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‘Not my kind of food’: Dietary polarisation on the transition towards sustainable diets

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Abstract

Across 3 pre-registered projects, we analysed the relationship between food representations and dietary behaviour to better understand why shifting towards sustainable diets is so difficult. Specifically, we investigated how polarised omnivores and vegans cognitively represent and publicly present meat and plant-based foods. For each project, food descriptions were coded according to whether they contained features about consuming and enjoying food (e.g. 'rich', 'indulgent', 'treat'), or to aspects independent of the consumption situation (e.g. 'healthy', 'protein', 'eco-friendly'). In Project 1 (N_{Study1} = 852; N_{Study2} = 3104), Instagram posts about meat foods were described in hashtags with more rewarding consumption language than posts about plant-based foods, which were instead described with more situation independent language – especially identity-focused discourse (e.g. 'vegan community'). In Project 2 ($N_{Exp. 1}$ = 220; $N_{Exp. 2}$ = 843), participants described ingroup foods (meat dishes for omnivores; plant-based dishes for vegans) with more rewarding consumption features than outgroup foods (plant-based dishes for omnivores; meat dishes for vegans). In contrast, omnivores used more situation independent features for outgroup foods, and vegans more social and political context language (e.g. 'animal abuse'). In Project 3 ($N_{Exp. 1}$ = 82; $N_{Exp. 2}$ = 913), when trying to make a plant-based dish appealing to omnivores in a hypothetical social media setting, participants used more rewarding consumption language than when appealing to vegans. Despite people thinking about in-group foods in terms of rewarding consumption, plant-based foods are not publicly described in this way, even by vegans. As reward expectations drive food choices, this typical presentation of plant-based foods can hinder mainstream consumer transitions towards sustainable food choices and strengthen dietary group polarisation.

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Published output:

Chapter 2 – Davis, T., & Papies, E. K. (2022). Pleasure vs. identity: More eating simulation language in meat posts than plant-based posts on social media #foodtalk. Appetite, 175, 106024. https://doi.org/10.1016/j.appet.2022.106024

Available as preprint:

Chapter 3 – Davis, T., Harkins, L., & Papies, E. K. (2022). *Polarising Plates: Both Omnivores and Vegans Represent In-Group Foods with Eating Simulations*. OSF Preprints. https://doi.org/10.31219/osf.io/p5k2v (Submitted for review)

Chapter 4 – Davis, T., Silberhorn, L., & Papies, E. K. (2023, January 31). *'Who says a salad can't taste good?': More appealing language used to promote foods to mainstream than to vegan consumers*. OSF Preprints. https://doi.org/10.31219/osf.io/p8g53

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Author's Declaration

This thesis contains the work conducted by Tess Davis at the School of Psychology and Neuroscience, University of Glasgow under the supervision of Dr Esther K Papies, between October 2019 and January 2023. I hereby declare that except where stated, the work included in this thesis is my own and no part of it has been submitted to any other university or degree.

Contributors Statement

Below are contribution roles for each chapter of this thesis. Contributions are listed following the Contributor Roles Taxonomy (CRediT) format.

Key

TD: Tess Davis; **EKP:** Esther K. Papies; **LB:** Lawrence Barsalou; **LH:** Libby Harkins; **LS:** Lara Silberhorn.

Chapter 1

TD: Conceptualisation, Writing – Original draft, Writing – Review & Editing. **EKP:** Conceptualisation, Writing – Review & Editing.

Chapter 2

TD: Conceptualisation, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – Original draft, Writing – Review & Editing, Visualisation, Project administration. **EKP:** Conceptualisation, Methodology, Resources, Writing – Review & Editing, Supervision.

Chapter 3

TD: Conceptualisation, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – Original draft, Writing – Review & Editing, Visualisation, Supervision, Project administration. **EKP:** Conceptualisation, Methodology, Resources, Writing – Review & Editing, Supervision. **LH:** Conceptualisation, Methodology, Formal analysis, Investigation, Data curation, Resources.

Chapter 4

TD: Conceptualisation, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – Original draft, Writing – Review & Editing, Visualisation, Supervision, Project administration. **EKP:** Conceptualisation, Methodology, Resources, Writing – Review & Editing, Supervision. **LS:** Conceptualisation, Methodology, Formal analysis, Investigation, Resources, Data curation. **LB:** Writing – Review & Editing.

Chapter 5

TD: Conceptualisation, Writing – Original draft, Writing – Review & Editing. **EKP:** Writing – Review & Editing.

Abbreviations

FCQ	Food Choice Questionnaire
GHG	Greenhouse Gas
IOS	Inclusion of Other in the Self
IPCC	Intergovernmental Panel on Climate Change
LOESS	Locally Weighted Smoothing
SES	Socio Economic Status
SESOI	Smallest Effect Size of Interest
TEMS	The Eating Motivation Survey
VAS	Visual Analogue Scale
UK	United Kingdom

1. Chapter 1: General Introduction

1.1. Introduction

A global shift towards more plant-based diets is necessary to reduce the effects of anthropogenic climate change (Springmann et al., 2018). This requires a detailed understanding about how consumers communicate about food, which reflects a wealth of information about their attitudes and values (Graça et al., 2019a). The language within food discourse is also an important indicator of the non-conscious psychological representations (Papies et al., 2020a) involved in how people conceptualise food. Previous research has found that consumers differ in their representations of food in terms of taste or health features, which can impact consumption motivations (Sullivan et al., 2015). Utilising the large influence of taste (i.e. reward) on food choice can help create desire for sustainable foods (Boesveldt & de Graaf, 2017). This PhD project investigates how meat and plant-based foods are represented among and communicated by omnivore and vegan consumers, to understand the hesitation among mainstream consumers to adopt more sustainable consumption patterns.

1.1.1. Purpose of the Thesis

The purpose of this thesis is to contribute a piece of socio-cognitive psychological research that provides a rich understanding of influences that underpin the transition towards sustainable diets. We believe that, with a marked focus on dietary preferences, this piece of work can be used alongside behaviour change interventions to help reduce the carbon footprint of the mainstream consumer. From our findings, we hope to expand on current grounded cognition literature by accounting for the role of social group identification on the way that people think about, talk about and promote food.

1.1.2. Thesis Aims and Structure

The main aim of this thesis is to provide a more detailed understanding of the social and psychological processes that hinder the mainstream transition towards sustainable diets. Our first aim was to establish how both meat and plant-based foods were presented, or communicated about, about in a real-world setting, in order to identify any semantic differences in their deliberate, strategic descriptions. For our second aim, considering that the general public are not a homogenous entity, we wanted to understand how different consumer groups cognitively represent meat and plant-based foods, and how this impacts subsequent dietary behaviour. Our goal was to determine how the typical consumption patterns of a consumer affects how they cognitively represent dietary 'ingroup' and dietary 'outgroup' foods automatically, and how these representations of food fit into the cycle of consumption decisions. Following this, our final aim was to determine how consumers strategically present meat and plant-based foods to appeal to different audiences; namely their dietary 'ingroup' and their dietary 'outgroup'. Our intentions were to further discern the relationship between dietary identity, intergroup differences and food communication, to ascertain how mainstream consumers make sustainable foods desirable to their peers. As such, our general research questions are as follows:

RQ1. How do consumers present meat and plant-based foods?
RQ2. How do omnivores and vegans represent meat and plant-based foods?
RQ3. How do omnivores and vegans present meat and plant-based foods to appeal to omnivores and vegans?

In Chapter 1, we will give a comprehensive introduction to the topic, along with outlining important concepts, theories and terminology that will be present in the following chapters. In Chapter 2, we will present the first project (Project 1), which investigates the use of consumption and reward-focused language for meat, vegetarian and plant-based food posts on social media (Studies 1 and 2). Following this, we will turn to the second project (Project 2), which explores the relationship between dietary identity and cognitive representations of food, namely how omnivores and vegans represent meat and plant-based foods (Studies 3 and 4). Chapter 4 will focus on the third and final project (Project 3), which measures how omnivores and vegans promote meat and plant-based foods for omnivore and vegan audiences in a hypothetical social media setting (Studies 5 and 6). Lastly, Chapter 5 will address the three empirical projects in a general discussion, including common themes, theoretical and practical implications, notable findings and ideas for future research directions.

Project 1 was published in *Appetite* (see Davis & Papies, 2022), and also discussed in Papies et al. (2022). Project 2 is currently under review at *Personality and Social Psychology Bulletin*, with a pre-print available at: https://osf.io/p5k2v/. We intend to submit Project 3 (pre-print: https://osf.io/p8g53/) to an appropriate journal in Spring 2022. Please note that as these projects were written as separate journal articles, there may be overlap in the content of chapters 2 – 4.

