.e., plants with seeds in a pod, such as beans or peas; Lemken et al., 2018, 2019), tofu (i.e., a soft, pale high-protein food, made from the seed of the soya plant; Ottenfeld et al., 2008), seitan (i.e., a meat substitute made from wheat which can often resemble meat in texture; Véron, 2016); or they can be sourced from animals, such as insects (i.e., crickets, earthworms; Hartmann & Siegrist, 2016) and lab-grown meat (i.e., meat that is cultivated based on animal cells; Bryant & Barnett, 2018).

Studies of consumer perceptions of meat substitutes has been increasing in recent years, yet data is still relatively scarce (for recent reviews, see Graça et al., 2019a; Hartmann & Siegrist, 2017; van der Weele et al., 2019). Relevant studies on meat alternatives tend to focus on evaluations of a single product, treated in isolation from conventional sources of animal protein, such as meat and fish, and other meat alternatives. This individuated approach has produced a fragmented body of evidence regarding consumer perceptions of meat substitutes. A more comprehensive approach that assesses multiple perceptions across a range of conventional and unconventional products could yield new insights, as could the adoption of a 'grounded' approach to consumer perceptions.

The Grounded-Cognition Theory of Desire (Papies et al., 2020) articulates how people's appetite for food tends to occur within rich, multisensory "eating" situations. Appetitive cues, such as the look or smell of a product, within such contexts trigger approach and reward responses. Revisiting these appetitive cues, for example, when viewing an image of a product or hearing a description of a meal, can trigger mental simulations of prior consumption experiences. These simulations motivate behavior, often without conscious awareness. This perspective suggests that food presentations that facilitate positive consumption simulations, for example, by including factors that resemble prior eating contexts, are likely to enhance consumer desires. Hence, the present work considered how grounding (potentially unfamiliar) meat alternatives within a meal context might enhance consumer attitudes towards such products.

5.2.2. Impact of framing on food perception

Introducing meat alternatives poses several barriers, including the enjoyment people derive from the taste and texture of meat, the unfamiliarity and lower sensory attractiveness of meat substitutes, and the lack of knowledge and skills to prepare them (Graça et al., 2019a). Framing may be one way to help address some of the barriers associated with meat replacement. A study by Bryant and Barnett (2019) assessed consumer perceptions of lab-grown meat under different monikers – "clean meat", "cultured meat", "animal-free meat", or "lab-grown meat". Participants reported more positive attitudes towards the product when it was labelled as "clean meat" and "animal-free meat" than when the term "lab-grown meat" was applied. Additionally, when the product was described as "clean meat" participants reported greater willingness to sample the product than when it was labelled "lab-grown meat" (Bryant & Barnett, 2019). Associating meat with lab technology appears to be off-putting to many consumers. Bryant and Dillard (2019) investigated the acceptance of lab-grown meat under different frames,

highlighting either: the societal benefits of its consumption ("reducing harm to the environment and helping animals"), its technological novelty ("high tech"), or that cultured and conventional meat are the "same". The authors found that the high-tech framing group reported the least positive attitudes toward lab-grown meat and its consumption.

Other recent studies have examined the impact of framing on plant-based food choices and found that avoiding the label "vegetarian" within a menu can make meat-free products more desirable, compared to frames that avoid this term (e.g., describing a dish as "environmentally friendly") (Krpan & Houtsma, 2020). However, these effects differ as a function of the consumer, with non-vegetarian consumers responding more positively to such frames compared to vegetarians, who prefer vegetarian dishes to be labelled as such (Bacon & Krpan, 2018). Another approach to framing meat substitutes involves considering the way people represent the product as either a product in isolation or a constituent part of a meal. Studies by Elzerman and colleagues (Elzerman et al., 2011, 2015) have shown that the meal context may play a critical role for perceptions of meat alternatives. For instance, in line with a grounded cognition framework, they found that consumers were most positive toward meat substitutes that were similar in appearance to meat and when served with foods that were familiar to consumers (thus, likely to elicit consumption simulations). This suggests that framing meat substitutes within a broader context of an appealing meal may lead to more positive attitudes toward the product. Yet, as the authors recognized, more research is needed to test the potential benefits of meal framing when introducing novel or unfamiliar foods to consumers.

5.2.3. The present work: Aim and objectives

In two studies, the present work aims to contribute to an increased understanding of consumer perceptions of meat and meat alternatives, with the ultimate goal of gaining insights to help inform transitions toward healthier and more sustainable diets. Study 1 used an integrative bottom-up approach (free-association task) to uncover how consumers perceive a set of conventional and alternative sources of protein: red meat, white meat, fish and seafood, insects, legumes, tofu, seitan, and lab-grown meat. This set of meat alternatives covers a range of contemporary plant- and animal-protein sources of varied levels of availability. Multiple Correspondence Analysis was used to identify patterns of association (and opposition) within the data. Study 1 provided an integrative assessment of how consumers perceive meat alternatives vis-à-vis conventional animal proteins rather than focusing on evaluations of a single product or assessing meat alternatives in isolation from other sources of animal and plant-based protein. The consumer perception dimensions identified in Study 1 were then used to

inform the approach of Study 2, which addressed experimentally how consumers perceive the same set of meat substitutes under different product frames.

In Study 2, a second sample of consumers evaluated the products along nine evaluative dimensions: taste, edibility, healthiness, caloric content, naturalness, degree of processing, expensiveness, ethics and sustainability. These dimensions were either derived from Study 1 or previous research on meat and food selection (e.g., Blechert et al., 2014; Bryant et al., 2019; Prada et al., 2017). Study 2 examined how consumer perceptions differ as a function of whether the meat alternative was framed as a stand-alone food (individual frame) versus integrated within a meal (meal frame). Based on the findings of Elzerman et al. (2011, 2015), it was expected that presenting meat alternatives within a meal frame (e.g., tofu scramble) would promote more positive evaluations of the products than when presenting them as individual items (e.g., tofu). Consistent with a grounded cognition perspective (Papies et al., 2020), the reasoning was that meal frames provide a richer illustration to consumers of how a potentially unfamiliar food item, such as tofu or seitan, might be cooked and eaten, thus, increasing its appeal as an alternative to meat.

5.3. Study One: Consumers' Bottom-Up Representations of Conventional and Alternative Protein Sources

5.3.1. Method

5.3.1.1. Participants and procedure

The sample included 138 Portuguese participants (58.1% female) aged between 18 and 52 years old (M_{age} = 26.77, *SD* = 8.89). More than half of the sample (58.9%) had a higher education degree (Bachelor's, Master's or Doctorate degree), 38.8% completed secondary education and 2.3% completed primary education. Most participants included animal products (meat or fish) in their diets (82.8%), whereas 3.7% followed a vegetarian diet and 6% a vegan diet; 7.5% reported to have "other" dietary orientations (e.g., flexitarian). More detailed information about their eating habits is presented in the results section. Participants were invited to take part in a study of consumer perceptions of different foods via social networking websites (e.g., Facebook) and mailing lists. The data collection took place between 5th December 2018 and 7th January 2019. By clicking on a hyperlink, participants were directed to a secure webpage hosted by Qualtrics©. The opening page informed participants about the goals of the study (i.e., perceptions about food options), its expected duration (approximately 10 minutes), and ethical

considerations (i.e., anonymity, confidentiality and the right to withdraw at any point by closing the browser, without their responses being considered for analysis). After participants gave their informed consent, they were directed to the survey.

5.3.1.2. Measures

Participants were asked to write what they "think, feel or imagine" about the consumption of eight different food products: red meat, white meat, fish and seafood, insects, legumes, tofu, seitan, and lab-grown meat (e.g., "Eating insects makes me think, feel or imagine…"; five boxes to write associations). Each product was presented in a random order on a separate page. Afterwards, participants were asked to categorize their diet (e.g., omnivorous, pescatarian, ovo-lacto vegetarian, strict vegetarian/vegan). They also provided basic sociodemographic information, including age, gender, nationality, and education. Finally, participants were debriefed and thanked.

5.3.1.3. Data analyses

Data retrieved from the word association task was converged using NVivo 11 software, based on the same procedure used in Graça et al. (2015). A total of 3994 words/phrases were retrieved. Separate word lists were generated for each food category. To ensure that the meanings expressed by the participants were maintained, words with the same meaning were grouped together (e.g., "delicious" with "appetising"). In a second step, words from the same family were merged (e.g., "sea" with "beach", and "summer"). Infrequent words, with only one occurrence, were then dropped. In step three, the words were grouped into 102 categories (mentioned 2124 times). All responses were then coded according to the presence or absence of each category (*mentioned* or *not mentioned*). To avoid residual categories, only categories mentioned by at least 10% of the participants were retained for analysis and interpretation. This reduced the category system to 56 categories that were mentioned 1781 times (see Supplemental Material, Table C1). A multiple correspondence analysis (MCA) was then performed to explore the interrelationships between the categorical variables. This was followed by a hierarchical cluster analysis (HCA) to validate the MCA pattern solution. MCA standardised object scores were used as input variables. The HCA was suited by a k-means algorithm, a non-hierarchical clustering method. Analyses were performed using SPSS Statistics (version 23, IBM®).

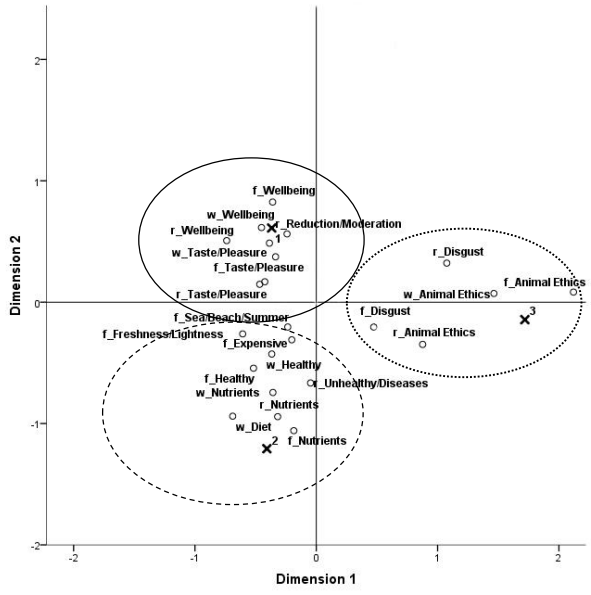
5.3.2. Results

A preliminary description of the answers to the free-association task is presented in Supplementary Material (see Appendix, Table C1 (i.e., frequencies and semantic content). Here is presented the interpretation of the dimensions identified in the MCA, the topological representation of the relationships between categories, and the results from the HCA.

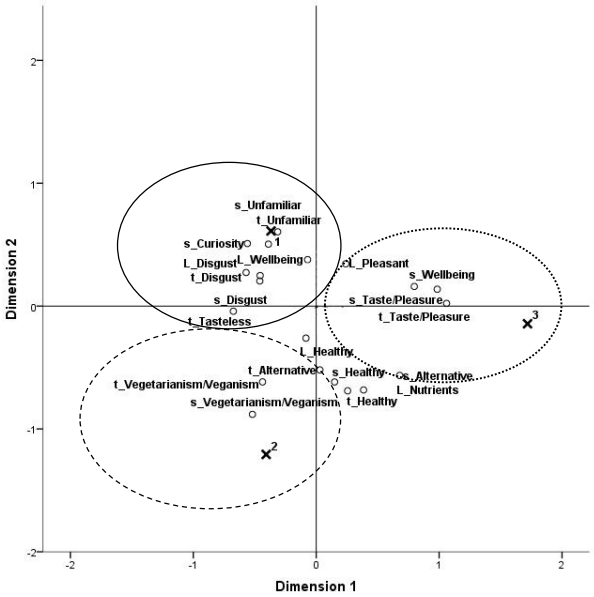
5.3.2.1. Dimensions identified in the MCA and topological representation

MCA was used to identify different clusters of consumers, based on the pattern of their association responses across the eight food products. The MCA identified two relevant dimensions accounting for 7.2% and 6.7% of the total variance, respectively. Discrimination measures of each variable for the two dimensions are presented in Supplementary Material (see Appendix, Table C1, "Dimensions" column). Figure 5.1 depicts the topological configuration of the intersection between Dimension 1 (affect dimension) and Dimension 2 (health/ nourishment dimension), along with the variables that contributed the most to the definition of the two dimensions (i.e., variables that had a discrimination measure greater than the inertia value for the respective dimension and the categories that had higher-than-average contributions – in this case, contributions greater than 0.018 = 1/56, 1 being the sum of the contributions for each dimension, and 56 the total number of categories). Because there was a great number of categories, the results of the MCA were spread across four separate frames to avoid overloading the figure. Nonetheless, all frames refer to the same MCA.

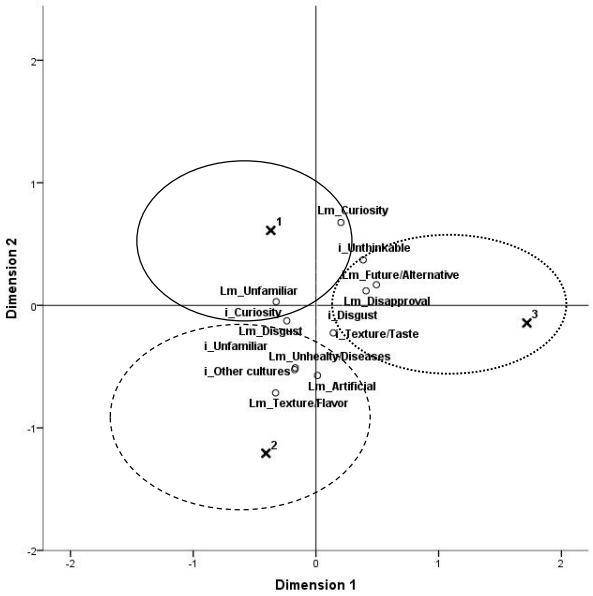
Frame 1



Frame 2



Frame 3



Frame 4

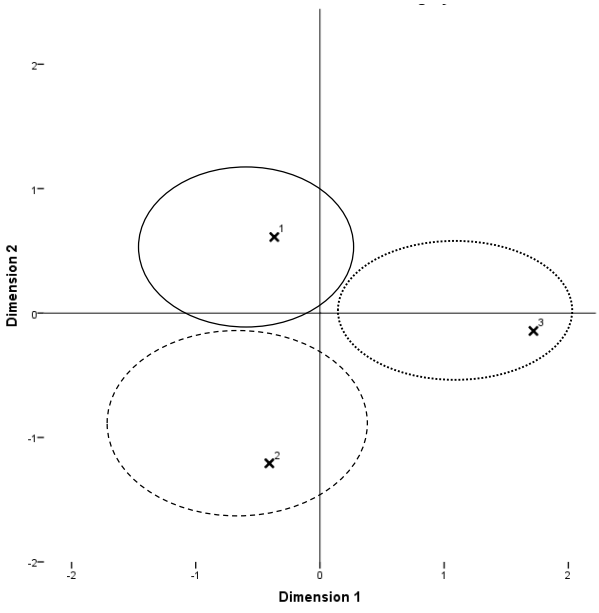


Figure 5.1. Associations of meat consumption and meat alternatives; topological configuration and projection of clusters. Note: Each cluster represents a "profile" of participants with similar associations. The border of each group is represented by a specific pattern (cluster 1 ──; cluster 2 - - -; cluster 3 ····). Frame 1: r = red meat; w = white meat; f = fish. Frame 2: L = legumes; t = tofu; s = seitan. Frame 3: i = insects; Lm = lab-grown meat. Frame 4 displays the coordinates from the three clusters identified in the MCA; these are passive variables, defined *a posteriori*, thus, they do not

actively contribute to the association patterns. Dimension 1 (horizontal axis): Affect dimension; <0 refers to negative evaluations of meat alternatives (e.g., tofu disgust) and positive evaluations of meat products (e.g., red meat taste), >0 refers to positive evaluations of meat alternatives (e.g., fish taste) and negative evaluations of meat products (e.g., fish animal ethics); Dimension 2 (vertical axis): Health/nourishment dimension; <0 refers to positive associations with meat alternatives (e.g., tofu healthy), white meat and fish (e.g., healthy), and negative associations with red meat (e.g., disease) and lab-grown meat (e.g., artificial), >0 refers to positive associations with legumes (e.g., wellbeing) and lab-grown meat (e.g., curiosity), the unfamiliarity of tofu and seitan, and positive associations with red meat (e.g., nutrients), white meat or fish (e.g., healthy).

The first dimension (horizontal axis in Figure 5.1) differentiated individuals largely in terms of the affective and hedonic aspects of food, related to taste/disgust, wellbeing, and awareness of the ethical implications of animal products. Along this horizontal dimension, on one side (<0), included associations referring to negative evaluations of meat alternatives (e.g., tofu disgust) and positive evaluations of (red) meat consumption related to pleasure, taste and wellbeing. On the other side of this dimension (>0) were positive associations with tofu and seitan, feelings of disgust and negativity towards (red) meat, references to animals as victims, and ethical concerns associated with animal products.

The second dimension (vertical axis in Figure 5.1) differentiated individuals in terms of more practical and functional aspects of food related to nourishment, nutritional value, and health, and perceptions of which groups/cultures eat certain foods. Along this vertical dimension, on one side (<0), were categories related to the nutritional aspect of animal protein and legumes, the perception that white meat, fish, legumes, tofu and seitan are healthy, that tofu and seitan are associated with vegetarian or vegan diets, that red meat and lab-grown meat have health risks, that lab-grown meat is perceived as artificial, and that eating insects is associated with Asian cultures. On the opposite side of this dimension (>0) were categories referring to the taste and wellbeing aspects of legumes, the wellbeing benefits of fish, the tastiness of white meat, the strangeness and unfamiliarity of tofu and seitan, and curiosity about lab-grown meat.

5.3.2.1. Projection of clusters

The results of the HCA validated the MCA solution and yielded three clusters of participants matching the three groups that emerged on the MCA (see Frame 4). Cluster 1 included more than half of the participants (55.8%). It included those participants with positive, hedonic orientations towards eating meat and reported disgust towards plant-based meat alternatives.

Cluster 2 included around a fourth of the participants (26.1%) and captured a profile of meat eaters more focused on health, nutrition and the functional value of eating. Cluster 3 included a minority of participants (18.1%), who tended to avoid and felt disgust towards meat, displayed ethical concerns with regard to meat consumption, and had positive orientations toward plant-based products. Table 5.1 characterizes each of the three clusters in terms of demographic variables and eating habits. Chi-square (χ^2), Kruskal-Wallis (H), and independent samples t-tests revealed significant differences between the three clusters in self-reported diet, frequency of food consumption (Table 5.2), and place of residence (with residence ranging from predominantly rural to predominantly urban).

Table 5.1. Chi-square comparisons regarding participants' demographic characteristics and self-reported diet.

		Cluster 1		Cluster 2		Cluster 3		χ^2
		N	%	N	%	N	%	
Participants[a]	N	77	55.8	36	26.1	25	18.1	
Gender	Male	32	44.4	14	41.2	8	34.8	0.68
	Female	40	55.6	20	58.8	15	65.2	
Age	<25	35	48.6	21	61.8	10	43.5	2.51
	25-40	30	41.7	11	32.4	10	43.5	
	>40	7	9.7	2	5.9	3	13	
Education	Basic	3	4.2	0	0	0	0	7.69
	Secondary	29	40.3	11	32.4	10	43.5	
	Higher	40	55.5	23	67.6	13	56.5	
Self-reported	Meat eaters[b]	69	98.6	34	100	8	40	62.35***
Diet	Meat avoiders[c]	1	1.4	0	0	12	60	

Note. [a]n = 129 (except for Self-reported diet, n = 124); [b]Meat eaters included omnivores and pescatarians; [c]Meat avoiders included vegetarians and vegans. ***p < .001

In sum, three profiles of consumers emerged. One profile referred to a group of hedonically motivated meat eaters uninterested in meat substitutes. Another profile referred to a group of health-oriented meat eaters open to some meat substitutes. The other profile referred to a smaller group of ethically conscious meat avoiders positively oriented to most meat alternatives (primarily, the plant-based ones), residing mainly in urban areas. Additionally, a set of key evaluative dimensions were identified, which informed the methods used in Study 2.

Table 5.2. Kruskal-Wallis H and independent t-test comparisons regarding participants' eating habits and place of residence.

		Cluster 1		Cluster 2		Cluster 3		*H*
		M	*SD*	*M*	*SD*	*M*	*SD*	
Frequency of consumption[a]	Red meat	3.49	1.25	3.71	1.29	1.75	1.42	26.88***
	White meat	4.31	1.23	4.59	1.33	1.79	1.18	44.44***
	Fish/seafood	3.32	1.11	3.65	0.92	2.04	1.37	22.28***
	Fruits/vegs	5.21	1.4	5.15	1.54	6.33	1.01	12.76**
	Legumes	3.94	1.41	4.35	1.45	5.17	1.58	10.61**
	Tofu	1.33	0.53	1.79	0.91	2.92	1.61	29.75***
	Seitan	1.22	0.63	1.88	1.04	2.46	1.21	40.14***
								t
Residence	Rural - Urban	4.82	1.98	5.71	1.47	6.00	1.78	5.00**

Note. [a]*Frequency* of consumption, *n* = 130; scale: 1 = *Never*, 2 = *Less than once a month*, 3 = *1 to 2 times a month*, 4 = *3 to 4 times a week*, 5 = *5 to 6 times a week*, 6 = *7 to 8 times a week*, 7 = *9 or more times a week.* Residence scale: 1 = *Predominantly rural* to 7 = *Predominantly urban*. **$p < .010$; ***$p < .001$

5.4. Study Two: Examining the Role of Meal Framing on Meat Alternatives

Study 2 sought to extend the insights uncovered in Study 1 by comparing consumer attitudes towards the same meat alternatives, but here the products were presented either as stand-alone products or as components of a meal. The framing of each food item was manipulated, between-subjects, to test the impact of meal framing on consumer perceptions related to nine evaluative dimensions, most of which emerged in Study 1 (e.g., healthiness, tastiness, sustainability, edibility, ethics), and some additional dimensions that have been identified in past work on food choices (e.g., caloric content, degree of processing).

5.4.1. Method

5.4.1.1. Participants and design

The sample included 285 Portuguese participants (68% female) aged 18 to 66 years ($M = 30.21$, $SD = 10.19$). More than half of the sample (56.8%) had a higher education degree (Bachelor's, Master's or Doctorate degree), 41.1% completed secondary education, and 2.1% completed primary education. Most participants were employed (60.4%) or were students (22.1%). Most participants included meat or fish in their diets (59.6%), whereas 15.1% followed a vegetarian diet, 21.1% had a vegan diet, and 4.2% reported "other" dietary orientations. Single-sample t-

tests against the scale midpoint of 4 revealed that, on average, participants lived in predominantly urban areas (M = 5.24, SD = 1.91), $t(284) = 11.01$, $p < .001$.

The study used a 2 (framing: individual vs. meal) x 5 (food categories: legumes, insects, lab-grown, tofu, seitan) mixed-measures design, with framing as a between-participants factor and food category as within-participants factor. Participants were randomly distributed across framing conditions, with 56% of participants assigned, at random, to the *individual frame condition* (n = 159) and 44% to the *meal frame condition* (n = 126).

5.4.1.2. Procedure and measures

Procedures regarding data collection were similar to Study 1 and the data was collected between 14th March and 5th April 2019. After providing their consent, participants completed a task which consisted of evaluating the five meat alternatives from Study 1 (legumes, tofu, seitan, insects, lab-grown meat) on nine subjective dimensions using 7-point rating scales (for details of each dimension, see Table 5.3). Participants were randomly assigned to one of two framing conditions (individual vs. meal) such that participants were presented all five food items according to the frame they were assigned to (see Table 5.4). The food items were presented in a random order, each on a single page. The order of the nine evaluative dimensions was randomised for each food item. Next, participants completed three measures that assessed their general attitudes, knowledge and level of familiarity with the five meat alternatives and three conventional meats (red meat, white meat, fish) (see Table 5.3). Participants then reported their diet and sociodemographic information, as they did in Study 1, pertaining to age, gender, nationality, educational level, and current occupational status. Finally, participants were thanked and debriefed.

Table 5.3. Evaluative dimensions and scale anchors.

