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Social Psychology

The Meat Ambivalence Questionnaire: Assessing Domain-Specific Meat-Related Conflict in Omnivores and Veg*ans

Benjamin Buttlar[1][a], Shiva Pauer[2], Matt B Ruby[3], Monique Chambon[2,4], Ann-Kathrin Jimenez-Klingberg[1], Jasmin Scherf[1], Vsevolod Scherrer[1]

[1] University of Trier, Trier, Germany, [2] University of Amsterdam, Amsterdam, the Netherlands, [3] School of Psychology and Public Health, La Trobe University, Wodonga, Australia, [4] National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands

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People are increasingly concerned about how meat affects the environment, human health, and animal welfare, yet eating and enjoying meat remains a norm. Unsurprisingly, many people are ambivalent about meat—evaluating it as both positive and negative. Here, we propose that meat-related conflict is multidimensional and depends on people's dietary group: Omnivores' felt ambivalence relates to multiple negative associations that oppose a predominantly positive attitude towards meat, and veg*ans' ambivalence relates to various positive associations that oppose a predominantly negative attitude. A qualitative study (N = 235; German) revealed that omnivores and veg*ans experience meat-related ambivalence due to associations with animals, sociability, sustainability, health, and sensory experiences. To quantify felt ambivalence in these domains, we developed the Meat Ambivalence Questionnaire (MAQ). We validated the MAQ in four pre-registered studies using self-report and behavioral data (N = 3,485; German, UK, representative US). Both omnivores and veg*ans reported meat-related ambivalence, but with differences across domains and their consequences for meat consumption. Specifically, ambivalence was associated with less meat consumption in omnivores (especially sensory-/animal-based ambivalence) and more meat consumption in veg*ans (especially sensory-/socially-based ambivalence). Network analyses shed further light on the nomological net of the MAQ while controlling for a comprehensive set of determinants of meat consumption. By introducing the MAQ, we hope to provide researchers with a tool to better understand how ambivalence accompanies behavior change and maintenance.

Introduction

People are conflicted about eating meat. On the one hand, people value meat because of its nutritional density, taste, or the cultural traditions associated with it (Leroy & Praet, 2015; Rosenfeld & Tomiyama, 2019). On the other hand, many people also realize the downsides of eating meat, particularly concerning animal welfare, human health, and the environment (Godfray et al., 2018; Joy, 2011; Willett et al., 2019). Meat consumption therefore is a prime example of a behavior that makes people experience ambivalence (Rozin, 2007).

Ambivalence arises if people hold two opposing evaluations towards an attitude object at the same time (van Harreveld et al., 2015). Ambivalence can be distinguished into two types: Potential ambivalence refers to the degree to which an attitudinal structure includes both positive and negative evaluations of an attitude object; and felt ambivalence refers to the meta-cognitive awareness of ambivalence that arises when opposing evaluations become simultaneously accessible (Priester & Petty, 1996; van Harreveld et al., 2015).

Thus, omnivores and veg*ans (i.e., vegetarians and vegans) may sit on the fence if they are aware of the upsides and downsides of eating meat at the same time. Indeed, research shows that not only omnivores (who eat meat) but also veg*ans (who eschew meat) are prone to experiencing ambivalence (Buttlar & Walther, 2018). Omnivores appreciate the taste of meat as well as its nutritional and social benefits; at the same time, they see its negative impacts, such as those pertaining to animal welfare, the environment, and human health (Berndsen & van der Pligt, 2004; Pauer et al., 2022; Povey et al., 2001). Consequently, 66.8% of omnivores reported experiencing at least some conflict-

a Correspondence should be addressed to buttlar@uni-trier.de

ing thoughts and/or feelings regarding meat consumption in a representative German sample (i.e., felt ambivalence; Pauer et al., 2022). Although veg*ans experience less ambivalence towards meat than omnivores on average (Buttlar & Walther, 2018), we argue that their ambivalence is constituted in a similar manner: Veg*ans are motivated to follow their diet due to negative associations arising from animal welfare, environmental, and health issues associated with meat (Hopwood et al., 2020); still, many veg*ans are aware of the positive aspects of meat, considering it to be tasty and/or a central part of social life (Rosenfeld & Tomiyama, 2019).

The Downstream Effects of Meat-Ambivalence

Experiencing felt ambivalence is discomforting (Moberly & Dickson, 2018; van Harreveld, Rutjens, et al., 2009). People cope with ambivalence in multifaceted ways to alleviate the discomfort and reestablish cognitive consistency (van Harreveld, van der Pligt, et al., 2009). People who have to make a decision based on an ambivalent attitude object, for instance, may seek new information to regain a univalent attitude and more easily come to a decision (Itzchakov et al., 2020; Nordgren et al., 2006), they can deny responsibility for making the decision (van Harreveld, van der Pligt, et al., 2009), they can postpone their decision (Nohlen, 2015), or they can abstain from the ambivalent attitude object more generally (Pauer et al., 2022).

For omnivores, research on meat-related ambivalence indicates that ambivalence is indeed associated with reduced meat consumption (Amiot et al., 2020; Berndsen & van der Pligt, 2004; Pauer et al., 2022). To explain this association, the model of ambivalence-motivated meat reduction (Pauer et al., 2022) proposes that stable ambivalent attitudes motivate people to avert the recurrence of aversive experiences of meat-related ambivalence through meat avoidance. Specifically, Pauer and colleagues (2022) found that people perceive meat avoidance as an effective way to avert meat ambivalence; thus, people may seek information that facilitates successful behavioral change.[1]

There is less research on meat ambivalence among veg*ans, but it can be argued that ambivalence is associated with increased meat consumption. We suggest that dietary violations or even a reversal back to an omnivorous diet are associated with felt ambivalence. In fact, current vegetarians hold less positive attitudes toward meat than former vegetarians; however, both groups equally hold negative attitudes toward meat (Barr & Chapman, 2002). Moreover, a recent study showed that veg*ans who experience more disgust towards meat experience less meat-related ambivalence (Buttlar & Walther, 2022). Thus, meat-related disgust is also considered a safeguard that helps veg*ans adhere to their diets more strictly (Rosenfeld, 2019a).

The Multi-Dimensionality of Meat-Related Ambivalence

While the associations that omnivores and veg*ans have towards meat might be similar, we argue that the origins of people's ambivalence depend on their dietary groups (Buttlar et al., 2022). Omnivores hold rather favorable attitudes toward meat while veg*ans hold rather unfavorable attitudes toward meat (Barr & Chapman, 2002; Buttlar & Walther, 2018). Thus, it is either negative (omnivores) or positive (veg*ans) associations that conflict with people's dominant attitude towards meat (Priester & Petty, 1996). For omnivores, ambivalence consequently implies a deviation from a univalent positive attitude towards meat. In line with this reasoning, research demonstrates that ambivalent omnivores more frequently hold negative attitudes toward meat compared to less ambivalent omnivores, yet, both groups similarly acknowledge the positive aspects of meat, such as its pleasant taste (Berndsen & van der Pligt, 2004). For veg*ans, however, ambivalence implies a deviation from a univalent negative attitude. While there is less research on veg*ans, some findings suggest that veg*ans who are less disgusted by meat (thus like the taste more) are more ambivalent towards it (Buttlar & Walther, 2022). The origin of meat-related ambivalence may thus depend on omnivores' and veg*ans' predominant attitudes. We argue that this explains why ambivalence is associated with decreased meat consumption in omnivores and more meat consumption in veg*ans: Ambivalence reduces the association between people's predominant attitude and their behavior.

However, the experience of meat-related ambivalence might differ by the dietary group not only in terms of the valence of conflicting evaluations but also in terms of the domain. Considering the different positive and negative associations that people have toward eating meat, we argue that meat-related ambivalence is multidimensional. For omnivores, ambivalence might be most relevant in domains that revolve around the common negative aspects of meat consumption such as the impact on the environment, health, and animal welfare (Hopwood et al., 2020). Indeed, research by Berndsen and van der Pligt (2004) suggests that these three aspects are particularly relevant in the emergence of ambivalence in omnivores. For veg*ans, ambivalence might occur in other domains that concern positive aspects pertaining to meat, such as its social role, taste, nutrients, or naturalness (Hopwood, Piazza, et al., 2021). This assertion is indirectly supported by research revealing that veg*ans who violated their diet are particularly motivated by the desire to make a social situation more comfortable or to enjoy the taste of meat (Rosenfeld & Tomiyama, 2019). Notably, this does not suggest that the domains are mutu-

1 In addition, one study found that ambivalent omnivores use more moral reasoning strategies, for instance, by attributing less mental and emotional capacities to animals (Buttlar & Walther, 2018). This latter study was however conducted with the mouse-tracking paradigm where people might also experience dissonance because this task requires them to make decisions while experiencing conflict (Buttlar et al., 2023).

ally exclusive for omnivores and veg*ans. Research by Barr and Chapman (2002) suggests, for instance, that veg*ans might experience ambivalence in the domain of health arising from positive associations with meat (e.g., "meat contains important nutrients") while omnivores might experience ambivalence in the same domain due to negative associations with meat (e.g., "meat contains toxins/antibiotics"). Thus, the origins of meat-related ambivalence depend on people's dietary groups, but ambivalence can be experienced in similar domains.

We argue that the domain of meat-related conflict determines how people try to resolve the ambivalence—and to fully understand the downstream consequences of meat-related ambivalence, we need to acknowledge the valence of the conflicting associations and the domains of conflict. For omnivores, research by Berndsen and van der Pligt (2004), for instance, suggests that negative behavioral beliefs about moral issues (pertaining mostly to animal welfare issues) are more strongly associated with ambivalent attitudes than environmental or health beliefs. For veg*ans, it has similarly been shown that moral and pro-social motivations (e.g., animal and environmental reasons) but not personal reasons to eschew meat (e.g., health reasons) are associated with less ambivalence towards meat (Buttlar et al., 2022). Due to these effects on ambivalence, Berndsen and van der Pligt (2004) argue that moral considerations regarding animal welfare are one of the most promising ways to motivate omnivores to change their dietary behavior. To understand how meat-related ambivalence is associated with meat consumption and other downstream consequences in omnivores but also veg*ans, it is therefore necessary to account for its multidimensionality.

Measuring Multi-Dimensional Ambivalence

Unfortunately, ambivalence research has so far been conducted with measures that cannot account for the origins of (meat-related) ambivalence. Prevailing self-report measures of potential and felt ambivalence only measure generalized conflict (Kaplan, 1972; Priester & Petty, 1996). To assess potential ambivalence towards meat, researchers usually compute an index of people's positive and negative evaluations asking for their "positive evaluations independent of their negative evaluations of meat" and vice versa (e.g., Povey et al., 2001). To assess felt ambivalence, researchers ask whether people "feel torn about the two sides of eating meat" (e.g., Berndsen & van der Pligt, 2004) or whether they experience "conflict", "indecision", or "mixed reactions" (e.g., Pauer et al., 2022). Thereby, these measures remain agnostic to the origin of meat-related ambivalence. Having a measure of domain-specific ambivalence would thus help to understand how ambivalence evolves and how it is associated with downstream consequences such as information seeking and meat consumption.

Moreover, measures of meat-related ambivalence should also be able to measure conflict experienced by veg*ans because ambivalence in veg*ans might help to understand why people who try to eschew meat sometimes violate their diets (cf. Buttlar & Walther, 2022). Yet, meat-related ambivalence has mostly been assessed via self-reports in omnivores (e.g., Berndsen & van der Pligt, 2004; Pauer et al., 2022). It remains unknown whether veg*ans interpret these questions in the same way as omnivores. For instance, Povey et al. (2001) demonstrated that omnivores and veg*ans hold widely different positive and negative beliefs about meat-based diets. Thus, generic questions on whether people "feel torn about the two sides of eating meat" (Berndsen & van der Pligt, 2004) might be understood differently by veg*ans than by omnivores. To circumvent such issues, one could assess meat-related ambivalence towards specific meat dishes. This has been done, for instance, in the mouse-tracking paradigm which assesses felt ambivalence from behavior (Buttlar & Walther, 2018). In the mouse-tracking paradigm, people rate different pictures as positive or negative. During this evaluation, people's mouse movements including the pull towards the non-chosen option are measured (Schneider et al., 2015). This way, mouse-tracking was used to assess meat-related ambivalence in omnivores and veg*ans (Buttlar & Walther, 2018). While evaluating ambivalence towards pictures of different meat-based dishes circumvents some of the issues of comparability in interpretation by omnivores and veg*ans, such measures still do not convey information about the origin of ambivalence.

The Present Investigation

In the present investigation, we aimed to provide a measure of meat-related conflict and designed and validated a questionnaire to measure domain-specific felt ambivalence towards meat in omnivores and veg*ans. Thereby, we aimed to demonstrate that meat-related conflict is multidimensional and depends on people's dietary groups. Specifically, we hypothesized that meat-related ambivalence can be assessed in different domains that arise due to different positive and negative associations towards meat. Moreover, we hypothesized that omnivores experience more meat-related ambivalence than veg*ans, but we aimed to explore whether this experience varies depending on the domain of the ambivalence. Lastly, we expected that meat-related ambivalence would be negatively associated with meat consumption in omnivores and positively associated with meat consumption (and negatively to dietary strictness) in veg*ans.

To test these hypotheses, we categorize people based on the central question at hand: Do they identify as omnivores or veg*ans? We define omnivores as people who regularly eat meat and label themselves as a meat eater or flexitarian (i.e., meat reducer); we define veg*ans as people who more generally eschew meat and label themselves as a vegetarian or vegan (De Groeve, 2021). To identify common origins of meat-related ambivalence, we then conducted a qualitative online survey among omnivores and veg*ans (N = 235), asking whether and why they experience conflict towards meat, and in which situations these conflicts arise. Thereby, we extracted five common domains of meat-related ambivalence.

To quantify meat-related ambivalence in these domains, we developed and validated a standard (25 items) and a short version (5 items) of the Meat Ambivalence Question-

naire (MAQ) within four pre-registered quantitative studies (total N = 3,485). The first quantitative study tested an initial version of the MAQ to provide a tool to measure ambivalence by accounting for its multidimensionality. The second study tested an improved version of the MAQ. The third study tested the improved and final version of the MAQ in a representative sample from the US to provide norm scores. The fourth study tested how the MAQ relates to ambivalence measured via mouse-tracking paradigm. In our studies, we collected data on potential and felt ambivalence using traditional self-report measures (Studies 1-3) and on behavioral ambivalence via the mouse-tracking paradigm (Study 4). These methods allowed us to measure ambivalence towards meat (Studies 1-4), as well as plant-based dishes and inanimate objects (Studies 3-4) to test the construct validity of the MAQ. We further collected data on meat consumption (Studies 1-3), and dietary strictness (Study 2) to assess criterion (concurrent) validity, allowing us to explore the incremental variance explained by the subscales of the MAQ (Studies 2 & 3). Alongside this traditional approach, we conducted network analyses to provide further insights into the MAQ's validity and its nomological net by showing how the MAQ relates to important variables related to meat-related attitudes, intentions, and behavior (Study 2).

We follow the journal article reporting standards (Appelbaum et al., 2018). All studies achieved ethics approval from the local ethics committee and were conducted in accordance with the Declaration of Helsinki. For all studies, we report how we determined sample sizes, all data exclusions, and all measures. There were no manipulations in these studies. We pre-registered methods, design, hypotheses, and analyses on the OSF for the quantitative studies. We analyzed all data using SPSS 28 (IBM Corp, 2021), Mplus 8 (Muthén & Muthén, 2017), and R 4.1.0 (R Core Team, 2013). Detailed information on methods, materials, data, and analysis scripts, as well as the supplemental materials for all studies can be retrieved from the OSF: https://osf.io/y96fx/.

Qualitative Study: Identifying Origins of Meat-Related Ambivalence

In the present research, we aimed to demonstrate that meat-related ambivalence is multidimensional and depends on people's dietary groups (omnivore or veg*an). The qualitative study thus aimed to identify the origins and domains of meat-related ambivalence in omnivores and veg*ans. Whereas research on the meat paradox and meat-related dissonance has often focused on moral issues and omnivore participants (Bastian & Loughnan, 2017; Gradidge et al., 2021; Rothgerber, 2020), we aimed to show that cognitive conflict can arise due to many reasons in both omnivores and veg*ans. Thus, we conducted a qualitative survey asking omnivores and veg*ans open-ended questions about whether they experience conflict towards meat. We expected that both dietary groups should experience ambivalence if they hold associations towards meat that oppose their predominant attitude. In other words, omnivores should experience ambivalence if they realize negative aspects of meat such as animal welfare, environment, and health issues (i.e., the most common components of potential ambivalence about meat and the prevailing motives to eschew meat; Pauer et al., 2022; Ruby et al., 2016). In a similar vein, we predicted that veg*ans would be ambivalent if they acknowledge positive aspects of meat such as the pleasant taste, health, or social benefits of eating meat (Rosenfeld & Tomiyama, 2019). Using a content analysis of the answers (Bengtsson, 2016), we extracted the most common situations in which omnivores and veg*ans experience ambivalence.