1.2. Climate Crisis and Sustainability

1.2.1. The Environmental Impact of the Western Food System

Global consumption behaviours are unsustainable and causing irreparable harm to the planet's climate and ecosystems. Anthropogenic activities are causing the global temperature to rise at the rate of 0.2°C per decade (IPCC, 2018). Without immediate action to change our consumption behaviour, this climate emergency will lead to higher probabilities of catastrophic events including extreme weather patterns, prolonged droughts, floods, tropical cyclones, deadly heatwaves, ocean acidification, permafrost reduction and sea level rise (Hoegh-Guldberg et al., 2018, 2019; Naumann et al., 2018). These events are likely to result in worldwide poverty, displacement, hunger and malnutrition, in addition to reduced water and food availability, increased vector borne diseases, heat-related morbidity and mortality, habitat loss and species extinction (Hoegh-Guldberg et al., 2018, 2019; Rogelj, 2018; Roy, 2018; Shultz et al., 2018, 2019). Limiting the impact of the climate crisis is still possible, with direct proportionate action, which includes achieving net zero global greenhouse gas (GHG) emissions by 2050 (Hoegh-Guldberg et al., 2018, 2019; IPCC, 2018; Matthews et al., 2018).

One consumption practice that significantly contributes to the climate crisis is what consumers from industrialised countries choose to eat. Clark and colleagues (2020) estimated that GHG emissions from the food sector alone will cause a global temperature rise of at least 1.5°C (i.e. the Paris Agreement target emissions limit) by 2051 – 2063. Nonetheless, these emissions can be reduced by 14 – 48% through decreased food waste, production efficiency and changes in dietary composition (i.e. reduced meat consumption) that align with the EAT-Lancet guidance for diets by 2050 (Clark et al., 2020; Willett et al., 2019). This guidance centres around an integrated, universal agenda for the food system that consciously considers planetary and human health boundaries, and recommends that 50% of our daily intake volume consist of vegetables and fruits (i.e. around 200 kcals), and less than 100 kcals per day derive from meat (Willett et al., 2019). Springmann and colleagues (2018) anticipate these kinds of ambitious dietary changes towards more flexitarian, plant-based consumption by 2050 could reduce global GHG emissions and other environmental impacts by 29 – 56% compared to baseline food system projections.

Why is meat consumption particularly harmful to the planet? The Intergovernmental Panel on Climate Change (IPCC, 2019) has found that up to 23% of total, global GHG emissions are derived from agriculture, forestry and other land uses, which includes 12 – 18% derived solely from livestock production (Gerber et al., 2013; Allen & Hof, 2019; Gomez-Zavaglia et al., 2020). Not only does the meat industry substantially impact GHG emissions, but also contributes to water and air pollution, biodiversity loss, water scarcity, land use, deforestation and antibiotic resistance (Bonnet et al., 2020; Dumont et al., 2016; Farchi et al., 2017; Godfray et al., 2018; González et al., 2020; Mekonnen & Hoekstra, 2012; Opio et al., 2012; Shepon et al., 2018). However, the consumption of meat products is on the rise worldwide. Basu (2015) suggests that the supply of meat has increased by 204% between 1960 - 2010, whereas Katare and colleagues (2020) suggest a rise of approximately 500% between 1992

– 2016. Currently, animal products account for 30% of total calorie consumption in the EU, and meat products are the main source of protein availability (Bonnet et al., 2020). Therefore, the consumption of meat in particular is a significant and expanding environmental threat.

1.2.2. The Continued Unsustainable Consumption of Meat

In the United Kingdom (UK), multiple sources have found a small overall reduction in daily meat intake per capita of 3% (Department for Environment, Food and Rural Affairs), 5.2% (Food and Agriculture Organisation) and 17.4% (National Diet and Nutrition Survey) between 2008 – 2019 (Smith et al., 2022; Stewart et al., 2021). However, a substantial acceleration of this trend is required to meet targets for sustainable consumption. It is estimated that beef intake needs to decrease by 89% to stay within planetary boundaries (Springmann et al., 2018), while only an 11% reduction in red-meat consumption has occurred over the last decade (Stewart et al., 2021). Additionally, recent findings indicate a shift from red meat towards white meat consumption (Godfray et al., 2018; Stewart et al., 2021; Sui et al., 2016; Zeng et al., 2019), suggesting mainstream consumers may be replacing the type of meat in their diets, rather than reducing their meat consumption altogether.

Recent evidence shows that over 90% of citizens in high-income countries have substantial awareness of the climate crisis (Lee et al., 2015b). However, despite an urgent need for these consumers to significantly reduce their meat intake for environmental reasons, a majority report a reluctance to do so (Sanchez-Sabate & Sabaté, 2019). Bryant, (2019) found that just 1 in 6 (13%) UK participants intended to ‘slightly decrease’ their meat consumption in the following month, and a recent Danish study found 57% of consumers were unwilling to reduce their meat intake (Hielkema & Lund, 2021). In addition, the consumption of specifically plant-based dishes among mainstream consumers is typically infrequent (Dagevos, 2021), and many are not inclined to incorporate more meat-free days into their diet or replace meat with more plant-based protein consumption (Lacroix & Gifford, 2019, 2020; Malek et al., 2019). Furthermore, only 19% of respondents in a 2017 YouGov survey reported reducing the amount of meat eaten in the past year, versus 5% of respondents who reported an increase (YouGov & Eating Better, 2017). Although willingness alone does not necessarily lead to a change in behaviour (Orbell & Sheeran, 1998), sustainable behaviour (Carrington et al., 2010) or sustainable dietary behaviour (de Bakker & Dagevos, 2012), most mainstream consumers do not intend to change their meat consumption habits, let alone taking action to do so.

Considering this reluctance to shift towards plant-based diets, research is needed to help develop simple, cost-effective strategies to help increase sustainable consumption globally (Ranganathan et al., 2016). For example, changes to the decision context or ‘nudging’ techniques, such as changing the default menu choice to plant-based (de Vaan et al., 2019), can help reduce meat consumption via automatic processes (Byerly et al., 2018; Dolan et al., 2012). Other strategies such as doubling the number of vegetarian options on a menu can increase plant-based dish sales by 40 – 80% and reduce meat dish sales (Garnett et al., 2019). It is also important to address factors that may limit the effectiveness of sustainable consumption behaviour-change interventions in real-world settings (Stoll-Kleemann & Schmidt, 2017), such as habits (Zur & Klöckner, 2014), meat attachment (Graça et al., 2015; Rothgerber, 2020), social norms (Kwasny et al., 2022), cultural influences (Zickfeld et al., 2018) and demographics (Cordts et al., 2014; Dowsett et al., 2018; Mata et al., 2023). However, although these strategies are successful to some degree (Vandenbroele et al., 2020), they do not address the main barrier of mainstream consumer attitudes towards sustainable foods (Corrin & Papadopoulos, 2017). Therefore, understanding consumer representations of plant-based foods is key to promote long-term, substantial dietary change among mainstream consumers.

Why are mainstream consumers hesitant to change what they eat? While the benefits of a more plant-based diet are well known amongst omnivores, evidence suggests vegetarianism and veganism is considered inconvenient, expensive or not enjoyable (Bryant, 2019; He et al., 2019; Rosenfeld et al., 2020). In particular, taste and reward expectations play a key role in our food choices (Rogers & Hardman, 2015; Boesveldt & de Graaf, 2017; Kourouniotis et al., 2016; Wahl et al., 2020), and are considered a significant barrier to reducing meat consumption (Gibbs & Cappuccio, 2022; Schenk et al., 2018). This may be because consumers represent foods they typically consume in terms of taste and reward (Papies et al., 2017), which can drive a desire for meat foods among omnivores. These motivations for meat intake are more likely to be pronounced in certain social, temporal, and situational contexts, such as when eating out in restaurants and cafes, and with family members (Biermann & Rau, 2020; Horgan et al., 2019; Wehbe et al., 2022). The perceived healthiness of plant-based foods can also be a key barrier to becoming vegan (Corrin & Papadopoulos, 2017; Kemper, 2020; Rosenfeld & Tomiyama, 2020), despite health concerns being a principal motivation for reducing meat consumption (Godfray et al., 2018; Willett et al., 2019).

Similarly, Tobler et al. (2011) found that consumers assessed eating less meat as the least environmentally friendly behaviour in comparison to buying organic foods, local foods or seasonal foods. This may be due to policymakers in government and industry being reluctant to address calls to eat less meat (Westhoek et al., 2011; Clare et al., 2022), suggesting a lack of explicit messaging to encourage consumers to reduce their meat intake. Alternatively, this may be a result of meat-eating justification strategies (Rothgerber, 2013) that consumers typically use to validate their consumption choices when faced with dissonant information about their dietary preferences, termed the ‘meat paradox’ (Bastian & Loughnan, 2017; Loughnan et al., 2010). These strategies often include arguments about the sensory appeal of meat (‘Nice’), the nutritional benefits of meat (‘Necessary’), the social acceptance of eating meat (‘Normal’) and the historic consumption of eating meat (‘Natural’) to justify omnivorous diets (Piazza et al., 2015). This suggests that these representations are ingrained and act as cognitive shortcuts when faced with a moral threat to one’s consumption habits (Bastian & Loughnan, 2017). Hence, we suggest that a more detailed, richer understanding of these cognitive representations underlying consumer food preferences can help to facilitate successful, long-term sustainable behaviour change in the face of personal, socio-cultural and external influences.