Dimensions Please indicate your opinion regarding the consumption of the following foods…	Response Scale
1. Tastiness	1 = *Not at all appetising* to 7 = *Extremely appetising*
2. Edibility	1 = *Not at all edible* to 7 = *Extremely edible*
3. Healthiness	1 = *Not at all healthy* to 7 = *Extremely healthy*
4. Caloric content	1 = *Not at all caloric* to 7 = *Extremely caloric*
5. Naturalness	1 = *Not at all natural* to 7 = *Extremely natural*
6. Processing	1 = *Not at all processed* to 7 = *Extremely processed*
7. Expensiveness	1 = *Not at all expensive* to 7 = *Extremely expensive*
8. Ethics	1 = *Not at all ethical to* 7 = *Extremely ethical*
9. Sustainability	1 = *Not at all sustainable* to 7 = *Extremely sustainable*
Attitude	1 = *Very negative to* 7 = *Very positive*
Knowledge	1 = *I have little knowledge to* 7 = *I have a lot of knowledge*
Familiarity	1 = *Never found to* 7 = *I found frequently*

Table 5.4. Manipulation of food categories presented by framing condition (individual vs. meal).

	Description task: "Please indicate your opinion regarding the consumption of (food category)…"	
	Individual Frame	Meal Frame
Food Category		
Legumes	…for example, chickpeas, beans, peas, lentils.	…for example, chickpea burger with potato chips, peas curry.
Tofu	…i.e., a plant-based product produced from leguminous plants.	…for example, grilled tofu with vegetables, pasta with sautéed tofu.
Seitan	…i.e., a plant-based product produced from cereals.	…for example, seitan roast with potatoes, seitan breaded with salad.
Insects	…for example, crickets, grasshoppers, earthworms, caterpillars.	…for example, fried rice with crickets, sautéed vegetables with grasshoppers.
Lab-grown meat	…i.e., meat produced in the laboratory from animal cells.	…for example, grilled laboratory meat with mashed potatoes, laboratory meatballs stuffed with rice.

5.4.1.3. Data analyses

Data analyses were performed using SPSS Statistics v.23 (IBM®). Zero-order correlations were calculated to examine relationships between the evaluative dimensions. Means scores of the food categories – legumes, insects, lab-grown meat, tofu and seitan – were compared using a repeated-measures ANOVA for each evaluative dimension. Greenhouse-Geisser correction was used whenever the assumption of Sphericity was violated. Based on post hoc comparisons with Bonferroni correction, categories with the highest and lowest score in each dimension were identified. Post-hoc analyses were used to explore any interaction effects observed between food category and framing condition.

5.4.2. Results

5.4.2.1. Correlations between evaluative dimensions

Overall, evaluative dimensions were highly correlated (see Table 5.5). Tastiness, edibility, healthiness, naturalness, ethics and sustainability were all positively correlated. Level of processing was positively correlated with expensiveness. Tastiness, edibility and sustainability were negatively (but not as strongly) correlated with expensiveness. Healthiness, naturalness and ethics were negatively correlated with processing. Caloric content was positively correlated with expensiveness and processing.

Table 5.5. Pearson's correlations between evaluative dimensions.

	1	2	3	4	5	6	7	8
1. Tastiness	-							
2. Edibility	.71***	-						
3. Healthiness	.47***	.57***	-					
4. Naturalness	.42***	.49***	.65***	-				
5. Processing	-.18**	-.12*	-.26***	-.23***	-			
6. Caloric content	.07	.15*	.06	.06	.27***	-		
7. Expensiveness	-.23***	-.13*	-.04	-.11	.41***	.24***	-	
8. Ethics	.51***	.61***	.63***	.55***	-.13*	.11	-.11	-
9. Sustainability	.47***	.55***	.65***	.63***	-.19***	.08	-.12*	.70***

Note. ***p < .001; **p <.010; *p < .050.

5.4.2.2. Food categories for evaluative dimensions

Food ratings across dimensions were analyzed as a function of framing condition (see Table 5.6).

Regarding the main effects of food category, legumes were the product considered the most natural, appetising, healthy, edible, ethical, sustainable and the least processed, independent of framing, all ps $\leq$ .026 (see Table 5.6). Insects were rated as the least appetising, healthy, edible, ethic, expensive and the least caloric, all ps $\leq$ .013. Lab-grown meat was rated as the least natural, sustainable, the most expensive, the most caloric and the most processed, all ps $\leq$ .019.

Regarding the main effects of framing, overall, products were considered as more natural, appetising, healthy, edible, ethical and sustainable when framed as a component of a meal, than

when described as an individual product, all *p*s ≤ .001 (see Table 5.6). Conversely, products were rated as more expensive and processed when presented in an individual frame compared to a meal frame, all *p*s ≤ .001.

Table 5.6. Food ratings for each evaluative dimension by food category and framing (individual vs. meal).

Dimensions	Framing	Food categories					
		Legumes	Tofu	Seitan	Insects	Lab meat	Total
		M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Tastiness	Individual	6.22 (1.17)	4.64 (1.90)	4.58 (1.74)	1.96 (1.53)	3.14 (1.77)*	4.11^{1} (0.88)
	Meal	6.12 (1.35)	5.01 (1.80)	4.92 (1.62)	1.94 (1.48)	6.12 (1.35)*	4.82^{2} (1.00)
	Total	6.18 (1.25)	4.80 (1.86)	4.73 (1.69)	1.95 (1.51)	4.46 (2.18)	4.42 (1.00)
Edibility	Individual	6.60 (.83)	5.53 (1.55)	5.26 (1.45)	2.60 (1.96)	3.48 (1.90)*	4.70^{1} (0.87)
	Meal	6.29 (1.28)	5.63 (1.58)	5.39 (1.55)	2.55 (1.88)	6.29 (1.28)*	5.23^{2} (0.99)
	Total	6.46 (1.06)	5.58 (1.56)	5.32 (1.49)	2.58 (1.92)	4.73 (2.16)	4.93 (0.96)
Healthiness	Individual	6.48 (0.78)	5.27 (1.34)*	4.98 (1.21)	3.64 (1.84)	2.87 (1.67)*	4.65^{1} (0.74)
	Meal	6.05 (1.22)	5.62 (1.30)*	5.16 (1.32)	3.57 (1.87)	6.05 (1.22)*	5.29^{2} (0.82)
	Total	6.29 (1.02)	5.42 (1.33)	5.06 (1.26)	3.61 (1.85)	4.27 (2.17)	4.93 (0.84)
Naturalness	Individual	6.35 (1.05)*	4.84 (1.57)	4.87 (1.43)	4.33 (2.32)	1.92 (1.47)*	4.46^{1} (0.85)
	Meal	5.99 (1.36)*	5.01 (1.48)	4.82 (1.41)	4.30 (2.34)	5.99 (1.36)*	5.22^{2} (0.83)
	Total	6.19 (1.21)	4.91 (1.53)	4.85 (1.41)	4.32 (2.32)	3.72 (2.47)	4.80 (0.92)
Processing	Individual	2.74 (2.03)	4.42 (1.32)	4.21 (1.36)	2.43 (1.83)	5.77 (1.62)*	3.91^{1} (0.83)
	Meal	3.11 (1.86)	4.25 (1.51)	4.29 (1.40)	2.79 (1.80)	3.11 (1.86)*	3.51^{2} (1.05)
	Total	2.90 (1.96)	4.35 (1.41)	4.24 (1.38)	2.59 (1.82)	4.59 (2.18)	3.74 (0.95)
Caloric content	Individual	3.96 (1.53)	3.85 (1.18)	3.91 (1.16)	3.57 (1.48)	4.45 (1.18)	3.95^{1} (0.71)
	Meal	4.21 (1.38)	3.84 (1.34)	4.13 (1.09)	3.73 (1.61)	4.21 (1.38)	4.03^{1} (0.85)
	Total	4.07 (1.47)	3.85 (1.25)	4.01 (1.14)	3.64 (1.54)	4.34 (1.28)	3.98 (0.78)
Expensiveness	Individual	2.79 (1.80)	4.35 (1.34)	4.31 (1.30)	3.30 (1.72)	4.99 (1.51)*	3.95^{1} (0.81)
	Meal	2.94 (1.78)	4.38 (1.57)	4.21 (1.48)	3.34 (1.79)	2.94 (1.78)*	3.56^{2} (1.09)
	Total	2.86 (1.79)	4.36 (1.44)	4.27 (1.38)	3.32 (1.75)	4.08 (1.92)	3.78 (0.96)
Ethics	Individual	6.26 (1.18)	5.57 (1.43)*	5.50 (1.41)	2.74 (1.88)	3.32 (1.98)*	4.68^{1} (0.84)
	Meal	6.18 (1.25)	5.95 (1.44)*	5.75 (1.43)	2.87 (1.95)	6.18 (1.25)*	5.39^{2} (0.91)
	Total	6.22 (1.21)	5.74 (1.44)	5.61 (1.42)	2.80 (1.91)	4.59 (2.21)	4.99 (0.94)
Sustainability	Individual	6.21 (1.02)	5.05 (1.31)	4.97 (1.46)	3.72 (2.21)	3.65 (2.01)*	4.72^{1} (0.93)
	Meal	5.90 (1.24)	5.36 (1.37)	5.23 (1.35)	3.87 (2.15)	5.90 (1.24)*	5.25^{2} (0.85)
	Total	6.08^{a} (1.13)	5.19^{c} (1.34)	5.08^{c} (1.42)	3.79^{b} (2.18)	4.65^{b} (2.05)	4.96 (0.93)

Note. Different superscripts (^{1,2}) indicate differences according to framing (i.e., main effect of condition), all *p*s ≤ .001. (*) indicates a significant mean difference due to framing within a food category, all *p*s < .028. Results are presented with Bonferroni correction.

There were also multiple interaction effects between food category and framing, with certain food products being more affected by framing condition than other products. There was an interaction between food category and framing on all dimensions, $p < .001$, except caloric content, $p = .108$. Specifically, legumes were perceived as more edible, healthier, more natural and more sustainable when presented in an individual frame than a meal frame, all $ps \leq .022$, whereas lab-grown meat was perceived as more edible, more appetising, healthier, more natural, less processed, more sustainable, more ethical and less expensive when presented in a meal frame than in an individual frame, all $ps < .001$. Tofu was also perceived as healthier and more ethical when presented in the context of a meal, all $ps \leq .028$ (see Table 5.6).

5.4.2.3. Food categories for attitude, knowledge and familiarity

Table 5.7 presents food category ratings on attitude, knowledge and familiarity by framing condition, for conventional meat products and the five alternatives. As can be seen, participants rated legumes as the most positive and familiar, compared to all other food categories, all $ps \leq .001$. Legumes were the meat alternative that participants had the greatest knowledge of, all $ps \leq .001$, with mean scores on par with red meat, white meat, and fish. Insects were considered the least familiar category, all $ps \leq .001$. Additionally, insects were rated the least positive category, along with lab-meat, and the product that participants had the least knowledge about, all $ps \leq .001$. When averaging across food category, there were no significant main effects of framing on ratings of attitude, knowledge, and familiarity. Interaction effects between food category and framing were not found either, $p \leq .142$. Follow-up analyses revealed three significant simple effects of framing within the food categories of legumes and tofu. Legumes bucked the trend for most food categories and were rated more positive, $p = .047$, and more familiar, $p < .001$, when presented as an individual product than a meal component. By contrast, tofu was rated as more positive when presented as part of meal than when presented as an individual product, $p = .036$ (see Table 5.7).

Table 5.7. Food product ratings for attitude, knowledge and familiarity by food category and framing (individual vs. meal).

Dimension	Framing	Food categories								
		Red Meat	White Meat	Fish	Legumes	Tofu	Seitan	Insects	Lab meat	Total
		M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Attitude	Individual	2.82 (2.01)	3.71 (2.48)	3.89 (2.44)	6.56 (0.99)*	5.23 (1.78)*	4.92 (1.82)	2.29 (1.69)	2.48 (1.70)	*3.99 (0.09)*[1]
	Meal	2.98 (2.12)	3.97 (2.56)	4.07 (2.45)	6.29 (1.26)*	5.66 (1.65)*	5.31 (1.80)	2.30 (1.84)	2.64 (1.81)	*4.15 (0.87)*[1]
	Total	*2.89 (2.06)*	*3.82 (2.51)*	*3.97 (2.44)*	*6.44 (1.13)*	*5.42 (1.73)*	*5.09 (1.82)*	*2.29 (1.76)*	*2.55 (1.75)*	*4.06 (0.89)*
Knowledge	Individual	5.61 (1.67)	5.74 (1.54)	5.79 (1.49)	6.13 (1.25)	4.55 (2.20)	4.23 (2.33)	2.12 (1.57)	2.22 (1.63)	*4.55 (1.13)*[1]
	Meal	5.71 (1.58)	5.88 (1.57)	5.67 (1.62)	5.81 (1.58)	4.64 (2.12)	4.25 (2.38)	2.32 (1.73)	2.54 (1.90)	*4.60 (1.18)*[1]
	Total	*5.66 (1.63)*	*5.80 (1.55)*	*5.74 (1.55)*	*5.99 (1.41)*	*4.59 (2.16)*	*4.24 (2.35)*	*2.21 (1.65)*	*2.36 (1.76)*	*4.57 (1.15)*
Familiarity	Individual	4.67 (2.54)	4.97 (2.45)	4.94 (2.40)	6.31 (1.36)*	4.21 (2.21)	3.81 (2.27)	1.19 (0.76)	1.47 (1.12)	*3.95 (0.91)*[1]
	Meal	4.46 (2.46)	4.91 (2.46)	4.72 (2.28)	5.59 (1.86)*	4.25 (2.28)	3.73 (2.28)	1.33 (1.05)	1.79 (1.69)	*3.85 (0.87)*[1]
	Total	*4.58 (2.51)*	*4.95 (2.45)*	*4.85 (2.35)*	*5.99 (1.64)*	*4.22 (2.23)*	*3.77 (2.27)*	*1.25 (0.90)*	*1.61 (1.41)*	*3.90 (0.89)*

Note. Different superscripts ([1,2]) indicate significant framing differences, i.e., main effect of condition. (*) indicates a significant mean difference due to framing within a food category, all *p*s $\leq$ .047. Results are presented with Bonferroni correction.

5.5. Discussion

In two studies, consumer perceptions of meat and meat alternatives were examined, using mixed methods, to better understand pathways and barriers to adopting meat alternatives. Study 1 explored consumers' free associations with different types of meat (red meat, white meat, and fish) and meat alternatives (insects, legumes, tofu, seitan, and lab-grown meat) with the aim of identifying distinct consumer profiles. Study 2 used an experimental design to test how framing meat alternatives as either isolated products or components of a meal can affect how consumers perceive these products.

The findings from the first study revealed the presence of three profiles of consumers. The first group was comprised of committed meat eaters who had a uniformly positive orientation towards meat consumption, expressed an aversion towards plant-based alternatives, but also reported some curiosity about lab-grown meat. This profile of consumers is similar to the profile of "high meat attachment" found by Graça et al. (2015) in their exploration of consumer representations of meat. It also shares aspects in common with the personality profiles of individuals who tend to rationalize meat eating as "natural" and "nice" (see Hopwood & Bleidorn, 2019). The second group of consumers involved meat eaters concerned largely with health issues, nutrition and the functional value of eating. This group associated tofu and seitan with vegetarian and vegan diets, and considered white meat and fish as healthier options than red meat – a belief that has been found consistently in past studies (e.g., Clifton & Tapsell,

2013). In this group, consumers were also concerned about the potential negative impact of lab-grown meat on health, which is a concern documented in other studies as well (e.g., Laestadius et al., 2015; Siegrist et al., 2018; Verbeke et al., 2015). Finally, a third cluster of participants was observed characterized by disgust towards meat and ethical concerns for animals. This third group included participants that exclude meat from their diets, experience disgust towards meat and fish, display ethical concerns about meat consumption, find pleasure in plant-based meat alternatives (e.g., tofu, seitan), and tend to reside in urban areas. These findings align with the results from Graça et al. (2015), who identified a group of consumers that excluded meat from their diet, experienced disgust towards meat, and perceived farmed animals as victims. The present research extends these observations by showing that this group of consumers tends to reject *animal-sourced* meat alternatives, such as lab-grown meat and insects.

The findings from Study 2 supported and extended those uncovered with the free association method used in Study 1. In Study 2, legumes were considered the most natural, appetising, healthy, edible, ethical, sustainable and the least processed of the meat alternatives, which coincided with the free associations reported of legumes with regards to health and taste. In Study 2, insects were rated as the least appetising, healthy, edible, caloric, and ethical, but also the least expensive. These negative perceptions of insects were also observed in the free associations task and align with findings that consumers in Western cultures tend to reject insects as a food source (Hartmann et al., 2017). Lab-grown meat was also viewed quite negatively. In Study 2, lab-grown meat was perceived as the least natural and most processed of all the meat alternatives, and, in Study 1, it was associated with risks to health and artificiality. These finding converge with consumer concerns that lab-grown meat is unnatural and artificial (Bryant et al., 2018; Laestadius et al., 2015; Siegrist et al., 2018; Verbeke et al., 2015). In addition, Study 2 found that lab-grown meat was perceived as the least sustainable, most expensive and highest-caloric food from all the meat alternatives. One potential factor reinforcing feelings of aversion to lab-grown meat may be the way in which it is labelled. Both studies used the term "lab-grown meat," which may evoke imagery of scientists working in a laboratory to construct an artificial product. Recent findings from Bryant et al. (2019) suggest that such technological framings reduce consumer interest in cultured meat, compared to alternative labels (e.g., clean meat), which evoke thoughts of the environmental benefits of this product.

Consumer appraisals of some products were highly contingent on how the products were presented, particularly lab-grown meat and legumes. Overall, meal framing had a more positive impact on consumer appraisals, compared to presenting meat alternatives as individual

products. Food categories were considered as more natural, appetising, healthy, edible, ethical and sustainable, and less expensive and processed, when presented in the meal frame than in the individual frame, but this main effect seemed to be driven mostly by lab-grown meat. Meal frames may be generally beneficial because one prerequisite for the acceptance of meat substitutes is that consumers must recognize them as alternatives to meat (Elzerman et al., 2011). This representational task may be easier when the product is presented as a meat replacement within a meal context than when reflecting on the product alone. These findings are also meaningful in light of the Grounded Cognition Theory of Desire, which suggests that food stimuli may appear more appealing when situated in familiar eating contexts than when abstracted from such contexts (Papies et al., 2020).

Lab-grown meat particularly benefitted from a meal framing. It was perceived as more edible, more appetising, healthier, more natural, less processed, more sustainable, more ethical and less expensive when presented as part of a meal. Tofu was also perceived as healthier and more ethical when presented in a meal context. Legumes were an interesting exception to the rule. Legumes were appraised more positively (i.e., edible, healthier, natural, sustainable) when presented as an individual product. This contrast might relate to the perceived familiarity of this meat alternative. Legumes seemed to be the most familiar meat alternative for participants in the present studies, which may explain their positive ratings. By contrast, insects and lab-grown meat were the least familiar foods, which may explain their highly negative ratings. Interestingly, legumes were perceived as more familiar and more positive when presented as an individual product than when presented within a meal. By contrast, tofu was rated more positively when presented in a meal frame than as an individual product. Seitan also received more positive ratings in a meal context, though the levels were not statistically significant. Presenting insects in the context of a meal did not improve the very low ratings this product received. Insects seemed to be the least promising meat alternative based on consumer appraisals. Taken together, these results suggest that familiarity may be an important moderator to consider when deciding how best to introduce a meat alternative to market. A hypothesis to address in future studies is that meal frames may be useful for novel products, such as lab-grown meat, as they help ground unfamiliar products within a wider appetitive context, but they may lose their value as products gain acceptance and familiarity, and thus can trigger rich, multisensory simulations on the basis of the product alone.

5.5.1. Limitations and future directions

One limitation of the present research is that it only considered a limited set of meat substitutes. Future studies should widen the scope of investigation to include and compare other protein alternatives, including alternatives to dairy and cow's milk (e.g., soymilk), gaining popularity in many Western cultures (Sizter, 2019; Villegas et al., 2008), and products derived from algae, jackfruit, and mushrooms. Furthermore, in Study 2, the meal frames always paired the meat alternative with other plant-based foods, usually carbohydrates or other legumes. Arguably, some meal frames may be more beneficial than others. For instance, pairing a food with potato chips may elicit a different appraisal, in terms of perceived tastiness, healthiness and caloric content, then when pairing the same food with rice or sautéed vegetables. Thus, an important direction for future research would be to examine the impact of combining different ingredients within a meal framing.

It should also be noted that Portugal has a strong meat-eating culture, particularly seafood (Almeida et al., 2015), and the current samples had a disproportionate number of self-identified vegetarians and vegans. On the one hand, given the aims of the current work, there was value in sampling participants with a wider range of experiences with meat substitutes. On the other hand, to strengthen confidence in the current findings and test their generalisability there is a clear need for replication of both studies in diverse cultural settings, preferably with large representative samples to reinforce external validity. Finally, the present research relied on preexisting consumer knowledge and beliefs about the different meat alternatives, rather than attempting to manipulate their perceptions of the qualities of the product via descriptive information or visuals. Future studies should also investigate how consumer evaluations may be affected by the provision of such additional information pertaining to, for example, the nutritional content or visual presentation of different meat alternatives.

5.6. Conclusion

The current findings point to several directions for improving the marketing of meat alternatives to promote healthier and more sustainable diets. Three consumer profiles were observed towards meat alternatives and meal framing was found to improve consumer perceptions of these products, especially lab-grown meat and tofu. These findings suggest that promoting meat alternatives may benefit from acknowledging and targeting different profiles of consumers. More specifically, it was possible to identify segments of consumers that have quite different associations with meat substitutes, from those who have already adopted many alternatives to

the most challenging segment of consumers with largely negative attitudes towards meat substitution. It was also observed that meal framing can help promote meat alternatives, either by highlighting well-known products within individual frames (e.g., legumes), or by demonstrating how less familiar products (e.g., tofu) can be incorporated into a meal. The current findings suggest that there is not a single way to frame all meat alternatives that will improve their appeal to all consumers. Further studies are warranted to explore how specific frames can be tailored for different meat alternatives, while accounting for distinctive consumer profiles and cultural particularities.