Method

Participants and Design

Based on feasibility, we recruited 237 participants via the participant pool and mailing lists of a large German university. Two participants provided non-sensical answers and were thus excluded from data analysis, resulting in a final sample of N = 235. One hundred and thirteen participants identified as veg*ans (23 vegans and 93 vegetarians; 21 men, 92 women; M_{age} = 29.62, age range = 18-79) and 122 identified as omnivores (31 men, 91 women; M_{age} = 26.75, age range = 17-68). Student participants received course credits for their participation.

Materials and Procedure

At the beginning of the survey, participants gave informed consent. Subsequently, they were asked three open-ended questions. To assess positive and negative associations towards meat, we asked participants "What are your thoughts when you think about meat?" [Was sind deine Gedanken, wenn du über Fleisch nachdenkst?; Q1]. To assess whether and how people experience felt ambivalence towards meat, we asked participants "Do you have conflicted thoughts when you think about meat?" [Verspürst du konfliktbehaftete Gedanken, wenn du über Fleisch nachdenkst?; Q2]. Lastly, we assessed the situations in which people experience conflict: "In which moments do you experience these conflicts?" [In welchen Momenten empfindest du die Konflikte?; Q3]. In addition, we assessed participants' self-labeled dietary group (vegan, vegetarian, omnivore), how long they pursued their current diet (open-ended), how intensively they engage with information on meat-free diets (scale from 1 = not at all – 5 = intensively), and how intensively their social environment engages with this information (scale from 1 = not at all – 5 = intensively). Lastly, participants indicated their gender and age.

Results

Answers to all three questions varied in length (0 to 1206 characters) and mostly comprised separate sentences, bullet points, or words. Three authors (AJK, JS, BB) separated these text bits into units of meaning (Bengtsson, 2016). Then they inductively established codes by relying on the manifest words, staying close to their original meaning. We identified five main categories in our data: animal-based,

socially-based, sustainability-based, health-based, and sensory-based ambivalence. Animal-based ambivalence arises when people connect meat to its animal origin; socially-based ambivalence arises due to the social role of meat; sustainability-based ambivalence arises when people contemplate how their diet impacts the environment; health-based ambivalence arises when people weigh between the health risks and benefits of eating meat; and sensory-based ambivalence arises when people think about the taste, smell, or somatic experiences of eating meat. We extended this bottom-up approach by doing a deductive (top-down) literature review regarding potential triggers of meat-related conflict (e.g., Berndsen & van der Pligt, 2004; Pauer et al., 2022; Povey et al., 2001; Rosenfeld & Tomiyama, 2019; Rothgerber, 2020). Using these two approaches, we were able to identify sub-categories for animal-based, socially-based, and sensory-based ambivalence, and strengthen our coding scheme (see Table 1).

After establishing the coding scheme, we quantified how many participants experienced a conflict in a particular domain. Two independent raters, who were not involved in developing the coding scheme, were trained to code the responses. First, raters were instructed to immerse themselves in the data and read all comments carefully. Then, they indicated if the participants reported a conflict in one or more of the five main categories in the coding scheme. Because we define ambivalence as the co-presence of opposing thoughts or feelings, the raters indicated the presence of a conflict in the five main categories if an association towards meat opposed the predominant attitude of omnivores and veg*ans, respectively. The raters therefore coded the origin of omnivores' conflicts based on their negative associations because this opposes their positive attitude towards meat; they coded the origin of the veg*ans' conflicts based on positive associations towards meat because this opposes their negative attitude towards meat.[2]

Raters coded the data in binary format, indicating whether a conflict was present (1) or absent (0) in each of the five categories. Overall, the raters agreed in 92.6% of the coded conflicts across categories. To account for chance agreement, we calculated interrater reliability using the KALPHA macro for SPSS to calculate Krippendorff's Alpha (Hayes & Krippendorff, 2007). Our analysis was based on 10,000 bootstrap samples and revealed a Krippendorff's nominal α of .84 (95% CI [.80, .87]). This suggests substantial interrater reliability (Krippendorff, 2018), allowing us to draw conclusions based on the content of this analysis. If no initial agreement existed, an additional coder decided whether a conflict was present in a specific category.

Across all items, 94.3% of omnivores and 70.8% of veg*ans indicated experiencing at least one conflict arising from an association that opposed their predominant attitude; and 55.7% of omnivores (range: 0 – 4; M = 1.77; SD = 0.96) and 29.6% of veg*ans (range: 0 – 3; M = 1.01; SD = 0.79) reported multiple conflicts. Omnivores indicated conflict in all five categories, but veg*ans indicated conflicts only in domains of socially-based, health-based, and sensory-based ambivalence. There were substantial differences between the groups in terms of the domains of their conflicts (see Table 2): Omnivores more often reported conflicts in regard to animal-based, sustainability-based ambivalence, and health-based ambivalence; veg*ans reported more conflict concerning socially-based ambivalence, and sensory-based ambivalence. Chi-square tests indicated that the frequency of reported conflict differed in all five categories (all χ^2 (1) > 11.17; all p < .001). Thus, although omnivores and veg*ans both experience conflict, there are differences in the amount and the domain in which they experience ambivalence. Notably, some miscellaneous topics were not captured by the coding scheme in line with previous research, e.g., the (low) price of meat (cf. Lea et al., 2006).

Discussion

Our qualitative study revealed that omnivores and veg*ans both experience meat-related conflict. Here, we conceptualized meat-related conflict as ambivalence, that is, the inconsistency between positive and negative associations towards meat. For omnivores, negative associations that oppose their predominantly positive attitudes towards meat may trigger meat-related ambivalence; for vegetarians, the same applies if positive associations are inconsistent with their predominantly negative attitudes towards meat. Our qualitative data shows that omnivores have conflicting thoughts and or feelings towards meat more often than veg*ans, yet a substantial percentage of veg*ans indicated similar experiences.

As expected, we distinguished different domains of meat-related conflict by coding the origin of the associations that oppose people's predominant attitude. This revealed that the majority of omnivores experience ambivalence when considering meat's animal origin, but they also experience ambivalence due to its social role, environmental impact, health consequences, and sensory properties. Veg*ans experienced ambivalence most often if they acknowledged meat's social role or sensory properties, but also its health benefits. No veg*an in our study indicated animal-based or sustainability-based ambivalence, but we believe that veg*ans could potentially experience these conflicts. For instance, veg*ans might see an important role of farm animals (or their manure) in organic farming, or they might argue that farm animals benefited from co-evolution with humans (see Pollan, 2007, for similar arguments).

2 At two times, questions regarding the coding scheme arose during this process, and coders reached out to the first author. Questions pertained to what happens when people eat meat but self-identified as veg*n, and the socially-based subscale (i.e., whether answers pertaining to the social role of meat were supposed to form a conflict).

Table 1. Coding Scheme Including Identified Categories and Sub-Categories, with Examples for Omnivores (O) and Veg*ans (V)

Main Category	*Sub-Category*	*Example(s)*
Animal-Based	Being reminded of farm animals	O: *Increasingly often, I think about the animals that have to die for it [eating meat]. (Q1)*
	Exposure to information about farm animal welfare	O: *Enjoyment of meat in dishes, summer barbecues, and burgers versus the cruelty of slaughterhouses and factory farming. (Q2)*
	Connecting meat to animals	O: *When others are talking about what kind of animal you are eating and you realize that it is not right that the animal died for you when it could have had a nice life. (Q3)*
	Moral concerns regarding the killing of living beings	O: *On the one hand I like meat very much and I think that every living being kills to eat, on the other hand I can't reconcile it with my conscience. (Q3)*
Socially-Based	Identification of oneself as a (non-)eater of animals	O: *When I am confronted with vegetarian/vegan campaigns. (Q3)* V: *Actually always, but especially when I feel like I have to justify being a vegetarian. (Q3)*
	In the presence of people with other diets	O: *In groups of vegetarians I almost feel bad eating; eating meat has a bitter aftertaste, as opinion in society is also divided.* V: *Being a vegetarian myself, usually in conversations with people who eat meat – and they make jokes about it - I usually don't bring up the subject that I don't eat meat. (Q2)*
	Sociability	O: *Maybe when many people around me have a strong aversion to meat. (Q3)* *V: Barbecuing with friends and family. (Q3)*
Sustainability-Based	*NA*	O: *I think it is delicious, but I also know that it is not good for the environment to excessively consume meat. (Q2)*
Health-Based	*NA*	O: *At least "red meat" is also considered cancerogenic. Often interspersed with (fear) hormones and antibiotics. (Q1)* V: *Necessary food source? Necessary for survival? Important for maintaining health? (Q2)*
Sensory-Based	Thoughts and feelings about the smell of meat	O: *Raw meat causes disgust, repulsive smell. Good taste, nutritious but disgusting smell! (Q1 & Q2)* V: *Sometimes I feel a conflict towards meat when it is prepared and smells good but I would not eat it. In these moments, I think it is wrong what I feel. (Q2)*
	Thoughts and feelings about the taste of meat	O: *Sometimes [meat is just] not tasty. (Q1)* V: *I often crave the taste [of meat], but then I don't eat it because I think of the suffering animals and then it's really not worth it for me. (Q2)*
	Thoughts and feelings about the somatic experiences related to meat	V: *When I see and smell chicken food truck on the street, my mouth waters even though I haven't eaten meat for more than 10 years. (Q3)* O: *When I bite into cartilage. (Q3)*

Note. Q1 to Q3 indicates the question to which questions the answers were given.

Table 2. Frequencies of Conflict in the Five Domains of Ambivalence in Percent by Omnivores and Veg*ans

Dietary Group	Animal-Based	Socially-Based	Sustainability-Based	Health-Based	Sensory-Based
Omnivore (*n* = 122)	87.7%	26.3%	27.0%	25.4%	11.2%
Veg*an (*n* = 113)	0%	51.3%	0%	8.8%	41.6%

Quantitative Study 1: Measuring Multidimensional Ambivalence (Developing the MAQ)

In the present research, we aimed to test whether ambivalence towards meat is a multidimensional construct that depends on people's dietary groups. More specifically, we argue that meat-related ambivalence is related to negative associations in omnivores and to positive associations in veg*ans. Based on the qualitative study, we inferred that these associations may arise in domains revolving around meat's animal origin, its social ramifications, its effects on health and sustainability, and its sensory properties. Thus, we propose that ambivalence toward meat can also be quantified in these domains. In addition, we expect that a higher-order general factor can be derived based on these five domains. That is, ambivalence in each specific domain substantially correlates with ambivalence in other domains and the common variation of the five ambivalence domains can be explained by a general ambivalence factor. This gen-

eral factor refers to whether a person generally reports ambivalence towards meat across all five domains.

To assess people's felt ambivalence in these domains in a first quantitative study, we drafted a pool of 42 items to assess omnivores' ambivalence (elicited by negative associations) and vegetarians' ambivalence (elicited by positive associations) towards meat. Notably, we focused on vegetarians in the first two quantitative studies because they differ from vegans in how they construe their dietarian identity (Rosenfeld, 2019b). By extracting suitable items from this pool, we aimed to develop an initial version of the Meat Ambivalence Questionnaire (Big MAQ) including subscales for all domains and a short version of the MAQ (Mini MAQ). For the Mini MAQ, each subscale contained one item that was designed as a short scale estimate of the general factor. The results of the first quantitative study revealed the assumed higher-order five-factor structure of the Big MAQ for omnivores and vegetarians within a shortened 25-item questionnaire. The Big and Mini MAQ also showed promising signs regarding convergent, discriminant, and criterion validity despite some limitations. A full description of the methods, results, and discussion of the first quantitative study can be found in the supplemental materials on the OSF including more details on the item development (https://osf.io/q3mhd/).

Quantitative Study 2: Measuring Multidimensional Ambivalence (Improving the MAQ)

The second quantitative study was conducted to test an improved version of the MAQ. The results of the first quantitative study suggested that the initial 25-item version of the Big MAQ and the Mini MAQ are useful to validly assess how omnivores and vegetarians experience meat-related ambivalence and its downstream consequences. However, improvements regarding the factor structure for vegetarians and higher levels of measurement invariance were desirable. Thus, we added alternative items to the 25 retained items by developing new items and modifying some of the old items from Quantitative Study 1. Moreover, it seemed that meat consumption as measured in Study 1 was not a good criterion for vegetarians due to a floor effect. Instead of meat consumption, we thus used dietary strictness as a criterion variable for vegetarians. We believe that dietary strictness is a better criterion variable because it is not an exact estimate of meat consumption; instead, it shows how rigorously people adhere to their diet (Rosenfeld & Burrow, 2018). By assessing dietary strictness, we aimed to resolve the floor effect in our criterion variable and provide another angle on vegetarians' dietary behavior.

In addition to the traditional approach employed in Study 1, we also conducted network analyses to explore and visualize the coherence of the MAQ with related variables. This provides insights into the MAQ's nomological net and again into its validity. More specifically, we aimed to explore how meat-related ambivalence is associated with meat-related attitudes and behaviors in omnivores and vegetarians when controlling for the effects of other variables. This would allow us, for example, to test whether the MAQ is related to negative associations in omnivores and positive associations in vegetarians.

Traditional Analyses

In Study 2, our hypotheses were similar to the first quantitative Study. Specifically, we pre-registered that (https://osf.io/394rz):

> H1: the Big MAQ can be properly described by the five assumed dimensions with a higher-order general factor on the top.

> H2: the five general items of the Mini MAQ can be properly described by one factor that represents the general factor.

> H3: (a) the five subscales, (b) the Big MAQ (general factor), and (c) the Mini MAQ (short scale) are measurement invariant when comparing omnivores and vegetarians.

> H4: omnivores experience more ambivalence towards meat overall and on all subscales of the MAQ compared to vegetarians. However, we will explore differences among the subscales.

> H5: (a) the MAQ (Big MAQ/Mini MAQ) will show a significant correlation with the 3-item felt ambivalence towards meat; (b) the MAQ (Big MAQ/Mini MAQ) will show a significant correlation with potential ambivalence towards meat (c) the correlation between the MAQ and felt ambivalence is higher than the correlation between the MAQ and potential ambivalence the MAQ.

> H6: the MAQ (Big MAQ/Mini MAQ) and its subscales predict meat consumption in omnivores, with higher ambivalence predicting lower meat consumption.

> H7: the MAQ (Big MAQ/Mini MAQ) and its subscales predict dietary strictness in vegetarians, with higher ambivalence predicting lower dietary strictness.[3]

Network Analyses

Alongside this traditional approach, we aimed to examine how the different factors of the MAQ, potential, and felt ambivalence particularly relate to meat-related attitudes, intentions, and behaviors. Network analyses help to explore and visualize multivariate data by looking at the pairwise conditional associations between multiple variables (Borsboom et al., 2021), and thereby offer valuable insights

3 Notably, we also pre-registered hypothesis 8 for the stages of change in Study 2 which was not concerned with the validation of the MAQ but a conceptual model of meat-related ambivalence (cf. Buttlar et al., 2022). Thus, this hypothesis will not be reported in the present manuscript.

into the nomological net of the MAQ. We first computed an overall network based on the full sample, after which we computed separate networks for omnivores and vegetarians to compare both groups. The variables that are included in such networks are called *nodes*. Between each node, conditional associations are calculated with nodewise regression analysis that are referred to as *edges*. Edges only arise when associations between two variables remain after partialling out the variance explained by all of the other variables in the network; put differently, edges vanish if the association between two variables can be explained by other variables in the network (Borsboom et al., 2021). For the edges, edge weights provide information about the strength of the conditional associations.

Because network analyses examine associations between variables while controlling for every other variable in a multivariate dataset, the selection of nodes is of great importance for the outcome and interpretation of the network (Borsboom et al., 2021). We pre-registered 29 variables as nodes that we deemed as most important to explore how meat-related attitudes, intentions, and behaviors as well as demographics are related to meat-related ambivalence (cf. Table 4 and the methods overview on the OSF).