1.3. Grounded Cognition

1.3.1. The Grounded Cognition Theory of Desire

A recent theory that demonstrates how cognitive representations regulate and motivate eating behaviour is the Grounded Cognition Theory of Desire (Papies & Barsalou, 2015; Papies et al., 2022a). Through a grounded cognition perspective, this theory suggests that taste expectancies which drive food consumption are the result of underlying representations of eating and enjoying a food. Specifically, the Grounded Cognition Theory of Desire proposes that when people think about a food, they experience non-conscious, multi-modal simulations of what is like to eat it, and if rewarding, can increase desire for that food (Papies et al., 2020a). This is due to 'situated conceptualisations' (Barsalou, 2016), which are dynamic representations of food which are formed, accumulated and stored in memory during episodes of consumption. These situated conceptualisations can then be activated in later situations and inform action (Papies et al., 2017). These cognitive representations can contain information about the sensory features (e.g. taste, texture, visual appearance), motor behaviour (e.g. biting, using your hands), external context (e.g. time, location, social setting), internal context (e.g. bodily, cognitive and affective states) and the immediate consequences (e.g. hedonic enjoyment and affective experience) of consumption.

For example, an individual eating pork ribs at a summer family barbecue may encode information about eating with their hands, being outside in a garden, the sweet tasting glaze on the ribs, the multiple condiments on the dining table, being amongst their relatives and the smell of barbecue smoke. When an element of an existing and associated situated conceptualisation is cued at a later date, for example smelling barbecue smoke on someone's clothes, or seeing pork ribs on a restaurant menu, this may lead to a partial re-enactment of the earlier appetitive experience at the summer family barbecue. These are not exact replays of the previously encoded information, but are modality-specific to what is salient during idiosyncratic coding and retrieval (Papies et al., 2022a). This activation can result in goal-directed behaviour through a process of pattern completion inferences (Barsalou, 2008; 2016), or simulations of possible actions and desirable outcomes (Barsalou, 2009). In other words, on receiving a cue about pork ribs, one can infer what it would be like to eat them at present, and whether this would be rewarding. This can lead to taking action to consume pork ribs, such as buying pork ribs at a supermarket, or choosing pork ribs on a restaurant menu.

1.3.2. Grounded Cognition: Empirical evidence

Significant empirical research supporting the Grounded Cognition Theory of Desire has shown that the vivid detail of situated conceptualisations can induce neural, physiological and behavioural responses (Krishna & Schwarz, 2014). For example, the same neural responses within the 'core eating network' (Kaye et al., 2009), that are associated with taste and reward processing (Simmons et al., 2005), are activated when presented with a visual food cue as when actually eating food (Chen et al., 2016; van der Laan et al., 2011). Additionally, asking participants to imagine the process of eating a food triggers salivation, particularly for attractive foods (Keesman et al., 2016; Xie et al., 2016), and increases desire (Muñoz-Vilches et al., 2019; 2020) and expectations of pleasure (Cornil & Chandon, 2016; J. S. Larson et al., 2014). This suggests that the process of simulating eating a food can have affective and bodily implications, which can be initiated by rewarding representation cues. Similarly, contextual situations that are congruent with consuming a food, like being in a cinema for 'popcorn', can cue consumption simulations, which in turn increases expected liking and desire (Papies et al., 2022c). In terms of the conscious experience of simulations, Tatar and colleagues (2021) found that participants reported detailed mental imagery of eating after viewing images of attractive foods in a mindfulness-based study. Thus, cognitively simulating rewarding consumption can trigger a range of visceral, sensory and emotional experiences, which can affect behavioural outcomes such as intake.

When measuring the output of cognitive representations, researchers often use free production tasks (Londerée & Wagner, 2021) such as asking participants to list the features of a food (Papies et al., 2020c), in order to convey the richness of an individual's experiences via natural language descriptors (McRae et al., 2005). Studies that employ feature listing methodologies have shown that people describe foods with particular reference to their specific physical, social and temporal contexts (Jouravlev & McRae, 2016; Keller & van der Horst, 2013). For example, foods that are considered attractive (e.g. crisps, cookies) are described with more sensory, hedonic and contextual features than less attractive foods (e.g. rice, apple; Keesman et al., 2018; Papies, 2013). Similarly, Papies and colleagues (2022b) found that participants represented appealing drinks more in terms of consumption and reward features, and these representations predicted the volume of drinks consumed afterwards in a laboratory setting.

Situated conceptualisations can also be activated via language cues. For example, exposure to advertising slogans has been found to affect taste perceptions via sensory simulations (Elder & Krishna, 2010). Furthermore, reading words like "garlic" or "cinnamon" activates olfactory brain areas, which suggests the re-enactment of a consumption episode (González et al., 2006). In fact, using consumption and reward features has been found to increase desire for foods (Papies et al., 2020b). This demonstrates that cueing simulations related to eating and enjoyment is an important determinant of food choice (see: Higgs, 2016).

1.4. Influencing Representations: The Role of Frequency

Considering the influence of simulations on motivation, desire and consumption (Cornil & Chandon, 2016; Larson et al., 2014; Muñoz-Vilches et al., 2019; Papies et al., 2020a), there is evidence to suggest that rewarding representations of food can strengthen frequent eating behaviour, and vice versa. Recent findings have shown that consumption and reward features are used more for frequently consumed foods and drinks (Papies et al., 2021; 2022), which suggests the situated conceptualisations associated with these foods and drinks are more commonly retrieved, acted upon and updated. In other words, the more a product was consumed, the more likely it was to be represented in terms of the (enjoyable) experience of consuming (Dutriaux et al., 2021; Kruglanski & Szumowska, 2020; Papies et al., 2022b; Rodger et al., 2021; Rodger & Papies, 2022). These rewarding representations can also motivate the consumption of similar types of food (e.g. other meat dishes), due to a greater number of situated conceptualisations stored for frequently consumed foods (Papies et al., 2022a) that reflect one's typical dietary practices (i.e. meat eating), which can facilitate the performance of a related consumption behaviour.

We suggest that within the context of dietary groups, the frequency of eating certain types of food can also ground ingroup eating practices. Implicit attitudes towards different types of food were found to be in line with one's eating habits (Cliceri et al., 2018), such that more positive emotions were associated with meat-free dishes among vegetarians than omnivores and flexitarians. As omnivores, flexitarians, vegetarians and vegans likely have different experiences with meat and plant-based foods, they will have different situated conceptualisations and therefore different pattern completion inferences when presented with a food cue (Papies et al., 2017). It is possible that these inter-group differences in reward expectations and simulations can determine whether target foods are likely to be consumed or not. From the perspective of the grounded cognition theory of desire and motivated behaviour, when it comes to dietary change and encouraging mainstream consumers towards sustainable food choices, the contemplated new behaviour must produce more appealing outcome simulations than the habitual behaviour if it is to be performed (Papies et al., 2022a). From this perspective, without framing plant-based foods as a rewarding choice, behaviour change is unlikely to occur.

1.5. Dietary Groups: The Great Divide

1.5.1. How Behaviour Becomes Identity

In addition to one's typical consumption patterns and the eating experiences that shape motivation, eating behaviour is guided by social norms, reflecting what is perceived as socially appropriate (Best & Papies, 2019; Higgs, 2016; Versluis & Papies, 2016). Deliberating the consequences of one's food choice in a social context may result in conforming to shared 'scripts' of what is acceptable to consume (Sobal, 2005). Positive social outcomes, such as social approval, co-ordinating with the behaviour of others, or sharing a social identity (Brick et al., 2021; Hawkins et al., 2019; Higgs, 2015), may be encoded as situated conceptualisations that could be simulated at a later date. These simulations of potential social outcomes may increase the appeal of normative behaviours, by aligning with the conduct of a target ingroup (Hackel et al., 2018). This suggests that consumption is not always an individual phenomenon, but includes many social drivers (Stoll-Kleemann & Schmidt, 2017). As such, the reward expectations of an individual's food choices can be heavily influenced by the expected reactions of others.

From this, we can understand how eating behaviour helps form dietary social groups. People draw upon repertoires, such as situated conceptualisations, to make food choices, and enact and construct their dietary identities by executing these choices (Arbit et al., 2017; Rosenfeld & Burrow, 2018). In turn, people then may rely on dietary identities to inform their attitudes, values and behaviour surrounding food (Sobal et al., 2014). A shared pattern of daily consumption practices with others that follow the same diet can be interpreted as a shared exercise with the ingroup (Judge et al., 2022), which reinforces a sense of belonging, obligation and concern for other ingroup members (Janssen et al., 2016). Dietary behaviour, therefore, can strongly influence food making decisions, especially those that are deliberate and reflective (Hagger et al., 2015; Wolstenholme et al., 2021).

For the mainstream consumer, meat consumption is the default, and is considered a key dietary staple for many (Piazza et al., 2015; Sobal, 2005). Past research has found that the strength of omnivore identity negatively predicts willingness to reduce one's meat consumption (De Groeve et al., 2019), and negatively correlates with perceived behavioural control related to reduced meat consumption (Carfora et al., 2017). Although the omnivorous identity may be less evocative than other dietary identities given its socially normative status, it becomes more pronounced when encountering members of a dietary outgroup (Kirsten et al., 2020) that may be perceived as a threat to the moral or cultural identity of omnivores (MacInnis & Hodson, 2017; Minson & Monin, 2012). For example, Wehbe and colleagues (2022) found that meat and dairy reducers faced many social challenges from omnivorous consumers when making sustainable food choices, such as having to explain, justify, or hide their plant-based food choices. This suggests that it is not just macro-level historical, economic and political structures that facilitate high meat consumption among the mainstream omnivorous majority, but also identity-based social resistance at the micro-level when faced with the promotion of sustainable diets (Graça, 2016; Graça et al., 2019a; Harguess et al., 2020).