5.8. References

Aiking, H. (2011). Future protein supply. *Trends in Food Science & Technology*, *22*(2–3), 112–120. https://doi.org/10.1016/j.tifs.2010.04.005

Alexander, P., Brown, C., Arneth, A., Dias, C., Finnigan, J., Moran, D., & Rounsevell, M. D. A. (2017). Could consumption of insects, cultured meat or imitation meat reduce global agricultural land use? *Global Food Security*, *15*, 22–32. https://doi.org/10.1016/ j.gfs.2017.04.001

Almeida, C., Karadzic, V., & Vaz, S. (2015). The seafood market in Portugal: Driving forces and consequences. *Marine Policy*, *61*, 87–94. https://doi.org/10.1016/j.marpol.2015.07.012

Bacon, L., & Krpan, D. (2018). (Not) Eating for the environment: The impact of restaurant menu design on vegetarian food choice. *Appetite*, *125*, 190–200. https://doi.org/10. 1016/j.appet.2018.02.006

Berndsen, M., & van der Pligt, J. (2005). Risks of meat: The relative impact of cognitive, affective and moral concerns. *Appetite*, *44*(2), 195–205. https://doi.org/10.1016/ j.appet.2004.10.003

Blechert, J., Meule, A., Busch, N. A., & Ohla, K. (2014). Food-pics: An image database for experimental research on eating and appetite. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.00617

Bryant, C., & Barnett, J. (2018). Consumer acceptance of cultured meat: A systematic review. *Meat Science*, *143*, 8–17. https://doi.org/10.1016/j.meatsci.2018.04.008

Bryant, C., & Dillard, C. (2019). The impact of framing on acceptance of cultured meat. *Frontiers in Nutrition*, *6*, 103. https://doi.org/10.3389/fnut.2019.00103

Bryant, C. J., & Barnett, J. C. (2019). What's in a name? Consumer perceptions of in vitro meat under different names. *Appetite*, *137*, 104–113. https://doi.org/10.1016/j.appet.2019.02.021

Bryant, C., Szejda, K., Parekh, N., Desphande, V., & Tse, B. (2019). A survey of consumer perceptions of plant-based and clean meat in the USA, India, and China. *Frontiers in Sustainable Food Systems*, *3*, 11. https://doi.org/10.3389/fsufs.2019.00011

Clifton, P., & Tapsell, L. (2013). Diet and cardiovascular disease: Dietary patterns, foods and nutrients: Editorial. *Nutrition & Dietetics*, *70*(3), 170–171. https://doi.org/10.1111/ 1747-0080.12069

de Boer, J., & Aiking, H. (2017). Pursuing a low meat diet to improve both health and sustainability: How can we use the frames that shape our meals?. *Ecological Economics*, *142*, 238e248. https://doi.org/10.1016/j.ecolecon.2017.06.037

de Boer, J., & Aiking, H. (2018). Prospects for pro-environmental protein consumption in Europe: Cultural, culinary, economic and psychological factors. *Appetite, 121*, 29-40. https://doi.org/10.1016/j.appet.2017.10.042

Elzerman, J. E., Hoek, A. C., van Boekel, M. A. J. S., & Luning, P. A. (2011). Consumer acceptance and appropriateness of meat substitutes in a meal context. *Food Quality and Preference*, *22*(3), 233–240. https://doi.org/10.1016/j.foodqual.2010.10.006

Elzerman, J. E., Hoek, A. C., van Boekel, M. J. A. S., & Luning, P. A. (2015). Appropriateness, acceptance and sensory preferences based on visual information: A web-based survey on meat substitutes in a meal context. *Food Quality and Preference*, *42*, 56–65. https://doi.org/10.1016/j.foodqual.2015.01.010

Font-i-Furnols, M., & Guerrero, L. (2014). Consumer preference, behavior and perception about meat and meat products: An overview. *Meat Science*, *98*(3), 361–371. https://doi.org/10.1016/j.meatsci.2014.06.025

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., Pierrehumbert, R. T., Scarborough, P., Springmann, M., & Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science*, *361*(6399), eaam5324. https://doi.org/10.1126/science.aam5324

Graça, J., Cardoso, S. G., Augusto, F. R., & Nunes, N. C. (2020). Green light for climate-friendly food transitions? Communicating legal innovation increases consumer support for meat curtailment policies. *Environmental Communication*, 1-14. https://doi.org/10.1080/17524032.2020.1764996

Graça, J., Godinho, C. A., & Truninger, M. (2019a). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology*, *91*, 380–390. https://doi.org/10.1016/j.tifs.2019.07.046

Graça, J., Oliveira, A., & Calheiros, M. M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, *90*, 80–90. https://doi.org/10.1016/j.appet.2015.02.037

Graça, J., Oliveira, A., & Calheiros, M. M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, *90*, 80-90. https://doi.org/10.1016/j.appet.2015.02.037

Graça, J., Truninger, M., Junqueira, L., & Schmidt, L. (2019b). Consumption orientations may support (or hinder) transitions to more plant-based diets. *Appetite*, *140*, 19-26. https://doi.org/10.1016/j.appet.2019.04.027

Hartmann, C., & Siegrist, M. (2016). Becoming an insectivore: Results of an experiment. *Food Quality and Preference*, *51*, 118–122. https://doi.org/10.1016/j.foodqual.2016.03.003

Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology*, *61*, 11–25. https://doi.org/10.1016/j.tifs.2016.12.006

Krpan, D., & Houtsma, N. (2020). To veg or not to veg? The impact of framing on vegetarian food choice. *Journal of Environmental Psychology*, *67*, 101391. https://doi.org/10.1016/j.jenvp.2020.101391

Kumar, P., Chatli, M. K., Mehta, N., Singh, P., Malav, O. P., & Verma, A. K. (2017). Meat analogues: Health promising sustainable meat substitutes. *Critical Reviews in Food Science and Nutrition*, *57*(5), 923–932. https://doi.org/10.1080/10408398.2014.939739

Laestadius, L. I., & Caldwell, M. A. (2015). Is the future of meat palatable? Perceptions of *in vitro* meat as evidenced by online news comments. *Public Health Nutrition*, *18*(13), 2457–2467. https://doi.org/10.1017/S1368980015000622

Lemken, D., Spiller, A., & Schulze-Ehlers, B. (2019). More room for legume – Consumer acceptance of meat substitution with classic, processed and meat-resembling legume products. *Appetite*, *143*, 104412. https://doi.org/10.1016/j.appet.2019.104412

Lemken, D., Spiller, A., Schulze-Ehlers, B., Lemken, D., Spiller, A., & Schulze-Ehlers, B. (2018). *Will consumers substitute meat with legumes? - A clustered binational perspective*. https://doi.org/10.22004/ag.econ.273228

Leroy, F., & Praet, I. (2015). Meat traditions. The co-evolution of humans and meat. *Appetite*, *90*, 200–211. https://doi.org/10.1016/j.appet.2015.03.014

Papies, E. K., Barsalou, L. W., & Rusz, D. (2020). Understanding desire for food and drink: A grounded-cognition approach. *Current Directions in Psychological Science*, *29*(2), 193–198. https://doi.org/10.1177/0963721420904958

Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Prada, M., Garrido, M. V., & Rodrigues, D. (2017). Lost in processing? Perceived healthfulness, taste and caloric content of whole and processed organic food. *Appetite*, *114*, 175–186. https://doi.org/10.1016/j.appet.2017.03.031

Siegrist, M., Sütterlin, B., & Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science*, *139*, 213–219. https://doi.org/10.1016/j.meatsci.2018.02.007

Sizter, C. (2019). *US milk sales drop by more than $1 billion as plant-based alternatives take off*. World Economic Forum. https://www.weforum.org/agenda/2019/04/milk-sales-drop-by-more-than-1-billion-as-plant-based-alternatives-take-off/

Smetana, S., Mathys, A., Knoch, A., & Heinz, V. (2015). Meat alternatives: Life cycle assessment of most known meat substitutes. *The International Journal of Life Cycle Assessment*, *20*(9), 1254–1267. https://doi.org/10.1007/s11367-015-0931-6

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518–522. https://doi.org/10.1038/nature13959

van der Weele, C., Feindt, P., Jan van der Goot, A., van Mierlo, B., & van Boekel, M. (2019). Meat alternatives: An integrative comparison. *Trends in Food Science & Technology*, *88*, 505–512. https://doi.org/10.1016/j.tifs.2019.04.018

Verbeke, W., Marcu, A., Rutsaert, P., Gaspar, R., Seibt, B., Fletcher, D., & Barnett, J. (2015). 'Would you eat cultured meat?': Consumers' reactions and attitude formation in Belgium, Portugal and the United Kingdom. *Meat Science*, *102*, 49–58. https://doi.org/10.1016/j.meatsci.2014.11.013

Verbeke, W., Pérez-Cueto, F. J. A., Barcellos, M. D. de, Krystallis, A., & Grunert, K. G. (2010). European citizen and consumer attitudes and preferences regarding beef and pork. *Meat Science*, *84*(2), 284–292. https://doi.org/10.1016/j.meatsci.2009.05.001

Villegas, B., Carbonell, I., & Costell, E. (2008). Effects of product information and consumer attitudes on responses to milk and soybean vanilla beverages. *Journal of the Science of Food and Agriculture*, *88*(14), 2426–2434. https://doi.org/10.1002/jsfa.3347

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., … Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

CHAPTER 6

Concluding Remarks

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6.1. Highlights

Food systems are increasingly recognized as a relevant path to address the climate emergency the world is facing (Gropp & Verdier, 2020). Earlier calls have failed to promote large-scale transitions and to encourage robust policy responses to address these challenges. With a growing population and current unsustainable food systems, there have been several calls to make a fundamental shift to reduce the consumption of animal-based products and to adopt more plant-based diets. This transition is required to create a pattern in which healthier, more sustainable, and ethical food choices are the norm (Godfray et al., 2010; West et al., 2014).

However, achieving substantial transformations in this regard might be a challenging task for several reasons. First, food choices are among the most frequent human behaviors and are determined by myriad of factors and interactions (Köster, 2009). Second, meat is an element that has always been present in the human diet, and that induces a high level of attachment, with several segments of consumers not willing to change their eating habits (Latvala et al., 2021). Third, the strategies and psychosocial processes that might impact the transition towards reduced meat consumption and the perceptions and acceptability towards the adoption of alternative proteins are still understudied (Dagevos & Voordouw, 2013; Stoll-Kleemann & Schmidt, 2017). Therefore, more knowledge needs to be added in this regard, to fill the gaps in the complex question presented in the introductory section: How can we build insights on how to support transitions to more plant-forward diets? The general aim of this work was to develop more knowledge and to better comprehend this literature through a set of four articles, aiming to explore strategies and provide more insights and inputs on how to inform audiences interested in promoting more plant-based diets.

Additionally, food practices are increasingly seen as providing a novel perspective from which to observe individuals' basic psychological processes associated with everyday moral action (e.g., Bastian et al., 2012; Bratanova et al., 2015; Graça et al., 2016). Under the general framework of cognitive dissonance theory, there is an increasing body of evidence that many consumers experience the "meat paradox" – i.e., enjoying meat but disliking causing pain to animals (Loughnan et al., 2014). Evidence on the meat paradox is useful to inform audiences interested in promoting dietary shifts with regard to meat consumption and substitution. Furthermore, this research area also offers fundamental contributions to key research topics of

social psychology as a discipline (see Bastian & Loughnan, 2017). For instance, the meat paradox allows for investigating moral agency as a situated process (e.g., Graça et al., 2016), informing theories of moral reasoning, objectification and dehumanization (e.g., Loughnan et al., 2010; Piazza et al., 2015), and providing insights into the origins of prejudice, how prejudice can be resolved, and how it may become institutionalized (e.g., Bastian & Loughnan, 2017; Dhont et al., 2016). Accordingly, previous studies showed that speciesism is positively correlated with other prejudicial attitudes such as racism, sexism, and homophobia, along with ideological constructs associated with prejudice, such as social dominance orientation, human supremacy beliefs, and right-wing authoritarianism, suggesting that speciesism and other well-investigated forms of prejudice might share similar underlying psychological mechanisms (Caviola et al., 2018; Graça et al., 2018).

Against this backdrop, in the first article, we examined how people perceive the origin of meat, that is, the animals alive, uncut. (Figure 6.1).

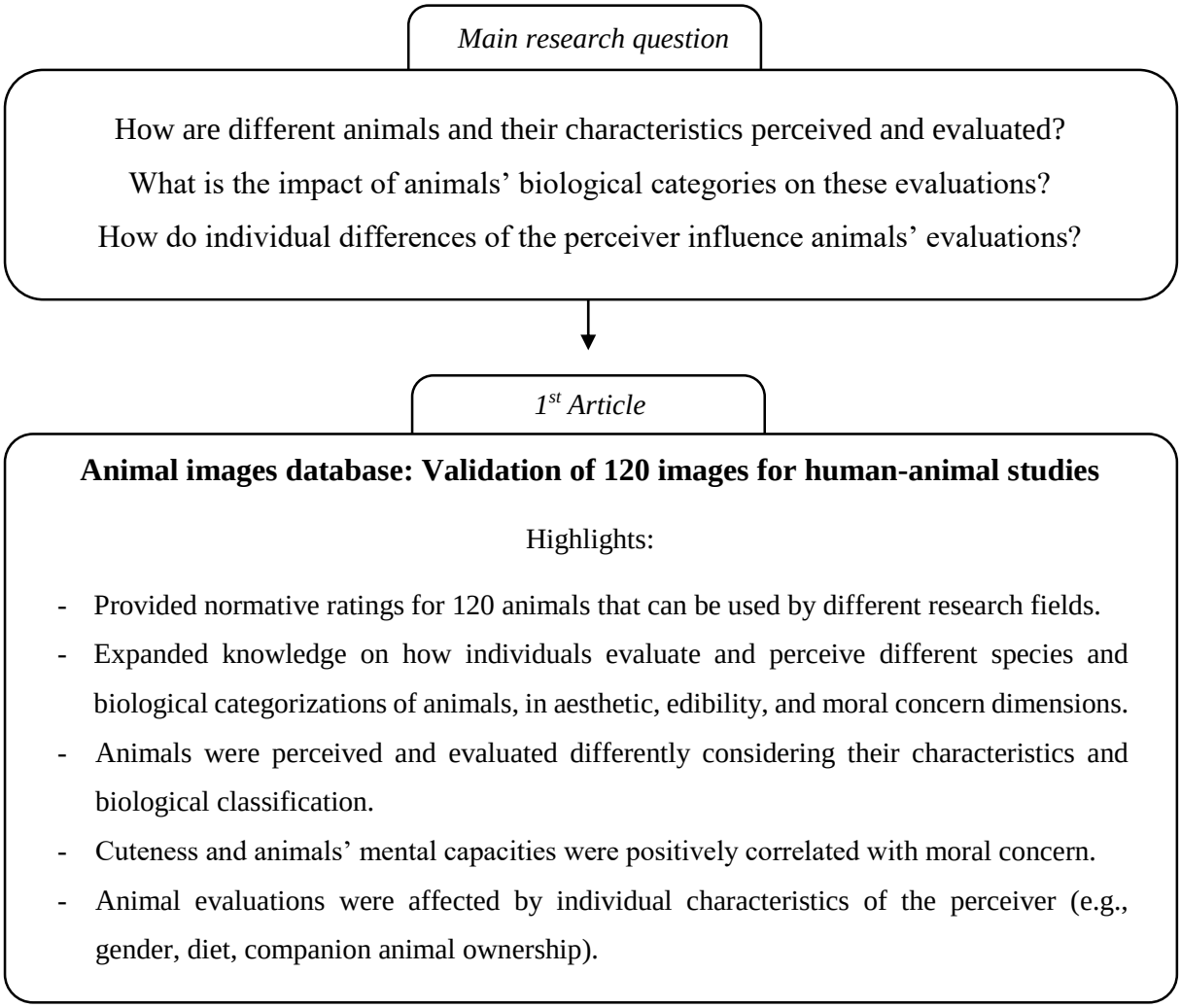


Figure 6.1. Main research questions and highlights of Article 1.

One of the major contributions of this work was the development of an extensive dataset with normative ratings for a broad set of animals (i.e., 120 species), from several biological classifications. These stimuli can be used by researchers from different areas, including human-animal relations and eating behavior. Furthermore, this work provided an expanded knowledge on how individuals evaluate and perceive different species and biological categorizations of animals, in aesthetic, edibility, and moral concern dimensions.

Results from this article suggested that animals were perceived and evaluated differently considering their biological classification (e.g., mammals) and their characteristics (e.g., cuteness). For instance, mammals had the most favorable attributions, in comparison with the remaining categories, as found in previous studies (Batt, 2009; Czech et al., 1998). Furthermore, cuteness and animals' mental capacities were relevant dimensions on their perceived moral concern, positively associated with the unacceptability to kill animals for human consumption. These results are in line with previous findings, suggesting that the perceived mental capacity or humanness of animals might influence meat consumption. For instance, people often deny animals mental capacities when motivated to eat animals (Bastian et al., 2012). Loughnan and colleagues (2010) found that participants attributed less mental capacity for suffering to animals after consuming dried beef in contrast to nuts. Correlational data has also associated mental capacity or intelligence of the animal to disgust and unwillingness to consume meat (Ruby & Heine, 2012). Additionally, animal mind having was also correlated with judgments of whether animals were deserving of moral consideration (Piazza et al., 2014).

Besides mind attribution, aesthetic perception has also been identified as a relevant factor in animals' evaluation. Aligned with previous research, we found that cuteness was positively correlated with moral concern (i.e., feeling of care and protection and unacceptability to kill animals for human consumption) and capacity to think and to feel. For instance, studies found that beauty positively affects the conservation support towards them (Gunnthorsdottir, 2001), people's willingness to protect their species (Landová et al., 2018), and is a relevant predictor of a species' presence in zoo populations (Marešová & Frynta, 2008). Accordingly, individuals tend to attribute increased moral standing towards beautiful (vs. ugly) animals (Klebl, Luo, Tan, et al., 2021). But why are cuteness and beauty perceptions linked to moral standing? A possible explanation may be linked to the baby-schema literature. Ethologist Konrad Lorenz (1943) described the baby schema ("Kindchenschema") as a group of infantile physical characteristics, that is perceived as cute, such as a round face and big eyes. These features are likely to motivate caretaking behavior with the evolutionary function of enhancing offspring survival, considering that there are species whose young depend on that care (Bowlby, 1999; Carter, 2005; Glocker

et al., 2009). Using functional magnetic resonance imaging and controlled manipulation of the baby schema in infants' faces, a study by Glocker et al. (2009) found that baby schema activates a key structure that mediates reward processing and appetitive motivation, suggesting that baby schema promotes human caregiving. The behavioral effects of the baby schema have been experimentally confirmed (Alley, 1981; Hildebrandt & Fitzgerald, 1979; McKelvie, 1993), with implications for infant-caretaker interactions (Langlois et al., 1995; Volk & Quinsey, 2002). Accordingly, previous studies found that cuteness elicits empathy, feelings of care, protection, and nurturance (Batson et al., 2005) and has a negative role on the willingness to consume meat (Piazza et al., 2018; Zickfeld et al., 2018). Furthermore, in a cross-cultural survey, participants reported increased disgust and less willingness to consume meat from animals with a cute appearance. Interestingly, they found the same pattern of results for animals that deviated from a neutral appearance, by either being particularly cute or ugly (Ruby & Heine, 2012). These findings suggest that cuteness (and the opposite – ugliness) might play a relevant role in reducing willingness to consume meat. Interestingly, we did not find a correlation between cuteness and edibility. Our results appear to conflict with previous findings, for example from Piazza et al. (2018), who found that people, particularly woman, revealed lower appetite for meat when exposed to baby animals. However, the authors principally focused on farmed animals, therefore, perhaps, the negative association between edibility and cuteness might not be a pattern that emerges in all groups of animals.

Our animals database was a relevant contributor for several studies. Recently, a study by Klebl, Luo, Tan, et al. (2021) rated the 120 images of our Animal Images Database on beauty, patienty (i.e., animals' ability to experience pain and pleasure), agency (i.e., animals' intelligence or cognitive capacities), harmfulness, and moral standing. In the first study, the authors found that beauty perceptions predicted moral standing regardless of perceived patiency, agency, and harmfulness. In the second study, they found that beauty causally affected moral standing attributions to animals independently from animals' perceived cognitive abilities and capacity to experience pain or pleasure, as well as other dimensions that may affect moral standing attributions, including their perceived familiarity, similarity to humans, and edibility. Summing up, these results suggest that perceived beauty is an external aesthetic quality that makes individuals ascribe moral standing to animals, regardless of their capacity to feel pleasure, to suffer, or whether they could cause us harm.

Another study by Klebl, Luo, and Bastian (2021) also asked participants to rate images of our Animal Images Database on beauty, moral standing and purity. Researchers found that beautiful animals were assigned more moral standing than ugly animals. This pattern of results

was found across several studies, including not only animals, but also humans and non-sentient entities, such as landscapes and buildings. For example, individuals also attributed greater moral standing towards beautiful (vs. ugly) landscapes and buildings (Klebl, Luo, & Bastian, 2021). The authors proposed a possible psychological mechanism through which beauty assigns moral standing to targets: purity. They tested whether the depicted targets (e.g., animals) evoked purity intuitions, asking participants to rate the extent to which the respective target made them think of something pure. Results revealed that purity intentions mediated the effect of beauty on moral standing attributions (i.e., desire to protect), providing preliminary empirical evidence for purity intuitions as a psychological mechanism through which individuals perceive beautiful entities as having moral standing. These findings suggest that beauty increases moral standing attributions through eliciting purity intentions, by an intuitive association between beauty and purity (Klebl, Luo, & Bastian, 2021). In line with these findings, previous studies also found that aesthetic attributes positively affect the way people attribute moral standing toward animals (Gunnthorsdottir, 2001; Landová et al., 2018), but also towards several targets. For example, individuals considered more attractive are also treated more positively than unattractive individuals, and attractive children are given greater attention and caregiving than unattractive children (Langlois et al., 2000).

Besides cuteness and beauty, past research has shown that animals' perceived similarity to humans may be related to meat avoidance (Angyal, 1941; Rozin & Fallon, 1987). However, interestingly, in our first study, similarity to humans was only correlated with feelings of care and protection, but not correlated with edibility and acceptability to kill for human consumption. This might be because some of the most cherished, protected, and similar animals to humans are mammals (e.g., dog), while at the same time most of the animals that humans typically eat are mammals (e.g., cow). These opposing perceptions might partially justify the absence of a correlation.

Additionally, our study also contributed to a better understanding of how different individuals perceive animals. Our findings revealed that animal evaluations were affected by individual characteristics of the perceiver, particularly gender, diet, and companion animal ownership. Specifically, women, meat avoiders, and pet owners reported more positive appraisals towards animals, in comparison with men, meat-eaters, and non-owners, respectively.

Having provided an initial approach to the topic of how individuals perceive different animals in this first article, we moved forward to explore how individuals perceive animals

considering socially constructed categories, namely, companion, farmed, predators and pest animals (Figure 6.2).

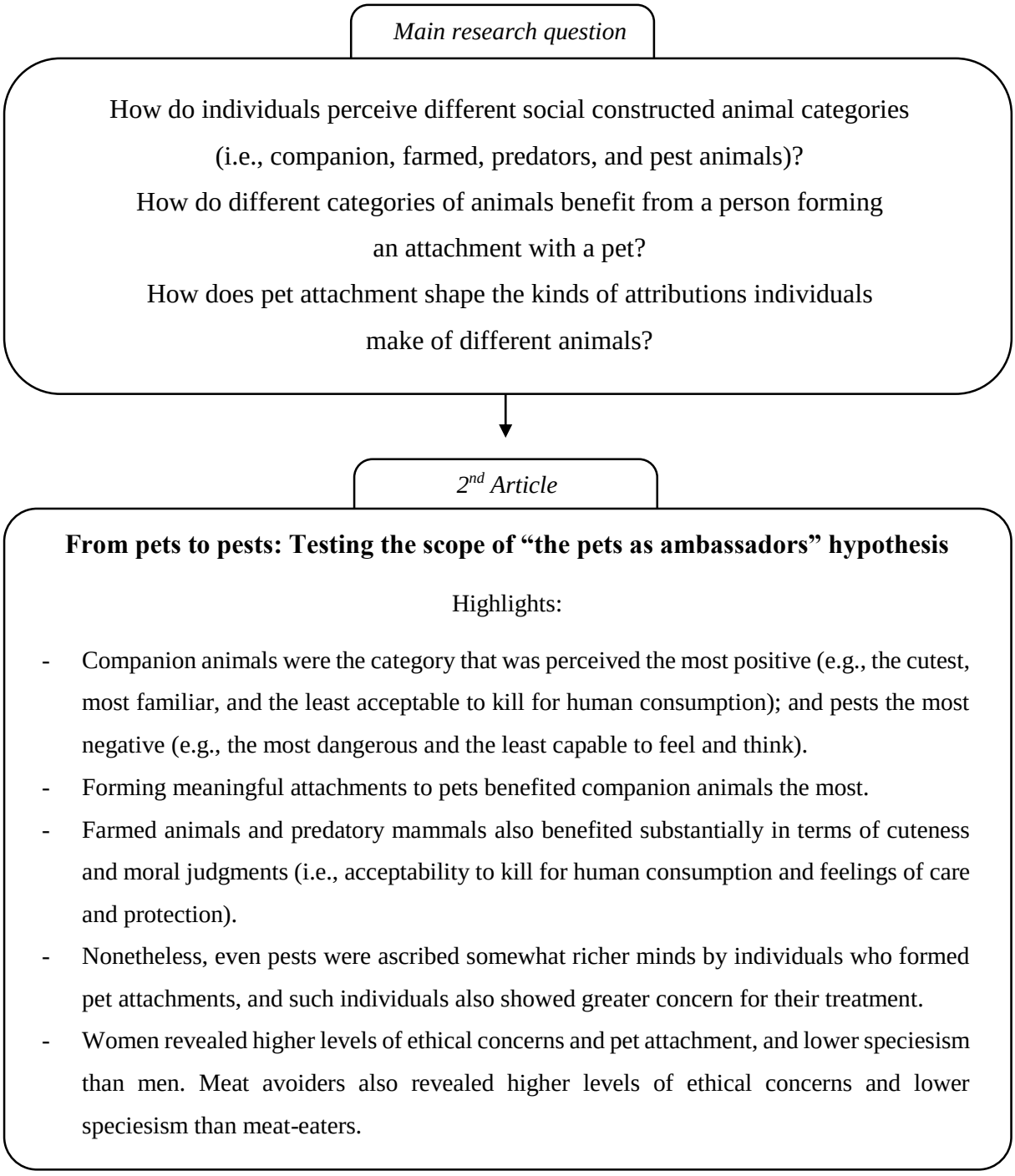


Figure 6.2. Main research questions and highlights of Article 2.

Previous research has shown that conceptions of animals often fall into these four categories, considering how animals are perceived and treated. Companion animals, such as dogs and cats, are usually perceived more positively (e.g., as warm, competent) and evoke high

moral concern. Oppositely, pests, including animals such as spiders or cockroaches, are a less desirable category, being perceived as both low in competence and warmth, and evoking feelings of fear and disgust. Predators, such as lions and wolves are usually seen as highly competent but low on warmth and tend to evoke both admiration and fear. Farmed animals, such as cows and pigs, are usually rated in the middle on both warmth and competence and evoke more neutral emotions (Leite et al., 2019; Sevillano & Fiske, 2016).