We included the MAQ subscales as well as potential and felt ambivalence as more traditional measures of meat-related ambivalence. We additionally included negative associations towards meat revolving around animal welfare, environmental, and health concerns regarding meat (Hopwood et al., 2020), and positive associations towards meat revolving around justifications that eating meat is necessary, natural, normal, and nice (Hopwood, Piazza, et al., 2021). Thereby, we aimed to explore whether specific associations in omnivores and vegetarians that are inconsistent with their predominant attitude are related to the subscales of the MAQ. We included four criterion variables to assess how these variables are associated with intentions and behaviors: information seeking about plant-based diets, signing a petition that demands more plant-based alternatives in cafeterias, dietary strictness (for vegetarians), and meat consumption (for omnivores). Lastly, we included moralization and moral emotions (i.e., disgust, anger, guilt; Feinberg et al., 2019) to investigate how meat-related ambivalence is associated with the process by which meat becomes a moral entity (Buttlar & Walther, 2022; Rozin et al., 1997).

Notably, previous research suggests that there is substantial variation in the evaluations of meat and the tendency to eat meat in omnivores and veg*ans (Buttlar & Walther, 2018). For instance, omnivores who endorse right-wing ideologies (including social dominance orientation and right-wing authoritarianism (Dhont & Hodson, 2014) hold more positive meat-related attitudes and eat more meat. In this vein, speciesism (the ascription of moral value based on species membership) seems to be an important predictor of meat consumption (Caviola et al., 2019). Similarly, veg*ans who are more conservative appear to violate their diet more often (Hodson & Earle, 2018). Recent surveys additionally indicate that omnivores do not change their diets if they fear stigmatization from significant others (Markowski & Roxburgh, 2019); in a similar vein, veg*ans eat more meat if they have less social support for their diet (Asher & Green, 2016). Moreover, demographics such as age or gender are associated with attitudes towards meat: For instance, women tend to like meat less as they associate more negative aspects and less positive aspects with it compared to men (Kubberød et al., 2002; Ruby et al., 2016); in a similar vein, some research suggests that younger people eat less meat and report less health- and environmental conflict (De Backer et al., 2020; Péneau et al., 2017) although there is mixed evidence on the association between age and moral disengagement strategies (Gradidge et al., 2021). It is also more likely that veg*ans lapse in their diet or even revert to an omnivorous diet in the early stages of adopting their diet; indeed, a recent study of (former) veg*ans indicates that 34% of them give up their diets within three months after adopting it (Asher & Green, 2016) and vegetarians adhere more strictly to their diets, the longer they eschew meat (Barr & Chapman, 2002). We thus included several boundary conditions of meat-related attitudes and meat consumption for omnivores and veg*ans, such as speciesism, social support for one's diet, the centrality of one's diet to one's identity, dietary duration, political orientation, age, and gender.

Method

Participants and Design

We aimed to recruit 1000 participants (500 omnivores, 500 vegetarians) from the UK via Prolific. This allowed us to meet requirements for both the traditional and network analysis. For the traditional analyses, we collected more than ten respondents per item (Boateng et al., 2018) and sampled more than 200 participants per dietary group allowing us to analyze our data with structural equation modelling and confirmatory factor analyses (Bentler & Chou, 1987). For the network analyses, this sample size is likely to result in accurate networks for both subsamples (Epskamp, 2017; van Borkulo et al., 2014). Notably, vegans were not included in Study 2 as in Study 1 because these groups differ in how they construe their dietarian identity (Rosenfeld, 2019b). We sequentially sampled participants until the final sample of N = 1000 was reached. As pre-registered, we excluded 90 participants who indicated that they do not follow an omnivorous or vegetarian diet, despite having indicated this in the pre-screeners; moreover, we excluded 54 participants who failed to pass the attention checks and time criterion. Further, 24 participants indicated that they were non-binary and could not be included in the network analysis (i.e., included only continuous and binary variables), but were included in the traditional analyses. To account for this in the network analyses, we aimed to recruit 24 additional participants. We oversampled four omnivores, however, because Prolific's pre-screeners were outdated. Thus, the final sample consisted of 1028 participants, of which 514 were omnivores (333 females, 171 males, 10 non-binary, M_{age} = 34.45, age range = 18-72) and 514 were vegetarians (414 females, 86 males, 14 non-binary, M_{age} = 33.09, age range = 18-71). As mentioned, only participants with binary gender could be included in the

network analyses. Thus, the network analyses were conducted on a sample of 1004 participants from which 504 were omnivores (333 females, 171 males, M_{age} = 34.57, age range = 18-72) and 500 were vegetarians (414 females, 86 males, M_{age} = 33.32, age range = 18-71).

Materials and Procedure

Traditional Analyses. ***Demographics and Diet-related variables.*** Following the provision of informed consent, we assessed demographic variables including gender, age, job status, education, and political orientation as in Study 1. Thereafter, we assessed diet-related variables mostly as in Study 1: We asked participants whether they describe themselves as meat-eater, meat-reducer, pescetarian, vegetarian, or vegan, and to indicate the duration of their dietary pattern in years and/or months ("How long have you been following your current dietary pattern?". We also assessed three items on dietary strictness (Omnivores: ω = .82; Vegetarians: ω = .92; Full Sample: ω = .95; Rosenfeld & Burrow, 2018), three items on dietary centrality (Omnivores: ω = .83; Vegetarians: ω = .88; Full Sample: ω = .86; Rosenfeld & Burrow, 2018), and one item on social support ("Is your dietary pattern largely supported or not supported by those around you?"; adapted from Kirsten et al., 2020). Moreover, to assess the stages of dietary change, participants selected the statement that applies to them: "I currently do not eat a meat-free diet and I am not thinking about it." (Pre-Contemplation); "I currently do not eat a meat-free diet but I think about it." (Contemplation); "I currently intend to eat a meat-free diet but do not do so right now." (Preparation); "I currently eat a meat-free diet but I have only begun to do so." (Action); "I currently eat a meat-free diet and I have maintained it for a while." (Maintenance). We adapted these statements from Armitage and Arden (2007) and Klöckner (2017). Lastly, participants reported their consumption of red meat, poultry, and seafood. We assessed consumption for these types of meat independently using three items, presented in randomized order ("On average, how often do you eat red meat [poultry / seafood] including side dishes and snacks? Please select one option and enter a number. (If you do not consume any red meat [poultry / seafood], select "year" and enter 0)"; (adapted from Pauer et al., 2022). Participants could then select one text box to indicate either the average frequency per day, week, month, or year with which they consumed each type of meat. We then extrapolated how often people eat meat per year and category, and then summed these values to estimate total meat consumption per year across all categories.

Traditional Measures of Ambivalence. We assessed general measures of meat-related potential and felt ambivalence in randomized order. To assess potential ambivalence, we used two split semantic differential items of positive and negative evaluations of meat (Kaplan, 1972; Pauer et al., 2022). That is, participants read the following instruction "Considering only the positive[/negative] aspects of meat consumption, while ignoring the negative[/positive] aspects, how positive[/negative] are your thoughts and/or feelings regarding meat consumption?". They then responded on separate 7-point scales by moving a slider from 1 (not at all positive[/negative]) to 7 (extremely positive[negative]). From these items, we calculated the similarity-intensity index using the formula (P + N)/2 - | P - N | (Thompson et al., 1995). High values on this index reflect strong but opposing evaluations.

To assess felt ambivalence, we used three items to capture the affective, behavioral, and cognitive components of ambivalence (Pauer et al., 2022; Priester & Petty, 1996). Participants indicated how they felt about meat via three items that were presented in random order ("Toward eating meat I feel [have] ..."). To assess the components of meat-related ambivalence, the scale endpoints differed for each of these items. That is, the 7-point scales ranged from "no conflict at all" to "maximum conflict", from "no indecision at all" to "maximum indecision", and from "completely one-sided reactions" to "completely mixed reactions". Overall, the internal consistency of this measure was surprisingly low (McDonalds's ω = .61; Hayes & Coutts, 2020). Thus, we analyzed the internal consistency for both groups separately; as in previous studies (Pauer et al., 2022), the internal consistency was high among omnivores (ω = .82), but low among vegetarians (ω = .42).

Meat Ambivalence Questionnaire (MAQ). To improve the MAQ, we used a 41-item pool. Based on the patterns we observed in Study 1, we created new items that resembled items that worked well, we adapted old items that were not retained in Study 1, and we tried to improve items that were retained but were not optimal (e.g., where the variance was not fully explained by the sub-factor) in Study 1. To assess agreement with these items, we used a fully verbalized 7-item scale with all response categories labeled as recommended by Menold and Bogner (2016): 1 (Strongly disagree), 2 (Disagree), 3 (Somewhat disagree), 4 (Neither agree nor disagree), 5 (Somewhat agree), 6 (Agree), 7 (Strongly agree). Items from each subscale were presented on separate pages. The order of the items on each page and the presentation order of the pages were randomized. We aimed to retain 25 items (i.e., 5 per subscale) via descriptive item analysis by applying the same criteria as in Study 1 (see analyses section of Quantitative Study 2).

We retained the general item of each subscale, allowing us to compute the Mini MAQ. Internal consistencies for the Big MAQ and its subscales were very high in both samples (Omnivores: ω = .96; Vegetarians: ω = .93; Full Sample: ω = .97; see Table 3 for internal consistencies of the subscales). The internal consistency of the Mini MAQ, however, was questionable for vegetarians (omnivores: ω = .84; vegetarians: ω = .69; full sample: ω = .84).

Network Analyses. Network analysis included the same variables as stated above for the traditional analyses, with the exception of variables that did not meet the continuous or binary criterion (i.e., job status and education). We included additional variables in the network analysis to provide a more comprehensive overview of related variables items (see introduction of Study 2 for a detailed explanation for this selection). Table 4 provides an overview of these variables including information on the number of items per scale, response format, internal consistencies,

Table 3. Improved Item Pool in Study 2 and Internal Consistencies (McDonald's Omega) for the Full Sample (F), Omnivores (O) and Vegetarians (V).

	O	V	F
Animal-Based Ambivalence	.94	.90	.94
Items kept from Study 1			
An_2 Watching cows, pigs and chickens makes me wonder whether I am able to eat meat.			
An_4 The idea of slaughterhouses makes me go back and forth about whether I should eat meat or not.			
An_5 When I become aware of the connection between meat and its animal origin, I feel conflicted about eating meat.			
An_6 Sometimes I am torn whether it is justifiable to eat meat when I become aware of the varying moral standards that are applied to different living beings.			
*An_g When I think of how animals are treated to produce meat, I experience a conflict about meat consumption.**			
Additional items for improvement			
An_9 I have mixed feelings towards eating meat when I see farm animals			
An_10 When I am reminded that animals are slaughtered, my feelings towards eating meat frequently change.			
An_11 When I think about meat's animal origins, I can't make up my mind whether or not I should eat it.			
An_12 My moral values regarding the treatment of animals make me go back and forth whether eating meat is right or wrong.			
Socially-Based Ambivalence	.90	.84	.90
Items kept from Study 1			
So_2 When someone asks me about my diet, I feel conflicted in regard to meat.			
So_3 I feel conflicted about meat consumption when I find out that someone else has a different diet regarding meat.			
So_5 I have mixed feelings about eating meat when the topic of meat consumption arises in the presence of people with a different diet.			
So_8 I am torn about eating meat when I have the feeling that my diet seems to offend others.			
So_g Due to the social role of meat in everyday life, I am torn whether eating meat is good or bad.			
Additional items for improvement			
So_9 Discussions about eating meat make me wonder whether meat consumption is good or bad.			
So_10 While eating with someone who has a different diet in terms of meat, I have strong feelings, both for and against meat.			
So_g2 Because of the role that meat plays in many people's daily life, I have opposing thoughts towards eating meat.			
Sustainability-Based Ambivalence	.95	.89	.95
Items kept from Study 1			
*Su_1 Due to environmental issues, my thoughts and feelings towards meat change frequently.**			
Su_4 Because of the state of our environment, I cannot decide whether meat consumption is right or wrong.*			
Su_5 I am torn whether I should eat meat when I think of sustainable diets.			
Su_6 Sometimes I find it difficult to decide whether I should eat meat when I become aware of how the actions of individuals can contribute to sustainable living.			
*Su_g When I think of a sustainable lifestyle, I feel a conflict in regard to meat.**			
Additional items for improvement			
Su_7 When I think about how food choices affect the environment, I have mixed feelings about eating meat.			
Su_8 I go back and forth about whether meat consumption is good or bad when thinking of an environmentally friendly way of life.			
Health-Based Ambivalence	.90	.83	.88
Items kept from Study 1			
He_2 When I think of what is good for my body, I know for sure how I feel about meat. (R)			
He_3 I am torn whether meat is good or bad for my health.			
He_4 I have conflicting thoughts and feelings whether it is/would be good for my health to avoid eating meat.			
He_6 I flip back and forth whether eating meat is good or bad for my health.			

He_g When I think of a healthy diet, I feel a contradiction as to whether I should eat meat.			
Additional items for insurances			
He_8 When it comes to my health, I sometimes feel that eating meat is good, but other times I'm not so sure.			
He_9 Thinking about my personal health, I am torn between the risks and benefits of eating meat.			
Sensory-Based Ambivalence	.87	.78	.86
Items kept from Study 1			
Se_3 Thinking about the taste of the dishes of my childhood, I feel conflicted about eating meat.			
Se_4 When I eat a plant-based meal, I go back and forth about whether eating meat is good or bad.			
Se_6 I have contradictory thoughts about eating meat due to the feeling of fullness it provides.			
Se_8 When imagining how my body feels after consuming meat, I experience strong feelings both for and against meat.			
Se_g Due to the sensations that prepared meat evokes, my thoughts and feelings towards eating meat are conflicted.			
Additional items for improvement			
Se_9 I can't make up my mind whether I should eat meat when I smell it being prepared in a restaurant.			
Se_10 When I smell traditional meat dishes, I go back and forth about eating meat.			
Se_11 The taste of meat- and plant-based dishes available in restaurants makes me wonder whether I should eat meat or not.			
Se_12 I am torn about eating meat when I imagine the feeling of fullness it might provide.			
Se_g2 I have mixed feelings towards eating meat due to the sensory experiences related to it.			

Note. The subscript "g" indicates that this item refers to the general factor. Items marked with an "(R)" are reversed. Items marked with a * were retained from Study 1 but slightly modified. The 25 italicized items were selected after descriptive item analyses for the analyses reported in Study 2, and constitute the final version of the MAQ that was used in Study 3.

and example items. Respective constructs were assessed on separate pages in random order.

Motivations to Eat Meat. We administered the Motivations to Eat Meat Inventory (MEMI, Hopwood, Piazza, et al., 2021) to capture positive associations toward meat. This inventory captures the most important positive associations that people cite to explain their motivations to eat meat. That is, people argue that meat consumption is necessary for a healthy diet, a normal part of social life, too nice (tasty) to quit, and a natural part of human life.

Motivations to Eschew Meat. We used the Vegetarian Eating Motives Inventory (VEMI, Hopwood et al., 2020) to assess negative associations towards meat pertaining to the motives that people most frequently mention to eschew meat in the global north: health, environmental and animal-welfare motivations (Hopwood, Rosenfeld, et al., 2021).

Moralization and Moral Emotions. We assessed moralization via three items on one page that assess how strongly one's attitude towards meat is attached to one's moral values; and we assessed moral emotions of disgust, anger, and guilt on a separate page (Feinberg et al., 2019).

Speciesism. We assessed speciesism with a 6-item questionnaire (Caviola et al., 2019).

Diet-Related Behaviors. We also assessed the extent to which people seek information on plant-based diets (Pauer et al., 2022) and whether people agreed to sign a petition demanding more plant-based alternatives in public cafeterias as additional behavioral variables.

Analyses

Traditional Analyses

All analyses and decision criteria were pre-registered. Before testing our research questions, we conducted descriptive item analyses including item-total correlation, *p*-value proportion (item difficulty), skew, and kurtosis for each item as well as McDonald's omega (Hayes & Coutts, 2020) for each scale separately for omnivores (Subsample A) and vegetarians (Subsample B). For the inclusion in the questionnaire, we preferred items that showed an item-total correlation > .39 and a *p*-value proportion of .3 to .9. In addition, we preferred items that showed the lowest skew and kurtosis values and indicated similar parameters across the omnivores and vegetarians (i.e., similar item-total correlation, *p*-value proportion, skew, and kurtosis). If all criteria for the descriptive item analysis were met, we also took subsequent measurement invariance tests into account for item selection (i.e., measurement invariant items were preferred). We then conducted our pre-registered analyses based on the selected 25 MAQ items (see Table 3). Analyses 1 to 3 tested the factor structure and measurement invariance of the MAQ; analyses 4 and 5 assessed the construct validity of the MAQ; and analyses 6 and 7 assessed criterion validity.

> H1: Factor Structure Big MAQ: We conducted three CFAs to test the factor structure of the big MAQ in subsamples A (omnivores) and B (vegetarians): a one-factor model (i.e., all 25 items are loading on one factor), a first-order five-factor model (i.e., the assumed dimen-

Table 4. Overview of the Variables (Nodes) for the Network Analyses, Including the Number of Items per Node, Examples of Items, and Their Response Scale as well as their Internal Consistencies (McDonald's Omega *ω*) for the Full Sample (F), Omnivores (O) and Vegetarians (V).