1.5.2. Being Vegan

Veganism, the practice of abstaining from all animal consumption, stands at odds from the mainstreamed practice of meat-eating. Recently, a systematic review found that across 16 longitudinal studies, a vegan diet produces significantly less GHG emissions than a vegetarian or omnivorous diet, and is currently considered the most environmentally friendly human diet (Chai et al., 2019). In terms of demographics, vegans are more likely to be female, younger, highly-educated and politically left-wing individuals (Asher et al., 2014). Estimates suggest that 1-2% of the adult population in the UK follow a vegan diet (Bryant, 2019) and can thus be considered as a minority group in most Western populations (Judge & Wilson, 2019). Nonetheless, veganism has been increasing in popularity over the past 5 years (Judge et al., 2022; Trent Grassian, 2020), with a marked increase in the proportion of individuals consuming plant-based alternative foods from 6.7% between 2008 – 2011 to 13.1% between 2017 – 2019 (Alae-Carew et al., 2022).

Why do vegans make the seemingly difficult decision to change from the dietary status-quo? Those that follow a vegan diet often cite health, animal welfare and environmental reasons for their dietary transition (Bastian et al., 2012; Hopwood et al., 2020; Kersche-Risch, 2015; Rosenfeld, 2018; 2019), and often report being motivated by a concern for others (i.e. animals, the environment) than the needs of the ingroup (i.e. vegans; Janssen et al., 2016). Vegans also hold stronger personal, pro-social and moral motivations, including pride about their dietary pattern, and view their diet as central to their social identity (Kirsten et al., 2020; Rosenfeld, 2019). Considering their social standing as a minority group, this motivation to identify with their ingroup can be a significant driver for their behaviour (Rosenfeld & Burrow, 2017). This behaviour often goes beyond their individual consumption practices, including active engagement to encourage others to pursue a vegan diet by raising awareness of the benefits of veganism (Plante et al., 2019; Thomas et al., 2019). From this perspective, veganism can be understood as a lifestyle that facilitates action-oriented goals to promote plant-based eating to the outgroup (Judge et al., 2022).

1.5.3. Dietary Group Polarisation

Considering the salience of dietary identity, research has found a clear ingroup-outgroup bias between people with differing dietary patterns (Judge & Wilson, 2019; Ruby et al., 2016). In particular, anti-vegan sentiments among omnivores is common both historically (Chiles & Fitzgerald, 2018) and in modern society (Dhont & Stoeber, 2020). Vegans often face stigmatisation, ridicule and exclusion from mainstream consumers (De Groeve et al., 2022; Doyle, 2016), even in UK national newspapers (Cole & Morgan, 2011) and in Reddit forums online (Gregson et al., 2022). As vegans are seen as ‘do-gooders’ (Minson & Monin, 2012) and advocate symbolic opposition to the ‘meat and two veg’ culture of traditional British meals (Riley, 2010), even just thinking about those that eschew meat can evoke hostile and defensive reactions among omnivores (Rothgerber, 2014). In general, diets can be seen as political indicators of moral foundations (Grünhage & Reuter, 2021), and bias against the vegan outgroup may magnify when seen to threaten the moral status of omnivores (MacInnis & Hodson, 2017). From this, vegans can be stereotyped by the majority as arrogant, judgemental and overcommitted (De Groeve et al., 2021; De Groeve & Rosenfeld, 2022a; Markowski & Roxburgh, 2019).

On the other hand, Pabian et al. (2022) found that anti-omnivore attitudes among vegans are significantly more negative than anti-vegan attitudes among omnivores. As adopting a vegan diet is often a voluntary moralistic decision, vegans can adopt a moral leadership position to encourage non-vegans to change their diets (Bolderdijk et al., 2018; Greenebaum, 2012). In addition, vegans may judge omnivores negatively as intentional agents causing harm to animals through their meat-eating practices (Hogg, 2016; Kunst & Hohle, 2016; Rosenfeld, 2019; Schein & Gray, 2018). Framing veganism in black-and-white moralistic terms can strengthen ingroup commitment and thus increase polarisation (Bastian, 2019; Bastian & Loughnan, 2017), especially through overtly presenting themselves as vegan to signal their group membership (Wrenn & Johnson, 2013).

This dietary polarisation can be a strong deterrent to performing more sustainable dietary behaviours among mainstream consumers. Evidence has found that the readiness to reduce one's meat intake is influenced by the social image and beliefs about people who do not consume meat (Branković & Budžak, 2021). Therefore, stereotyping vegans as difficult, strict and close-minded (De Groeve et al., 2021) can deter omnivores from wanting to share the same dietary practices. Moreover, meat consumption is deeply embedded in Western culture, and is by default legitimised because of its adoption by the majority of consumers (Graça, 2016; Trent Grassian, 2020). Consequently, identifying with the majority protects against social rejection (Martin & Hewstone, 2008) and does not warrant a salient dietary identity, unlike vegans (de Boer et al., 2017). The strained social relationship between omnivores and vegans is characterised by the refusal of non-vegans to provide or try plant-based dishes (Twine, 2014), or unpleasant experiences among family and friends of stigma after dietary changes are disclosed (Hirschler, 2011; MacInnis & Hodson, 2017). Thus, for plant-based consumption to be more widely adopted by omnivores, the association with the derogated vegan identity must be overcome, or bypassed.

1.6. Implications

1.6.1. Current Strategies: Making Sustainable Food Choices More Appealing

It is clear from the previous section that the animal welfare concerns and environmental factors that motivate vegans are unlikely to change eating behaviour among omnivores (Hartmann & Siegrist, 2020). Therefore, researchers are beginning to focus on how to present food in commercial settings in a way that *is* attractive to the mainstream consumer. In line with the Grounded Cognition Theory of Desire (Papies & Barsalou, 2015), taste and reward expectations are intrinsic to how we think about foods, and principally motivate food choice (Wahl et al., 2020). Along with convenience and familiarity, sensory appeal is necessary to facilitate dietary change (Graça et al., 2019a), especially among European and other Western consumers (Januszewska et al., 2011).

Framing plant-based foods with taste-focused language strategies has recently shown promising results. Turnwald et al. (2017a) found that in a real-world cafeteria setting, vegetables that were presented with indulgent labels (e.g. ‘rich buttery roasted sweetcorn’) were selected 25% more than basic labels (e.g. ‘corn’), 41% more than health-restrictive labels (e.g. ‘reduced-sodium corn’) and 35% more than health positive labels (e.g. ‘vitamin-rich corn’). Across multiple follow-up studies, taste-focused labelling again increased vegetable-based food selection between 29% - 38% compared to health-focused labelling, and 14% compared to basic labels, and improved post-consumption ratings of vegetable deliciousness (Turnwald et al., 2019; Turnwald & Crum, 2019). Similarly, further research has found that words that evoke consumption and reward simulations (e.g., ‘crunchy’, ‘aromatic’, ‘warming’) increased the attractiveness of novel, plant-based foods among omnivores (Papies et al., 2020b), especially among those with reported high typical meat consumption. These empirical results show that emphasising consumption and reward attributes can help increase plant-based consumption among omnivores.

1.6.2. The Presentation of Food in Commercial Settings

Despite these findings, plant-based foods are often described with less appealing features than meat foods. For example, Turnwald and colleagues (2017b) found that healthier (often plant-based) menu items were described as less exciting, spicy, hot, tasty and indulgent than standard menu items. Instead, healthier items were described with more words related to foreign cuisines (e.g. ‘Asian’), macronutrient (e.g. ‘protein’) and simple words (e.g. ‘plain’), referring to features independent of the exact consumption situation. Papies et al. (2020) also found that in the package descriptions of UK supermarket ready meals, meat foods were associated with more consumption and reward features related to the taste, context and enjoyment of consumption, than plant-based foods. Instead, plant-based ready meals were described with more situation independent features related to ingredients, visual features, and long-term health consequences of consumption, than meat ready meals. Describing plant-based foods with less appealing language may perpetuate beliefs that these foods are not rewarding, and may undermine the transition towards sustainable food choices.

1.7. The Current Thesis

The intention of this PhD project was to understand how one’s diet can transform the representations of meat and plant-based foods, and lend valuable insights into why the transition towards sustainable diets is so difficult for mainstream consumers. Specifically, this research can contribute important evidence of how omnivores and vegans think about, communicate about and present meat and plant-based foods. This can help improve understanding of how to reduce dietary group polarisation and inform dietary behaviour change interventions.

In the present thesis, we did not assess dietary identities directly as such, but indirectly through self-reported dietary preferences. Specifically, we asked participants to define what diet best describes their current dietary pattern, and then examined the degree to which dietary identities were referenced by those with vegan and omnivorous diets. This was to gain greater insight into the role of identity related processes within food representations and dietary practices.