Additionally, we examined the boundaries of the pets as ambassadors hypothesis, particularly, whether different categories of animals benefit from a person forming an attachment with a pet, and in which dimensions. So far, previous research had only examined the effect of pet attachment on animals as a general category and did not test whether this effect is limited to certain animal types or evaluative dimensions. Therefore, this study advanced work on this topic by investigating which categories of animals might benefit from pet attachment and in which ways they might benefit. We expected that pests would not benefit as much from pet attachment, considering the overall negative perceptions people have towards this animal group. However, we speculated that both predators and farmed animals, considering their mixed attributional profile, would more likely benefit from pet attachment.

In regard to animal appraisals, companion animals were the category that was perceived the most positive, evaluated as the cutest, most familiar, and the least acceptable to kill for human consumption, from all the categories. In contrast, pests were evaluated as the most negative, the most dangerous, and the least capable to feel and to think. As expected, our results supported the notion that forming meaningful attachments to pets appears to benefit companion animals the most. Nevertheless, concerning the pets as ambassadors hypothesis, farmed animals and predatory mammals also benefited substantially in terms of aesthetic and moral judgments, namely cuteness, acceptability to kill for human consumption, and feelings of care and protection. Interestingly, even pests were ascribed somewhat richer minds by individuals who formed pet attachments, and such individuals also showed greater concern for their treatment. With this work, we contributed to a better understanding of how individuals perceive different animal categories, and how pets and pet attachment might operate as ambassadors for other animals and promote more positive appraisals towards animals in general.

Moreover, in line with previous literature, we found that individuals who report higher pet attachment also report more positive attitudes toward animals in general and lower levels of speciesism (e.g., Auger & Amiot, 2017; Auger & Amiot, 2019a; Paul & Serpell, 1993; Serpell & Paul, 1994). As expected, we also replicated past findings regarding gender and dietary preferences (e.g., Herzog et al., 1991; Herzog, 2007; Knight & Barnett, 2008; Piazza et al.,

2015). We found that women revealed higher levels of ethical concern, higher pet attachment, and lower speciesism than men. Meat avoiders also revealed higher levels of ethical concern and lower speciesism than meat-eaters.

The third article focused on individuals' perception of animals cut, processed, and transformed into food products. Particularly, we examined the role of familiarity with the product and its animal resemblance on meat appetite, two relevant dimensions that may shape consumers' attitudes toward meat products and that affect their appraisals and consumption (Figure 6.3).

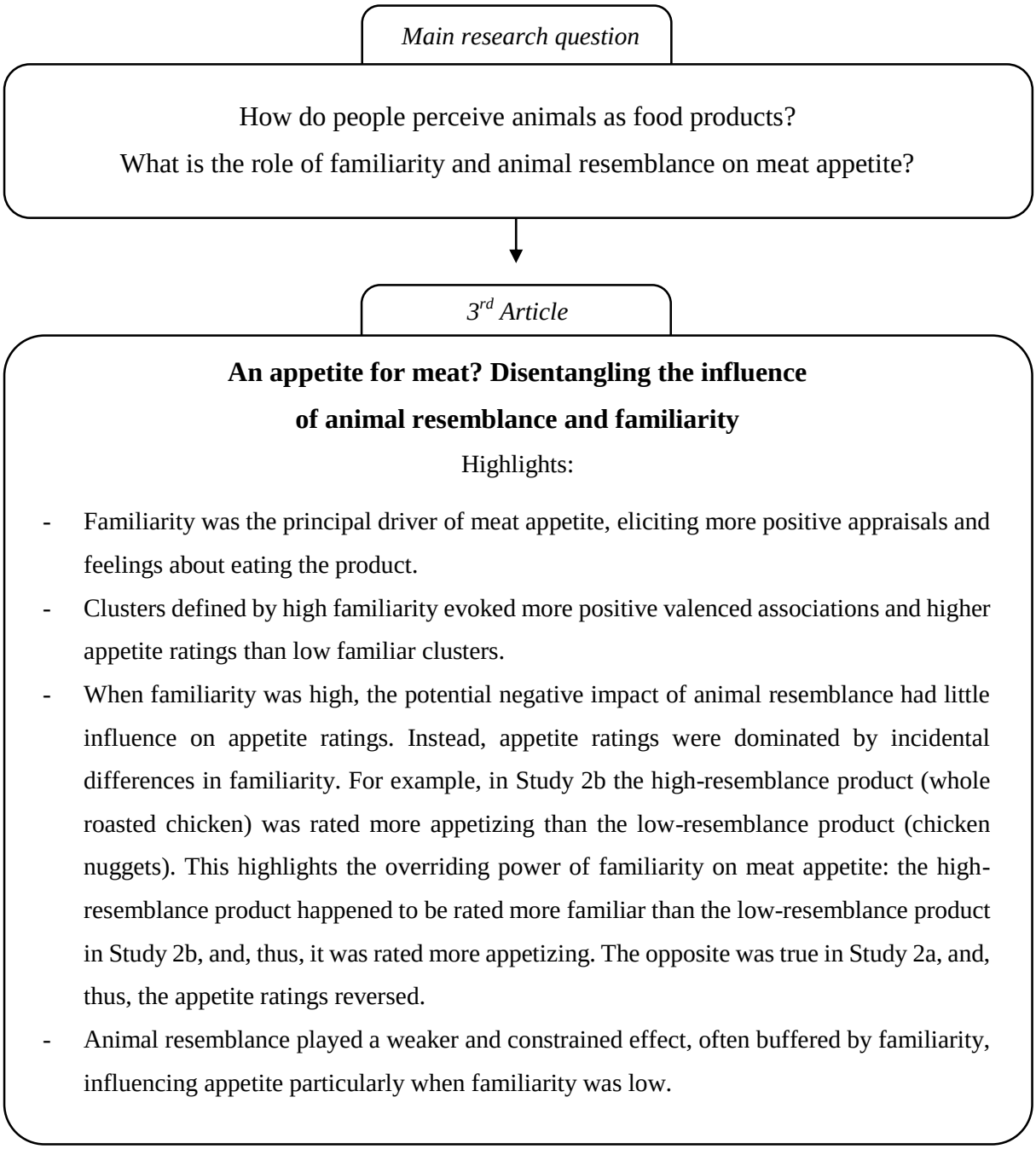


Figure 6.3. Main research questions and highlights of Article 3.

Familiarity, as previously mentioned, promotes more positive associations and appraisals, positively affecting consumers' acceptance, expectations, and appetite towards the products (Aldridge et al., 2009; Borgogno et al., 2015; Cooke & Wardle, 2005). In contrast, new foods are usually connected with strangeness, fear, distrust, and likely perceived as dangerous for human health (Hartmann & Siegrist, 2017; Wendin & Nyberg, 2021). For example, we saw in our first article that eating animals whose animals' flesh is normally encountered for human consumption, such as sardines or cows, was perceived as highly edible, whereas eating animals whose meat is not common and familiar, such as insects or amphibians, was perceived negatively, as inedible animals.

Another relevant dimension that may shape consumers' attitudes toward meat products and that affect their appraisals and consumption is how much the meat resembles the living animal. Studies showed that individuals tend to dissociate meat from its origin, not only because the more the meat resembled the living animal – for instance, meat with distinct animal body parts – the more likely it was to evoke disgust, and to induce avoidance to eat it (Kubberød et al., 2006; Tian et al., 2016). Additionally, animal resemblance also increases empathy for the animal and promotes the willingness to choose a vegetarian alternative dish (Kunst & Haugestad, 2018; Kunst & Hohle, 2016).

Therefore, our goal was to analyze how meat familiarity and animal resemblance shape consumers' appetite towards meat, by systematically disentangling animal resemblance and meat familiarity, and investigating their independent influence on meat appetite and how animal resemblance influences appetite depending on the familiarity of the meat product.

Overall, we found that familiarity was the principal driver of meat appetite, eliciting more positive appraisals and feelings about eating the product. Accordingly, clusters defined by high familiarity evoked more positive valenced associations and higher appetite ratings than low familiar clusters. Furthermore, the findings suggested that when familiarity was high, the potential negative impact of animal resemblance was almost irrelevant to the appetite ratings, to the point where meat with high animal resemblance (i.e., whole roasted chicken) was rated with higher appetite than when animal resemblance was low (i.e., chicken nuggets). Therefore, the effect of animal resemblance on appetite was often buffered by familiarity, affecting appetite only when products were less familiar.

There were possibly other factors affecting these appetitive ratings, besides animal resemblance (and familiarity). By using an association task, in the first study of this article, besides familiarity and animal resemblance we collected in-depth qualitative data on each of the 28 products. For instance, the whole chicken was perceived more positively than the chicken

nuggets – as healthier, more natural, more appealing – whereas the chicken nuggets were perceived as unhealthy, processed, dry and unappealing by some participants. Therefore, the perceived healthiness and the overall appearance of the products might have affected the appetite ratings and decreased the evaluation of the chicken nuggets.

Cultural differences are also a relevant aspect to consider in terms of food perception. Evidently, the perceived familiarity with one product depends on the type of products people are used to seeing in their cultural context. For instance, in Portugal most consumers are used to seeing a whole pig roasted or an entire squid cooked. Yet both foods were perceived by UK participants as less familiar food products. Thus, an individual's cultural background has a large impact on the way they perceive and evaluate meat products. In fact, we took that variable into account when we selected our set of images, to have high and low familiarity meat products considering the cultural background of our intended UK sample.

Importantly, we conducted a second experimental study with a different product replacing the whole chicken, on the high resemblance and high familiar quadrant, using a fish – and then we performed a mini meta-analysis by combining the results from both studies. The pattern of results revealed that familiarity played, in fact, a dominant role on meat appetite, and that animal resemblance had a more reliable impact on meat appetite when familiarity was low. These findings demonstrate how familiarity with animal products facilitates psychological adaptation, reducing disgust towards meat even when reminders of the animal source are highly visible (Piazza et al., 2020).

As concluded from the abovementioned studies, and from previous literature, familiarity positively affects consumers' acceptance and appetite towards meat. Therefore, by introducing unfamiliar products in a meal context it is expected that its appraisal becomes more positive. That was the hypothesis of the fourth article, where we aimed to explore how people perceive a set of meat and meat alternative products and examine how different framings impact meat alternatives appraisal (Figure 6.4).

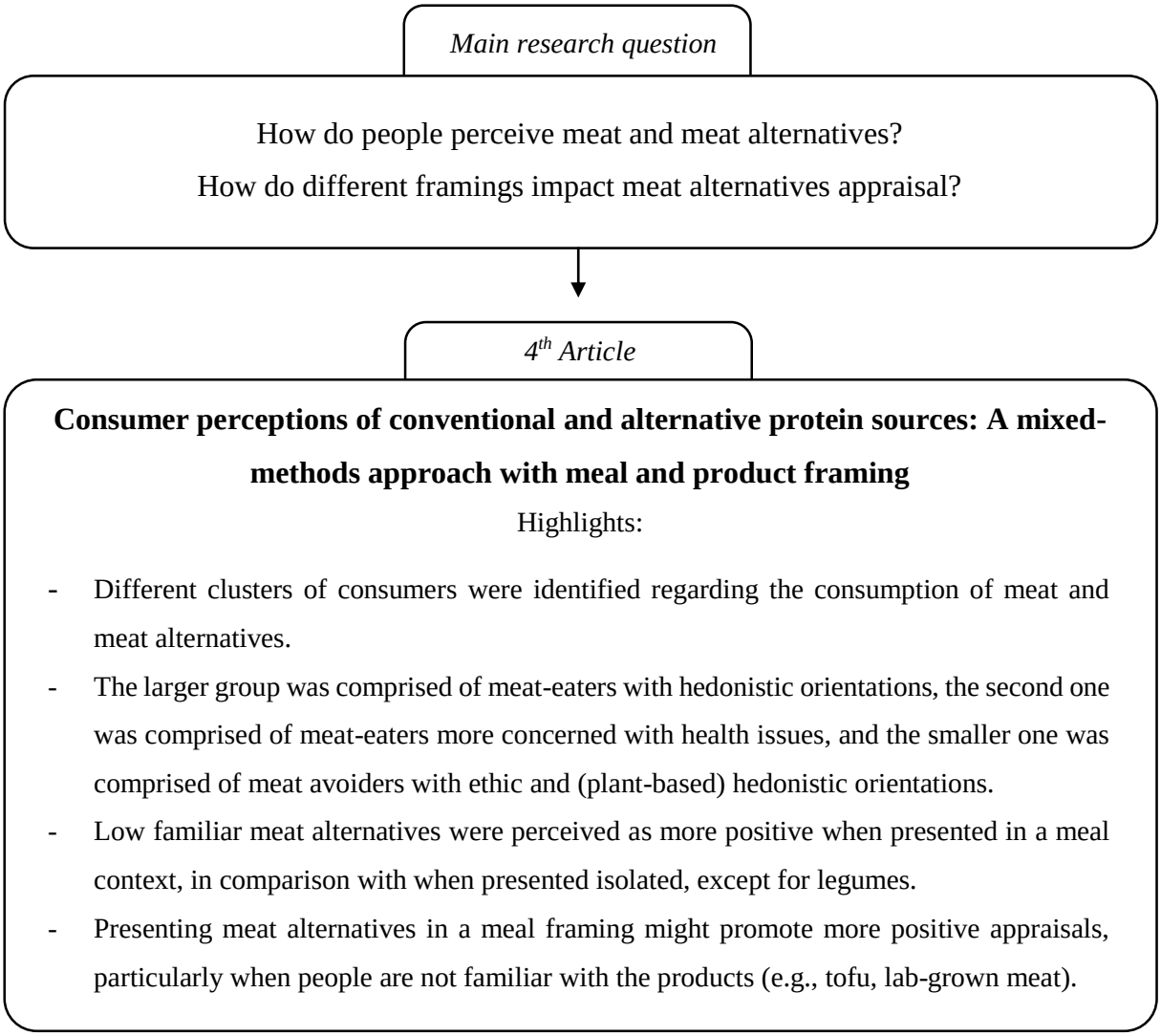


Figure 6.4. Main research questions and highlights of Article 4.

In general, meat alternatives were perceived as more positive when presented within a meal, except for legumes, which were perceived more positively when individually framed. Legumes are already a familiar food and were perceived as very healthy and natural, in the free association task. Therefore, when presented in a meal context, with other foods such as carbs (e.g., "potato chips" or "fried rice"), which tend to be perceived as more caloric and unhealthier, might have negatively contaminated perception towards legumes, causing them to be perceived as less healthy, less natural, more processed, and caloric, than when presented isolated. Insects were also evaluated quite negatively regardless of framing, which reveals the reluctance and unacceptability towards this alternative in our society. However, despite we found that presenting whole insects inserted in a meal context did not benefit their appraisal, insects integrated in other food products, like energy bars or used in flours, are gradually more present

in the current food markets, including the Portuguese supermarkets (e.g., Continente, Auchan). Thus, in the case of low familiar products, usually associated with disgust, such as insects, marketing strategies of companies such as Portugal Bugs – a company dedicated on selling insect-based food – try to reduce the animal resemblance of its products, by creating low animal resemblant products, such as energy bars and flour and, importantly, promoting insect-based foods using colorful, joyful and familiar packaging (MAGG, 2021).

Therefore, findings indicate that there is not one definitive strategy to frame all meat alternatives that will appeal to all consumers. In order to promote consumer acceptance of alternative proteins, it is relevant to take into account the product that is being promoted, its appraisals, particularly its perceived familiarity and acceptability, and other characteristics of the consumer, including individual, social and cultural dimensions, to design targeted and effective strategies, considering these interacting variables.

6.2. Inputs for intervention

Overall, our body of work provided some inputs that can inform multiple pathways for future interventions aimed at reducing meat consumption and promoting the adoption of more plant-based diets. We can think of interventions based on the different blocks of research presented throughout this project. We can develop interventions with the aim of changing the way people perceive the source of meat (i.e., animals); interventions with the aim of changing the way people perceive animals as meat products; and finally, and particularly important, the way people perceive meat alternatives and therefore explore how to increase acceptability towards plant-based products. Furthermore, there are multiple interacting variables influencing the process of behavior change, including individual, social and cultural variables, that must be considered when the goal is promoting transitions towards more plant-based diets (Figure 6.5).

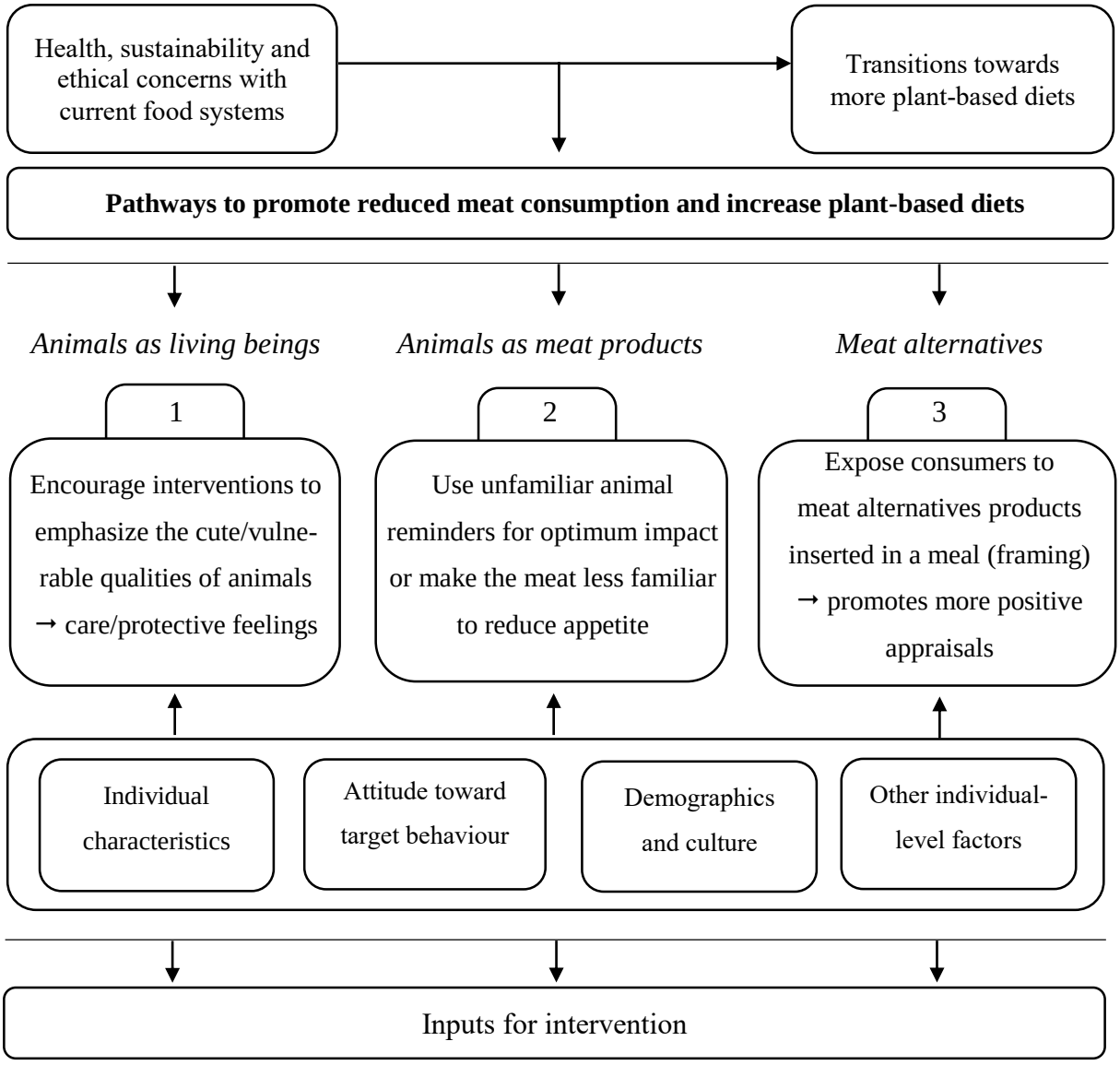


Figure 6.5. Main findings, implications, and pathways to plant-based diets promotion.

6.2.1. Animals as living beings

One possible strategy would be to try to change people attitudes toward the source of meat, that is, animals, and encourage them to think about the living animals and connect them to the food. As previously mentioned, the way people evaluate animals might affect their willingness to change eating habits and affect individuals' perceived edibility of the animal (Bastian et al., 2012; Tian et al., 2016). For instance, it has been well established that the idea of eating animals perceived as more cute, intelligent, or categorized as pets is perceived as disgusting (Rozin & Fallon, 1987).

However, the meat industry keeps developing marketing strategies that aim to create a growing distance between the meat and the living and sentient animal, increasingly blurring the

link between the "food" and the "animals" (Grauerholz, 2007; Kubberød et al., 2006), presenting incredibly appealing, fresh, and extremely processed meat products. This transformation process steps the consumer away from potential discomforting thoughts, making it difficult for some consumers to connect eating meat with animal harm and suffering (Hopkins & Dacey, 2008; Lin-Schilstra & Fischer, 2020; McEachern & Schröder, 2004).

Many consumers do not like to think about the animals and the killing process when they are eating meat. This is referred to as the "meat paradox" (Loughnan et al., 2010), the tension between enjoying eating animals' flesh but concern for animals as sentient entities, which might generate discomfort since most people are against violence to animals. This psychological conflict between people's dietary preference for meat and their moral response to animal suffering highlights this discrepancy between behavior and various ideals. Therefore, several researchers have focused on Cognitive Dissonance Theory to explain the psychology of eating meat (Bastian & Loughnan, 2017; Dowsett et al., 2018; Rothgerber, 2020). Dissonance consists of a state of emotional discomfort when individuals hold inconsistent attitudes or engage in behaviors that are inconsistent with their attitudes or beliefs (Festinger, 1957; Stone & Cooper, 2001). One way to reduce this dissonance is to counteract the potential negative effects of thinking about the living animal, to diminish this discomfort. Usually, people can adopt numerous strategies, including meat-animal dissociation, rationalization strategies (i.e., eating meat is natural, normal, necessary, and nice), animal mind/suffering denial, moral disengagement strategies, and processes of categorization (Bratanova et al., 2011; Graça et al., 2016; Kunst & Hohle, 2016; Loughnan et al., 2010; Piazza et al., 2015; Tian et al., 2016). The other way to reduce this dissonance is to avoid engaging in the conflicting behavior, which would be, in this case, to avoid eating meat. But how could that transition be facilitated?

Our first study corroborated the findings from previous literature, by revealing that people do not like to eat animals with minds (Loughnan et al., 2010, 2014) or cute animals (Piazza et al., 2018; Zickfield et al., 2017). We found that animals' capacity to think, capacity to feel, and cuteness were negatively correlated with acceptability to kill the animal for human consumption and/or edibility. Therefore, one option would be to design interventions that would promote more empathy towards animals, portraying cute animals in campaigns, bringing more awareness about their vulnerable qualities, with the aim of evoking higher feelings of care and protection. In fact, previous studies found that cuteness elicits caretaking behaviors, empathy, and has a negative correlation with the willingness to consume meat (Batson et al., 2005; Zickfeld et al., 2018). Interventions aiming to reduce meat consumption could thus focus on reminding the consumer of the living animal and promote the connection between the meat and

animals. That association strategy can be achieved, for instance, by presenting pictures of the living animals alongside meals with meat from the animal. Indeed, previous studies found that these meat-animal associations appear to be effective in lowering self-reported and/or intended meat consumption (Kunst & Hohle, 2016; Kunst & Haugestad, 2018; Earle et al., 2019; Tian et al., 2016). Another possibility would be to develop interventions aiming to promote mind attribution to animals that are perceived as food, highlighting their and mental capacities, their capacity to feel and to suffer, particularly in the meat industry. For instance, requesting participants to think about the cognitive and affective capacities of a pig can be an effective solution to defuse the dissonance-reduction strategy of mind denial and therefore decrease willingness to consume meat (Amiot et al., 2018).

Moreover, many consumers are inadequately informed and intentionally refuse information about the entire process of killing animals for food and the animal welfare conditions on factory farms, since they may be disturbing (Knight & Barnett, 2008; Onwezen & van der Weele, 2016). For some consumers, interventions that expose this process, describing animal factory conditions and animals suffering may conduct to dietary shift, possibly through cognitive dissonance; to others, this "moral shock" might be ineffective or even generate the opposite effect (Mathur et al., 2021; Rothgerber, 2020; Wrenn, 2013). Still, it is important to highlight the association between physical disgust and moral disgust (Mathur et al., 2021). Considering the robust influence of physical disgust on diet preferences (Rozin & Fallon, 1980), inducing moral disgust in the context of animal welfare may be a powerful strategy to affect consumers' eating behavior (Feinberg et al., 2019). Accordingly, previous studies suggested that interventions that show graphic imagery of factory farms, or animal reminders led to moral disgust, in part due to an increased physical disgust (Earle et al., 2019; Kunst & Hohle, 2016).