Node (# of Items)	Example Item	Scale	ω		
			O	V	F
MAQ Animal (5)	When I think of how animals are treated to produce meat, I experience a conflict about meat consumption.	1 (Strongly Disagree) - 7 (Strongly Agree)	.94	.90	.94
MAQ Social (5)	Due to the social role of meat in everyday life, I am torn whether eating meat is good or bad	1 (Strongly Disagree) - 7 (Strongly Agree)	.90	.84	.90
MAQ Sustainability (5)	When I think of a sustainable lifestyle, I feel a conflict in regard to meat.	1 (Strongly Disagree) - 7 (Strongly Agree)	.95	.89	.95
MAQ Health (5)	When I think of a healthy diet, I feel a contradiction as to whether I should eat meat.	1 (Strongly Disagree) - 7 (Strongly Agree)	.90	.83	.88
MAQ Sensory (5)	Due to the sensations that prepared meat evokes, my thoughts and feelings towards eating meat are conflicted.	1 (Strongly Disagree) - 7 (Strongly Agree)	.87	.78	.86
Felt Ambivalence (3)	Towards eating meat I feel…	e.g. 1 (no conflict at all) - 7 (maximum conflict)	.82	.42	.61
Potential Ambivalence (2; composite index)	Considering only the positive [negative] aspects of meat consumption, while ignoring the negative [positive] aspects, how positive [negative] are your thoughts and/or feelings regarding meat consumption?	1 (not at all positive) - 7 (extremely positive) 1 (not at all negative) - 7 (extremely negative)	-	-	-
Speciesism (6)	It is morally acceptable to trade animals like possessions.	1 (Strongly Disagree) - 7 (Strongly Agree)	.78	.74	.79
VEMI Health (4)	My health is important to me.	1 (Not important) - 7 (Very important)	.92	.92	.92
VEMI Environment (5)	Eating meat is bad for the planet.	1 (Not important) - 7 (Very important)	.96	.94	.96
VEMI Animal (6)	Animals do not have to suffer.	1 (Not important) - 7 (Very important)	.95	.95	.96
MEMI Normal (5)	I don't want other people to be uncomfortable.	1 (Not important) - 7 (Very important)	.77	.87	.81
MEMI Nice (5)	It is delicious.	1 (Not important) - 7 (Very important)	.91	.93	.95
MEMI Natural (4)	It is human nature to eat meat.	1 (Not important) - 7 (Very important)	.90	.88	.92
MEMI Necessary (6)	It makes me strong and vigorous.	1 (Not important) - 7 (Very important)	.90	.91	.92

Moralization (3)	To what extent is your position on eating meat a reflection of your core moral beliefs and convictions?	1 (Not at all) - 5 (Very much)	.85	.89	.91
Disgust (1) / Anger (1) / Guilt (1)	When thinking about eating meat, how strongly do you experience the following emotions?	1 (Not at all) - 5 (Very much)	-	-	-
Information Seeking (3)	Article example: "The easiest ways to transition to reduced-meat diets"	1 (Not at all) - 7 (Very much)	.89	.73	.79
Petition Signing (1)	Would you be interested in signing a petition [at the end of the survey] that aims at providing more plant-based food options in public institutions?	0 no 1 yes			
Centrality (3)	My dietary pattern is an important part of how I would describe myself.	1 (Strongly Disagree) - 7 (Strongly Agree)	.83	.88	.86
Dietary Strictness (3)	I can be flexible and sometimes eat foods that go against my dietary pattern.	1 (Strongly Disagree) - 7 (Strongly Agree)	.82	.92	.95
Meat Consumption (3)	On average, how often do you eat red meat [sea food/poultry] including side dishes and snacks?	-	-	-	-
Social Context (1)	Is your dietary pattern largely supported or not supported by those around you?	1 (Not Supported) - 7 (Strongly Supported)	-	-	-
Dietary Duration (1)	How long have you been following your current dietary pattern?	Months	-	-	-
Political Orientation (1)	Please indicate your political orientation.	-3 very left wing - +3 very right wing	-	-	-
Gender (1) / Age (1)	Please indicate your gender/age.	0 men 1 women / Years	-	-	-

Note. MAQ = Meat Ambivalence Questionnaire; MEMI = Meat Eating Motivations Inventory; VEMI = Vegetarian Eating Inventory. In the network analyses, we used factor scores for the MAQ, and we calculated means for the other multi-item measures if not denoted otherwise except for meat consumption where we computed a sum score.

sions are estimated by five items each. The five first-order factors are allowed to correlate), and a higher-order five-factor model (i.e., the assumed dimensions are estimated by their respective items; the five first-order factors are loading on a higher-order general factor). Figure S1 in the supplemental materials on the OSF illustrates these models.

H2: Factor Structure Mini MAQ: In subsamples A and B, we conducted a short scale CFA using five items (i.e., general items from each subscale loads on a "general" factor; see Figure S1).

H3: Measurement Invariance: We conducted several CFAs to test whether the short-scale (Mini MAQ), the higher-order factor from the hierarchical five-factor model (Big MAQ), and the five MAQ subscales are measurement invariant between omnivores and vegetarians, and successively tested increasing measurement invariance levels against each other (i.e., configural, metric, scalar, and strict invariance). To compare two models of different measurement invariance level, we used the difference between comparative fit indices (ΔCFI) and interpreted ΔCFI values of .01 or less as a tolerable deterioration in model fit (Chen, 2007). If one model did not hold one measurement invariance level, we conducted a partial measurement invariant model by removing some restrictions in some items based on modindices. According to Dimitrov (2010), partial measurement invariance can be assumed if not more than 20 percent of the invariance restrictions are removed (i.e., the restrictions in one of five items).

H4: Differentiation between Groups: We conducted several multi-group CFAs based on the complete sample to test whether omnivores reported higher ambivalence towards meat overall and on all MAQ subscales compared to vegetarians. For the Mini MAQ, the Big MAQ, and the MAQ subscales, we calculated a CFA where the factor means in omnivores and vegetarians were allowed to differ from each other and a second CFA where the factor means were fixed to the same size. If a ΔChi^2 difference test between these models was significant ($p < .05$) in one scale, we concluded that omnivores and vegetarians showed a different magnitude of ambivalence on this scale (i.e., different mean-levels).

H5: Convergent and Discriminant Validity: We conducted two SEMs (SEM_5.1_ Mini; SEM_5.1_Big) based on the full sample to test whether Mini MAQ and Big MAQ were related to felt ambivalence and potential ambivalence. We conducted additional SEMs (SEM_5.2_Mini; SEM_5.2_Big) to test whether the correlations of Mini MAQ and Big MAQ with felt ambivalence significantly differed from the correlations with potential ambivalence.
In SEM_5.1_Mini and SEM_5.1_Big, the correlations of the Mini MAQ and Big MAQ with felt ambivalence and potential ambivalence were freely estimated. In SEM_5.2_Mini and SEM_5.2_Big, the correlations of the Mini MAQ and Big MAQ with felt ambivalence and potential ambivalence were fixed to the same value. If the ΔChi^2 difference test between SEM_5.1_Mini/Big and SEM_5.2_Mini/Big was significant ($p > .05$), we concluded that the correlation of Mini MAQ/Big MAQ with felt ambivalence significantly differed from the correlations with potential ambivalence. Finally, to explore how the considered correlations differ by diet type, we conducted SEM_5.1_ Mini / SEM_5.1_Big again based on subsample A and subsample B and compared the correlations.

H6: Criterion Validity Omnivores: For omnivores, we conducted several SEMs to test whether Mini MAQ (SEM_6.1), Big MAQ (SEM_6.2), animal-based (SEM_6.3), socially-based (SEM_6.4), health-based (SEM_6.5), sustainability-based (SEM_6.6), and sensory-based subscales (SEM_6.7) predict meat consumption. We conducted one additional SEM (SEM_6.8) to test whether the five MAQ subscales incrementally predict meat consumption beyond the other MAQ subscales. That is, in SEM_6.8, the five MAQ subscales simultaneously predicted meat consumption.

H7: Criterion Validity Vegetarians: For vegetarians, we conduct several SEMs to test whether the Mini MAQ (SEM_7.1), Big MAQ (SEM_7.2), animal-based (SEM_7.3), socially-based (SEM_7.4), health-based (SEM_7.5), sustainability-based (SEM_7.6), and sensory-based subscales (SEM_7.7) predicted dietary strictness. We conducted one additional SEM (SEM_7.8) test whether the five MAQ subscales incrementally predict dietary strictness beyond the other MAQ subscales. That is, in SEM_7.8, the five MAQ subscales simultaneously predicted dietary strictness.

Network Analyses

We conducted network analyses with R (R Core Team, 2013) based on the tutorials by Dalege et al. (2017) and Haslbeck and Waldorp (2020). Network analyses were conducted with the factor scores for the MAQ and means for the other multi-item constructs; we also included all single item measures such as the potential ambivalence index, gender, or petition signing (see Table 4). We estimated the networks with mixed graphical models (mgm; Haslbeck & Waldorp, 2020) for binary and continuous data with all pairwise interactions ($k = 2$). Edge inclusion was based on 10-fold cross-validation (mgm default settings). We conducted the analyses for the total sample and the subsamples, respectively. We used multiple packages for the visualization of graphs (qgraph, Epskamp et al., 2012), the edge accuracy measures and edge difference tests as well as their interpretation (bootnet; Epskamp et al., 2018), the comparison of networks of the subsamples (NetworkComparisonTest; van Borkulo et al., 2021), and the community detection (igraph; Csardi & Nepusz, 2006).

To detect communities, we applied the cluster walktrap algorithm. As in Chambon et al. (2021), for each sample, we repeated community analysis (1000 iterations) based on mgm to analyze community stability. Thereby, we calculated how often different nodes belonged to the same community, resulting in a score between 0 and 1. The higher the score, the more certain a node belonged to the same community in every iteration (with 0 indicating that the nodes never belonged to the same community and 1 that the nodes belonged to the same community in each iteration). We assessed the final communities by using a com-

Table 5. Model Fit of the Confirmatory Factor Analyses in Study 2

Model	χ^2	*df*	SCF	*p*	CFI	RMSEA	SRMR
Subsample A: Omnivores (n = 514)							
One-factor model	2396.814	275	1.397	< .001	.714	.123	.081
First-order-factor model	483.133	265	1.337	< .001	.971	.040	.039
Higher-order five-factor model	510.090	270	1.337	< .001	.968	.042	.044
Short scale model	17.870	5	1.165	.003	.982	.071	.023
Subsample B: Vegetarians (n = 514)							
One-factor model	1499.405	275	1.763	< .001	.687	.093	.088
First-order-factor model	404.075	265	1.682	< .001	.964	.032	.042
Higher-order five-factor model	435.127	270	1.682	< .001	.958	.034	.050
Short scale model	13.816	5	1.640	.017	.964	.059	.032

Note. SCF = Scaling correction factor. One-factor model = all 25 MAQ items load on one factor. First-order-factor model = the assumed dimensions are estimated by five items each and the five first-order factors are allowed to correlate. Higher-order five-factor model = the assumed dimensions are estimated by their respective items and the five first-order factors load on a higher-order factor. Short scale model = five items load on one factor, each item represents one dimension.

munity detection analysis for each sample; we selected the communities with nodes that belonged to that community in over 90% of the iterations.

Results

Traditional Analyses

Descriptive item statistics for all 41 MAQ items, the chosen subset of 25 items, and the reasons why the remaining 16 items were excluded are reported in Table S3 in the supplemental materials. In the chosen items, item-total correlation ranged from .333 to .886, *p*-value proportion ranged from 8.171% to 66.667%, skew ranged from -.800 to 2.739, and kurtosis ranged from -1.364 to 7.743. The very high values in skew and kurtosis in some items, on the one hand, and the low *p*-value proportion in some items, on the other hand, can be explained by a low agreement of the vegetarians to some items. We trust that this tendency did not obscure the following factor and measurement invariance analyses as we applied the MLR estimator that is robust to non-normality in all latent analyses. Furthermore, even within the subsample of vegetarians, there was a substantial variation in the ratings of the chosen items (item *SD* ranged from 1.041 to 2.530).

H1: Factor Structure Big MAQ: Fit indices of the conducted CFAs in subsamples A and B based on the selected 25 MAQ items are reported in Table 5. The one-factor model did not reach adequate fit indices in both samples. The first-order five-factor model and the higher-order five-factor model both showed a very good fit to the data in both subsamples (CFI > .95, RMSEA < .06, and SRMR < .08; for exact fit indices, see Table 5).

H2: Factor Structure Mini MAQ: The short scale model reached an adequate model fit in both samples with one tolerable exception (i.e., in omnivores, the short scale model only reached a barely sufficient RMSEA of .071; see Table 5).

H3: Measurement Invariance: Measurement invariance results for all scales are reported in Table S4 in the supplemental materials. In Mini MAQ, animal-, health-, sustainability-, and sensory-based ambivalence, we estimated a scalar level of measurement invariance between omnivores and vegetarians. In the sociability-based ambivalence subscale, we estimated a partial scalar level of measurement invariance by allowing the variation in the intercept of one item. In the Big MAQ, we found a strict level of measurement invariance. Partial strict measurement invariant models are also reported in Table S4 in the supplemental materials.

H4: Differentiation between Groups: Multi-group CFAs indicated that omnivores showed significantly higher ambivalence than vegetarians on the Big and Mini MAQ as well as on all MAQ subscales (see Table 6).

H5: Convergent and Discriminant Validity: Latent correlations of Mini MAQ and Big MAQ with felt and potential ambivalence are reported in Table 7. As in Study 1, both Mini MAQ and Big MAQ were significantly higher correlated with felt ambivalence than with potential ambivalence.

H6: Criterion Validity Omnivores: Beta coefficients from SEMs predicting meat consumption in omnivores are reported in Table 8. Mini MAQ, Big MAQ, animal-, socially-, and sustainability-based ambivalence were negatively associated, whereas health-based and sensory-based ambivalence were not significantly associated with meat consumption. No MAQ subscale incrementally explained variance in meat consumption after controlling for the other subscales.

H7: Criterion Validity Vegetarians: Beta coefficients from SEMs predicting dietary strictness in vegetarians are reported in Table 8. Dietary strictness was negatively associated with the Mini MAQ, Big MAQ, and all MAQ subscales. Moreover, socially- and sensory-based ambivalence incrementally explained variance in dietary strictness after controlling for all MAQ subscales.

Network Analyses

Besides the traditional analyses, we aimed to provide insight into the MAQ's nomological net and demonstrate the MAQ's validity by exploring how meat-related ambivalence (including its different origins) is associated with other variables determining meat-related attitudes and meat

Table 6. MAQ Scales Mean-level Differences Between Omnivores and Vegetarians in Study 2

	Omnivores		Vegetarians		*d*	$\Delta\chi^2$	Δdf	Δp	ΔCFI
MAQ Scale	*M*	*SD*	*M*	*SD*					
Mini MAQ	0	1	-1.242	0.727	1.625	468.010	1	< .001	.292
Big MAQ	0	1	-1.277	0.744	1.644	690.969	1	< .001	.023
Animal	0	1	-1.127	0.989	1.139	274.280	1	< .001	.108
Socially	0	1	-0.817	0.696	1.100	183.798	1	< .001	.101
Sustainability	0	1	-1.224	0.777	1.527	666.519	1	< .001	.131
Health	0	1	-0.994	0.785	1.229	680.790	1	< .001	.144
Sensory	0	1	-0.988	0.643	1.398	502.477	1	< .001	.204

Table 7. Correlations of Mini MAQ and Big MAQ with Felt and Potential Ambivalence in Study 2

MAQ scale	Correlations with Felt Ambivalence		Correlations with Potential Ambivalence		Significance Test for the Difference between the correlations			
	r	*p*	*r*	*p*	$\Delta\chi^2$	Δdf	Δp	ΔCFI
Complete sample (n = 1028)								
Mini MAQ	.809	< .001	.592	< .001	37.224	1	< .001	.014
Big MAQ	.818	< .001	.543	< .001	42.109	1	< .001	.002
Subsample A: Omnivores (n = 514)								
Mini MAQ	.754	< .001	.502	< .001	7.426	1	0.006	.004
Big MAQ	.761	< .001	.496	< .001	6.561	1	0.010	.001
Subsample A: Vegetarians s (n = 514)								
Mini MAQ	.632	< .001	.318	< .001	0.065	1	0.798	.005
Big MAQ	.655	< .001	.306	< .001	0.021	1	0.885	.001

consumption in omnivores and vegetarians. We computed networks for our full sample and separately for omnivores and vegetarians to formally compare their networks. These comparisons enabled us to outline differences between the networks of the subsamples on a global level (i.e., network structure) and local level (i.e., edge differences; van Borkulo et al., 2021).