Project 1 investigated whether descriptions for meat and plant-based foods on social media were presented differently. We wanted to examine whether meat foods would be described with greater reference to an enjoyable eating experience in comparison to plant-based foods, which would convey more distal elements of consumption. From this, we can understand the associations with meat and plant-based foods in public discourse contexts that many consumers engage with on a daily basis (Barre et al., 2016), and use to form and maintain social community relationships (Blackwood, 2019).

Project 2 builds on these findings, measuring how omnivore and vegan dietary groups represent both meat and plant-based foods, and how this predicts consumption motivation and subsequent behaviour. Using a feature listing task (Papies et al., 2020c), we investigated the differences in cognitive representations across 10 meat and 10 plant-based dishes. By understanding the intergroup differences of how people think about food, we can determine the implicit nature of dietary group polarisation, and how this relates to later food choice. Furthermore, this research can also help establish whether any discrepancies emerge between how people spontaneously think about food, and how they strategically describe food in public.

Finally, Project 3 looked into the features used by omnivore and vegan participants to make meat and plant-based foods appealing for ingroup and outgroup audiences in a hypothetical social media context. We first measured the valence ratings among omnivores and vegans of the most popular hashtags for meat and plant-based foods gathered in Project 1. We then investigated how participants present foods to target vegan and omnivore audiences, in terms of the proportion of consumption and reward features and valence rating index scores. This mixed-methods research can further our insights into the relationship between food communication, dietary identity and valence attitudes in the context of omnivore-vegan polarisation.

2. Chapter 2: More Eating Simulation Language in Meat Posts than Plant-based Posts on Social Media

This chapter is an exact copy of the following published manuscript:

Davis, T., & Papies, E. K. (2022). Pleasure vs. identity: More eating simulation language in meat posts than plant-based posts on social media #foodtalk. *Appetite*, *175*, 106024. https://doi.org/10.1016/j.appet.2022.106024

2.1. Abstract

Current levels of meat consumption in Western societies are unsustainable and contribute to the climate emergency. However, most people are not reducing their intake. Here, we examine the language used on social media to describe meat and plant-based foods, since the ways people think and communicate about food could hinder the transition towards sustainable eating. In two pre-registered studies, we analysed the degree to which the language in food posts on Instagram reflects eating simulations, which have been found to be associated with desire for appetitive stimuli. Specifically, thinking about or presenting foods or drinks in terms of rewarding simulations (i.e., re-experiences of enjoying their consumption) has been found to increase their appeal. Here, we analysed the words used in Instagram hashtags (N_{Study1} = 852; N_{Study2} = 3104) and caption text (N_{Study1} = 682) to examine how much they refer to eating simulations (e.g., taste, texture, enjoyment, eating context) or to other food-related features (e.g., ingredients, preparation, health, category information). As hypothesised, meat posts contained more eating simulation hashtags than plant-based and vegetarian posts, which instead contained more eating-independent hashtags, for example referring to health or to vegan identity. Findings for the text words were generally in the same direction but much weaker. Thus, meat food posts contained hashtag language that is likely more appealing to mainstream consumers, because it refers to the enjoyable experience of eating the food, rather than the food being healthy or identity affirming. This pattern reflects polarisation surrounding sustainable foods, which may hinder the shift towards plant-based diets needed to curb climate change.

Keywords: Plant-based Food, Language, Social Media, Sustainability, Grounded Cognition

2.2. Introduction

Current levels of animal meat consumption in Western societies are unsustainable. Although meat products only provide 18% of the average calories consumed per day (Poore & Nemecek, 2018), the production of meat contributes to 14.5% of all human-induced greenhouse gas emissions (Gerber et al., 2013), and has a substantial negative impact on water pollution, agricultural land use, biodiversity loss and worldwide poverty (Hoegh-Guldberg et al., 2019; Springmann et al., 2018; Tilman & Clark, 2014). In fact, the increase in global temperature due to emissions from the food system alone would likely exceed the Paris Agreement 1.5° target between 2051 and 2063 (Clark et al., 2020). Additionally, health issues related to high meat consumption, such as diabetes, cancer and cardiovascular disease (Abete et al., 2014; Wolk, 2017) and associated moral concerns (Bastian et al., 2012; Rosenfeld et al., 2020), have also brought current Western meat eating habits into question.

Despite these concerns, just one in six meat-eaters intend to reduce their meat intake (Bryant, 2019). Why are sustainable food choices perceived as undesirable to the majority of consumers, even in the face of environmental, health and animal welfare pressures? Taste and reward expectations play a key role in food choices (Franchi, 2012), with vegetarian and vegan foods expected to be less tasty and enjoyable than meat (Corrin & Papadopoulos, 2017; Rosenfeld & Tomiyama, 2020). Here, we explored how individuals communicate about these foods on social media, in order to better understand socially shared perceptions of meat and plant-based foods, and help inform strategies aimed at promoting sustainable food choices among mainstream consumers.

The way we communicate about food reflects a wealth of information about our underlying attitudes and values (Stajcic, 2013). Daily behaviours such as eating habits are often guided by non-conscious processes (Graça et al., 2019b; Roberto, 2020), which then impact our language surrounding food (Riley & Cavanaugh, 2017). Conversely, language can be used to change food perceptions and preferences. Using labelling that focuses on the eating experience, such as words referring to the taste, texture or eating context, has been found to increase the appeal of plant-based foods, especially among more habitual meat-eaters (Papies et al., 2020b), boost healthy food selections, and enhance post-consumption ratings of vegetable deliciousness (Turnwald & Crum, 2019). Therefore, associating sustainable food choices with words that refer to the short-term enjoyment of eating a food, instead of long-term health benefits, can likely boost their appeal (Piqueras-Fiszman & Spence, 2015). At the same time, healthy and sustainable foods have been found to be described with less indulgent language than unhealthy or less sustainable foods on restaurant menus and ready meal packages (Papies et al., 2020b; Turnwald et al., 2017b) , suggesting that this strategy is not consistently used in food marketing.

Why can language focused on the eating experience increase food attractiveness? According to the Grounded Cognition Theory of Desire, food cues, such as words or images, can trigger rewarding simulations, or re-experiences, of eating a food, which can lead to desire, especially for more attractive foods (Papies et al., 2020a; Papies et al., 2022a). Indeed, viewing food words or images activates gustatory and reward areas in the brain, like when tasting a food, suggesting that food cues trigger re-experiences, or simulations, of eating (Chen et al., 2016; Simmons et al., 2005). Participants also spontaneously use more eating simulation words when describing 'attractive' foods such as crisps, than 'neutral' foods such as rice (Papies, 2013), suggesting that they simulate eating a food when describing it, especially if the food is attractive. These simulations predict desire to consume a food or drink, as well as intake, even when controlling for consumption habits (Papies et al., 2021). Further, such eating simulations can be enhanced by appropriate context cues (e.g., a setting where one would eat the food), suggesting that eating context plays an important role in food desire through its effects on eating simulations (Papies et al., 2022a). Together, these findings show that simulations of eating and enjoying a food can reflect and increase desire for it, and that language can be used to tap into and activate such simulations. In this paper, we examined the eating simulations in food language on social media, since this may reflect how users think about foods, and in turn influence the food perceptions of other users.

2.2.1. The Present Research

The current studies were designed to explore the language used when consumers communicate about meat, vegetarian, and vegan foods on Instagram, which hosts an abundance of online food discourse (Barre et al., 2016). Instagram is a popular photo-sharing platform which allows users to upload photos and videos alongside linguistic annotations in the form of text captions and searchable hashtags (Zappavigna, 2015). Hashtags describe the visual contents of the image (Giannoulakis & Tsapatsoulis, 2016), and express the affective stance of the user through a common set of text labels (Lee & Chau, 2018). Social media functions as interactive communication channels that are used to form and maintain social relationships (Blackwood, 2019), and have also been found to alter food preferences. For example, exposure to socially endorsed images of low energy-dense foods led to a greater consumption of healthy snacks by female students, and similarly, exposure to either health or taste framed Instagram feeds impacted future snack choice (Blundell & Forwood, 2021; Hawkins et al., 2021). Furthermore, engagement with food adverts on social media was associated with high intake of unhealthy foods (Gascoyne et al., 2021), and short videos typically posted on social media influenced food choice behaviour, liking and intentions to eat the foods portrayed (Ngqangashe & Backer, 2021). More generally, discursive psychological studies have found that online communication aids in establishing food identities (Sneijder & te Molder, 2006). However, research has yet to explore the language associated with different foods in an online setting.

We investigated whether different language is used to describe meat, vegetarian and plant-based foods. More specifically, we examined whether more eating simulation language is used for meat foods, which are part of the dominant Western eating culture and typically seen as more attractive than both vegetarian and vegan foods. We decided to distinguish between vegetarian and vegan dishes, as the language associated with foods that do not contain meat could differ from foods that do not contain any animal products. To analyse the language, we used a recently developed feature listing manual (Papies et al., 2020c) which categorises food-related words into three main categories:

consumption situation (i.e. sensory, contextual and hedonic aspects), non-consumption situation (i.e. production, preparation and cultural aspects) and situation-independent (i.e. health, content and visual aspects). In Study 1, we examined caption text and hashtag words for meat, vegetarian and plant-based food posts. In Study 2, we replicated this, looking at hashtag words in a larger dataset. We hypothesized that posts about meat dishes would contain more consumption situation words in hashtags (H1) and caption text (H3) than plant-based and vegetarian dishes, reflecting stronger eating simulations. Based on findings that sustainable foods are less likely to be described with indulgent language (Papies, et al., 2020b), we also hypothesised more situation-independent language in the hashtags (H2) and text (H4) of posts about plant-based and vegetarian dishes than meat dishes. Given the similarity in methodologies for Studies 1 and 2, we present the Methods and Results for both studies side by side to increase comparability.