It is also relevant to note that, in our first study, we asked participants to evaluate each animal individually. Previous research has demonstrated the "identifiable victim effect", revealing that individuals frequently experience more intense affective responses when thinking about a single, named individual rather than several individuals or a general group (Jenni & Loewenstein, 1997; Small & Loewenstein, 2005). For example, Västfjäll et al. (2014) found that participants donated a higher amount to the organization Save the Children after being exposed to a single named child scenario in comparison with reading about multiple children. Accordingly, interventions in animal welfare previously used this strategy, revealing that exposing people to individual animals was potentially more effective, in comparison with exposing people to statistics about the number of animals slaughtered (Mathur et al., 2021). Therefore, interventions aiming to encourage consumers to leave animals off their plates should

consider strategies where one single named individual is presented (e.g., “Lucy”, the chicken; Reese, 2015), instead of presenting animals as a group or generic statistics.

Moreover, we found that people who had meaningful attachments to pets tended to show greater concern for the treatment of farmed, predatory, and pest animals. Therefore, interventions could also use the “pets as ambassadors” principle to promote more positive attitudes and a more ethical treatment towards other animals. Most individuals acknowledge the sentience of companion animals, such as dogs and cats, and thus integrate them into their circle of moral concern. However, usually they do not include in that circle animals that are categorized as food but possess similar cognitive and emotional capacities (Rothberg, 2020). Strategies could thus use this form of dissonance to emphasize the moral equivalence of companion animals and other animals (e.g., farm animals) and therefore try to promote more positive attitudes towards them (Mathur, 2021).

6.2.2. Animals as food products

The second strategy would be to design interventions that aim to affect how people perceive meat. The meat industry is constantly looking to promote its products in the most appetizing way, increasing their familiarity and minimizing potentially uncomfortable animal reminders of meat.

As our results revealed, familiarity and animal resemblance are indeed two variables that impact on meat appetite. Animal reminders that are unfamiliar to consumers are the ones that are likely to disrupt appetites. Many of the examples from the literature that have proven successful (e.g., adding the pig head for ham; Kunst & Hohle, 2016), are likely successful partly because they are unfamiliar. Despite meat-animal association being a critical mechanism that might impact meat appetite, systematical exposure and therefore increased familiarity to meat products with animal resemblance may lead to a psychological adaptation to meat, that reduces empathy for animals slaughtered, and reduce the likability to think about the animal when confronted with meat products, even when the products have highly resemblance, which buffers – or even neutralizes – the impact of associating the animal with the food. Therefore, we would suggest that interventions that utilize animal reminders should consider ways of making either the animal reminder or the meat seem less familiar or more unusual for optimal impact, to therefore reduce appetite. One possible strategy could be to use unfamiliar meat sources in the context of meat consumption. For example, the Yulin Dog Festival where dogs are presented in a food context is a good example of the general public indignation and disgust towards unusual meat sources. Interventions could also contrast the scenario of the consumption of

unconventional meat (e.g., dogs in the Yulin Dog Festival) with the consumption of conventional meat (e.g., turkey on Thanksgiving), and therefore trigger cognitive dissonance by targeting the perceived morality of both behaviors. Another possible strategy could be to use animal reminders from conventional meat sources but use unfamiliar body parts, such as eyes or genitals, to disrupt the familiar associations. For example, interventions could focus on exposing consumers to meals including a cow' rectum, or a chicken' sphincter, since both cows and chickens are animals that are conventionally eaten, however, those body parts are less familiar, to therefore evoke disgust and reduced appetite.

Additionally, this pathway for intervention must consider the different cultural backgrounds of each consumer, since different cultural contexts prepare and exhibit meat differently, affecting consumers' perceived familiarity with food products (Kunst & Haugestad, 2018). For example, there is a smaller effort in disguising the animal origin of meat in Portugal, where it is common to cook whole fishes with the head and to place animal figures outside deli shops, in comparison with Anglo-Saxon countries. Therefore, individuals' cultural background should be considered to optimize interventions, being a significant variable on the way people perceive and evaluate meat products and its familiarity.

Furthermore, the meat industry consistently reinforces justifications for why people should eat meat, even though most people know there is animal death involved. For example, persuading consumers that animals have lived good lives before slaughter, linking meat with nutrition, satiation, masculinity, and muscle-building, particularly for men. Therefore, with the current marketing discourse of several food companies reinforcing that meat consumption is essential to masculinity (Bogueva & Marinova, 2019), it is also relevant to develop interventions with the aim of disrupting these perpetuating stereotyped gender-based diets. Social norms can, indeed, have a pertinent impact on how people perceive meat (Amiot et al., 2018; Norris & Hannan, 2019; Reese, 2015). According to the Integrative Model of Behavior Change (Fishbein & Cappella, 2006), to shape individuals' intention toward a reduced meat consumption and more plant-based diets, effective interventions should consider perceptions of normative influence and social pressure about that behavior. Therefore, interventions framing plant-based diets as a normative behavior, by showing that most people are increasingly adopting it and stopping meat consumption (e.g., presenting statistics about how many people are eating plant-based) might be a powerful strategy to promote dietary change (The Good Food Institute, 2020). Accordingly, previous studies found that depicting the desired behavior based on descriptive (i.e., what most people do) or injunctive social norms (i.e., what people believe one should do might be an effective strategy to trigger a behavior change (e.g., food choices;

Higgs, 2015; Schultz et al., 2007). Moreover, linking animal welfare interventions to a standing social movement may be a successful strategy by prompting a normative influence and "process motivations" for participation (Robinson, 2010, 2017), making the process of participating in the social movement itself (e.g., reducing meat consumption) intrinsically motivating, since it promotes social interaction and support, perceived belonging, identity development and can increase participants' perceptions of collective efficacy (Bandura, 2002). Veganuary, for instance, an annual challenge that educates and encourages people to follow a vegan diet during January to thus contribute to more ethical and sustainable lifestyle choices, successfully reflects this pattern, with an adherence that has been increasing year after year, with around 400,000 participants signing up in 2020. Therefore, interventions that connect behavior to standing social movements, ethical values, and self-identity, can be particularly powerful and effective (Robinson, 2010, 2017; Walton, 2014). Likewise, similar interventions have effectively decreased childhood obesity-related behaviors and risk factors for cardiovascular disease and diabetes by appealing to ethical and cultural values in order to encourage physical activity, rather than by appealing directly to obesity reduction or other health motivations (Robinson et al, 2003, 2010; Weintraub et al., 2008). Possibly, interventions advocating animal welfare might operate in the same way (Mathur, 2021).

6.2.3. Meat alternatives

Not all consumers experience cognitive dissonance or feel discomfort when connecting the meat they have on their plate with the process of killing animals for food. And the ones who do, usually adopt rationalization strategies to maintain the dissonant behavior (i.e., eating meat). Therefore, it may be promising to design campaigns not only centered on the behavior to be avoided but focused on the behavior to be promoted. Promoting consumers' acceptance of meat alternatives is thus fundamental to trigger dietary transitions (Tso et al., 2020).

Several authors found that habits and routines are among the main barriers to reduced meat consumption (Dagevos & Voordouw, 2013; Graça et al., 2015; Lea et al., 2006; O'Riordan & Stoll-Kleemann, 2015). This happens particularly when the eating habit formation was largely or even completely unconscious (Köster, 2009). Eating meat, its purchase and preparation are determined by the habits and unconscious routines of day-to-day practices. This form of unconscious learning is therefore almost inaccessible to cognitive arguments and therefore are most resistant to change (Köster, 2009). Convenience has also been identified as a significant influence on food purchasing habits, encouraged by a lack of time or skills. Therefore, in order to successfully promote meat replacement, it is imperative to consider strategies that promote

familiarity and knowledge towards plant-based products, reducing uncertainty towards these novel foods, promoting self-efficacy perceptions, that is the knowledge, ability, and skills to prepare plant-based foods and meals (Fishbein & Cappella, 2006). Thus, as our findings suggested, a potentially effective way to promote more positive appraisals towards alternative protein products is to present them in a meal, since this strategy may promote self-efficacy and make people feel more familiar and comfortable with the product, by having a suggestion about how they can prepare it and with what they can eat it.

Products that are still unavailable in the market, are less familiar or are not that common in traditional or conventional diets, such as lab-grown meat and tofu, may benefit from the meal framing the most. Based on previous literature and theories about human behavior and behavior change, this might also be a promising strategy because it presents diet change within a positive framing. Previous literature found that positive framings, which emphasize the advantages of conformity with the message, are more persuasive than negative appeals, which highlight the negative consequences of nonconformity (Baxter & Gram-Hanssen, 2016; Dijkstra et al., 2011; Mir et al., 2016; O'Keefe & Jensen, 2007). Thus, presenting alternative products that can substitute the animal protein due to their similar aspect, texture, and nutritional purpose (i.e., protein source) might be an effective strategy, since it does not explicitly ask to eliminate meat from their diets, neither generates discomfort nor makes consumers question their moral choices, as the abovementioned strategies. Another example of a positive framing is to simply present a list of plant-based recipes for several meals (Norris & Hannan, 2019). Therefore, in line with our findings, previous research suggests that it is relevant to consider the framing of the message on the promotion of alternative proteins, promoting familiar and positive appeals.

However, according to our findings, more familiar products, such as legumes, did not seem to benefit from being presented in a meal with other elements that were less healthy (e.g., fries), since these elements might spillover and negatively affect the perception of other products.

Insects also did not benefit from the meal framing since they are usually perceived as repugnant and therefore unacceptable for consumption. Nevertheless, the Portuguese supermarket chain Continente (2022) has used that strategy, specifically promoting insect food on their website describing examples of meals with insects (e.g., "Grasshopper patties or crickets à lagareiro are dishes that will soon be part of the Portuguese menu"). Therefore, these effects should be continuously investigated in the future, considering that perceptions toward this segment of products are not only contingent to geographical and cultural context but also shaped throughout time.

Thus, our findings suggest that there are several ways to frame meat alternatives with the goal of optimizing consumers' appealness. Consequently, to promote protein alternatives acceptability, it is relevant to consider not only the product that we want to promote, but also the cultural background of the target, social norms, and other characteristics of the consumer, to design targeted and effective strategies, considering these interacting variables.

6.3. Limitations and Additional Future Directions

There are also additional potential pathways to trigger transitions towards more plant-based diets that were not explored in the present work. A possible pathway could consist of further exploring and designing campaigns focused on raising awareness about the health or sustainability advantages of reducing meat consumption and the adoption of a more plant-based diet. Findings to date suggest consumers are motivated mostly by health reasons when opting for alternative proteins, and less by environmental or animal welfare concerns. For instance, in 2020, the COVID-19 pandemic has been associated with an increasing demand for plant-based meat alternatives due to concerns about food security and the risk of disease from animal-based foods (Attwood & Hajat, 2020). In the United States, plant-based products sales more than doubled in April 2020 during the COVID-19 pandemic, compared with the previous year (Nielson, 2021). In fact, there have been concerns that the livestock industry is providing a hotbed for zoonotic diseases to arise, and specialists from both the European Food Safety Authority and the United Nations have formerly recognized industrial animal farming as one of the major causes of new infectious diseases in humans in the past decade and have likewise warned about its likelihood in triggering new pandemics. Accordingly, experts concluded that more than 60% identified infectious diseases in people can be spread from animals, and 75% of the emerging infectious diseases in people come from animals (CDC, 2021). Therefore, the World Health Organization suggests that promoting health and sustainability, mostly by reducing unsustainable animal-based consumption, is necessary to decrease the risk of future pandemics (Sandhu et al., 2021).

The literature shows that campaigns focused on providing information about dangers and risks or health advice are not always effective (Köster & Mojet, 2007). Nevertheless, experts suggest that people should be more informed about the negative consequences of eating meat. In pair with that, the communication regarding the health impact of alternative proteins should be clear and objective, mentioning the nutritional information of their consumption and different preparation methods (Tso et al., 2021). Moreover, due to the current lack of consumer trust in many food alternatives (European Institute of Innovation & Technology, 2021), there

is an important need to encourage food companies to share necessary information about the quality and origin of their ingredients and to be transparent about the nutritional quality and sustainability of their production methods.

Furthermore, although we focused our analysis on a robust set of alternative proteins, including legumes, tofu, seitan, insects and cultured meat, there were some products we did not cover, such as algae. Considering their high protein content and the fact this alternative has not reached the mainstream consumer market, future studies should keep exploring consumer acceptance towards them.

Framing is a relevant factor on alternative products acceptance and, accordingly, we found that meal framing might be an effective strategy to promote more positive appraisals. However, there are certain formats or contents that might be more successful than others. For instance, the impact of meal framing can be different considering if the meat alternative is presented within a "healthy" meal frame vs. a "junk food" frame. Future studies and interventions could examine the different impacts of these strategies, possibly tailored to different profiles of consumers. Additionally, other aspects of the communication framing of these food products must be considered. For instance, labelling cultured meat as "animal-free meat" or "clean meat", in comparison with "lab-grown meat", was revealed to induce more positive attitudes and increase their acceptance (Bryant & Barnett, 2019).

Furthermore, previous findings revealed that another way to increase familiarity and acceptance of novel proteins is to framing them as a narrative, for example, providing a story about a family sharing plant-based meals on a holiday (The Good Food Institute, 2020). Another effective strategy to promote familiarity is to consider the sensory qualities of the plant-based products and make consumers feel related to their previous experiences, therefore promoting the overall liking (Fiorentini et al., 2020). Therefore, developing plant-based products that imitate meat products, its appearance, taste and texture, might be an effective marketing option (The Good Food Institute, 2020; Tso et al., 2021). This strategy has been used by several companies, such as Beyond Burger and Impossible Foods, with burgers, meatballs, sausage and chicken analogues. Also, in the Portuguese market, Nobre and Isidoro have been developing plant-based sausages and ham that mimic the animal-based products.

Therefore, another identified strategy that might promote the acceptance of plant-based options is to develop products that imitate meat (e.g., appearance; The Good Food Institute, 2020). However, to the best of our knowledge, previous research has yet to systematically explore the role of resemblance to meat products of plant-based alternatives, according to individual characteristics. Hence, future studies could systematically explore different

strategies considering the type of diet (vegetarians vs. non-vegetarians), also controlling for the motivations to adhere to a vegetarian diet and the duration, meat attachment and food neophobia.

Communication strategies used to promote alternative proteins should therefore consider that alternative products need to be framed in an appropriate way, using tailored communication approaches, adapted to different products and consumers (Tso et al., 2021). Furthermore, these strategies should also contemplate individual characteristics of the consumer, since they are a relevant factor shaping food perception. We found that, for instance, meal framing can be an effective strategy to promote some less familiar alternative proteins, but we did not compare these effects between relevant individual characteristics, such as diet.

Additionally, future studies exploring how to trigger transitions towards more plant-based diets should try to measure actual meat consumption behavior, instead of measuring only self-reported behavior or behavioral intentions (Peacock, 2018). Outcome variables should also be designed to measure the quantity of meat eaten or purchased (e.g., the number of servings of beef, pork, fish) in order to enable effect sizes to be translated into direct measures of societal impact, in addition to frequency of purchase or consumption (Mathur et al., 2021). Importantly, future directions must integrate the different approaches and pathways considering the inherent and complex interaction of individual, psychological, social, and cultural variables, to build an integrated knowledge on consumers' willingness to change their current patterns of meat consumption, and therefore turn research into practice, materializing the goal of achieving more sustainable, healthier, and ethical food practices.

6.2. Conclusion

The present body of work tried to explore different pathways to promote dietary transitions toward more sustainable, healthier and ethical diets, focusing on meat consumption reduction and plant-based foods increasing.

We aimed to provide a threefold approach on how to trigger such transitions, by analyzing the multiple perspectives towards the different stages of the process of eating animals and the potential shift towards more plant-based diet. Therefore, firstly, we analyzed how people perceive the source of meat, that is the animals as living beings. We considered the influence of multiple individual and contextual factors, including individual characteristics of the perceiver/ consumer (e.g., gender, pet attachment), of the target (e.g., biological category of the animals), evaluating different perceptions, from affective (e.g., valence, arousal) to moral concern dimensions (e.g., moral concern; feelings of care and protection). Secondly, we

explored how people perceive animals transformed into food products and how that transformation process, its resemblance to the animal source, independently from its perceived familiarity, impacts on appetite for meat. We tried to include different products to cover the multiple perceptions towards the vast variety of animal-based foods existing in the circumplex reflected by the interaction of products' familiarity and animal resemblance. Finally, we investigated consumers attitudes towards not only animal food products but also towards a set of protein alternatives to meat consumption, to examine consumers perceptions and acceptation towards them. Again, we tried to include an expressive number of meat alternatives, not only already established products in the current market, such as legumes, tofu and seitan, but also less familiar and novel products such as insects and cultured meat, to capture the multiple perceptions that consumers have toward these products. Additionally, we aimed to integrate multiple methodologies, including both qualitative and quantitative methods, from free-associations and multiple correspondence analysis to correlation and experimental designs, to therefore provide a more integrative, rich and comprehensive understating of the phenomena in study (Salkind, 2010).

Overall, we found that people have mixed attitudes toward animals and that individual characteristics of the perceiver, particularly gender, diet and companion animal ownership play a role in this perception. Highlighting animals' cuteness and capacity to feel might be good strategies to reduce meat consumption, since they predicted moral attitudes towards animals. Pet attachment emerges as an impactful variable in promoting more positive attitudes towards other animals. When it comes to meat appraisal, our findings suggest that interventions should consider using unfamiliar animal reminders, since familiarity played a powerful role, capable of softening the psychological impact of animal reminders on appetite. Finally, we found that meal framing might be an effective strategy to promote meat alternatives, particularly when they are perceived as less familiar, such as tofu. Therefore, to develop effective interventions for plant-based promotion, the present body of work suggests that is relevant to adapt the framing to each alternative protein, also considering consumer's individual characteristics, social and cultural variables.

6.3. References

Alley, T. R. (1981). Head shape and the perception of cuteness. *Developmental Psychology, 17*(5), 650–654. https://doi.org/10.1037/0012-1649.17.5.650

Amiot, C. E., Boutros, G. E. H., Sukhanova, K., & Karelis, A. D. (2018). Testing a novel multicomponent intervention to reduce meat consumption in young men. *PloS One, 13*(10), Article e0204590. https://doi.org/10.1371/journal.pone.0204590

Angyal, A. (1941). Disgust and related aversions. *The Journal of Abnormal and Social Psychology, 36*(3), 393–412. https://doi.org/10.1037/h0058254

Attwood, S., & Hajat, C. (2020). How will the COVID-19 pandemic shape the future of meat consumption? *Public Health Nutrition, 23*(17), 3116–3120. https://doi.org/10.1017/S136898002000316X

Auger, B., & Amiot, C. (2017). Testing and extending the pets as ambassadors hypothesis: The role of contact with pets and recategorization processes in predicting positive attitudes toward animals. *Human–Animal Interaction Bulletin, 5*, 1–25.

Auger, B., & Amiot, C. E. (2019). Testing the roles of intergroup anxiety and inclusion of animals in the self as mechanisms that underpin the "pets as ambassadors" effect. *Anthrozoös, 32*(1), 5–21. https://doi.org/10.1080/08927936.2019.1550277

Bandura, A. (2002). Social foundations of thought and action: A social cognitive theory (chapter 6). In D. F. Marks (Ed.), *The health psychology reader* (pp. 94–106). https://doi.org/ 10.1017/S0813483900008238

Bastian, B., & Loughnan, S. (2017). Resolving the meat-paradox: A motivational account of morally troublesome behavior and its maintenance. *Personality and Social Psychology Review, 21*(3), 278–299. https://doi.org/10.1177/1088868316647562

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

Batson, C. D., Lishner, D. A., Cook, J., & Sawyer, S. (2005). Similarity and nurturance: Two possible sources of empathy for strangers. *Basic and Applied Social Psychology, 27*(1), 15–25. https://doi.org/10.1207/s15324834basp2701_2

Batt, S. (2009). Human attitudes towards animals in relation to species similarity to humans: a multivariate approach. *Bioscience horizons, 2*(2), 180-190. https://doi.org/10.1093/biohorizons/hzp021

Baxter, J., & Gram-Hanssen, I. (2016). Environmental message framing: Enhancing consumer recycling of mobile phones. *Resources, Conservation and Recycling, 109*, 96–101. doi:10.1016/j.resconrec.2016.02.012

Bogueva, D., & Marinova, D. (2019). Reconciling not eating meat and masculinity in the marketing discourse for new food alternatives. In *Environment, Health and Business Opportunities in the New Meat Alternatives Market* (pp. 260–282). GI Global.

Bowlby, J. (1999). *Attachment and loss* (2nd ed). Basic Books.

Bratanova, B., Loughnan, S., & Bastian, B. (2011). The effect of categorization as food on the perceived moral standing of animals. *Appetite, 57*(1), 193–196. https://doi.org/10.1016/j.appet.2011.04.020

Bratanova, B., Vauclair, C.-M., Kervyn, N., Schumann, S., Wood, R., & Klein, O. (2015). Savouring morality. Moral satisfaction renders food of ethical origin subjectively tastier. *Appetite, 91*, 137–149. https://doi.org/10.1016/j.appet.2015.04.006

Bryant C., & Barnett J. (2019). What's in a name? Consumer perceptions of in vitro meat under different names. *Appetite, 137*, 104–113. doi: 10.1016/j.appet.2019.02.021

Carter, C. S. (Ed.). (2005). *Attachment and bonding: A new synthesis*. MIT Press in cooperation with Dahlem University Press.

Caviola, L., Everett, J. A. C., & Faber, N. S. (2019). The moral standing of animals: Towards a psychology of speciesism. *Journal of Personality and Social Psychology, 116*(6), 1011–1029. https://doi.org/10.1037/pspp0000182

CDC - The Centers for Disease Control and Prevention (2021). *Zoonotic Diseases.* https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html

Continente (2022). *Os Insectos Chegaram a Portugal!* https://foodlab.continente.pt/

Czech, B., Krausman, P. R., & Borkhataria, R. (1998). Social construction, political power, and the allocation of benefits to endangered species. *Conservation Biology, 12*(5), 1103-1112. https://doi.org/10.1046/j.1523-1739.1998.97253.x

Dagevos, H., & Voordouw, J. (2013). Sustainability and meat consumption: Is reduction realistic? *Sustainability: Science, Practice and Policy, 9*(2), 60–69. https://doi.org/10.1080/15487733.2013.11908115

Dhont, K., Hodson, G., & Leite, A. C. (2016). Common ideological roots of speciesism and generalized ethnic prejudice: The social dominance human–animal relations model (SD–HARM). *European Journal of Personality, 30*(6), 507–522. https://doi.org/10.1002/per.2069

Dijkstra, A., Rothman, A., & Pietersma, S. (2011). The persuasive effects of framing messages on fruit and vegetable consumption according to regulatory focus theory. *Psychology & Health, 26*, 1036–1048. doi:10.1080/08870446.2010.526715

Dowsett, E., Semmler, C., Bray, H., Ankeny, R. A., & Chur-Hansen, A. (2018). Neutralising the meat paradox: Cognitive dissonance, gender, and eating animals. *Appetite, 123*, 280–288. https://doi.org/10.1016/j.appet.2018.01.005

Earle, M., Hodson, G., Dhont, K., & MacInnis, C. (2019). Eating with our eyes (closed): Effects of visually associating animals with meat on antivegan/vegetarian attitudes and meat consumption willingness. *Group Processes & Intergroup Relations, 22*(6), 1–18. https://doi.org/10.1177/1368430219861848

European Institute of Innovation & Technology (2021). *EIT Food TrustTracker*. https://www.eitfood.eu/projects/eit-food-trusttracker

Feinberg, M., Kovacheff, C., Teper, R., & Inbar, Y. (2019). Understanding the process of moralization: How eating meat becomes a moral issue. *Journal of Personality and Social Psychology*, *117*, 50–72. https://doi.org/10.1037/pspa0000149

Festinger, L. (1957). *A theory of cognitive dissonance* (Stanford University Press).

Fiorentini, M., Kinchla, A. J., & Nolden, A. A. (2020). Role of sensory evaluation in consumer acceptance of plant-based meat analogs and meat extenders: A scoping review. *Foods, 9*(9), 1334. https://doi.org/10.3390/foods9091334

Fishbein, M. & Cappella, J. N. (2006).The role of theory in developing effective health communications. *Journal of Communication 56*, S1–17.