As we expected to find differences between omnivores and vegetarians in the relations between the nodes, we discuss the network of the full sample from a more global perspective, after which we interpret the associations between nodes more detailed for the networks of the subsamples. An overview of all edge weights is provided in the supplemental material, for both the full sample and the separate networks for omnivores and vegetarians (Table S5). We also note the relevant edge weights in brackets. Edge accuracy analysis indicated generally stable and therefore reliable edges (i.e., confidence intervals of the edge weights were generally not wide, see supplemental materials on network analyses). The edges in the network figures are depicted relative to a maximum coefficient of .60. This threshold is based on the strongest edge (rounded up) found in the three networks presented here (i.e., total, omnivores, and vegetarians).

Figure 1 depicts the network of the full sample (combining vegetarians and omnivores). Networks provide information about the interconnectedness of variables in the form of communities: Highly interrelated variables are clustered together and indicated by different colors (see Figure 1). Notably, these communities are not mutually exclusive and associations may exist between variables of different communities. Looking at the full sample, communities mapped as follows: Meat-related ambivalence measured via the MAQ (blue), positive associations towards meat measured via the Motivations to Eat Meat Inventory (yellow), negative associations towards meat measured via the Vegetarian Eating Motives Inventory and speciesism (orange and brown), moral reactions to meat (green), engagement (red), and dietary behavior and demographics (grey and pink) formed communities. This mapping aligns with the expected grouping of nodes based on the psychometric instruments included in this study.

Indicating the construct validity of the MAQ, its subscales were associated with variables of a related domain after controlling for every other variable in the network:

Table 8. Beta Coefficients from SEMs Predicting Dietary Behavior by MAQ Scales in Study 2

	Step 1: Separate prediction		Step 2: Simultaneous prediction	
	β	*p*	β	*p*
Subsample A: Omnivores (n = 514). Prediction of Meat Consumption				
Mini MAQ	-.123	< .001	-	-
Big MAQ	-.131	< .001	-	-
Animal	-.129	.003	-.077	.367
Socially	-.197	.013	-.124	.174
Sustainability	-.128	.003	-.070	.427
Health	-.070	.068	.018	.782
Sensory	-.059	.194	.118	.231
Subsample B: Vegetarians (n = 514). Prediction of Dietary Strictness				
Mini MAQ	-.357	< .001	-	-
Big MAQ	-.393	< .001	-	-
Animal	-.262	< .001	-.045	.634
Socially	-.379	< .001	-.237	.040
Sustainability	-.265	< .001	-.016	.813
Health	-.255	< .001	.091	.399
Sensory	-.383	< .001	-.224	.050

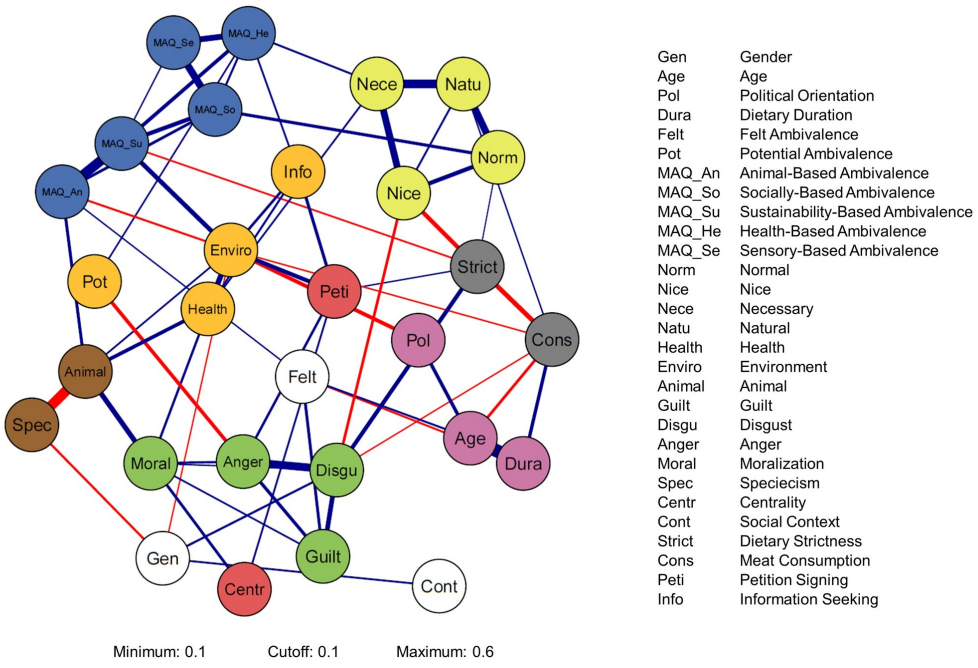

Figure 1. Network of Psychological and Demographic Factors Associated with Meat-related Ambivalence in the Full Sample

Note. Psychometric factors are depicted as nodes. Colored groups represent interconnected clusters of nodes (communities)—white nodes could not be assigned to specific communities. Negative associations between variables are depicted as red edges, and positive associations between variables as blue edges. The strength of the association is denominated by the thickness of the edges (below |.10| is omitted to improve readability). Binary nodes are coded as 0 and 1 (Gender 1: Woman; Petition Signing 1: Yes), with a blue (red) edge indicating that increasing the other node results in a higher (lower) probability for category 1 of the binary node.

Animal-based ambivalence was related to animal-welfare motivations to eschew meat (.16), sustainability-based ambivalence to environmental motivations to eschew meat (.22), socially-based ambivalence was related to the assumption that meat consumption is normal (.17), health-based ambivalence to the assumption that meat consumption is necessary (.13), and sensory-based ambivalence with

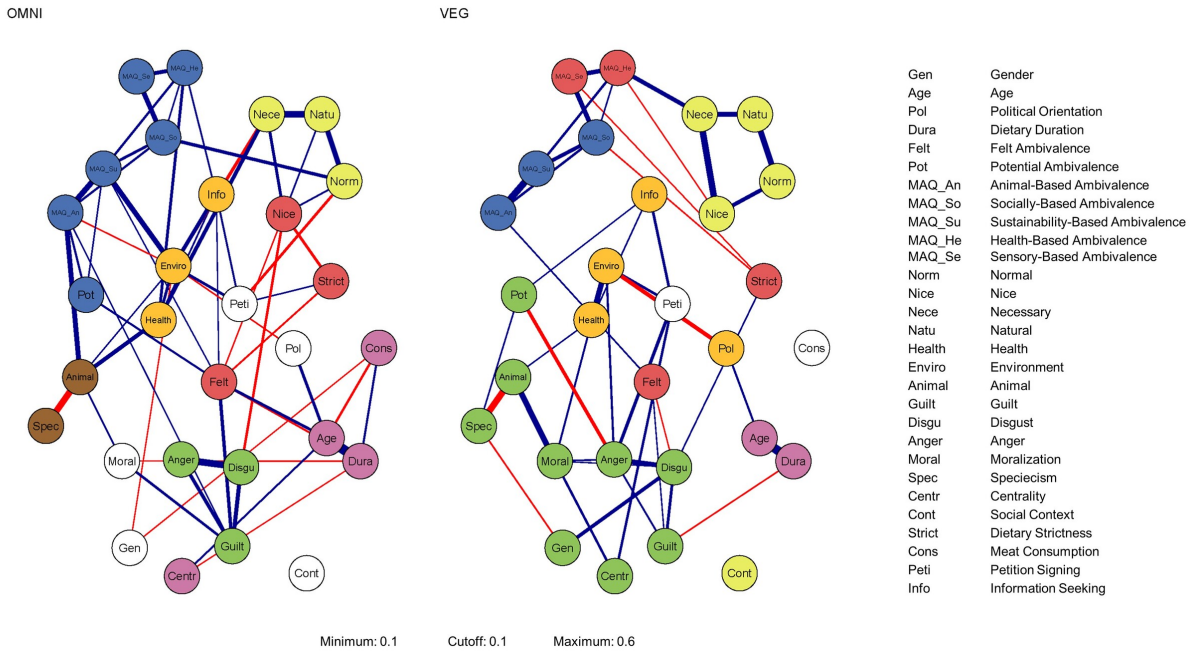

Figure 2. Separate Networks for Omnivores (OMNI) and Vegetarians (VEG) of Factors Associated with Meat-Related Ambivalence

Note. For interpretation, see description of Figure 1.

that meat consumption is nice (.06; below |.10| so not depicted in Figure 1).

Next, we looked at the separate networks for omnivores and vegetarians on a more detailed level. Interestingly, some nodes moved to different communities, indicating that the interconnectedness of certain variables differed across subsamples (see Figure 2). The interconnectedness of MAQ subscales also differed between omnivores and vegetarians. For omnivores, the subscales were highly connected among each other, but also with potential ambivalence. In vegetarians, meat-related ambivalence was split into two different communities (although strong associations were found between all five subscales), indicating that two of the subscales showed higher interrelatedness with dietary strictness and felt ambivalence than with the three other MAQ subscales. Interestingly, also in vegetarians, a large community was formed in which speciesism, animal-welfare motivation, gender, dietary centrality, and potential ambivalence were included in the moralization cluster. This indicates higher interconnectedness between these variables for vegetarians than for omnivores.

We then used the network comparison test to formally compare the networks of omnivores and vegetarians. This enables us to test whether global differences exist between the networks of the subsamples (i.e., differences in the connectivity or the structure of the networks), and whether the strength of specific associations between nodes (i.e., edge weights) differed significantly when comparing the subsamples. Results showed a significant difference in the connectivity of the networks (global strength 2.78, p = .018), indicating that the network of omnivores is more connected (i.e., is higher in number and weights of associations between nodes) than the network of vegetarians. The network invariance test indicated that the network structure also differed between the subsamples (network invariance 0.30, p = .014), indicating that there are significantly different edges in the networks of the subsamples. Figure 3 presents which edges differed significantly between omnivores and vegetarians.

Construct Validity. In line with our hypotheses, the MAQ subscales were associated with positive associations towards meat in vegetarians, measured via the Motivations to Eat Meat Inventory, and negative associations in omnivores, measured via the Vegetarian Eating Motives Inventory, after controlling for all other nodes in the network (see Figure 2). The edge weights were highest for the associations that matched the origin of the MAQ subscales. For omnivores, animal-based ambivalence was associated positively with animal-welfare motivations to eschew meat (.30), sustainability-based ambivalence with environmental motivations to eschew meat (.30), and health-based ambivalence with health motivations to eschew meat (.19). For vegetarians, there was a positive association between health-based ambivalence and the assumption that meat consumption is necessary (.26), but also a negative association with health motivations to eschew meat (-.09; omitted from network figure because below |.10|). In addition, sensory-based ambivalence was positively associated with the assumption that meat consumption is nice (.08). Lastly, we found a positive association between socially-based ambivalence and the assumption that eating meat is normal in omnivores (.22).

Importantly, these associations seem to differ depending on people's dietary groups. The network comparison test

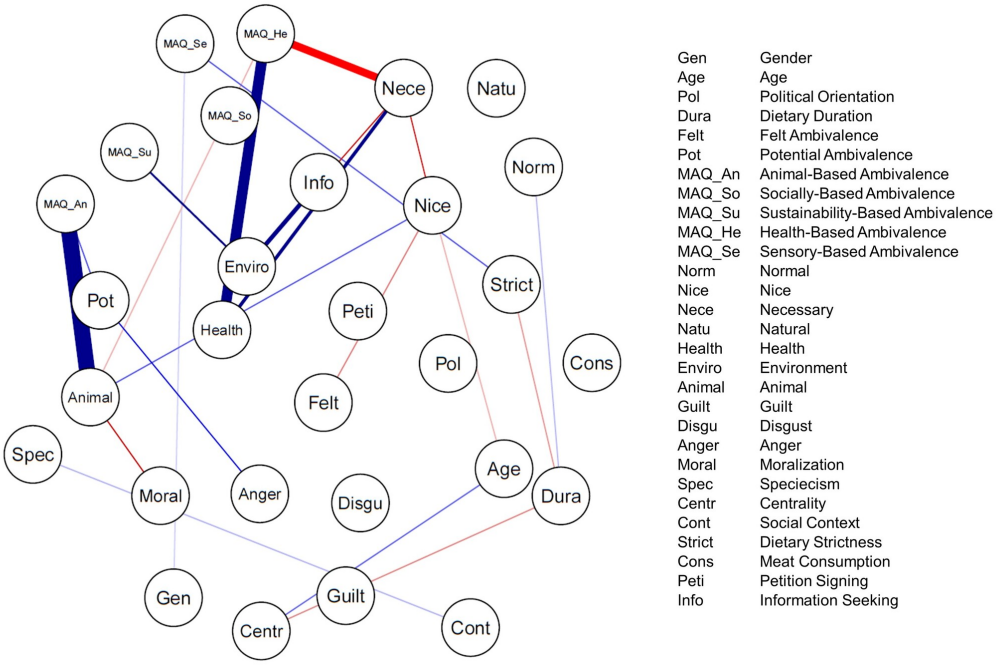

Figure 3. Network Comparison Test for the Networks of Omnivores and Vegetarians

Note. Blue (red) edges imply that the edge weight in the vegetarian (omnivore) subsample is significantly weaker, absent, negative, or more negative than in the omnivorous (vegetarian) subsample. These edges cannot be interpreted as positive or negative relations as in the network analysis. Notably, we lowered the significance threshold error to $p = .01$ to adjust for multiple comparisons and avoid type I errors. This threshold was set to also avoid type II errors resulting from a Holm correction that appears to be too conservative given the high number of edges in the network (cf. Chambon, Dalege, Waldorp, et al., 2021).

indicated that negative associations were more strongly (and more positively) related to the respective subscales of the MAQ in omnivores than in vegetarians (see Figure 3). More specifically, animal-based ambivalence was related to animal welfare motivations only in omnivores (.30; vegetarians .00); sustainability-based ambivalence was related to environmental motivations more strongly in omnivores (.30) than in vegetarians (.07); and health-based ambivalence was positively related to health motivations in omnivores (.19) whereas negatively related in vegetarians (-.09). Contrarily, the positive association that meat consumption is necessary for a healthy diet was (positively) related to health-based ambivalence only in vegetarians (.26; omnivores .00). Thus, ambivalence seems to arise in certain domains and is associated with certain positive and negative associations depending on people's dietary groups.

Criterion Validity. Finally, we explored how meat-related ambivalence was related to our criterion variables and whether accounting for the origin of that ambivalence would explain additional variance over and above the traditional measures of ambivalence. The MAQ subscales were related to our criterion variables after controlling for the traditional measures and for each other, and all other variables included in the network. For omnivores, information seeking was associated with sustainability-based ambivalence (.06), health-based ambivalence (.13), and sensory-based ambivalence (.05); petition signing was associated only with sensory-based ambivalence (.05). For vegetarians, information seeking was associated with health-based ambivalence (.08), and dietary strictness was associated with socially-based ambivalence (-.11) and sensory-based ambivalence (-.10). The traditional measures of potential and felt ambivalence were associated with information seeking (felt ambivalence .11) and meat consumption (potential ambivalence .08) in omnivores as well as with information seeking (felt ambivalence .04; potential ambivalence .10) and dietary strictness (felt ambivalence -.04) in vegetarians. Notably, there were no significant differences when looking at the associations with traditional measures between omnivores and vegetarians; only via the MAQ did we observe a significant difference between socially-based ambivalence and dietary strictness.

As these conditional associations controlled for all other variables in the network, we argue that meat-related ambivalence is an important variable accompanying intentions and behaviors revolving around meat consumption. For instance, looking at our main behavioral criterion variable in vegetarians, dietary strictness was only associated with disgust (.11), animal-welfare motivation to eschew meat (.06), dietary duration (.09), and the assumption that meat consumption is nice (-.05) besides ambivalence. Moreover, for information seeking in vegetarians, the traditional measures of ambivalence and health-based ambivalence were associated with information seeking beyond health motivations to eschew meat (.11) and other variables such as anger (.08), guilt (.04), age (-.09), and dietary duration (-.08).

Although meat consumption as our behavioral criterion variable in omnivores was not significantly associated with the MAQ after controlling for all other variables in the network model (the strongest associations of meat consumption were with demographic variables such as age, gender,

and dietary duration), meat-related ambivalence provided unique insights into meat-related intentions in the network analysis: The aforementioned associations of the MAQ with information seeking in omnivores are unique relations after controlling for every other variable in the network, including associations with environmental (.24), health (.12), and animal-welfare (.06) motivations to eschew meat; in a similar vein, the association of the MAQ with petition signing is a unique relation after controlling for the other variables, including environmental motivations to eschew meat (.18), the assumption that meat consumption is normal (-.18) and necessary (-.09), dietary duration (-.09), speciesism (-.08), and moralization (.06).