2.3. Methods

2.3.1. Design and Sample Size

Both observational studies had food type as the independent variable, and consumption situation and situation-independent language proportions as the dependent variables. All variables, measures and exclusions are reported. Sample sizes were determined before data analysis. Both studies were pre-registered, with all materials available here: https://osf.io/uy45w/.

We used G*Power (version 3.1; Erdfelder et al., 1996) for power analyses. For Study 1, we ran a power analysis for a fixed-effects, one-way ANOVA, as we had initially planned to run linear models. Our goal was to obtain .95 power to detect a very small effect size of .10 (Sawilowsky, 2009) with an adjusted alpha of .0125 for our pairwise comparisons testing in H1-H4. This produced a minimum required sample size of 1548 posts total, or 516 per food type. For Study 2, we ran our power calculations based on a two independent proportions z-test for our pairwise comparisons testing in H1-H2. Our group proportion parameters were set at 0.33 and 0.28, based on the Study 1 meat and vegetarian consumption situation hashtag means, which had the smallest between-group proportional difference (0.34 vs 0.26, respectively). Our goal was to obtain .95 power to find a 5% difference in proportions (adjusted alpha =.025), which produced a minimum required sample size of 6603 posts total, or 2201 per food type.

2.3.2. Data Collection

For Study 1, data was collected manually from the most recent search engine results on Instagram by TD in November 2019, using three searchable labels: '#plantbased', '#meat' and '#vegetarian'. We generated separate datasets for the post hashtags and caption text because a) hashtags are used to search for relevant content (Highfield & Leaver, 2015) and are therefore included in posts for different purposes than the text, and b) a maximum limit of 30 hashtags and 2,200 characters for captions per post means there is a considerable difference between these two types of data in length and form. Although we only focused on language and not on the image content, we excluded posts that had no food-related image, to ensure that we included only language from food-related posts. We further excluded posts that were not written in English, contained videos, and commercial marketing posts from business accounts. We also excluded posts of non-savoury and dessert foods (e.g. chocolate, ice cream, puddings). 1200 posts for each food type were collected to ensure sufficient power after these planned exclusions. Using these criteria, and after removing posts with missing data, a total of 852 posts (N_{meat} = 306, $N_{plantbased}$ = 250, $N_{vegetarian}$ = 296) were included for analysis of hashtags, and 682 posts (N_{meat} = 237, $N_{plantbased}$ = 252, $N_{vegetarian}$ = 193) for analysis of caption text.

For Study 2, data was gathered manually from the most recent search engine results on Instagram by TD and a research assistant between August and September 2020. To avoid potential effects of the COVID-19 lockdowns on eating behaviour (Ammar et al., 2020), we decided to collect posts from February 2020. We could not use the same searchable labels as Study 1, as search results are ordered by most recent on the Instagram search engine, and the vast number of post results generated from our food type searchable labels made it impossible to scroll back far enough. Therefore, we decided to collect posts using 33 pre-registered dish searchable labels across 12 dish categories (see Table 1), that had a post results total of 120,000 or fewer, which made it possible to scroll back to posts from February 2020.

Table 1

Dish Searchable Labels by Food Type for Study 2

Dish Category	Meat	Plant-Based	Vegetarian
Breakfast	#fullenglishbreakfast	#plantbasedbreakfast	#vegetarianbreakfast
Brunch	#baconsandwich	-	#cheeseontoast
Burger	#lambburger	#veganburgers	#veggieburgers
Burrito	#chickenburrito	#veganburrito	#veggieburrito
Curry	#beefcurry	#vegetablecurry	#eggcurry
Pasta	#beeflasagna	#tomatopasta	#macaronicheese
Pizza	#chickenpizza	#plantbasedpizza	#veggiepizza
Ramen	#chickenramen	#veganramen	#veggieramen
Rice	#chickenfriedrice	#mushroomrisotto	#eggfriedrice
Roast	#roastlamb	#veganroast	#nutroast
Salad	#beefsalad	#vegetablesalad	-
Wrap	-	#veganwrap	#veggiewrap

In addition to the Study 1 exclusion criteria, we excluded posts that did not include one of the three food type hashtags (#plantbased, #meat, #vegetarian) or a hashtag that clearly referred to a food type (e.g. #vegan, #carnivore, #veggie). Unlike Study 1, posts were excluded at the point of data collection. Using these criteria, and after removing posts with missing data, we collected a total of 3104 posts (N_{meat} = 515, $N_{plantbased}$ = 1946, $N_{vegetarian}$ = 643). We could not achieve our desired sample size due to the introduction of new automaticity measures by Instagram during our data collection period, which restricted our ability to manually scroll retrospectively to February 2020 posts (Instagram, 2020b).

In line with the Instagram Terms of Use Data Policy (Instagram, 2020a) we gathered publicly accessible data from each post. No personally identifiable information was collected.

2.3.3. Data Coding

Data was coded according to a hierarchical coding scheme designed to categorise features of food and drink descriptions (see Papies et al., 2020c). This coding scheme categorises features into 5 main categories, and 42 sub-categories. Features are coded as 'consumption situation' language if they refer to aspects of situations where the food is consumed, such as the sensory aspects (e.g. "spicy, "thick", "warm"), consumption context (e.g. "evening", "café", "with a beer") or the immediate experiences of eating a food (e.g. "delicious", "comforting", "bloating"). Features are coded as 'non-consumption situation' language if they refer to aspects of situations in which the food is present but not consumed, such as the production (e.g. "recipe", "local", "cow"), purchasing (e.g. "cheap", "drive-thru", "supermarket"), preparation (e.g. "fridge", "sliced", "frozen") or the cultural aspects of a food (e.g. "italian, "popular", "christmas"). Features are coded as 'situation-independent' language if they refer to aspects that are independent of a consumption situation, such as the health consequences (e.g., "healthy", "good for you", "fattening"), ingredients and content (e.g. "high protein", "broccoli", "gluten-free"), visual properties (e.g. "red", "beautiful", "round") or the overall evaluations of a food ("good", "bad", "favourite"). Features that could be equally coded in two or more main categories are coded as 'ambiguous' language, and features that cannot be identified as a food word in the study language (i.e. English) are coded as 'nonword'. Syncategorematic words, i.e. words that do not stand by themselves such as prepositions, logical connectives, articles and quantifiers (e.g. "at", "the", "in", "of") are also coded as 'nonword'. For further details and subcategories, see the Supplementary Online Materials (SOM).

During the coding process, we decided to add three novel categories to capture words specific to our data. First, considering that many identity-related words were found in the text and hashtags, and given that identity expression is a crucial motivation for social media use (Baym, 2015), we added an identity subcategory within the situation-independent main category to capture language referencing the group membership of the consumer in relation to the food they eat (e.g., “foodie”, “carnivore”, “vegancommunity”). Second, we also added a social and political context subcategory into the main situation-independent category to capture words that refer to general social norms or political ideas or movements (e.g., “climate”, “movement”, “yes2meat”), which are commonly used to communicate attitudes within online platforms (Lee et al., 2015a). Finally, we added a social media main category for any feature that refers to the social media platform (e.g., “blog”, “followers”, “dailypost”) rather than the food. Therefore, 6 main categories and 44 sub-categories in total were used for coding.

Features that consisted of several words were divided into the smallest meaningful units and coded separately, for example “#healthyfoodporn” became “healthy” (situation independent: long-term positive health consequences) and “foodporn” (situation independent: visual), and “dinner with friends” became “dinner” (consumption situation: time setting and frequency) and “with friends” (consumption situation: social setting). Features such as “#tasteshealthy” remained as one meaningful unit (consumption situation: immediate positive consequences: hedonic), as this communicates one situated concept, i.e. a food tasting healthy. Further examples can be found in Table 2. We excluded food type searchable labels from Study 1 (‘#plantbased’, ‘#meat’, ‘#vegetarian’), and food type and dish searchable labels from Study 2 (e.g. ‘#mushroomrisotto’, ‘#chickenburrito’, ‘#nutroast’; see Table 1), as these had been used to identify and select the posts for inclusion in the studies, and including them in our analyses could have influenced category means.

TD coded all features for both studies, and secondary coding was completed by BT, who had previous experience using the feature listing coding scheme, to test for interrater reliability (McHugh, 2012). Secondary coding sample sizes for each study were calculated as 1% of the total unique words coded (i.e. single instances of words used, without counting repetitions). For Study 1, secondary coding of a random 50-word sample resulted in weak agreement (κ = .48) at the main category level. After discussing coding discrepancies, TD recoded the dataset. An additional random 50-word sample was coded by BT. Results showed moderate agreement (κ = .64). For Study 2, a 75-word sample was double coded by BT, which resulted in moderate agreement (κ = .65), which was deemed satisfactory for our analyses.