Glocker, M. L., Langleben, D. D., Ruparel, K., Loughead, J. W., Valdez, J. N., Griffin, M. D., Sachser, N., & Gur, R. C. (2009). Baby schema modulates the brain reward system in nulliparous women. *Proceedings of the National Academy of Sciences, 106*(22), 9115–9119. https://doi.org/10.1073/pnas.0811620106

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., Pretty, J., Robinson, S., Thomas, S. M., & Toulmin, C. (2010). Food security: The challenge of feeding 9 billion people. *Science, 327*(5967), 812–818. https://doi.org/10.1126/ science.1185383

Graça, J., Calheiros, M. M., & Oliveira, A. (2015). Attached to meat? (Un)Willingness and intentions to adopt a more plant-based diet. *Appetite, 95*, 113–125. https://doi.org/10.1016/j.appet.2015.06.024

Graça, J., Calheiros, M. M., & Oliveira, A. (2016). Situating moral disengagement: Motivated reasoning in meat consumption and substitution. *Personality and Individual Differences, 90,* 353–364. https://doi.org/10.1016/j.paid.2015.11.042

Graça, J., Calheiros, M. M., Oliveira, A. & Milfont, T. L. (2018). Why are women less likely to support animal exploitation than men? The mediating roles of social dominance orientation and empathy. *Personality and Individual Differences, 129,* 66-69. https://dx.doi.org/10.1016/j.paid.2018.03.007.

Grauerholz, L. (2007). Cute enough to eat: The transformation of animals into meat for human consumption in commercialized images. *Humanity & Society, 31*(4), 334–354. https://doi.org/10.1177/016059760703100404

Gropp, R. E., & Verdier, J. M. (2020). From climate emergency to climate response. *BioScience, 70*(1), 3–3. https://doi.org/10.1093/biosci/biz156

Gunnthorsdottir, A. (2001). Physical attractiveness of an animal species as a decision factor for its preservation. *Anthrozoös, 14*(4), 204–215. https://doi.org/10.2752/089279301786999355

Herzog, H. A., Betchart, N. S., & Pittman, R. B. (1991). Gender, sex role orientation, and attitudes toward animals. *Anthrozoös, 4*(3), 184–191. https://doi.org/10.2752/089279391787057170

Higgs, S. (2015). Social norms and their influence on eating behaviours. *Appetite, 86,* 38–44. https://doi.org/10.1016/j.appet.2014.10.021

Hildebrandt, K. A., & Fitzgerald, H. E. (1979). Facial feature determinants of perceived infant attractiveness. *Infant Behavior and Development, 2,* 329–339. https://doi.org/10.1016/S0163-6383(79)80043-0

Hopkins, P. D., & Dacey, A. (2008). Vegetarian meat: Could technology save animals and satisfy meat eaters? *Journal of Agricultural and Environmental Ethics, 21*(6), 579–596. https://doi.org/10.1007/s10806-008-9110-0

Jenni, K., & Loewenstein, G. (1997). Explaining the identifiable victim effect. *Journal of Risk and Uncertainty* (3), 235–257. https://doi.org/10.1023/A:1007740225484

Klebl, C., Luo, Y., & Bastian, B. (2021). Beyond aesthetic judgment: Beauty increases moral standing through perceptions of purity. *Personality and Social Psychology Bulletin,* 014616722110236. https://doi.org/10.1177/01461672211023648

Klebl, C., Luo, Y., Tan, N. P.-J., Ping Ern, J. T., & Bastian, B. (2021). Beauty of the beast: Beauty as an important dimension in the moral standing of animals. *Journal of Environmental Psychology, 75,* 101624. https://doi.org/10.1016/j.jenvp.2021.101624

Knight, S., & Barnett, L. (2008). Justifying attitudes toward animal use: A qualitative study of people's views and beliefs. *Anthrozoös, 21*(1), 31–42. https://doi.org/10.2752/089279308X274047

Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference, 20*(2), 70–82. https://doi.org/10.1016/j.foodqual.2007.11.002

Köster, E. P., & Mojet, J. (2007). *Understanding consumers of food products*. In L. J. Frewer (Eds). CRC Pr.

Kubberød, E., Dingstad, G. I., Ueland, Ø., & Risvik, E. (2006). The effect of animality on disgust response at the prospect of meat preparation—An experimental approach from Norway. *Food Quality and Preference, 17*(3–4), 199–208. https://doi.org/10.1016/j.foodqual.2005.04.004

Kunst, J. R., & Haugestad, C. A. (2018). The effects of dissociation on willingness to eat meat are moderated by exposure to unprocessed meat: A cross-cultural demonstration. *Appetite, 120*, 356–366. https://doi.org/10.1016/j.appet.2017.09.016

Kunst, J. R., & Hohle, S. M. (2016). Meat eaters by dissociation: How we present, prepare and talk about meat increases willingness to eat meat by reducing empathy and disgust. *Appetite, 105*, 758–774. https://doi.org/10.1016/j.appet.2016.07.009

Landová, E., Poláková, P., Rádlová, S., Janovcová, M., Bobek, M., & Frynta, D. (2018). Beauty ranking of mammalian species kept in the Prague Zoo: Does beauty of animals increase the respondents' willingness to protect them? *The Science of Nature, 105*(11–12), 69. https://doi.org/10.1007/s00114-018-1596-3

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin, 126*(3), 390–423. https://doi.org/10.1037/0033-2909.126.3.390

Langlois, J. H., Ritter, J. M., Casey, R. J., & Sawin, D. B. (1995). Infant attractiveness predicts maternal behaviors and attitudes. *Developmental Psychology, 31*(3), 464–472. https://doi.org/10.1037/0012-1649.31.3.464

Lea, E., Crawford, D., & Worsley, A. (2006). Public views of the benefits and barriers to the consumption of a plant-based diet. *European Journal of Clinical Nutrition, 60*(7), 828–837. https://doi.org/10.1038/sj.ejcn.1602387

Leite, A. C., Dhont, K., & Hodson, G. (2019). Longitudinal effects of human supremacy beliefs and vegetarianism threat on moral exclusion (vs. Inclusion) of animals. *European Journal of Social Psychology, 49*(1), 179–189. https://doi.org/10.1002/ejsp.2497

Lin-Schilstra, L., & Fischer, A. R. H. (2020). Consumer moral dilemma in the choice of animal-friendly meat products. *Sustainability, 12*(12), 4844. https://doi.org/10.3390/su12124844

Lorenz, K. (1943). Die angeborenen Formen möglicher Erfahrung. *Zeitschrift Für Tierpsychologie, 5*(2), 235–409. https://doi.org/10.1111/j.1439-0310.1943.tb00655.x

Loughnan, S., Bastian, B., & Haslam, N. (2014). The psychology of eating animals. *Current Directions in Psychological Science, 23*(2), 104–108. https://doi.org/10.1177/0963721414525781

Loughnan, S., Haslam, N., & Bastian, B. (2010). The role of meat consumption in the denial of moral status and mind to meat animals. *Appetite, 55*(1), 156–159. https://doi.org/10.1016/j.appet.2010.05.043

MAGG (2021). *O Continente já vende insetos comestíveis. Conheça os snacks de larvas ou as barras proteicas de farinha de inseto.* https://magg.sapo.pt/comida/artigos/snack-larvas-crocantes-insetos-comestiveis-portugal

Mathur, M. B., Peacock, J., Reichling, D. B., Nadler, J., Bain, P. A., Gardner, C. D., & Robinson, T. N. (2021). Interventions to reduce meat consumption by appealing to animal welfare: Meta-analysis and evidence-based recommendations. *Appetite, 164*, Article 105277. https://doi.org/10.1016/j.appet.2021.105277

Marešová, J., & Frynta, D. (2008). Noah's Ark is full of common species attractive to humans: The case of boid snakes in zoos. *Ecological Economics, 64*(3), 554–558. https://doi.org/10.1016/j.ecolecon.2007.03.012

McEachern, M. G., & Schröder, M. J. A. (2004). Integrating the voice of the consumer within the value chain: A focus on value-based labelling communications in the fresh-meat sector. *Journal of Consumer Marketing, 21*(7), 497–509. https://doi.org/10.1108/07363760410568716

McKelvie, S. J. (1993). Stereotyping in perception of attractiveness, age, and gender in schematic faces. Social Behavior and Personality: *An International Journal, 21*(2), 121–128. https://doi.org/10.2224/sbp.1993.21.2.121

Mir, H. M., Behrang, K., Isaai, M. T., & Nejat, P. (2016). The impact of outcome framing and psychological distance of air pollution consequences on transportation mode choice. *Transportation Research Part D: Transport and Environment, 46*, 328–338. doi:10.1016/j.trd.2016.04.012

Nielson. (2021). Which pandemic-inspired purchasing shifts are here to stay? https://nielseniq.com/global/en/insights/analysis/2021/which-pandemic-inspired-purchasing-shifts-are-here-to-stay/

Norris, J., & Hannan, R. (2019). *Leafleting and booklet effectiveness. Technical report.* Vegan Outreach. https://veganoutreach.org/leafleting-and-booklet-effectiveness/

O'Keefe, D. J., & Jensen, J. D. (2007). The relative persuasiveness of gain-framed loss-framed messages for encouraging disease prevention behaviors: A meta-analytic review. *Journal of Health Communication, 12*, 623–644. doi:10.1080/10810730701615198

Onwezen, M. C., & van der Weele, C. N. (2016). When indifference is ambivalence: Strategic ignorance about meat consumption. *Food Quality and Preference, 52*, 96–105. https://doi.org/10.1016/j.foodqual.2016.04.001

O'Riordan, T., & Stoll-Kleemann, S. (2015). The challenges of changing dietary behavior toward more sustainable consumption. *Environment: Science and Policy for Sustainable Development, 57*(5), 4–13. https://doi.org/10.1080/00139157.2015.1069093

Paul, E. S., & Serpell, J. A. (1993). Childhood pet keeping and humane attitudes in young *adulthood. Animal Welfare, 2*(4), 321–337.

Peacock, J. (2018). *Measuring change in diet for animal advocacy*. Technical report, the Humane League Labs. https://thehumaneleague.org/articl

Piazza, J., Landy, J. F., & Goodwin, G. P. (2014). Cruel nature: Harmfulness as an important, overlooked dimension in judgments of moral standing. *Cognition, 131*(1), 108–124. https://doi.org/10.1016/j.cognition.2013.12.013

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite, 91*, 114–128. https://doi.org/10.1016/j.appet.2015.04.011

Reese, J. (2015). *Testing the effectiveness of animal advocacy messages with Amazon Mechanical Turk. Technical report.* The Sentience Institute. https://jacyreese.com/ assets/downloads/Testing_the_Effectiveness.pdf.

Robinson, T. N. (2010). Save the world, prevent obesity: Piggybacking on existing social and ideological movements. *Obesity, 18*(S1), S17–S22. https://doi.org/10.1038/ oby.2009.427

Robinson, T. N. (2017). Stealth interventions for obesity: Strategies for behavioral, social, and policy changes. In K. D. Brownell, & B. T. Walsh (Eds.), *Eating disorders and obesity: A comprehensive handbook* (pp. 609–613). Guilford Publications (chapter 99). Robinson, T. N., Killen, J. D., Kraemer, H. C., Wilson, D. M., Matheson, D. M., Haskell, W. L., Pruitt, L. A., Powell, T. M., Owens, A., & Thompson, N. (2003). Dance and reducing television viewing to prevent weight gain in African-American girls: The stanford GEMS pilot study. *Ethnicity & Disease, 13*(Suppl 1), S1–S65. https ://www.ethndis.org/priorsuparchives/ ethn-13-s1-65.pdf

Rothgerber, H. (2020). Meat-related cognitive dissonance: A conceptual framework for understanding how meat eaters reduce negative arousal from eating animals. *Appetite, 146,* 104511. https://doi.org/10.1016/j.appet.2019.104511

Rozin, P., & Fallon, A. (1980). The psychological categorization of foods and non-foods: A preliminary taxonomy of food rejections. *Appetite, 1*(3), 193–201. https://doi.org/10.1016/S0195-6663(80)80027-4

Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review, 94*(1), 23–41. https://doi.org/10.1037/0033-295X.94.1.23

Ruby, M. B., & Heine, S. J. (2012). Too close to home. Factors predicting meat avoidance. *Appetite, 59*(1), 47–52. https://doi.org/10.1016/j.appet.2012.03.020

Salkind, N. (2010). *Triangulation. Encyclopedia of Research Design*. https://doi.org/10.4135/9781412961288.n469

Sandhu, H., Arora, A., Sarker, S., Shah, B., Sivendra, A., Winsor, E., & Luthra, A. (2021). *Pandemic prevention and unsustainable animal-based consumption.* WHO Press. https://doi.org/10.2471/blt.20.276238

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science, 18*(5), 429–434. https://doi.org/10.1111/j.1467- 9280.2007.01917.x

Serpell, J. A., & Paul, E. (1994). Pets and the development of positive attitudes to animals. In A. Manning, *Animals and human society: Changing perspectives* (pp. 127–144). Routledge.

Sevillano, V., & Fiske, S. T. (2016). Warmth and competence in animals: Social perception of animals. *Journal of Applied Social Psychology, 46*(5), 276–293. https://doi.org/10.1111/jasp.12361

Stoll-Kleemann, S., & Schmidt, U. J. (2017). Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: A review of influence factors. *Regional Environmental Change, 17*(5), 1261–1277. https://doi.org/10.1007/s10113-016-1057-5

Stone, J., & Cooper, J. (2001). A self-standards model of cognitive dissonance. *Journal of Experimental Social Psychology, 37*(3), 228–243. https://doi.org/10.1006/jesp.2000.1446

The Good Food Institute (2020). *Strategies to Accelerate Consumer Adoption of Plant-Based. Meat Recommendations from a Comprehensive Literature Review*. https://gfi.org/images/uploads/2020/03/FINAL-Consumer-Adoption-Strategic-Recommendations-Report.pdf

Tian, Q., Hilton, D., & Becker, M. (2016). Confronting the meat paradox in different cultural contexts: Reactions among Chinese and French participants. *Appetite, 96*, 187–194. https://doi.org/10.1016/j.appet.2015.09.009

Tso, R., Lim, A. J., & Forde, C. G. (2020). A critical appraisal of the evidence supporting consumer motivations for alternative proteins. *Foods, 10*(1), 24. https://doi.org/10.3390/foods10010024

Västfjäll, D., Slovic, P., Mayorga, M., & Peters, E. (2014). Compassion fade: Affect and charity are greatest for a single child in need. *PloS One, 9*(6), Article e100115. https://doi.org/10.1371/journal.pone.0100115

Volk, A., & Quinsey, V. L. (2002). The influence of infant facial cues on adoption preferences. *Human Nature, 13*(4), 437–455. https://doi.org/10.1007/s12110-002-1002-9

Walton, G. M. (2014). The new science of wise psychological interventions. *Current Directions in Psychological Science, 23*(1), 73–82. https://doi.org/10.1177/ 0963721413512856

Weintraub, D. L., Tirumalai, E. C., Haydel, K. F., Fujimoto, M., Fulton, J. E., & Robinson, T. N. (2008). Team sports for overweight children: The stanford sports to prevent obesity randomized trial (SPORT). *Archives of Pediatrics and Adolescent Medicine, 162*(3), 232–237. https://doi.org/10.1001/archpediatrics.2007.43

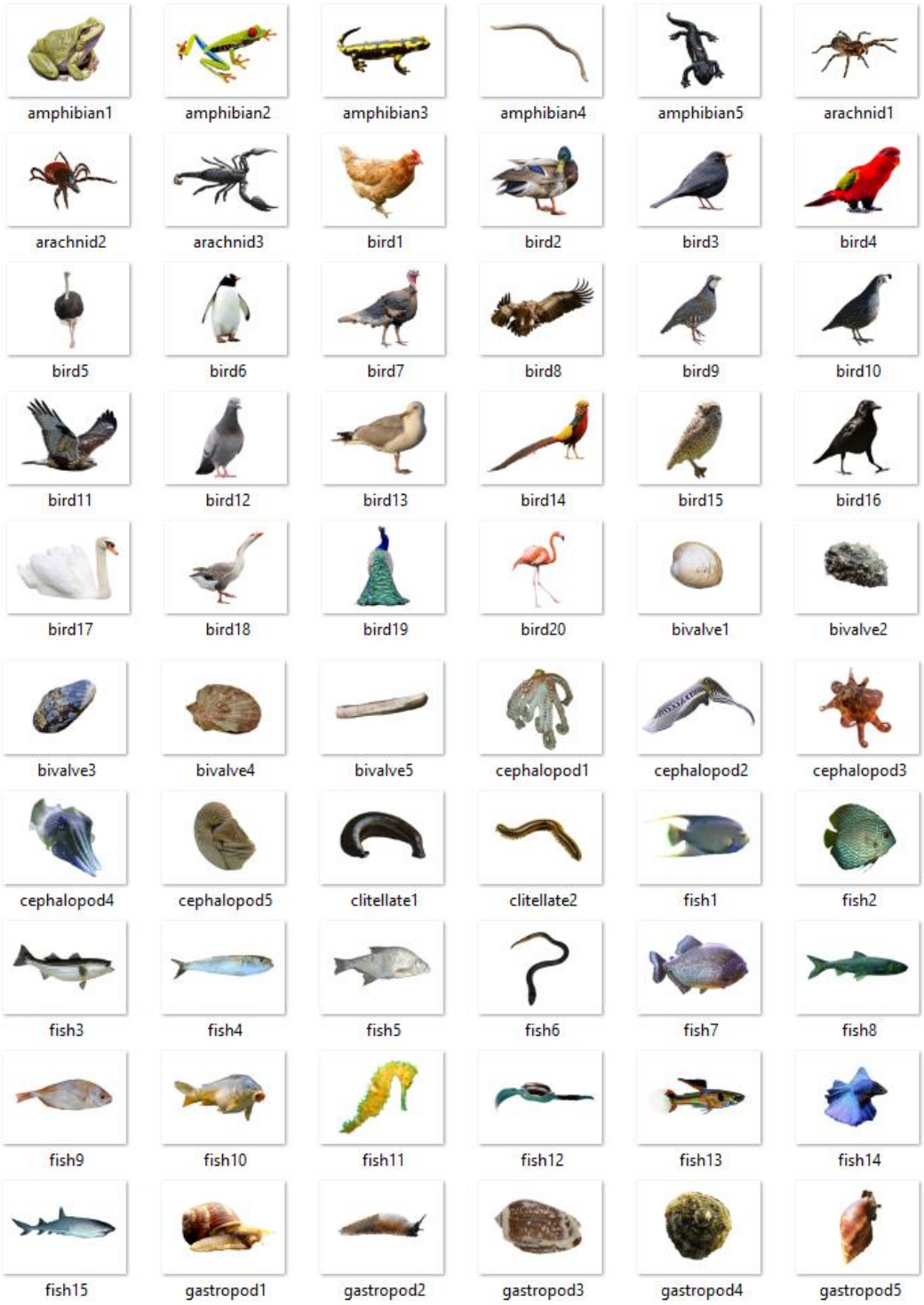
West, P. C., Gerber, J. S., Engstrom, P. M., Mueller, N. D., Brauman, K. A., Carlson, K. M., Cassidy, E. S., Johnston, M., MacDonald, G. K., Ray, D. K., & Siebert, S. (2014). Leverage points for improving global food security and the environment. *Science, 345*(6194), 325–328. https://doi.org/10.1126/science.1246067

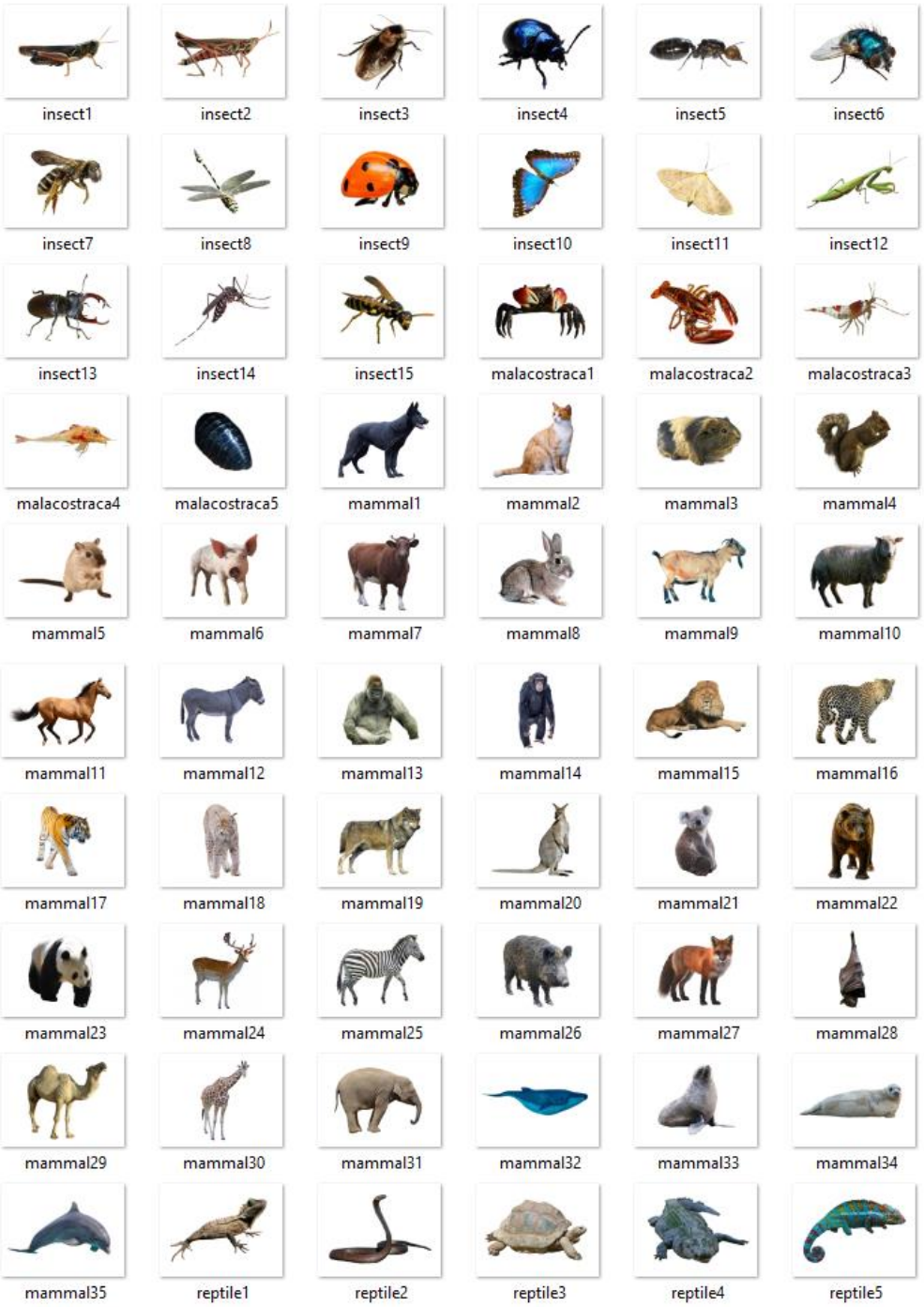
Wrenn, C. L. (2013). Resonance of moral shocks in abolitionist animal rights advocacy: Overcoming contextual constraints. *Society and Animals, 21*(4), 379–394. https://doi.org/10.1163/15685306-12341271

Zickfeld, J. H., Kunst, J. R., & Hohle, S. M. (2018). Too sweet to eat: Exploring the effects of cuteness on meat consumption. *Appetite, 120*, 181–195. https://doi.org/10.1016/j.appet.2017.08.038

Appendix A

Supplementary Table A1. Stimulus set from Article 1 (120 animal images).




insect1
insect2
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malacostraca1
malacostraca2
malacostraca3
malacostraca4
malacostraca5
mammal1
mammal2
mammal3
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mammal6
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mammal35
reptile1
reptile2
reptile3
reptile4
reptile5

Supplementary Table A2. Item-level data from Article 1 (means and standard deviations).