Discussion

Using an improved version of the MAQ in Study 2, we found evidence for the multidimensional nature of meat-related ambivalence. We observed that the assumed higher-order five-factor structure of the Big MAQ (including subscales) and Mini MAQ show a good fit with the data. Importantly, the MAQ and all subscales were measurement invariant for omnivores and vegetarians. We were also able to demonstrate good construct validity when it comes to the differentiation between groups and the correlations with more traditional measures of ambivalence. Moreover, the MAQ and its subscales were related to meat consumption and dietary strictness, but the association depended on the domain and dietary group.

Going beyond traditional analyses, we wanted to illuminate how meat-related ambivalence relates to other psychological variables that have been discussed as important determinants of meat consumption depending on people's commitment to eat or eschew meat. Therefore, we conducted network analyses to shed further light on the nomological net, as well as the construct and criterion validity of the MAQ. The network analyses suggested that meat-related ambivalence was indeed related to domain-specific positive and negative associations depending on people's dietary groups. Domain-specific ambivalence was associated with the criterion variables above and beyond general conflict, motivations to eschew or eat meat, and other important constructs linked to meat-related attitudes and meat consumption. This was especially the case for information seeking in omnivores and dietary strictness in vegetarians.

Although we were surprised to not find associations of the MAQ with meat consumption in omnivores with network analyses, this might be because these analyses are rather conservative controlling for all other variables in the network. Moreover, associations between ambivalence and meat consumption might occur over time; if so, such effects would not be detectable with the cross-sectional data in this study. For instance, Pauer et al. (2022) showed that the effect of ambivalence on intentions to eschew meat is mediated via information seeking for plant-based diets. While this suggests that information seeking might be associated with reduced meat consumption, the effect of information seeking on meat consumption might not be immediate. That is, people first must inform themselves about plant-based cooking before seeking out plant-based meat alternatives, although they already intend to reduce their meat consumption. Because we measured meat consumption rather than intentions to eschew meat, this effect might not be detected in our cross-sectional network analyses.

In a similar vein, most variance in meat consumption in omnivores was explained by demographic variables such as age, dietary duration, and gender rather than psychological variables in the network analyses. We argue that this might be because our assessment of meat consumption was rather generic. That is, we asked people how often they eat meat in a day/week/month/year. To the contrary, we found associations between the MAQ and dietary strictness in vegetarians, where we asked about specific situations. It might thus be argued that such an assessment is better suited to detect relations between the MAQ and behavior, because the MAQ also refers to specific situations and does not refer to a general tendency to eat meat.

Quantitative Study 3: Assessing Multidimensional Ambivalence in a Representative Sample

In Study 3, we wanted to demonstrate the multidimensional nature of meat-related ambivalence in a more representative sample and extend the scope of our research. Thus, we sampled US participants according to the data from the US Census Bureau. This way, we also expanded our sample and now included vegans alongside vegetarians. With this representative sample, we then aimed to provide norm scores for the MAQ and its subscales that allow researchers to compare data from individuals or groups with a reference sample.

For vegetarians in Studies 1 and 2, the Felt Ambivalence Questionnaire (Pauer et al., 2022; Priester & Petty, 1996) towards meat in general lacked internal consistency. Moreover, the data yielded an impermissible floor effect for self-reported meat consumption in vegetarians. We thus used a different measurement approach in Study 3: We assessed generalized felt and potential ambivalence by assessing people's ambivalence towards a variety of meat- and plant-based products as well as inanimate objects that were presented as pictures. In this vein, we were also able to assess the desire to eat certain plant- and meat-based dishes as a proxy for meat consumption. Besides the desire to eat different kinds of dishes, we also asked for meat consumption in general using a less detailed assessment compared to Study 2.

For Study 3, all hypotheses except for H4 were similar to or based upon the previous quantitative studies. Notably, H5 and H6 concerned the criterion validity using two different criteria compared to Studies 1 and 2. Specifically, we pre-registered that (https://osf.io/kezhj):

> H1: the Big MAQ can be properly described by the five assumed dimensions with a higher-order general factor on the top.

> H2: the five general items of the Mini MAQ can be properly described by one factor that represents the general factor.

> H3: (a) the MAQ (Big MAQ/Mini MAQ) shows a significant positive correlation with people's felt ambivalence elicited by pictures of meat; (b) the MAQ (Big MAQ/Mini MAQ) shows a significant positive correlation with people's potential ambivalence elicited by pictures of meat; (c) the correlation between the MAQ and felt ambivalence is higher than the correlation between the MAQ and potential ambivalence elicited by the pictures of meat the MAQ.

> H4: (a) the correlations of the MAQ and potential/felt ambivalence elicited by pictures of meat are higher compared to correlations between the MAQ and potential/felt ambivalence elicited by pictures of plant-based dishes (b) and correlations between the MAQ and potential/felt ambivalence elicited by inanimate objects.

> H5: (a) the MAQ (Big MAQ / Mini MAQ) and its subscales predict the desire to eat meat in omnivores, with higher ambivalence predicting a lower desire to eat meat. (b) The MAQ (Big MAQ / Mini MAQ) and its subscales predict the desire to eat meat in veg*ans, with higher ambivalence predicting a higher desire to eat meat.

> H6: (a) the MAQ (Big MAQ / Mini MAQ) and its subscales predict meat consumption in omnivores, with higher ambivalence predicting lower meat consumption. (b) The MAQ (Big MAQ / Mini MAQ) and its subscales predict meat consumption in veg*ans, with higher ambivalence predicting a higher meat consumption.

In addition, we wanted to define and report the norm scores of the Big MAQ, its subscales, and the Mini MAQ for the full representative sample as well as for omnivores and veg*ans separately. We also provided norm scores for different strata concerning the age and gender of the participants. With these, researchers can compare their samples or even individuals to the norm sample, for example, providing a benchmark for cross-cultural research.

Method

Participants and Design

Based on feasibility, we aimed to collect data from a representative sample of approximately 2400 adults in the United States. Therefore, we used the representative sample feature from Prolific that stratifies the sample across three demographics (age, sex, and ethnicity) based on data from the US Census Bureau. We estimated that the study would take 10 minutes after an initial pilot, but it took participants approximately 15 minutes to complete the survey. Thus, we were able to recruit 2060 participants with the available funding. Participants were compensated with a rate of £6 per hour for their participation. We pre-registered the inclusion criteria that participants had to successfully complete four attention checks and label themselves as meat eaters, meat reducers, vegetarians, or vegans, but not as pescatarians. This was done because pescatarians eschew most meat but still eat some animals (i.e., fish). Thus, they form a distinct dietary group separating themselves from omnivores and vegetarians (Rosenfeld & Tomiyama, 2021). Consequently, we excluded data from 40 participants who indicated they follow a pescatarian diet, and 90 participants due to failed attention checks.

The final sample included 1930 participants (963 females, 944 males, 23 non-binary, M_{age} = 44.40, age range = 18-90; one participant claimed to be 499 years old. Because we presume that this was a typo, the participant was removed from the analyses concerning age but retained for the other analyses). 1381 people indicated Non-Hispanic White, 122 people indicated Hispanic, 240 people indicated Black or African American, 3 people indicated American Indian or Alaska Native, 130 people indicated Asian American, and 36 people indicated Multi-Ethnic as their ethnicity; 8 participants preferred not to answer. Omnivores were the majority of our sample, as 1840 participants labeled themselves as a meat-eater or meat-reducer (909 females, 910 males, 21 non-binary, M_{age} = 44.43, age range = 18-90) and 90 participants labeled themselves as a veg*an (67 vegetarians, 23 vegans; 54 females, 34 males, 2 non-binary, M_{age} = 43.83, age range = 18-74). The final sample thereby exceeded the requirement for CFAs and SEMs and resulted in sufficient power for our analyses (Bentler & Chou, 1987). Indeed, a sample of $N \geqslant 1000$ is considered excellent for factor analysis in scale development (Boateng et al., 2018).

Materials and Procedure

Demographics and Diet-related variables. After the provision of informed consent, we assessed demographics referring to gender, age, ethnicity, native language, political orientation, and job status. Then, we assessed meat consumption, fish consumption, and animal product consumption. The items were worded 'Please specify how often you eat meat [fish, other animal products (e.g., milk, cheese, eggs)]'. Participants answered these items on a scale from 1 to 5 (1 never, 2 once a month, 3 once per week, 4 multiple times a week, 5 daily). In addition, we assessed dietary group and dietary duration as in Studies 1 and 2. Moreover, we asked participants whether they were trying to lose weight at the moment, whether they currently paid special attention to their diet (open answer), how tall they are, what their current weight was, and when they last ate.[4]

Picture Ratings. Next, participants rated six pictures by using a slider (0 disagree – 100 agree) regarding their com-

4 These items and some questions in regard to the pictures were assessed in order to develop a picture data bank as a secondary aim of this data collection.

plexity ('This object is complex'), arousal ('When I see this object I experience an emotional arousal'), anger ('When I see this object I experience anger'), disgust ('When I see this object I experience disgust'), compassion ('When I see this object I experience compassion'), palatability ('This food is palatable'), desire to eat ('I would like to eat this food right now if it were in front of me'), valence ('Evaluate this object'), positivity ('How positive is this object regardless of its negative aspects?'), negativity ('How negative is this object regardless of its positive aspects?'), and felt ambivalence ('To what extent do you experience conflicting thoughts or feelings towards this object?'). Participants saw the six pictures in random order and provided their answers to each question in blocks. The order of blocks was randomized as well (except for positivity and negativity, which were assessed to compute the similarity-intensity index). Notably, the desire to eat and palatability were only assessed for food stimuli.

The pictures were randomly drawn from a pool of 796 pictures of various content against a white background (https://osf.io/cyauw/?view_only=7dbf0726bd1f4ee8a2a083ce62e5a108). Most pictures depicted food stimuli, such as meat, fish, cheese, fruits, vegetables, and a variety of processed foods. The pool also comprised pictures of inanimate objects, plants, and animals. For our hypotheses, we were interested only in pictures of meat and plant-based food as well as inanimate objects. Thus, we ensured that every participant saw a picture of a meat-based dish, a picture of a plant-based dish, and a picture of an inanimate object. To do so, we created separate blocks including all 130 pictures of meat, 130 pictures of plant-based foods, and all 136 pictures of inanimate objects; from these blocks, one picture was drawn at random for each participant. The other three pictures were randomly drawn from the remaining 400 pictures. Because there were additional pictures of plant-based dishes in the remaining pool, we calculated a mean if participants provided multiple ratings for plant-based dishes as pre-registered.

Meat Ambivalence Questionnaire (MAQ). We assessed the MAQ with the 25 retained items as in Study 2 (see Table 3). Internal consistencies for the Big MAQ and its subscales were good to great in Study 3 (all ω > .86; see Table S6 for detailed information).

Analyses

In Study 3, we aimed to demonstrate the higher-order five-factor structure of the MAQ in a representative US sample. We also aimed to demonstrate the construct and criterion validity of the MAQ and to calculate norm scores regarding age, gender, and diet type for Mini MAQ, Big MAQ, and MAQ subscales based on the representative sample. We analyzed the data with the same software and the same approaches as in Studies 1 and 2 based on 25 MAQ items that were selected in Study 2. Because we had the same hypotheses for omnivores and veg*ans in H3 and H4, we tested these hypotheses in the full sample using latent analyses. As the predictions in H5 and H6 depended on people's dietary groups, these hypotheses were tested separately for omnivores and vegetarians. Note that in omnivores, we were able to apply latent analyses methods (i.e., SEM based on latent factor scores) to tests H5 and H6, whereas in vegetarians, we could only apply manifest analyses methods (i.e., correlations and multiple regression analyses based on scale means) due to the small sample size of n = 90 participants.

> H1: Factor Structure Big MAQ: We conducted the same CFAs as in Studies 1 and 2 to test the factor structure of the ambivalence questionnaire in the complete sample.

> H2: Factor Structure Mini MAQ: We conducted one short scale CFA based on five items in the complete sample.

> H3: Convergent and Discriminant Validity: In the full sample, we calculated latent correlations of Mini MAQ and Big MAQ with felt and potential ambivalence both elicited by pictures of meat and tested whether the correlations of Mini MAQ and Big MAQ with felt ambivalence significantly differed from the correlations with potential ambivalence. We calculated the same SEMs as in Studies 1 and 2 using felt and potential ambivalence elicited by pictures of meat instead of scale means.[5]

> H4: Convergent and Discriminant Validity: In the full sample, we conducted several SEMs to test whether the correlations of Mini MAQ and Big MAQ and potential/felt ambivalence elicited by pictures of meat were higher compared to correlations of Mini MAQ and Big MAQ with potential/felt ambivalence elicited by pictures of plant-based dishes and correlations between the MAQ and potential/felt ambivalence elicited by inanimate objects. In SEM_4.1 Mini, we tested whether Mini MAQ was correlated with potential ambivalence elicited by pictures of meat, pictures of plant-based dishes, or pictures of inanimate objects (all correlations were freely estimated). In SEM_4.1_Mini_a, the correlations between Mini MAQ and potential ambivalence elicited by pictures of meat and potential ambivalence elicited by pictures of plant-based dishes were fixed to the same value. In SEM_4.1_Mini_b, the correlations between Mini MAQ and potential ambivalence elicited by pictures of meat and potential ambivalence elicited by pictures of inanimate objects were fixed to the same value.

> In SEM_4.2_Mini, we tested whether Mini MAQ was correlated with felt ambivalence elicited by pictures of meat, pictures of plant-based dishes, or pictures of inanimate objects (all correlations were freely estimated). In SEM_4.2_Mini, the correlations between Mini MAQ and felt ambivalence elicited by pictures of meat and felt ambivalence elicited by pictures of plant-based dishes were fixed to the same value. In

5 We also calculated the correlations for H3 and H4 for omnivores and veg*ans separately. These analyses are reported in Table S7 and S8 in the supplemental materials on the OSF.

Table 9. Model Fit of the Confirmatory Factor Analyses in Study 3

Model	χ^2	*df*	SCF	*p*	CFI	RMSEA	SRMR
One-factor model	7907.227	275	1.526	< .001	.752	.120	.120
First-order-factor model	966.273	265	1.458	< .001	.977	.037	.037
Higher-order five-factor model	1080.098	270	1.463	< .001	.974	.039	.033
Short scale model	66.972	5	1.455	< .001	.979	.080	.021

SEM_4.2_Mini_b, the correlations between Mini MAQ and felt ambivalence elicited by pictures of meat and felt ambivalence elicited by pictures of inanimate objects were fixed to the same value. The same analyses were conducted for the Big MAQ.[5]

H5: Criterion Validity: In omnivores, we conducted several SEMs to test whether Mini MAQ (SEM_5.1), Big MAQ (SEM_5.2), animal-based (SEM_5.3), socially-based (SEM_5.4), health-based (SEM_5.5), sustainability-based (SEM_5.6), and sensory-based subscales (SEM_5.7) predicted desire to eat meat. We conducted one additional SEM (SEM_5.8) to test whether the five MAQ subscales incrementally predict the desire to eat meat beyond the other MAQ subscales. That is, in SEM_5.8, the five MAQ subscales simultaneously predict the desire to eat meat. In vegetarians, the same tests were carried out by multiple regression analyses. That is, in Step 1, each MAQ scale was investigated as a separate predictor of the desire to eat meat. In Step 2, the five MAQ subscales were investigated as simultaneous predictors of the desire to eat meat.

H6: Criterion Validity: In omnivores, we conducted several SEMs to test whether Mini MAQ (SEM_6.1), Big MAQ (SEM_6.2), animal-based (SEM_6.3), socially-based (SEM_6.4), health-based (SEM_6.5), sustainability-based (SEM_6.6), and sensory-based subscale (SEM_6.7) predicted meat consumption. We conducted one additional SEM (SEM_6.8) to test whether the five MAQ subscales incrementally predict meat consumption beyond the other MAQ subscales. That is, in SEM_6.8, the five MAQ subscales simultaneously predict meat consumption. In vegetarians, the same tests were carried out by multiple regression analyses. That is, in Step 1, each MAQ scale was investigated as a separate predictor of meat consumption. In Step 2, the five MAQ subscales were investigated as simultaneous predictors of meat consumption.

H7: We calculated norm scores (i.e., *z*-scores, *T*-scores percentile ranks) for the Mini MAQ, Big MAQ, and all MAQ subscales for the full representative sample. We also provide norm scores stratified based on age, gender, and dietary group.