Table 2

Example of Text and Hashtag Data Coding for a Sample Post

Example	Features	Main Category	Subcategory
Text Data			
"loaded nachos for a cosy night in"	"loaded"	situation independent	ingredients and content
	"nachos"	situation independent	ingredients and content
	"for"	nonword	-
	"a"	nonword	-
	"cosy"	consumption situation	immediate positive emotional consequences
	"night in"	consumption situation	time setting and frequency
Hashtag Data			
"#food #foodporn #foodposts #delicious #meat"	"food"	situation independent	category information
	"foodporn"	situation independent	visual
	"foodposts"	social media	-
	"delicious"	consumption situation	immediate positive hedonic consequences
	"meat"	situation independent	ingredients and content

Note: Words were coded with reference to the Instagram post context

2.3.4. Analysis Plan

Although we had pre-registered to analyse category means in Study 1, we decided to analyse proportions instead, in order to control for the substantial variation in the overall number of words used in the hashtags and text captions. Proportions were calculated for each post by dividing the number of words coded per category (e.g. consumption situation features) by the total number of words coded across all 3 main categories, namely consumption situation, non-consumption situation and situation-independent features. For example, if a post had three consumption situation features out of ten coded main category features total, the consumption situation proportion for that post would be 0.30. Ambiguous, nonword and social media words were excluded from analysis, as these were considered separate to the food language of interest. As a robustness check, we re-ran our analyses with all categories included in our proportions denominator, and only found minor changes which did not change our overall conclusions (for further details, see the OSF).

All analyses were conducted in R (version 4.0.4; R Core Team, 2022) with data processing and visualisation generated using the *tidyverse* library and associated packages (version 1.3.1; Wickham et al., 2019). For Study 1, we fitted linear mixed-effects models with the *lm* function of the *lme4* package (version 1.1-31; Bates et al., 2014) and ran pairwise comparisons with the *emmeans* package (version 1.6.0; Lenth, 2021). Across all our Study 1 models, we predicted proportions with a fixed effect for food type. To control for familywise error rate from multiple testing, we adjusted our alpha level in Study 1 to $p < 0.0125$ using the Bonferroni correction.

For Study 2, we also ran linear mixed-effect models using the *lmer* function of the *lme4* package, and pairwise comparisons with the *emmeans* package. Across all linear mixed-effects models, we used a maximal random effects structure (Barr et al., 2013), predicting proportions (logit transformed) with a fixed effect for food type, and a random intercept for dish type. We obtained F values for the overall main effects using the *anova* function of the *stats* package (version 4.0.4; R Core Team, 2022). Again, to control for familywise error rate from multiple testing, we adjusted our alpha level to $p < 0.025$. Variance explained was estimated using the *r.squaredGLMM* function of the *MuMIn* package (version 1.43.17; Bartoń, 2020).

Following the results of our confirmatory analyses, we decided to run several exploratory analyses. Firstly, we ran three linear mixed-effect models, with non-consumption situation proportions as our dependent variable for the hashtag data in Studies 1 and 2, and the text data in Study 1. Non-consumption situation is the third main category in the feature listing manual, which was used in our proportion calculations. Therefore, we also explored differences in non-consumption situation proportions. We further ran two linear mixed-effect models comparing the frequency of hashtag words coded in the identity subcategory, between food types.

Data visualisation was produced using raincloud plots (Allen et al., 2019). Model diagnostics were assessed using the *DHARMa* package (version 0.3.3.0; Hartig, 2020). Although our models showed slight deviation from the expected distribution (Kolmogorov–Smirnov test), this is unlikely to influence Type 1 error rate, standard error or empirical power estimates. Considering this, we decided to run our models without corrections.

2.4. Results

A total of 62,247 words, 10,036 (16%) unique, were coded across the three datasets. Table 3 shows the numbers of words coded in each study. The most frequently used features for each food type can be seen in Table 4. For further Descriptives, please see the SOM.

Table 3

Number of Words Coded for Study 1 and 2

	Total Words	Unique Words	Unique Words (%)	Mean Words per Post	SD Words per Post
Study 1					
Text	6,775	2,127	31%	9.93	10.29
Hashtag	12,072	3,966	33%	14.17	8.03
Study 2					
Hashtag	43,400	11,483	26%	13.98	7.67

Table 4

Most Frequent Words by Food Type

	Meat			Plant-based			Vegetarian		
	Word	Freq.	% of posts	Word	Freq.	% of posts	Word	Freq.	% of posts
Study 1 Hashtag Words									
1	food	145	46%	veganfood	119	47%	food	105	33%
2	foodporn	126	39%	healthy	102	27%	healthy	99	26%
3	foodie	95	29%	whatveganseat	79	31%	recipes	80	18%
4	dinner	67	22%	foodporn	78	24%	foodporn	73	24%
5	bbq	66	18%	food	77	31%	foodie	68	22%
6	beef	65	20%	recipes	73	21%	healthyfood	66	22%
7	steak	56	15%	healthyfood	61	24%	breakfast	61	12%
8	lunch	=54	17%	breakfast	51	15%	veggie	56	16%
9	yummy	=54	17%	govegan	50	20%	lunch	49	14%
10	delicious	53	17%	veganlife	48	19%	homemade	=44	13%
Study 2 Hashtag Words									
1	food	189	34%	veganfood	1099	50%	recipes	197	22%
2	foodporn	178	32%	whatveganseat	563	27%	food	168	23%
3	foodie	166	31%	recipes	535	22%	foodie	159	23%
4	dinner	142	20%	dinner	501	19%	healthy	155	20%
5	sunday	87	22%	foodporn	421	18%	foodporn	148	21%
6	delicious	79	15%	veganlife	327	16%	brunch	125	12%
7	yummy	75	14%	healthy	322	13%	dinner	114	13%
8	lunch	70	11%	meals	290	12%	slimmingworld	111	6%
9	slimmingworld	66	6%	plantbaseddiet	287	15%	healthyfood	106	15%
10	homemade	61	11%	lunch	284	10%	homemade	101	12%
Study 1 Text Words									
1	good	23	9%	delicious	37	15%	lunch	25	10%
2	beef	=21	9%	day	32	10%	food	24	10%
3	chicken	=21	8%	tofu	31	11%	made	21	10%
4	steak	=21	7%	food	=29	9%	good	19	8%
5	food	19	8%	breakfast	=29	10%	delicious	=18	9%
6	time	15	6%	good	23	8%	tomatoes	=18	9%
7	cooked	=14	6%	brunch	21	6%	sauce	=18	7%
8	delicious	=14	6%	salad	=20	6%	eggs	=18	8%
9	bbq	=13	5%	spinach	=20	8%	happy	17	8%
10	pork	=13	5%	garlic	=20	8%	potato	=16	6%

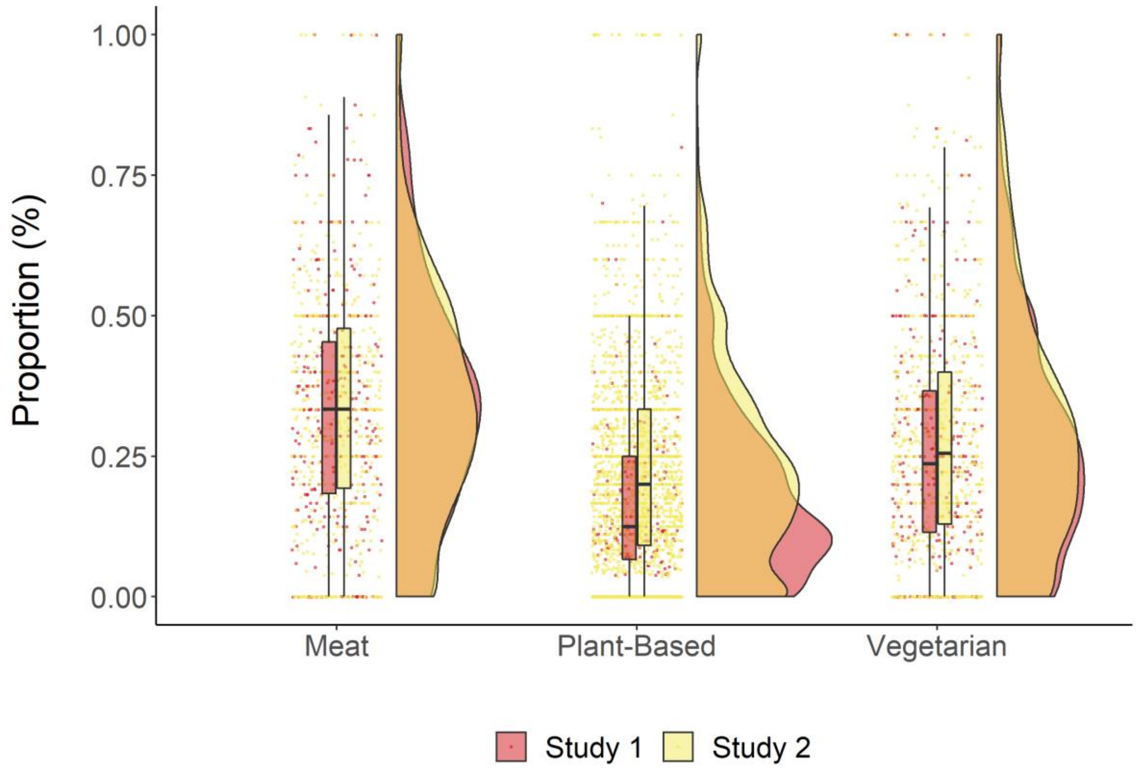
2.4.1. Confirmatory Analyses

2.4.1.1. Consumption Situation Words in Hashtags

We predicted that meat posts would contain more consumption situation hashtag words than plant-based posts (H1). We also predicted that meat posts would contain more consumption situation hashtag words than vegetarian posts in Study 1, but did not predict this in Study 2. In line with these predictions, the overall effect of food type on the proportion of consumption situation hashtag words was significant in Study 1, $F(2, 849) = 41.51$, $p < .001$, $R^2 = 0.09$, and Study 2, $F(2, 2481.8) = 57.80$, $p < .001$, $R^2_m = 0.04$, $R^2_c = 0.06$ (see Figure 1). Pairwise comparison statistics are displayed in Table 5. Study 1 meat posts had a higher proportion of consumption situation hashtag words than plant-based posts, and vegetarian posts. Vegetarian posts also had a higher proportion of consumption situation hashtag words than plant-based posts. Exactly the same pattern was found in Study 2.