				Valence		Familiarity		Cuteness		Dangerousness		Similarity to humans		Capacity to feel		Arousal		Edibility		Acceptability to kill		Feelings of care		Capacity to think	
Picture	Picure name	Category	Animal	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	SD	*M*	*SD*	*M*	*SD*
#1	amphibian1	Amphibian	frog	3.88	1.52	4.25	2.02	2.96	1.80	3.06	1.67	1.98	1.32	4.37	2.04	3.31	1.79	1.88	1.70	1.90	1.65	3.47	1.88	3.47	1.74
#2	amphibian2	Amphibian	frog	3.82	1.71	4.37	2.10	4.08	1.95	3.67	1.93	1.67	0.89	4.76	1.69	4.04	1.84	2.27	1.87	2.37	1.91	3.90	1.99	3.59	1.68
#3	amphibian3	Amphibian	newt	3.59	1.42	3.70	2.01	3.24	1.82	4.02	1.77	1.59	0.96	4.13	1.86	3.15	1.86	1.74	1.25	2.07	1.69	3.07	1.95	2.76	1.42
#4	amphibian4	Amphibian	blindworm	2.88	1.67	3.33	2.10	1.88	1.48	2.98	2.21	1.57	1.21	3.65	2.08	2.76	1.95	1.63	1.17	2.10	1.56	2.45	1.83	2.41	1.72
#5	amphibian5	Amphibian	triton	2.98	1.66	3.54	1.93	2.56	1.93	4.21	1.80	1.98	1.39	3.94	2.06	3.37	1.86	1.71	1.21	2.02	1.64	2.25	1.97	3.17	1.75
#6	arachnid1	Arachnid	spider	2.40	1.46	4.86	2.29	1.92	1.54	5.10	1.76	1.64	1.14	4.04	2.22	3.68	2.12	1.96	1.68	2.46	2.02	2.42	1.84	3.14	1.85
#7	arachnid2	Arachnid	tick	2.62	1.73	3.48	1.89	2.04	1.66	5.00	1.66	1.79	1.38	3.54	1.81	3.62	2.11	1.83	1.37	2.71	2.08	2.33	1.75	2.96	1.66
#8	arachnid3	Arachnid	scorpion	2.92	1.88	3.50	2.13	2.06	1.54	5.85	1.27	1.85	1.32	4.10	2.16	3.13	2.02	2.00	1.63	2.38	1.91	2.58	1.71	3.19	2.06
#9	bird1	Bird	chicken	4.91	1.42	5.98	1.46	3.75	1.80	2.15	1.26	2.53	1.30	5.19	1.61	4.04	1.63	5.81	1.61	5.17	1.75	4.15	1.77	3.94	1.84
#10	bird2	Bird	duck	5.00	1.37	5.81	1.52	4.94	1.62	2.60	1.52	2.81	1.61	5.32	1.50	4.32	1.64	5.26	2.06	4.64	2.25	5.11	1.63	4.40	1.77
#11	bird3	Bird	blackbird	5.16	1.66	5.34	1.88	5.29	1.63	1.86	1.39	2.05	1.49	5.25	1.91	3.82	1.87	2.50	2.01	2.48	1.94	5.48	1.56	4.02	2.05
#12	bird4	Bird	parrot	5.42	1.32	5.52	1.45	5.65	1.43	1.90	1.12	2.79	1.80	5.63	1.52	4.50	1.91	2.25	2.03	2.02	1.74	5.42	1.59	5.17	1.52
#13	bird5	Bird	ostrich	4.48	1.43	5.06	1.78	4.44	1.79	4.10	1.48	2.81	1.51	5.50	1.49	4.29	1.66	3.04	2.17	3.00	2.23	4.69	1.82	4.50	1.64
#14	bird6	Bird	penguin	5.90	1.42	5.52	1.31	6.24	1.10	2.50	1.42	3.58	1.67	5.58	1.53	5.00	1.34	2.24	1.85	1.94	1.63	5.82	1.29	5.14	1.11
#15	bird7	Bird	turkey	4.14	1.57	5.34	1.76	3.12	1.83	2.62	1.48	2.56	1.66	5.28	1.80	3.56	1.63	4.90	2.17	4.40	2.14	3.74	1.90	4.00	1.87
#16	bird8	Bird	vulture	3.88	1.69	4.02	2.04	2.92	1.85	4.63	1.47	2.21	1.29	5.48	1.46	3.98	1.67	2.37	1.88	2.46	1.99	3.94	1.82	4.75	1.40
#17	bird9	Bird	partridge	4.86	1.34	4.69	1.71	4.82	1.42	2.57	1.59	2.80	1.62	5.12	1.83	4.04	1.58	3.10	2.13	2.73	1.91	4.96	1.58	4.63	1.80
#18	bird10	Bird	coderniz	4.47	1.53	4.60	1.87	4.47	1.82	2.13	1.13	2.38	1.58	5.30	1.65	3.53	1.86	3.02	1.96	3.11	1.90	4.34	2.09	4.38	1.79
#19	bird11	Bird	hawk	4.78	1.58	4.22	1.77	4.29	1.70	4.04	1.73	2.55	1.57	5.31	1.90	3.94	1.82	2.39	1.64	2.31	1.81	4.82	1.87	4.73	1.86
#20	bird12	Bird	pigeon	3.31	1.74	5.63	1.81	3.16	1.99	2.61	1.64	2.14	1.50	4.84	1.76	3.65	1.82	2.63	1.98	2.84	1.92	3.33	2.02	3.84	1.98
#21	bird13	Bird	seagull	4.20	1.58	5.51	1.71	3.86	1.68	2.45	1.40	1.88	1.25	5.04	1.66	3.51	1.65	2.16	1.52	2.27	1.56	4.08	1.66	3.98	1.71
#22	bird14	Bird	pheasant	4.96	1.58	4.18	1.79	5.43	1.58	2.14	1.09	2.57	1.44	4.86	1.58	4.02	1.59	3.14	2.02	2.73	2.04	4.98	1.61	4.21	1.64
#23	bird15	Bird	owl	5.13	1.62	5.17	1.48	5.15	1.53	3.04	1.47	2.98	1.54	5.54	1.36	4.40	1.49	2.31	1.77	2.13	1.65	5.31	1.46	4.85	1.64
#24	bird16	Bird	crow	3.87	1.54	4.96	1.84	3.82	1.96	2.80	1.59	2.64	1.59	5.16	1.84	3.58	1.75	2.38	1.58	2.64	1.79	4.07	1.82	4.38	1.79

#25	bird17	Bird	swan	4.84	1.24	5.43	1.40	5.61	1.11	3.43	1.75	2.65	1.53	5.71	1.33	4.14	1.56	3.04	2.05	2.96	2.10	4.76	1.46	4.22	1.60
#26	bird18	Bird	goose	4.81	1.44	4.88	1.85	4.62	1.35	2.94	1.47	2.75	1.57	5.08	1.70	3.79	1.54	4.35	2.14	4.04	2.12	4.54	1.39	4.31	1.67
#27	bird19	Bird	peacock	5.28	1.42	5.04	1.98	5.34	1.87	3.04	1.51	2.11	1.25	4.74	1.73	4.51	1.61	2.70	1.93	2.79	2.09	4.77	1.91	3.74	1.83
#28	bird20	Bird	flamingo	5.17	1.41	4.58	1.86	5.52	1.35	2.71	1.36	2.38	1.51	5.27	1.57	4.02	1.67	2.33	1.95	2.56	2.02	4.63	1.89	4.12	1.72
#29	bivalve1	Bivalve	clam	4.52	1.42	5.15	2.08	2.63	1.63	1.26	0.71	1.33	0.91	2.65	1.75	2.80	1.61	5.46	1.98	5.06	2.04	2.61	1.89	2.04	1.60
#30	bivalve2	Bivalve	oyster	4.20	1.46	3.64	2.23	2.09	1.36	1.89	1.19	1.67	1.48	2.96	1.76	2.76	1.43	3.62	2.33	3.84	2.29	3.11	1.84	2.44	1.60
#31	bivalve3	Bivalve	mussel	4.47	1.40	4.87	1.91	2.23	1.40	1.38	0.86	1.43	0.91	2.94	1.99	2.68	1.60	5.26	2.07	5.21	1.92	2.85	1.69	2.09	1.57
#32	bivalve4	Bivalve	scallop	4.35	1.63	3.88	2.13	2.67	1.79	1.52	1.06	1.27	0.87	2.46	1.69	2.94	1.81	3.98	2.59	4.12	2.35	2.98	1.90	1.87	1.44
#33	bivalve5	Bivalve	razor shell	3.59	1.58	3.35	2.23	1.90	1.34	1.94	1.43	1.47	1.14	3.27	1.89	2.61	1.74	3.59	2.48	3.73	2.35	2.88	2.03	2.43	1.55
#34	cephalopods 1	Cephalopod	octopus	4.20	1.50	5.22	1.87	3.22	1.70	3.71	1.63	2.31	1.47	5.14	1.62	3.59	1.59	5.29	2.05	4.88	2.02	3.41	1.84	4.45	2.00
#35	cephalopods 2	Cephalopod	cuttle fish	4.49	1.33	3.88	2.21	3.88	1.90	2.92	1.59	2.37	1.50	4.43	1.90	3.49	1.68	4.24	2.39	3.92	2.21	4.00	1.83	3.86	1.85
#36	cephalopods 3	Cephalopod	blue ringed octupus	4.55	1.32	4.43	1.96	3.88	2.02	3.49	1.70	2.10	1.43	4.57	1.88	4.14	1.72	4.31	2.48	3.69	2.28	3.90	1.81	4.31	1.73
#37	cephalopods 4	Cephalopod	squid	4.22	1.62	3.45	2.14	4.06	1.85	3.65	1.62	1.86	1.11	4.59	1.83	3.69	1.79	4.08	2.40	4.16	2.29	3.84	2.00	3.57	1.75
#38	cephalopods 5	Cephalopod	nautilus	4.00	1.50	2.84	1.60	3.07	1.84	2.41	1.40	1.86	1.18	3.73	2.06	3.02	1.61	3.05	1.82	3.05	1.91	3.45	1.94	2.71	1.88
#39	clitellata1	Clitellate	leech	2.62	1.44	2.44	1.73	1.84	1.23	3.24	1.70	1.50	1.22	3.28	1.94	2.62	1.88	1.58	1.11	2.10	1.47	2.62	1.71	2.48	1.73
#40	clitellata2	Clitellate	earthworm	2.89	1.46	3.35	1.92	1.89	1.30	2.78	1.75	1.50	0.98	3.28	2.05	2.80	1.77	1.63	1.47	2.61	2.09	2.28	1.78	2.57	1.90
#41	fish1	Fish	queen angelfish	4.87	1.60	4.63	1.69	5.07	1.64	2.07	1.43	2.30	1.51	4.52	1.85	4.00	1.81	3.89	2.28	3.57	2.24	4.65	1.88	3.63	1.80
#42	fish2	Fish	discus	4.94	1.36	4.30	1.75	5.19	1.58	2.00	1.19	2.09	1.23	4.51	1.73	3.89	1.58	3.58	1.95	3.23	1.95	4.62	1.69	3.49	1.69
#43	fish3	Fish	sea bass	4.62	1.32	4.38	2.03	2.92	1.61	2.13	1.38	2.23	1.47	3.95	1.70	3.07	1.66	6.13	1.46	5.15	1.91	3.47	1.78	2.87	1.73
#44	fish4	Fish	sardine	4.66	1.35	5.66	1.76	2.62	1.35	1.64	1.05	1.98	1.36	4.04	1.69	3.00	1.47	6.16	1.33	5.04	2.13	3.66	1.61	3.08	1.60
#45	fish5	Fish	codfish	4.62	1.45	4.85	2.12	2.79	1.68	1.57	0.99	2.23	1.70	4.64	2.02	3.53	1.76	5.96	1.60	5.47	1.73	3.87	1.76	3.21	1.67
#46	fish6	Fish	eel	2.83	1.46	3.98	1.99	2.02	1.42	4.91	1.94	1.72	1.39	4.45	1.95	4.23	2.10	2.45	2.01	2.72	1.90	2.98	1.94	3.74	1.84
#47	fish7	Fish	piranha	4.71	1.23	4.65	1.77	4.00	1.37	2.50	1.49	2.00	1.25	4.35	1.95	3.58	1.53	4.40	2.04	3.92	1.98	3.98	1.54	3.37	1.68
#48	fish8	Fish	trout	4.45	1.50	5.00	1.76	3.20	1.59	1.96	1.26	2.20	1.47	3.92	1.71	3.43	1.80	5.31	1.84	5.06	1.80	3.78	1.85	3.22	1.79
#49	fish9	Fish	blackspot seabream	4.72	1.57	5.48	1.80	3.38	1.64	1.88	1.49	2.62	1.82	4.26	1.79	3.48	1.84	5.70	2.02	5.26	1.96	4.04	1.83	3.08	1.72
#50	fish10	Fish	carp	4.31	1.23	4.30	1.95	3.06	1.68	2.54	1.44	2.20	1.42	4.44	1.84	3.52	1.55	4.98	1.73	4.76	1.78	3.83	1.59	3.41	1.45
#51	fish11	Fish	seahorse	5.14	1.49	4.74	1.89	5.26	1.73	1.91	1.27	1.98	1.51	4.07	1.94	3.68	1.68	1.60	1.10	1.91	1.47	4.91	1.77	3.51	1.70
#52	fish12	Fish	manta ray	4.24	1.34	2.96	1.83	3.96	1.99	3.43	1.53	1.96	1.25	4.69	1.78	3.59	1.61	2.73	1.96	2.59	2.05	4.39	2.01	3.92	1.87
#53	fish13	Fish	guppy	4.48	1.45	4.38	1.77	4.52	1.67	1.79	1.24	2.17	1.31	4.64	1.78	3.60	1.31	3.67	2.11	3.12	2.06	4.40	1.52	3.64	1.76

#54	fish14	Fish	betta	5.16	1.31	3.46	1.80	5.30	1.58	2.66	1.69	2.08	1.59	4.26	1.72	3.84	1.58	3.18	2.10	3.16	1.93	4.58	1.99	3.08	1.74
#55	fish15	Fish	shark	3.68	1.57	4.50	2.18	3.66	1.62	5.86	1.41	2.46	1.53	5.48	1.47	4.58	1.72	3.20	1.99	2.42	1.75	3.90	2.20	4.70	1.85
#56	gastropod1	Gastropod	snail	4.48	1.41	5.87	1.52	3.13	1.59	1.26	0.71	1.83	1.26	4.07	1.97	3.26	1.63	4.87	2.27	4.61	2.11	3.65	1.86	2.89	1.88
#57	gastropod2	Gastropod	slug	3.53	1.54	4.88	1.90	2.31	1.56	1.78	1.37	1.84	1.25	3.80	2.09	2.67	1.70	2.35	1.85	3.00	1.96	3.00	1.83	2.94	1.92
#58	gastropod3	Gastropod	sea snail	4.19	1.57	3.90	1.95	3.37	1.78	1.71	1.13	1.52	1.11	3.73	2.10	3.10	1.61	3.08	1.95	3.37	2.03	3.33	1.88	2.83	1.84
#59	gastropod4	Gastropod	limpet	3.72	1.47	3.30	2.31	1.66	1.06	1.44	0.79	1.20	0.53	2.76	1.90	2.10	1.53	4.10	2.22	4.38	2.20	2.80	2.02	1.88	1.32
#60	gastropod5	Gastropod	common periwinkle	4.55	1.32	4.22	1.75	3.10	1.71	1.69	1.28	1.55	0.91	3.63	1.94	3.06	1.69	3.92	2.23	4.00	2.25	3.39	1.87	2.78	1.79
#61	insect1	Insect	cricket	3.77	1.61	4.00	2.26	2.38	1.51	2.02	1.23	1.90	1.40	4.23	2.04	2.92	1.71	2.10	1.79	2.15	1.96	2.96	1.89	3.17	1.93
#62	insect2	Insect	grasshopper	3.49	1.42	4.35	2.02	2.39	1.79	2.57	1.55	1.86	1.50	4.00	1.97	3.31	2.08	2.65	2.18	2.80	2.03	2.59	1.94	3.02	1.94
#63	insect3	Insect	coackroach	2.20	1.37	4.24	2.38	1.48	1.11	2.98	1.89	1.48	1.00	3.44	1.92	3.43	2.30	1.76	1.36	2.69	2.15	1.96	1.43	2.28	1.61
#64	insect4	Insect	scarab	2.75	1.57	3.67	1.80	2.20	1.48	2.80	1.66	1.39	0.70	3.69	2.17	3.27	1.87	1.67	1.40	2.65	2.10	2.53	1.81	2.57	1.72
#65	insect5	Insect	ant	3.44	1.55	4.46	2.31	2.02	1.56	2.58	1.59	1.68	1.20	3.20	1.82	2.60	1.53	1.76	1.44	2.38	1.93	2.74	1.83	2.90	1.62
#66	insect6	Insect	fly	2.15	1.25	4.75	2.30	1.40	0.72	2.77	1.76	1.38	0.86	3.40	2.00	2.79	1.74	1.49	1.20	2.06	1.93	1.85	1.45	2.53	1.80
#67	insect7	Insect	bee	3.92	2.09	4.86	2.37	2.43	1.71	4.88	1.44	1.98	1.41	4.35	2.17	3.98	2.17	1.57	1.25	2.10	1.87	3.20	2.32	3.41	2.00
#68	insect8	Insect	dragonfly	4.15	1.75	4.64	1.98	3.47	1.96	2.04	1.30	1.81	1.29	4.13	1.99	3.75	1.82	1.77	1.49	2.09	1.56	3.89	2.22	3.32	1.87
#69	insect9	Insect	ladybug	5.24	1.55	5.55	1.77	5.47	1.39	1.49	1.16	1.67	1.07	4.16	2.03	3.80	1.68	1.88	1.62	2.41	2.08	4.78	1.94	3.22	1.98
#70	insect10	Insect	butterfly	5.31	1.70	5.76	1.29	5.51	1.65	1.75	1.41	2.24	1.52	4.22	1.77	4.49	1.59	1.76	1.38	2.04	1.62	4.88	1.80	3.37	1.64
#71	insect11	Insect	moth	4.21	1.65	4.66	2.12	3.23	2.01	1.60	1.01	1.72	1.42	3.49	1.95	3.06	1.76	1.53	1.21	2.15	1.73	3.53	1.93	2.79	1.72
#72	insect12	Insect	praying mantis	3.93	1.75	4.33	2.05	2.96	1.72	2.54	1.50	1.74	1.10	3.65	2.00	3.41	1.81	2.39	1.77	2.56	1.86	3.17	1.85	3.02	1.75
#73	insect13	Insect	beetle	3.07	1.58	3.54	1.87	2.06	1.39	3.24	1.64	1.70	1.09	4.07	2.01	3.30	1.82	1.98	1.49	2.72	2.09	2.87	2.05	3.00	1.87
#74	insect14	Insect	mosquito	1.88	1.22	4.22	2.27	1.48	0.91	4.26	1.82	1.42	1.09	3.30	2.19	3.20	2.26	1.34	0.89	2.78	2.14	1.42	1.05	2.40	1.64
#75	insect15	Insect	wasp	2.84	1.88	5.02	2.28	2.35	1.55	5.27	1.43	1.61	1.10	4.45	2.15	4.10	2.19	1.69	1.42	2.20	1.84	2.71	1.96	3.25	2.00
#76	malacostraca 1	Malacostran	crab	4.11	1.46	4.92	2.26	3.15	1.77	3.55	1.58	1.68	1.12	4.04	2.00	3.49	1.89	5.34	2.21	4.70	2.28	3.42	1.92	3.06	1.76
#77	malacostraca 2	Malacostran	losbter	4.33	1.56	4.88	2.03	2.85	1.50	3.37	1.55	1.81	1.22	4.17	2.02	3.90	1.66	5.67	1.71	5.27	1.85	3.38	2.02	3.13	1.95
#78	malacostraca 3	Malacostran	shrimp	4.49	1.25	3.87	2.10	3.16	1.93	2.24	1.60	1.69	1.06	4.00	2.07	3.36	1.52	4.76	2.26	4.29	2.21	3.58	1.86	3.02	1.69
#79	malacostraca 4	Malacostran	krill	3.47	1.19	2.16	1.49	2.41	1.40	2.88	1.49	1.71	1.27	3.92	1.98	3.27	1.67	2.88	1.98	3.22	1.90	3.41	2.01	3.16	1.90
#80	malacostraca 5	Malacostran	woodlouse	3.53	1.39	3.25	1.92	2.33	1.40	2.10	1.30	1.63	1.09	3.76	2.10	2.47	1.46	1.94	1.49	2.43	1.78	2.82	1.77	2.98	1.81
#81	mammal1	Mammal	dog	5.61	1.72	5.84	1.84	5.84	1.50	3.45	1.55	4.22	1.84	6.04	1.40	5.22	2.02	1.63	1.37	1.43	1.06	5.82	1.53	5.65	1.69
#82	mammal2	Mammal	cat	5.96	1.26	6.53	0.94	6.40	0.94	3.07	1.63	4.27	1.84	6.38	0.91	5.73	1.25	2.13	1.90	1.62	1.07	6.22	1.17	5.82	1.39

#83	mammal3	Mammal	Guinea pig	5.16	1.60	5.50	1.80	5.64	1.47	2.26	1.48	2.64	1.60	4.96	1.91	4.14	1.92	2.08	1.72	1.90	1.62	5.22	1.79	4.20	1.91
#84	mammal4	Mammal	squirrel	5.69	1.22	5.31	1.63	6.16	1.08	2.49	1.35	3.57	1.92	5.82	1.35	4.92	1.51	2.18	1.86	2.10	1.71	5.55	1.62	5.04	1.52
#85	mammal5	Mammal	mouse	4.20	1.77	5.18	2.02	4.58	1.91	3.42	1.43	3.14	1.84	5.24	1.73	4.06	1.89	2.18	1.64	2.20	1.91	4.16	1.84	4.34	1.83
#86	mammal6	Mammal	pig	5.04	1.41	5.94	1.55	4.59	1.84	2.27	1.24	4.39	1.87	5.80	1.54	4.14	1.73	5.63	1.91	4.88	2.11	4.61	1.68	4.84	1.75
#87	mammal7	Mammal	cow	5.11	1.44	5.75	1.67	4.41	1.40	3.39	1.57	3.32	1.71	5.84	1.29	4.45	1.45	5.89	1.51	4.84	1.90	4.71	1.74	4.86	1.55
#88	mammal8	Mammal	rabbit	5.68	1.52	6.45	0.85	6.40	0.95	1.58	1.01	3.19	1.77	5.92	1.33	4.96	1.71	4.19	2.48	3.91	2.37	5.75	1.39	5.00	1.69
#89	mammal9	Mammal	goat	4.74	1.39	5.08	1.71	4.32	1.71	3.17	1.49	2.75	1.43	5.25	1.52	4.17	1.67	5.43	1.82	4.75	2.10	4.47	1.44	4.09	1.60
#90	mammal10	Mammal	sheep	5.36	1.41	5.78	1.57	5.12	1.49	2.26	1.50	3.36	1.77	5.64	1.41	4.42	1.34	5.02	2.05	4.60	2.09	4.76	1.67	4.66	1.70
#91	mammal11	Mammal	horse	5.60	1.25	6.24	1.19	5.84	1.31	3.06	1.53	3.92	1.78	5.98	1.48	5.38	1.31	3.10	2.07	2.34	1.73	5.86	1.31	5.76	1.41
#92	mammal12	Mammal	donkey	5.45	1.60	6.00	1.36	5.69	1.45	2.20	1.31	3.80	2.21	6.06	1.30	4.84	1.57	2.27	1.78	2.06	1.74	5.65	1.52	5.69	1.42
#93	mammal13	Mammal	gorila	4.81	1.87	5.21	1.93	4.94	1.90	4.88	1.37	6.37	1.07	6.56	0.89	5.19	1.60	1.75	1.44	1.67	1.53	5.35	1.85	6.13	1.28
#94	mammal14	Mammal	chimp	6.13	1.11	6.19	1.27	5.70	1.35	3.55	1.44	6.60	0.95	6.23	1.40	5.36	1.46	1.64	1.39	1.57	1.39	6.08	1.37	6.34	0.98
#95	mammal15	Mammal	lion	4.81	1.78	5.17	1.84	5.92	1.28	6.26	1.02	3.79	1.72	6.11	1.48	5.40	1.50	1.96	1.59	1.36	0.94	5.34	1.85	5.55	1.49
#96	mammal16	Mammal	leopard	5.21	1.51	5.04	1.60	5.73	1.66	6.04	1.28	3.63	1.83	6.06	1.33	5.35	1.56	2.35	1.97	2.06	1.84	5.52	1.83	5.79	1.56
#97	mammal17	Mammal	tiger	5.02	1.41	4.77	2.13	6.02	1.24	6.42	0.87	3.04	1.60	5.67	1.62	4.96	1.92	1.98	1.49	1.67	1.31	5.37	1.66	5.17	1.59
#98	mammal18	Mammal	lynx	5.04	1.59	4.47	1.80	5.67	1.44	5.41	1.47	3.04	1.46	5.88	1.29	4.76	1.88	1.98	1.57	1.65	1.26	5.18	1.83	5.27	1.64
#99	mammal19	Mammal	wolf	4.46	1.58	5.44	1.69	5.38	1.35	5.52	1.32	3.92	1.84	6.10	1.21	4.67	1.77	1.92	1.49	1.90	1.39	4.92	2.01	5.54	1.34
#100	mammal20	Mammal	kangaroo	5.25	1.44	4.84	1.72	5.66	1.37	4.04	1.41	3.91	1.56	5.59	1.52	4.73	1.68	2.77	2.01	2.43	1.84	5.54	1.25	5.02	1.52
#101	mammal21	Mammal	koala	5.96	1.23	5.40	1.69	6.40	1.23	2.22	1.33	3.76	1.82	5.94	1.45	4.86	1.81	1.40	0.95	1.50	1.22	6.02	1.44	5.68	1.42
#102	mammal22	Mammal	bear	4.75	1.44	4.87	1.79	5.66	1.27	5.64	1.58	4.25	1.62	5.89	1.44	4.47	1.76	2.45	2.00	2.00	1.62	5.47	1.68	5.25	1.69
#103	mammal23	Mammal	panda	5.90	1.33	5.35	1.81	6.35	1.17	3.88	1.40	4.40	1.61	6.13	1.33	5.15	1.50	2.08	1.61	1.83	1.38	5.98	1.58	5.69	1.38
#104	mammal24	Mammal	deer	5.51	1.06	5.13	1.61	6.06	1.11	3.15	1.37	3.15	1.65	5.74	1.31	4.62	1.66	3.64	2.06	2.74	1.81	5.55	1.49	5.15	1.49
#105	mammal25	Mammal	zebra	5.76	1.28	6.02	1.25	5.86	1.21	3.06	1.53	3.04	1.76	6.02	1.22	4.82	1.52	2.45	1.81	1.90	1.53	5.57	1.65	5.31	1.54
#106	mammal26	Mammal	boar	4.55	1.38	5.24	1.85	3.61	1.60	4.37	1.77	3.88	1.87	5.53	1.70	3.78	1.60	5.35	1.94	4.53	1.94	4.16	1.70	4.69	1.78
#107	mammal27	Mammal	fox	4.92	1.58	5.20	1.96	5.94	1.28	3.90	1.64	3.47	1.78	5.80	1.47	4.61	1.41	2.06	1.71	2.02	1.79	5.29	1.59	5.27	1.78
#108	mammal28	Mammal	bat	3.57	1.69	3.74	2.03	3.25	2.02	3.43	1.54	2.70	1.67	4.42	2.02	3.17	1.55	2.00	1.68	2.08	1.66	3.68	2.14	3.91	1.89
#109	mammal29	Mammal	camel	5.12	1.30	4.84	1.81	4.64	1.48	2.88	1.41	2.94	1.70	5.54	1.64	4.32	1.53	2.72	1.93	2.52	1.78	5.16	1.53	5.16	1.49
#110	mammal30	Mammal	giraffe	5.73	1.67	5.56	1.61	5.92	1.43	2.81	1.62	3.40	1.88	6.06	1.31	4.96	1.75	2.00	1.53	1.73	1.44	5.83	1.43	5.50	1.41
#111	mammal31	Mammal	elephant	5.92	1.32	5.84	1.61	5.82	1.33	3.69	1.83	4.04	2.08	6.06	1.39	5.22	1.52	1.65	1.38	1.67	1.41	5.82	1.69	5.82	1.47
#112	mammal32	Mammal	whale	5.16	1.58	4.82	1.92	4.80	1.61	4.00	1.60	3.20	1.89	5.63	1.48	4.35	1.63	2.59	1.91	2.04	1.54	4.65	1.91	5.25	1.95