Results

H1: Factor Structure Big MAQ: Fit indices of the CFAs based on the complete sample are reported in Table 9. The one-factor models did not reach adequate fit indices. The first-order five-factor model and the higher-order five-factor model both showed a very good fit to the data (CFI > .95, RMSEA < .06, and SRMR < .08).

H2: Factor Structure Mini MAQ: The short scale model reached an adequate model fit (CFI = .979, RMSEA = .080, and SRMR = .021) with the exception that the observed RMSEA of .080 was higher than the recommended criterion of .06.

H3: Convergent and Discriminant Validity: Correlations of Mini and Big MAQ with felt and potential ambivalence elicited by pictures of meat are reported in Table 10. All correlations were significant. In addition, both the Mini MAQ and the Big MAQ were significantly more correlated with felt ambivalence than with potential ambivalence.

H4: Convergent and Discriminant Validity: Correlation coefficients of the Mini MAQ and the Big MAQ with potential and felt ambivalence elicited by pictures are reported in Table 11. The Mini and Big MAQ were positively associated with potential ambivalence elicited by pictures of meat and plants but not related to potential ambivalence elicited by pictures of objects. As expected, the correlations with potential ambivalence elicited by pictures of meat were significantly higher than the correlation with potential ambivalence elicited by pictures of plants and objects. Moreover, the Mini MAQ and Big MAQ were positively associated with felt ambivalence elicited by pictures of meat, but also with felt ambivalence elicited by pictures of plants and objects. The correlations with ambivalence towards meat were again significantly higher than the significant correlations with felt ambivalence elicited by pictures of plants and objects.

H5: Criterion Validity: Regression coefficients of the SEMs predicting the desire to eat meat by all MAQ scales are reported in Table 12. In omnivores, SEMs indicated that all MAQ scales negatively predicted the desire to eat meat when not controlling for other MAQ subscales. SEM_5.8 indicated that animal origin and sustainability were negative predictors of the desire to eat meat even after controlling for all other MAQ subscales. In vegetarians, multiple regression analyses indicated that all MAQ scales positively predicted the desire to eat meat when not controlling for other MAQ subscales. Moreover, the sensory ambivalence subscale positively predicted the desire to eat meat even after controlling for all other MAQ subscales.

H6: Criterion Validity: Regression coefficients of the SEMs predicting meat consumption by all MAQ scales are reported in Table 12. In omnivores, SEMs indicated that all MAQ subscales negatively predicted meat consumption when not controlling for other MAQ subscales. SEM_6.8 indicated that the animal-based and sensory-based subscales were negative predictors of meat consumption even after controlling for all other MAQ subscales. In vegetarians, multiple regression analyses indicated that all MAQ

Table 10. Correlations of Mini MAQ and Big MAQ with Felt and Potential Ambivalence in Study 3

MAQ scale	Correlation with Felt Ambivalence		Correlation with Potential Ambivalence		Significance test for the difference between the correlations			
	r	*p*	*r*	*p*	$\Delta\chi^2$	Δdf	Δp	ΔCFI
Mini MAQ	.373	< .001	.229	< .001	9.957	1	.002	.003
Big MAQ	.364	< .001	.217	< .001	11.595	1	.001	.001

Table 11. Correlations of Mini MAQ and Big MAQ with Potential and Felt Ambivalence in Study 3

Correlation of				Significance test against correlation to ambivalence elicited by meat			
		r	*p*	$\Delta\chi^2$	Δdf	Δp	ΔCFI
Mini MAQ	Potential (meat)	.229	< .001				
Mini MAQ	Potential (plants)	.061	.014	35.520	1	< .001	.008
Mini MAQ	Potential (objects)	.024	.338	44.413	1	< .001	.010
Big MAQ	Potential (meat)	.217	< .001				
Big MAQ	Potential (plants)	.053	.028	34.276	1	< .001	.001
Big MAQ	Potential (objects)	.014	.549	46.693	1	< .001	.001
Mini MAQ	Felt (meat)	.373	< .001				
Mini MAQ	Felt (plants)	.112	< .001	116.795	1	< .001	.037
Mini MAQ	Felt (objects)	.090	< .001	97.086	1	< .001	.022
Big MAQ	Felt (meat)	.364	< .001				
Big MAQ	Felt (plants)	.118	< .001	111.988	1	< .001	.002
Big MAQ	Felt (objects)	.094	< .001	93.565	1	< .001	.001

Note. Potential (meat) = potential ambivalence elicited by pictures of meat. Felt (meat) = felt ambivalence elicited by pictures of meat.

scales positively predicted meat consumption when not controlling for other MAQ subscales. Moreover, the sensory-based subscale positively predicted meat consumption even after controlling for all other MAQ subscales.

Norm Scores

Norm scores (Percentile ranks, *z*-, and *T*-scores) of the Mini MAQ, Big MAQ, and all MAQ subscales are reported in Table S9 in the supplemental materials. The norm scores are available for the full sample (excluding people who failed the attention checks), and the subsamples of omnivores, and veg*ans. We also stratified the data according to age and gender.

Based on this, we were interested in how our subsamples of omnivores and vegetarians from the UK in Study 2 (where the same questionnaire was employed) compared to the US representative sample. The analyses revealed that omnivores and vegetarians from the UK in Study 2 scored slightly higher on the Big and Mini MAQ as well as its subscales compared to their respective counterparts in the representative US sample (see Table 13). Compared with the full norm sample, omnivores still had higher values on the MAQ in Study 2, and vegetarians in Study 2 experienced less ambivalence compared to the full norm sample (see Table 13).

Discussion

In Study 3, we provided further evidence for the multidimensional nature of ambivalence as well as the convergent, discriminant, and concurrent validity of the MAQ in a representative sample. Extending our previous studies, we assessed potential and felt ambivalence towards a broad range of concrete meat and plant-based dishes as well as inanimate objects. This allowed us to assess people's ambivalence not only in general but also to specific attitude objects. It also enabled us to assess people's desire to eat certain dishes. While the results of Study 3 were mostly as expected, we found associations of the MAQ not only with ambivalence elicited by meat but also by plants and objects. We believe that these unexpected correlations might arise because people who are ambivalent in one domain tend to be more ambivalent in other domains—suggesting trait differences in how often or strongly people feel ambivalent (Schneider et al., 2022). Importantly, however, the correlations with ambivalence elicited by plant and object pictures were smaller than the correlation with ambivalence elicited by meat pictures.

Quantitative Study 4: Relations between Multidimensional and Behavioral Ambivalence

In Study 4, we again aimed to provide evidence for the multidimensional nature of ambivalence as well as the va-

Table 12. Regression Coefficients of Desire to Eat Meat and Meat Consumption on MAQ Scales in Study 3

MAQ scale	Omnivores (n = 1840)				Vegetarians (n = 90)			
	Step 1: Separate prediction		Step 2: Simultaneous prediction		Step 1: Separate prediction		Step 2: Simultaneous prediction	
	β	*p*	*β*	*p*	*β*	*p*	*β*	*p*
Prediction of Desire to eat Meat								
Mini MAQ	-.169	< .001	-	-	.574	< .001	-	-
Big MAQ	-.154	< .001	-	-	.597	< .001	-	-
Animal	-.187	< .001	-.190	< .001	.429	< .001	-.103	.506
Socially	-.105	< .001	.059	.265	.577	< .001	.203	.209
Sustainability	-.095	< .001	.039	.398	.480	< .001	-.122	.393
Health	-.167	< .001	-.133	.006	.516	< .001	.168	.343
Sensory	-.107	< .001	.054	.280	.406	< .001	.512	< .001
Prediction of Meat Consumption								
Mini MAQ	-.253	< .001	-	-	.544	< .001	-	-
Big MAQ	-.254	< .001	-	-	.578	< .001	-	-
Animal	-.240	< .001	-.123	.005	.385	< .001	-.149	.331
Socially	-.197	< .001	.091	.135	.577	< .001	.235	.145
Sustainability	-.182	< .001	.037	.414	.489	< .001	-.102	.469
Health	-.217	< .001	-.014	.767	.477	< .001	.098	.576
Sensory	-.268	< .001	-.269	< .001	.646	< .001	.560	< .001

Note. In omnivores, analyses were carried out by structure equation modeling. In vegetarians, analyses were carried out by multiple regressions.

Table 13. Comparison of the Means (Scale 1 to 7) in the Omnivorous and Vegetarian Subsamples (Study 2) with the Norm Scores in Study 3

	Omnivores (n = 514)				***Vegetarians (n = 514)***			
	M	*SD*	*PR Full*	*PR Omn*	*M*	*SD*	*PR Full*	*PR Veg*
Mini MAQ	3.78	1.40	58.85	58.15	2.18	1.17	28.03	54.44
Big MAQ	3.67	1.31	55.29	54.18	2.08	1.03	27.42	54.44
Animal	4.53	1.81	58.60	57.88	2.57	1.87	31.74	53.33
Socially	3.20	1.47	60.73	59.67	1.88	1.09	28.23	54.44
Sustainability	4.11	1.74	61.39	60.54	2.05	1.41	31.13	60.00
Health	3.55	1.42	56.26	55.11	2.20	1.21	31.59	63.33
Sensory	2.98	1.37	59.61	58.80	1.71	0.95	28.59	50.00

Note. *M* = Mean; *SD* = Standard Deviation; *PR Full* = Percentile rank compared with the full sample in Study 3; *PR Omn/Veg* = Percentile rank compared with the omnivorous/vegetarian subsample in Study 3. Percentile ranks refer to the percentage of scores in a frequency distribution that are below that score.

lidity of the MAQ by showing its relation to conflict reflected in people's actual behavior. That is, our previous studies relied on self-reports (except for more behavioral measures on information seeking and petition signing in Study 2). Despite being the gold standard, self-report measures of ambivalence might be prone to issues such as a lack of introspection or social desirability. Thus, we aimed to validate the MAQ with a behavioral measure of ambivalence.

Ambivalence can be observed in people's behavior, for instance, via their body movements if they waver between opposing options or are torn between two sides of an issue (Schneider et al., 2013). To assess this behavioral component of conflicts, process tracing tools have been developed (Schneider et al., 2015) like the mouse-tracking paradigm (e.g., Freeman & Ambady, 2010). The mouse-tracking paradigm usually includes an evaluation task in which people have to decide between two opposing response options. If these response options are labeled "positive" and "negative", ambivalence—as the concurrent activation of opposing associations towards an attitude object—can then be inferred from people's mouse trajectories (Schneider et al., 2015). Specifically, ambivalence is quantified by the extent to which people's mouse trajectories are pulled towards the non-chosen option (Schneider et al., 2015).

Mouse-tracking allows researchers to capture the dynamic aspects of ambivalence during a decision and not only people's self-reports after a decision (Schneider et al., 2015). Mouse-tracking as a behavioral measure of ambivalence thereby addresses important limitations of self-report (Schneider et al., 2015). Mouse-tracking has been used to assess ambivalence towards unhealthy snacks (Gillebaart et al., 2016), food past its best before dates (Buttlar et al., 2021), plastic (Hahn et al., 2021), and meat consumption (Buttlar & Walther, 2018)—where the lack of introspection or social desirability may bias people's responses.

In Study 4, we used mouse-tracking to measure meat-related ambivalence during the evaluation of pictures of meat and plant-based dishes as well as inanimate objects. Our approach was similar as in Study 3, but we assessed ambivalence in multiple trials and did not rely on self-report. Our first two hypotheses in Study 4 were therefore identical to hypotheses H3 and H4 in Study 3. In addition, we aimed to explore how the subscales of the MAQ related to our behavioral measure of meat-related ambivalence. Thereby, we investigated which kinds of ambivalence are reflected in people's behavior. We specifically predicted that:

> H1: (a) the MAQ (Big MAQ/Mini MAQ) shows a significant positive correlation with people's behavioral ambivalence elicited by pictures of meat.

> H2: (a) the correlations of the MAQ (Big MAQ/Mini MAQ) and behavioral ambivalence elicited by pictures of meat are higher compared to correlations between the MAQ and behavioral ambivalence elicited by pictures of plant-based dishes (b) and correlations between the MAQ and behavioral ambivalence elicited by inanimate objects.

> H3: Lastly, we aimed to explore how the different subscales of the MAQ correlated with people's behavioral ambivalence.

Method

Participants and Design

The present study is part of a separate replication study of Buttlar and Walther (2018) on ambivalence and attitudes towards animals. We aimed to recruit up to 200 participants based on feasibility and recruitment success. Such sample sizes are common for mouse-tracking studies with highly powered within-subjects designs (e.g., Buttlar & Walther, 2018; Schneider et al., 2015). We recruited participants in the participant pool from a large German University, and participants received course credits for their participation. As outlined in the pre-registration, we stopped data collection on March 1st 2022. The initial dataset comprised 107 participants, but one participant did not use a computer device, which prevented the collection of mouse-tracking data. No participant failed both attention checks. Thus, we were able to analyze the data of 106 participants (62 omnivores, 7 pescatarians, and 37 veg*ans; 84 females, 21 males, 1 non-binary; M_{age} = 22.56, age range = 18-54). This final sample allowed us to find a small to medium-sized effect of r = .235 with a power of 1-β = .80 testing a one-tailed correlation (Cohen, 1992; Faul et al., 2007).

Materials and Procedure

Mouse-Tracking. After participants consented to take part in the study, we assessed whether they used a desktop device with either a computer mouse or a trackpad. They were screened out if they did not use a computer device. Then, they completed the mouse-tracking paradigm. To conduct mouse-tracking online, we adapted the software by Mathur and Reichling (2019) that was initially developed in JavaScript for the Qualtrics survey platform to be usable on the Unipark survey platform. During the mouse-tracking paradigm, we asked participants to evaluate 120 pictures as positive or negative. Twenty pictures showed meat; 20 pictures showed plant-based food; 80 pictures showed inanimate objects. For meat and plant-based food, 10 pictures depicted raw food and 10 pictures showed cooked food. These pictures were almost identical except for the degree of processing. All pictures were taken from the same picture database as in Study 3. Notably, the 120 experimental trials were preceded by five practice trials that depicted various household items and were not included in any analyses.

Figure 4 depicts the set-up of the mouse-tracking task. To start a trial, participants had to click the 'Next'[Weiter] button in the lower middle of the response window. Then, a randomly selected picture appeared. Participants used their cursor to evaluate each picture by clicking on one of the 'Positive'[Positiv] or 'Negative'[Negativ] buttons which were located in the upper right and left corners of the screen. Notably, we counterbalanced the location of the response buttons between participants. After participants responded, the picture disappeared and the screen turned white. Participants could not change their responses and had to click on the 'Next' button to proceed. In this setting, we operationalized ambivalence by the extent to which participants' mouse trajectories diverge horizontally from an ideal trajectory spanning from the initial position of the mouse to the selected response button (see Figure 4; Mathur & Reichling, 2019). We rescaled this maximum deviation by the unit of measurement as outlined by Mathur and Reichling (2019). Thus, higher values indicate greater maximum deviation and thereby more ambivalence.

In line with the recommendations by Mathur and Reichling (2019), we took a variety of measures to ensure valid measurement and comparability of results in online settings. By fixing the height (925px) and width (675px) of the response window, we ensured that the response window was equally sized independent of participants' technical devices. To ensure optimal visibility of the response window, participants were alerted after each trial if their browser window was too small and prompted to ensure that the screen is on full display. To capture the dynamic aspects of ambivalence during the decision, participants also received several alerts via pop-up windows about the timing of their mouse movements after they responded: Participants received an alert if their mouse cursor was not in the area of the next button after the page was fully loaded ("STARTED TOO EARLY. You moved the cursor from

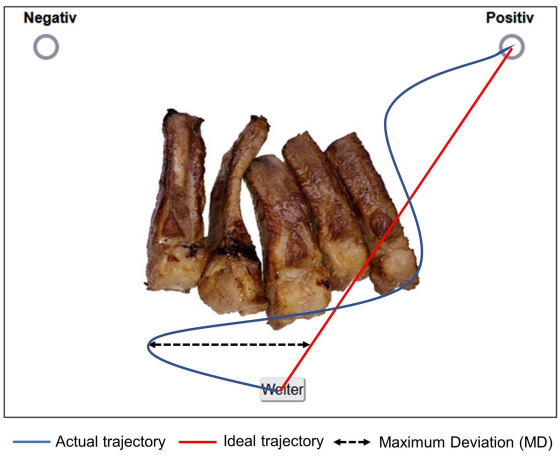

Figure 4. Illustration of the Ideal Mouse-Trajectory and an Actual Mouse-Trajectories as well as its Maximum Deviation in One Trial in the Mouse-Tracking Paradigm.

Note. Trajectories were not visible to participants.

the start position 'Next' before the question was fully displayed), if they did not move 800ms after the page was fully loaded ("STARTED TOO LATE. You waited a little too long to move the cursor. To speed up your answer, move the cursor earlier, even if you haven't made a final decision on your answer."), and if they did not complete their response within 5,000ms ("THE TIME LIMIT IS EXCEEDED. You took longer than 5 seconds to respond.").

Meat Ambivalence Questionnaire (MAQ). We assessed the MAQ with a German translation of the final version (see Table 3; and materials on the OSF). Internal consistencies for the Big MAQ and its subscales were good to great with this version of the MAQ (Big MAQ: ω = .95: Animal-Based Ambivalence: ω = .92: Socially-based ambivalence: ω = .90; Sustainability-based ambivalence: ω = .92 Health-based ambivalence: ω = .84; Sensory-based ambivalence: ω = .85). The internal consistency for the Mini MAQ: ω = .77 was adequate.

Additional Measures. In addition to the mouse-tracking and MAQ, we assessed traditional measures of felt and potential ambivalence as in Studies 1 and 2, the Motivations to Eat Meat Inventory (Hopwood, Piazza, et al., 2021), and primary and secondary emotions attributed to animals (Bilewicz et al., 2011). These measures were included for a separate project to replicate Buttlar and Walther (2018), and are thus not relevant for the present analyses.

Diet-related variables and Demographics. Lastly, we assessed diet-related variables and demographics as in previous studies: We asked participants for their self-labeled dietary group, dietary duration, and dietary strictness, as well as meat, seafood, and animal product consumption. Then, we asked them about their age, gender, education, and job status including their field of study, people in their household, and responsibility for cooking and shopping.

Analyses and Results

As pre-registered (https://aspredicted.org/jw7g6.pdf), we assured high data quality by removing trials in which participants started too early or took too little or too much time to react: Participants reacted too early in 4.6 percent of all trials (i.e., diverged 45px to the right, left or top and 25px to the bottom from the "Next" button); and they reacted too slow in 3.9 percent of the remaining trials based on a median absolute deviation criterion (i.e., median +/- 3*MAD; Leys et al., 2013). We calculated the split-half reliabilities for the remaining trials using 10000 iterations. The maximum deviation measure showed acceptable to good split-half congeneric reliabilities in the stimuli groups (Meat: ρ_{SC} = .802; Plant-Based: ρ_{SC} = .766; Objects: ρ_{SC} = .882; Steinke & Kopp, 2020; see supplemental materials for details). We then calculated means for the categories.

Because we did not reach the recommended n = 200 participants to conduct latent analyses (Bentler & Chou, 1987), we tested our hypotheses in manifest analyses. An inspection of the histograms and QQ plots indicated a non-normal distribution of the data. Therefore, we used Spearman rank correlations (ρ_S) to test the associations between the MAQ and the maximum deviation in trials depicting meat, plant-based food, and objects in the mouse-tracking paradigm.

H1: The Big MAQ (ρ_S = .302, p = .002) and Mini MAQ (ρ_S = .228, p = .019) were positively associated with people's maximum deviation in trials depicting meat. This indicates that people with high scores on the MAQ also show greater behavioral ambivalence.

H2: The correlation of the Big MAQ with maximum deviation in trials including pictures of meat was significantly higher (t = 2.502, p = .014) than the correlation of the Big MAQ with pictures of plant-based dishes (ρ_S = .021, p = .827) but not significantly higher than its correlation with pictures of inanimate objects (ρ_S = .122, p = .212; t = 1.924, p = .057). For the Mini MAQ, a similar pattern emerged as the correlation with the maximum deviation in trials depicting meat dishes was significantly higher (t = 2.091, p = .039) than the correlation with people's maximum deviation in trials depicting plant-based food (r = .001, p = .990), but not in trials depicting inanimate objects (ρ_S = .063, p = .520; t = 1.887, p = .063). Taken together, this suggests that the MAQ indeed measures felt ambivalence towards meat that relates to people's behavioral tendency when evaluating meat but not plant-based foods.

H3: As can be seen in Table 14, people's maximum deviation in trials in which meat dishes were significantly correlated with all sub-scales except for the sustainability-based subscale. To gain more insight into this, we calculated the Bayes factors for the Spearman rank correlations (van Doorn et al., 2020). The results depicted in Table 14 suggested strong evidence for sensory- and health-based ambivalence, moderate evidence for socially-based ambivalence, and weak evidence for animal-based ambivalence in favor of the H1, i.e., implying an association between the MAQ and the maximum deviation as a behavioral measure of ambivalence (van Doorn et al., 2021). Contrarily, the Bayes factor for the correlation between sustainability-

Table 14. Spearman Rank Correlations (ρ_S) of the MAQ Subscales with Behavioral Ambivalence as Measured via the Maximum Deviation in the Mouse-Tracking Paradigm

	ρ_S	*p*	*BF01*
Animal	.253	.031	2.267
Socially	.285	.012	4.966
Sustainability	.123	.209	0.278
Health	.306	.007	10.493
Sensory	.283	.012	21.307

Note. To account for the exploratory nature of these analyses, we used Holm corrections to adjust the *p*-values.

based ambivalence and maximum deviation provided (weak) evidence in favor of the H0, indicating the absence of an effect. These differences in the correlational patterns again suggest that accounting for the multidimensional nature of meat-related ambivalence may improve one's understanding of meat-related conflict.

General Discussion

In many cultures, meat consumption has become controversial: People value meat for its positive aspects such as taste and social function (Leroy & Praet, 2015); yet they are also concerned about the negative aspects of meat such as its detrimental consequences for the environment, health, and animal welfare (Godfray et al., 2018). Here, we conceptualize this conflict as ambivalence, i.e., as the simultaneous presence of positive and negative associations toward meat. By doing so, the multidimensional nature of meat-related ambivalence in omnivores and veg*ans becomes apparent: We argue that because omnivores typically hold positive attitudes towards meat, they experience ambivalence due to specific negative associations with meat consumption; whereas veg*ans typically have negative attitudes towards meat, and experience ambivalence due to specific positive associations with meat consumption.

Using a mixed-methods approach, our investigation demonstrates that meat-related ambivalence is indeed multidimensional and experienced by both omnivores and veg*ans in different domains. Our qualitative data indicates that meat-related ambivalence may arise due to the animal origin, social role, environmental consequences, health impact, and sensory properties of meat. Omnivores and veg*ans differed in the frequency of experienced conflict and the domains of their meat-related conflict. Omnivores most often experienced animal-based ambivalence but reported conflicts in all five domains; in contrast, veg*ans most often experienced socially- and sensory-based ambivalence and sometimes health-based ambivalence.

To quantify meat-related ambivalence in these five domains, we developed and tested the MAQ in four studies. Highlighting the multidimensional nature of meat-related ambivalence, the MAQ showed the assumed higher-order five-factor structure and was measurement invariant for omnivores and vegetarians. In line with our hypotheses, we were able to demonstrate the construct validity of the MAQ (Boateng et al., 2018): The MAQ allowed us to differentiate between known groups, as we found the expected differences in meat-related ambivalence between omnivores and vegetarians (Study 1 & 2). In addition, the MAQ was associated more strongly with felt than potential ambivalence (Study 1-3), while the correlations between the MAQ and potential ambivalence were comparable to correlations between traditional measures of felt and potential ambivalence in other studies (e.g., Pauer et al., 2022; Sargent & Newman, 2021). The MAQ was more strongly associated with ambivalence toward specific meat dishes than towards plant-based dishes or inanimate objects (Study 3 & 4). This was the case with self-report measures (Study 3), but also when using the mouse-tracking paradigm as behavioral measure of ambivalence (Study 4). Lastly, network analyses provided insights into the nomological net of the MAQ: The MAQ subscales seem to be domain-specific because they were uniquely linked to positive and negative associations that opposed dominant attitudes towards meat in omnivores and vegetarians. In these analyses, traditional measures for felt and potential ambivalence did not differentiate between omnivores and veg*ans on specific meat-related associations (Study 2). This does not come as a surprise, however, as traditional measures of self-reported ambivalence in vegetarians showed low psychometric qualities.

Importantly, different domains of conflict were associated with the downstream consequences of ambivalence in omnivores and veg*ans. For omnivores, animal- and sensory-based ambivalence were especially associated with reduced meat consumption, and for veg*ans, socially- and sensory-based ambivalence were associated with less dietary strictness (Study 2) and more meat consumption (Study 3). Network analyses in Study 2 indicated that the associations between ambivalence and dietary strictness for veg*ans remained significant when controlling for other important determinants of meat-related behavior. Moreover, the network analyses revealed that meat-related ambivalence was associated with information seeking in both omnivores and veg*ans beyond other determinants of meat consumption: Omnivores more often looked for information on plant-based diets if they reported higher sustainability-, health-, and sensory-based ambivalence; vegetarians more frequently looked for information on plant-based diets if they experienced more health-based ambivalence. Moreover, sustainability-based ambivalence was the only MAQ subscale that did not seem to be associated with behavioral meat-related ambivalence in Study 4 in the mouse-tracking paradigm.

These results of the present investigation corroborate the findings in the growing literature on interventions that motivate people to reduce their meat consumption. These studies have found that providing information about animal welfare issues and the moral implications of meat consumption is most effective (e.g., Cordts et al., 2014; Mathur et al., 2021; Palomo-Vélez et al., 2018). This aligns with our findings that animal-based ambivalence is linked more tightly to meat reduction in omnivores than other domains of conflict. Thus, we agree with Berndsen and van der Pligt (2004), who argued in their seminal work that increasing ambivalence via moral beliefs would be a promising pathway to motivate omnivores to decrease their meat consumption. Besides moral (animal welfare) messages, disgust-oriented messages have been found to strongly influence meat-related attitudes in both omnivores and veg*ans (e.g., Buttlar & Walther, 2022; Palomo-Vélez et al., 2018). Our findings again mirror the results from these intervention studies, as sensory-based ambivalence was associated with lowered meat consumption in omnivores and heightened meat consumption in veg*ans. We argue that domain-specific ambivalence could serve as an underlying process fostering these effects on dietary behaviors (Buttlar & Walther, 2022; Pauer et al., 2022): It might make people more pliable to change their behavior (Conner & Armitage, 2008). Thus, assessing domain-specific ambivalence via the MAQ may help one better understand the effects of such interventions on behavior change and behavior maintenance.

This shows how important it is to consider the multidimensional nature of meat-related ambivalence to understand meat-related conflict. Thus, researchers should disentangle who experiences meat-related conflict, and why they do so, for instance, by using the MAQ: Because the factors of the MAQ scales are scalar measurement invariant for omnivores and veg*ans, the full scale and the subscales can be used to study both populations separately or to compare them. For studying effects within or across dietary groups with the MAQ, researchers may use means in manifest analyses; however, if researchers compare means between omnivores and veg*ans, we recommend using latent analyses. Additionally, researchers who are interested in a particular domain may use one (or more) subscale(s) of the MAQ, and researchers who are interested in the general factor may employ either the short version with five items (Mini MAQ) or the long version with 25 items (Big MAQ). Because we also assessed the MAQ and its subscales in a representative US sample and provided norm scores, researchers may compare their samples or even individuals to this reference sample or subsamples where we stratified the sample based on diet, age, and gender. This way, we hope the MAQ will help to foster research on meat-related conflict in omnivores and veg*ans.

Limitations

We used a multi-method approach to develop and test the multidimensional nature of ambivalence—outlining the domains in which omnivores and veg*ans experience conflict. By using both qualitative and quantitative data, including self-report and behavioral measures, we account for issues arising from unexplained shared variance with other constructs or methods in our cross-sectional data. Going beyond traditional analyses, we additionally analyzed the coherence of important determinants of meat-related attitudes and behavior from a network perspective in Study 2. This way, we demonstrated that the associations of meat-related ambivalence with meat-related intentions and behaviors remain beyond other determinants of meat consumption, for example, comprehensive measures of attitudes that pertain to the motivations to eschew or eat meat (Hopwood, Piazza, et al., 2021; Hopwood, Rosenfeld, et al., 2021). These methodological and statistical approaches combined with our quasi-experimental research designs allowed us to provide compelling support for the multi-dimensional nature of ambivalence—suggesting that the experiences and downstream consequences of meat-related ambivalence depend on people's dietary groups. However, future researchers should aim to provide further insights into the causal dynamics of meat-related ambivalence by conducting longitudinal and experimental studies.

In addition, our samples only include participants from WEIRD samples (Henrich et al., 2010) as we recruited participants from Germany, the UK, and the US. Although our third study covers a representative sample from the US, our research in predominantly WEIRD countries might hamper the applicability of the MAQ in other cultural contexts. Indeed, in recent years, cross-cultural research in the domain of meat-related dissonance has received more attention, sampling from countries such as India, China, and Ecuador (e.g., Khara et al., 2021; Kunst & Palacios Haugestad, 2018; Tian et al., 2016). This research suggests that people in most parts of the world experience meat-related conflict, but that their cultural background moderates how they cope with their conflict. We believe that the found dimensions might generalize across countries; it is likely, however, that the triggers and consequences of meat-related ambivalence also depend on people's cultural backgrounds. By providing norm scores from a US sample, we hope that the present investigation fosters systematic cross-cultural research. Here, the five-factor structure of MAQ allows investigating differences in the magnitudes of domain-specific ambivalence. Based on other research, it might be hypothesized, for example, that socially-based ambivalence could be more pronounced in India (Khara et al., 2021; Ruby & Heine, 2012), or that animal-based ambivalence can be less pronounced in Ecuador (Kunst & Palacios Haugestad, 2018) compared to our norm sample. Future research should thus go beyond WEIRD populations and investigate how and why people across the world experience meat-related conflict.

In this vein, it should be noted that the triggers of meat-related ambivalence may not be exhaustive, although we believe that the MAQ covers the most common domains of meat-related ambivalence in the sampled populations. That is, there were some reports of conflict in our qualitative data that were not captured by our coding scheme. These referred for instance to price considerations (i.e., meat is too cheap; cf. Pauer et al., 2022) or the social issues caused

by current meat production systems. Future research might want to investigate these triggers, even if they are less common than the triggers scrutinized in the present line of research.

Conclusion

Using a mixed-methods approach, we demonstrate that meat-related ambivalence is multi-dimensional and experienced by both omnivores and veg*ans. We predicted that omnivores experience ambivalence if specific negative associations oppose their predominantly positive evaluation of meat, and that veg*ans experience ambivalence if specific positive associations oppose their predominantly negative evaluation of meat. One qualitative and four quantitative studies—in which we developed the MAQ—support these claims, showing that meat-related ambivalence can be elicited in various domains. As our results suggest that the domains of meat-related conflict predict differences in experiences of conflict and their downstream consequences, we hope that the MAQ will help researchers to better understand meat-related conflict in omnivores and veg*ans.

Author Contributions

Conceptualization: Benjamin Buttlar, Shiva Pauer, Matthew B. Ruby, and Vsevolod Scherrer.
Data curation: Benjamin Buttlar, Ann-Kathrin Jimenez-Klingberg, and Jasmin Scherf.
Formal analysis: Benjamin Buttlar, Monique Chambon, and Vsevolod Scherrer.
Funding acquisition: Benjamin Buttlar and Matthew B. Ruby.
Investigation: Benjamin Buttlar, Shiva Pauer, Matthew B. Ruby, Ann-Kathrin Jimenez-Klingberg, Jasmin Scherf, and Vsevolod Scherrer.
Methodology: Benjamin Buttlar, Shiva Pauer, Matthew B. Ruby, Monique Chambon, Ann-Kathrin Jimenez-Klingberg, Jasmin Scherf, and Vsevolod Scherrer.
Project administration: Benjamin Buttlar.
Resources: Benjamin Buttlar.
Software: Benjamin Buttlar, Ann-Kathrin Jimenez-Klingberg, Jasmin Scherf, and Vsevolod Scherrer.
Supervision: Benjamin Buttlar and Pauer Shiva.
Validation: Benjamin Buttlar.
Visualization: Benjamin Buttlar, Shiva Pauer, Monique Chambon, and Vsevolod Scherrer.
Writing - original draft: Benjamin Buttlar and Vsevolod Scherrer.
Writing - review & editing: Benjamin Buttlar, Shiva Pauer, Matthew B. Ruby, Monique Chambon, and Vsevolod Scherrer.

Competing Interests

We have no conflict of interest to declare.

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Open Science Statement

Materials, design, hypotheses and analyses for the four quantitative studies were pre-registered (Study 1; Study 2; Study 3; Study 4). Methods, materials, data, and analysis scripts as well as supplemental materials are available on the OSF.

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Supplementary Materials

Description of Study 1 Supplement

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Figure S1

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