#113	mammal33	Mammal	sealion	5.47	1.57	5.33	1.58	5.80	1.18	3.29	1.64	3.22	1.81	5.37	1.83	4.59	1.73	2.04	1.59	1.98	1.77	5.45	1.79	5.08	1.90
#114	mammal34	Mammal	sea	5.67	1.19	5.20	1.52	5.98	1.32	2.96	1.39	3.41	1.60	6.22	1.05	4.78	1.53	2.45	1.94	2.22	1.90	5.71	1.45	5.25	1.53
#115	mammal35	Mammal	dolphin	6.17	1.13	6.17	1.11	6.51	0.78	2.66	1.54	4.57	1.83	6.51	0.88	5.51	1.37	1.94	1.58	1.72	1.53	6.40	0.83	6.21	1.04
#116	reptile1	Reptile	iguana	4.16	1.52	4.36	1.85	3.48	1.95	3.18	1.91	2.36	1.55	4.86	1.81	3.62	1.74	1.70	1.36	1.88	1.49	4.06	1.90	3.96	1.70
#117	reptile2	Reptile	snake	2.34	1.71	3.87	2.39	2.28	1.71	6.06	1.36	1.51	1.01	3.85	2.06	3.74	2.31	2.08	1.67	2.23	1.76	2.58	1.98	3.66	2.00
#118	reptile3	Reptile	turtle	5.41	1.58	5.33	1.97	4.92	1.96	2.02	1.41	2.37	1.60	5.37	1.80	4.00	1.83	1.86	1.60	1.65	1.49	5.24	2.07	4.75	1.97
#119	reptile4	Reptile	crocodile	2.83	1.61	4.42	2.08	2.60	1.74	6.45	0.99	2.28	1.45	5.09	1.47	4.58	2.01	3.45	1.98	3.34	2.11	3.21	2.01	4.30	1.74
#120	reptile5	Reptile	chameleon	5.00	1.54	4.84	1.70	5.06	1.84	2.43	1.63	2.33	1.65	5.12	1.70	4.12	1.98	1.94	1.78	1.96	1.77	4.92	1.84	4.12	1.60

Supplementary Table B1. Meat images and descriptive captions from Article 3.

Chicken liver pate
Origin: Northern and central European cuisines.
Preparation/Cooking: Chic ken livers are grinded and mixed with butter, spices, and herbs.

Dobrada
Origin: Portuguese dish.
Preparation/Cooking: Made from a cow's flat white stomach lining and usually stewed.

Kangaroo biltong
Origin: Australian origin.
Preparation/Cooking: Kangaroo meat is dried and can be added to soups, stews, and salads.

Snake
Origin: Originally found in Southeast Asian cuisines.
Preparation/Cooking: Snakes are usually skinned, cut into pieces, and then fried.

Alligator meat
Origin: Common in various cuisines of the Southern United States.
Preparation/Cooking: Alligator meat can be eaten fried or grilled.

Insect protein powder
Origin: A food developed in several countries around the world.
Preparation/Cooking: Insects are dried and grinded into powder and commonly used on smoothies, pasta, bread, cookies.

Butelo
Origin: Produced in Portugal.
Preparation/Cooking: Smoked sausage made with pork meat and pork loin from a local breed.

Beef burger
Origin: Originally from the USA.
Preparation/Cooking: Meat from cows is minced and combined with garlic, onions, salt and pepper, then formed into patties.

Sausage
Origin: Originally from Mesopotamia, now eaten around the world.
Preparation/Cooking: It is a meat mixture often stuffed in a casing, usually grilled or fried.

Sushi
Origin: Japanese dish.
Preparation/Cooking: Sushi is a dish traditionally made with raw fish or other seafood (e.g., eel, crab). Sushi rolls are prepared with sweetened, vinegared rice, and may include other ingredients (e.g., vegetables).

Fish fillet
Origin: Eaten in most countries.
Preparation/Cooking: The flesh of a fish which has been cut or sliced away from the bone, usually grilled.

Pork steak
Origin: Eaten around the world.
Preparation/Cooking: Pork steak is cut from a pig's shoulder and usually grilled.

Chicken steak
Origin: Associated with the Southern cuisine of the United States.
Preparation/Cooking: A cut of meat usually thin and selected from the round is breaded and fried.

Chicken nuggets
Origin: Originally from the USA and is now eaten around the world.
Preparation/Cooking: Nuggets are usually made from chicken meat that is breaded or battered, then deep-fried or baked.

Octopus
Origin: Eaten in many countries, mostly in Asian and European countries
Preparation/Cooking: Usually grilled.

Squid
Origin: Eaten from Japan to Portugal, mainly in Spain, Italy, China, Republic of Korea.
Preparation/Cooking: Usually grilled or fried.

Escargot
Origin: Part of the European cuisine, particularly France.
Preparation/Cooking: Snails are eaten whole and cooked.

Crocodile
Origin: It has been used in various cuisines of the Southern United States and has become a very popular meat in Australia.
Preparation/Cooking: Usually fried or grilled.

Scorpion
Origin: Vietnam and certain regions of China.
Preparation/Cooking: Eaten deep-fried from claw-to-tail.

Insects
Origin: Cultures in Central and South America, Africa, Asia, Australia, and New Zealand.
Preparation/Cooking: Insects like grasshoppers and crickets. Usually fried.

Snake
Origin: Generally eaten in Southeast Asian countries.
Preparation/Cooking: The skin is removed, and the snake meat is usually fried or used to make soup.

Turkey
Origin: A popular poultry dish, especially in North America.
Preparation/Cooking: Usually roasted.

Chicken
Origin: Eaten worldwide.
Preparation/Cooking: It can be grilled, breaded or deep-fried.

Hog roast
Origin: Philippines, Puerto Rico, Cuba, United States, Brazil and UK.
Preparation/Cooking: The whole pig is roasted over an open fire or wood fired oven.

Lobster
Origin: Eaten around the world.
Preparation/Cooking: It is commonly served boiled or steamed in the shell.

Shrimp
Origin: Eaten worldwide in Asian cuisines, North America, and Europe.
Preparation/Cooking: Common methods of preparation include baking, boiling, frying, and grilling.

Crappit heids
Origin: Scottish dish.
Preparation/Cooking: Made with (usually haddock or cod) stuffed fish heads.

Fish
Origin: Common dish found in countries from Asia and Europe.
Preparation/Cooking: The whole fish is usually grilled.

Supplementary Table B2. Number of associations mentioned in each category for each product, from Article 3.

	Low Familiarity										High Familiarity									
	15 - Octopus		**16 - Squid**		**17 - Escargot**		**18 - Crocodile**		**19 - Scorpion**		**22 - Turkey**		**23 - Chicken**		**26 - Shrimp**		**28 - Fish**			
	Negatively valenced	127	Negatively valenced	105	Negatively valenced	126	Negatively valenced	151	Negatively valenced	153	Positively valenced	123	Animal identification	105	Positively valenced	95	Animal identification	136		
	Animal identification	51	Positively valenced	83	Animal identification	67	Ethics	58	Animal identification	58	Animal identification	27	Positively valenced	103	Animal identification	92	Positively valenced	81		
	Positively valenced	38	Animal identification	68	Sensory attributes	67	Animal identification	57			Sensory attributes	26	Negatively valenced	49	Negatively valenced	61	Negatively valenced	72		
High Resemblance			Sensory attributes	37	Positively valenced	29							Sensory attributes	25						
	20 - Insects		**21 - Snake**		**24 - Hog roast**		**25 - Lobster**		**27 - Crappit heids**											
	Negatively valenced	170	Negatively valenced	179	Negatively valenced	146	Animal identification	103	Negatively valenced	192										
	Animal identification	76	Animal identification	75	Animal identification	59	Negatively valenced	57	Animal identification	85										
	Sensory attributes	30	Sensory attributes	52	Ethics	58	Positively valenced	54												
							Ethics	37												
	2 - Dobrada		**3 - Kangaroo bites**		**4 - Snake bites**		**5 - Alligator bites**		**7 - Butelo**		**1 - Pate**		**8 - Beef burger**		**9 - Sausage**		**10 - Sushi**			
	Negatively valenced	79	Negatively valenced	121	Positively valenced	75	Positively valenced	81	Negatively valenced	111	Negatively valenced	74	Positively valenced	147	Positively valenced	141	Positively valenced	103		
	Positively valenced	58	Sensory attributes	71	Negatively valenced	63	Health	50			Positively valenced	67					Negatively valenced	62		
	Health	25			Sensory attributes	35	Negatively valenced	45			Sensory attributes	25					Animal identification	33		
	Sensory attributes	24			Health	25	Sensory attributes	26												
Low Resemblance											**11 - Fish fillet**		**12 - Pork steak**		**13 - Chicken steak**		**14 - Chicken nuggets**			
											Positively valenced	15 2	Positively valenced	124	Animal identification	98	Positively valenced	50		
											Animal identification	12 8	Negatively valenced	36	Negatively valenced	89	Negatively valenced	36		
											Health	26			Positively valenced	86	Animal identification	32		
											Sensory attributes	25			Sensory attributes	38	Sensory attributes	24		

Supplementary Table B3. Evaluative dimensions ratings per meat product, from Article 3.

		Familiarity				Animal resemblance				Appetite			
		M	*SD*	*95% IC for Mean*		*M*	*SD*	*95% IC for Mean*		*M*	*SD*	*95% IC for Mean*	
				LB	*UP*			*LB*	*UP*			*LB*	*UP*
Cluster 1	Octopus	2.28	1.46	2.09	2.47	5.30	1.48	5.11	5.49	3.05	1.85	2.81	3.29
	Squid	2.59	1.54	2.39	2.79	5.39	1.50	5.19	5.58	3.36	1.94	3.11	3.61
	Snail	1.86	1.11	1.71	2.00	6.28	1.27	6.11	6.44	2.56	1.79	2.33	2.79
	Crocodile	1.10	0.43	1.04	1.16	6.69	1.07	6.55	6.83	2.09	1.54	1.89	2.29
	Scorpion	1.10	0.55	1.03	1.17	6.75	1.03	6.61	6.88	1.58	1.08	1.44	1.72
	Insects	1.21	0.69	1.12	1.30	6.61	1.24	6.45	6.77	1.90	1.41	1.72	2.09
	Snake	1.09	0.47	1.03	1.15	6.01	1.53	5.81	6.21	1.63	1.23	1.47	1.79
	Hog	2.47	1.43	2.29	2.66	6.71	0.80	6.61	6.82	3.36	2.07	3.09	3.63
	Lobster	3.06	1.60	2.85	3.26	6.73	0.82	6.62	6.84	4.06	2.03	3.80	4.32
	Crappit	1.24	0.66	1.16	1.33	6.12	1.39	5.94	6.30	1.79	1.21	1.63	1.94
	Total	1.80	0.60	1.72	1.88	6.26	0.80	6.15	6.36	2.54	1.08	2.40	2.68
Cluster 2	Turkey	4.66	1.45	4.47	4.85	5.65	1.24	5.49	5.81	5.57	1.39	5.39	5.75
	Chicken	6.28	1.07	6.14	6.41	5.71	1.25	5.54	5.87	5.90	1.39	5.71	6.08
	Shrimp	4.21	1.81	3.97	4.44	6.42	1.04	6.29	6.56	4.49	2.10	4.22	4.76
	Fish	4.89	1.69	4.67	5.11	6.82	0.50	6.75	6.88	4.64	1.90	4.39	4.88
	Total	5.01	1.06	4.87	5.15	6.15	0.74	6.05	6.25	5.15	1.27	4.98	5.31
Cluster 3	Dobrada	1.21	0.80	1.11	1.32	1.38	0.96	1.26	1.51	2.10	1.39	1.92	2.28
	Biltong	1.14	0.59	1.06	1.21	1.24	0.70	1.15	1.33	2.76	1.80	2.52	2.99
	Fried snake	1.07	0.48	1.01	1.13	1.33	0.78	1.23	1.43	2.40	1.58	2.19	2.60
	Alligator	1.13	0.53	1.06	1.20	1.34	0.86	1.22	1.45	3.20	1.80	2.97	3.43
	Insect powder	1.17	0.75	1.07	1.26	1.07	0.47	1.00	1.13	2.81	1.87	2.56	3.05
	Butelo	1.24	0.67	1.15	1.33	2.17	1.43	1.99	2.36	3.73	1.68	3.51	3.95
	Total	1.16	0.34	1.11	1.20	1.42	0.56	1.35	1.49	2.83	1.24	2.67	2.99
Cluster 4	Pate	3.60	1.75	3.37	3.83	1.19	0.75	1.09	1.29	3.95	1.96	3.69	4.20
	Burger	5.66	1.41	5.48	5.85	1.66	1.28	1.49	1.82	5.67	1.50	5.47	5.86
	Sausage	5.76	1.54	5.56	5.96	1.56	1.17	1.41	1.71	5.61	1.67	5.39	5.82
	Sushi	4.15	1.79	3.92	4.38	1.52	1.02	1.39	1.65	4.76	2.22	4.47	5.05
	Fillet	5.66	1.38	5.48	5.84	2.36	1.55	2.16	2.56	5.83	1.42	5.65	6.02
	Pork steak	4.72	1.62	4.51	4.93	1.80	1.18	1.65	1.96	5.08	1.62	4.87	5.29
	Chicken steak	5.63	1.50	5.44	5.83	1.90	1.24	1.74	2.06	5.75	1.37	5.57	5.93
	Nuggets	5.13	1.60	4.92	5.34	1.38	1.02	1.25	1.51	5.10	1.68	4.88	5.32
	Total	5.04	1.06	4.90	5.18	1.67	0.86	1.56	1.78	5.22	1.08	5.08	5.36

Supplementary Data B4. Participant-level analysis.

Correlation analysis revealed that both animal resemblance, $r(228) = .23$, $p < .001$, and familiarity, $r(228) = .45$, $p < .001$, were positively correlated with appetite. Moreover, animal resemblance and familiarity were also positively correlated, $r(228) = .28$, $p < .001$, which means that participants who tended to be familiar with meat products also tended to think the products resembled the animal source. Regression analysis revealed that familiarity was a significant independent predictor of appetite, $\beta = .41$, $t(226) = 6.72$, $p < .001$; that is, participants who tended to be familiar with meat products tended to rate them more appetizing. Animal resemblance did not emerge as a significant independent predictor of appetite at the participant level, $\beta = .11$, $t(226) = 1.79$, $p = .075$; that is, participants who tended to see meat products resembling animals did not tend to rate meat products as more or less appetizing. The overall model was significant, $F(2, 226) = 30.00$, $p < .001$, and explained 21% of the variation in appetite. Thus, similar to the product-level analysis, the participant-level analysis revealed a robust relationship between familiarity with meat and appetite; however, the relationship between animal resemblance and appetite was weaker.

Supplementary Table C1. Frequency, proportion and discrimination measures for each category, from Article 4.

(Task) Food category	Dimensions [a]			
	n (%)		1	2
(Associations to) Red Meat				
Taste/Pleasure	72	31.0	**.231**	.023
Animal Ethics	45	19.4	**.372**	.059
Unhealthy/Disease	44	19.0	.001	**.208**
Disgust	21	9.1	**.208**	.019
Wellbeing	20	8.6	**.087**	.041
Nutrients	16	6.9	.013	**.117**
Reduction/Moderation	14	6.0	.007	.036
(Associations to) White Meat				
Healthy	73	36.1	**.143**	**.193**
Taste/Pleasure	54	26.7	**.090**	**.143**
Animal Ethics	25	12.4	**.451**	.001
Wellbeing	18	8.9	.031	.057
Nutrients	17	8.4	.018	**.078**
Diet	15	7.4	.058	**.108**
(Associations to) Fish/Seafood				
Taste/Pleasure	69	25.4	**.113**	**.140**
Healthy	46	16.9	**.134**	**.148**
Sea/Beach/Summer	43	15.8	.025	.019
Wellbeing	31	11.4	.038	**.197**
Nutrients	19	7.0	.005	**.179**
Expensive	17	6.3	.006	.014
Freshness/Lightness	17	6.3	.052	.010
Animal Ethics	15	5.5	**.548**	.001
Disgust	15	5.5	.027	.005
(Associations to) Legumes				
Healthy	85	39.2	.011	**.109**
Pleasant	58	26.7	.041	**.083**
Wellbeing	34	15.7	.002	.047
Nutrients	25	11.5	.031	**.098**
Disgust	15	6.9	.040	.009
(Associations to) Tofu				
Healthy	57	27.7	.045	**.325**
Vegetarianism/Veganism	32	15.5	.058	**.115**
Disgust	31	15.0	.060	.018
Taste/Pleasure	26	12.6	**.261**	.000
Unfamiliar	23	11.2	.020	**.073**
Tasteless	19	9.2	.064	.000
Alternative	18	8.7	.000	.038
(Associations to) Seitan				
Healthy	48	23.6	.012	**.197**
Unfamiliar	34	16.7	.046	**.077**
Vegetarianism/Veganism	29	14.3	.069	**.198**
Taste/Pleasure	25	12.3	**.214**	.004
Disgust	23	11.3	.038	.007
Alternative	16	7.9	.056	.039
Wellbeing	14	6.9	.072	.003
Curiosity	14	6.9	.035	.029
(Associations to) Insects				
Disgust	92	42.2	.000	.003
Unfamiliar	32	14.7	.016	.005
Other cultures	28	12.8	.008	**.070**
Unthinkable	24	11.0	.030	.027

Curiosity	21	9.6	.019	.000
Texture/Taste	21	9.6	.004	.009
(Associations to) Lab-grown Meat				
Unfamiliar	46	19.9	.010	.001
Artificial	46	19.9	.000	**.164**
Disgust	31	13.4	.000	.003
Unhealty/Disease	31	13.4	.008	**.072**
Disapproval	25	10.8	.035	.003
Future/Alternative	20	8.7	.041	.005
Curiosity	18	7.8	.006	**.069**
Texture/Taste	14	6.1	.011	.053

Note. [a]Values in bold are above inertia (variance mean value) for each dimension.
Factor 1 tended to involve affect and hedonic features of a product, such as its tastiness or relevance for animal ethics. Factor 2 tended to involve more health and nourishment related features, for example, the health impact or nutritional value of a product.

Table C1 shows the most frequent categories that emerged from the participants' responses to each food category. Red meat was mostly associated with hedonic feelings (Taste/Pleasure) and Wellbeing. However, it was also associated with animal suffering and lack of ethics (Animal Ethics), with Disease (e.g., cancer), perceived as Unhealthy and associated with negative and repulsive feelings (Disgust). Red meat was also seen as a source of Nutrients. Some participants also mentioned efforts to reduce or moderate their red meat consumption (Reduction/Moderation). Regarding white meat, participants often mentioned this was a Healthy option, but it was also associated with Wellbeing and enjoyment (Taste/Pleasure). Some participants also linked white meat to Animal Ethics. White meat also emerged as a good source of Nutrients and associated it with Diet(ing). Fish and seafood were mostly associated with positive hedonic feelings (Taste/Pleasure), Wellbeing, Health and the Sea/Beach/Summer. Freshness and Lightness were also common associations. This food category was also considered rich with Nutrients and Expensive. Like all animal products we sampled, references to Animal Ethics also emerged, and feelings of Disgust.

Concerning plant-based products, legumes were considered Healthy, Pleasant and a source of Nutrients and Wellbeing. Some participants revealed their Disgust about eating legumes. Tofu was mostly considered Healthy and linked to Vegetarianism/Veganism. Disgust and lack of taste (Tasteless) emerged in relation to tofu, yet some participants associated it with Taste/Pleasure. Tofu was an Unfamiliar product for some participants, and considered a food alternative to meat. Perceptions about seitan revealed a similar pattern of categories as tofu, that is, it was perceived as Healthy, Unfamiliar, associated with Vegetarianism/Veganism, and an alternative to meat. It was also associated with hedonic feelings (Taste/Pleasure) and

Wellbeing. Different from tofu, seitan was not associated with Disgust to any significant degree. Although it was an Unfamiliar product, participants expressed Curiosity about it.

Insects were mostly viewed with Disgust. Participants also expressed their Unfamiliar(ity) with this category and frequently associated insects with other cultures (e.g., Asian cultures). Whereas some considered it Unthinkable to eat, others expressed their Curiosity and willingness to try these products and wondered about their Texture/Taste (e.g., crunchy). Lastly, lab-grown meat was mostly viewed as Unfamiliar and Artificial. Participants also expressed their Disgust towards this product and associated it with Disease/Unhealthy. Some mentioned their Disapproval of its use. Others considered it a Future/Alternative product (e.g., "the future"; "alternative"). Similar to insects, some participants also expressed their Curiosity and willingness to try these products and made reference to its Texture/Taste (e.g., "weird texture"; "not very tasty").

Overall, the content of the answers provided by the participants pointed towards the existence of diverse patterns or profiles of consumers in relation to their perceptions towards meat and meat alternatives. The existence of divergent profiles was subsequently supported and revealed in the MCA.