Figure 1

Proportion of Consumption Situation Hashtag Words by Food Type



Note: Raincloud plot of the consumption situation category proportion means in hashtags on Instagram posts about meat foods, plant-based foods, and vegetarian foods in Study 1 and 2. The boxplots represent the proportion means and the scatterplots and violin plots represent the distribution of the proportions for all observations.

Table 5

Pairwise Comparisons of Consumption Situation Words Between Food Categories

	Meat	Plant-based	Vegetarian	Meat vs. Plant-based	Meat vs. Vegetarian	Plant-based vs. Vegetarian
	M (SD)	*M (SD)*	*M (SD)*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*
Study 1						
Text	0.35 (0.33)	0.32 (0.25)	0.33 (0.27)	0.07 (0.17) 0.69 [-0.27 – 0.41]	-0.05 (0.19) 0.81 [-0.41 – 0.32]	-0.12 (0.18) 0.53 [-0.47 – 0.24]
Hashtag	0.34 (0.21)	0.17 (0.15)	0.26 (0.21)	0.98 (0.11) **<0.001** [0.76 – 1.18]	0.42 (0.10) **<0.001** [0.22 – 0.62]	-0.56 (0.11) **<0.001** [-0.77 – -0.34]
Study 2						
Hashtag	0.34 (0.21)	0.23 (0.19)	0.29 (0.21)	0.65 (0.07) **<0.001** [0.51 – 0.78]	0.20 (0.08) **0.01** [0.04 – 0.35]	-0.45 (0.06) **<0.001** [-0.57 – -0.33]

2.4.1.2. Situation-Independent Words in Hashtags

We predicted that the proportion of situation-independent hashtag words would be higher for plant-based posts and vegetarian posts than meat posts in Study 1, and higher for plant-based posts than meat posts in Study 2 (H2). In line with these predictions, we found an overall effect of food type on situation-independent hashtag word proportions in Study 1, $F(2, 849) = 43.25$, $p < .001$, $R^2 = 0.09$. and in Study 2, $F(2, 2460.2) = 54.63$, $p < .001$, $R^2_m = 0.04$, $R^2_c = 0.05$ (see Figure 2). Pairwise comparison results (see Table 6) showed that in Study 1, plant-based posts had higher situation-independent hashtag word proportions than meat posts and vegetarian posts. Vegetarian posts also had a higher proportion of situation-independent hashtag word proportions than meat posts. The same results were found for Study 2.

Figure 2

Proportion of Situation-Independent Hashtag Words by Food Type

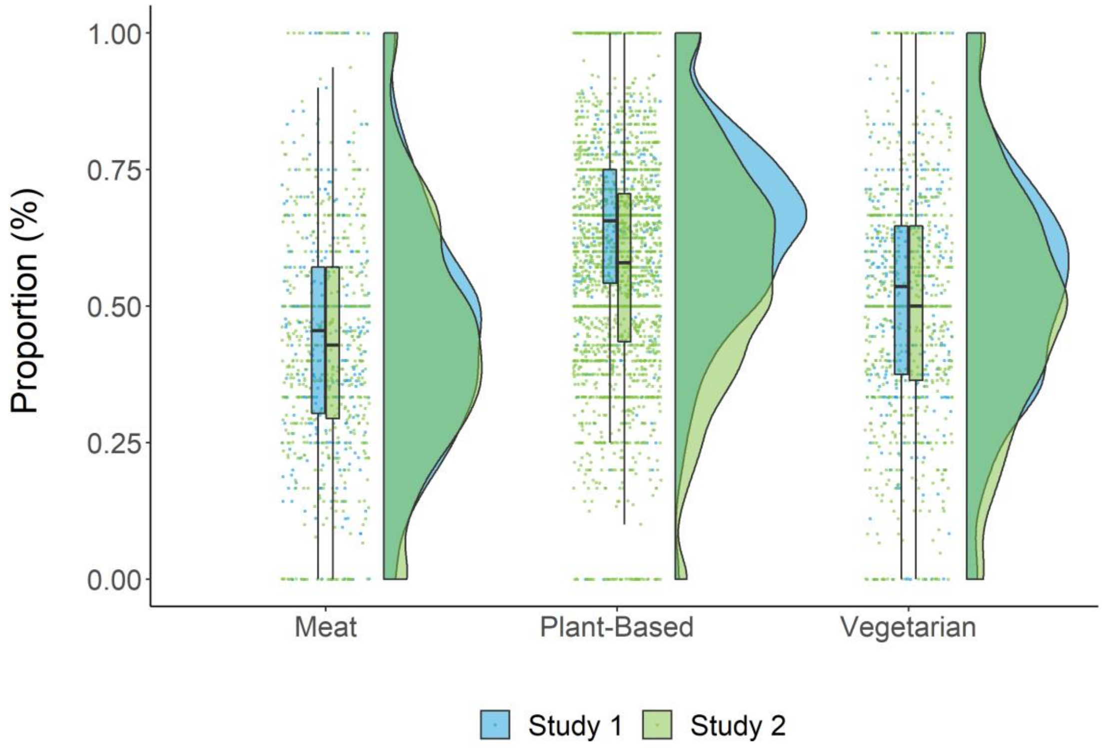


Table 6

Pairwise Comparisons of Situation Independent Words Between Food Categories

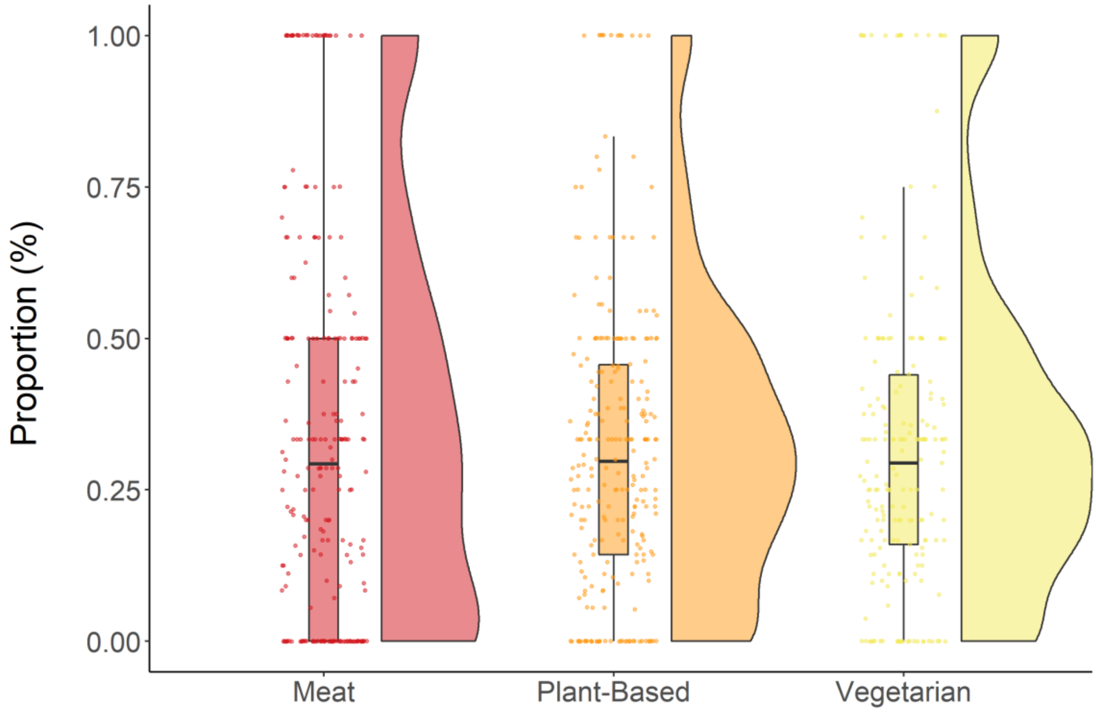
	Meat	Plant-based	Vegetarian	Meat vs. Plant-based	Meat vs. Vegetarian	Plant-based vs. Vegetarian
	M (SD)	*M (SD)*	*M (SD)*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*
Study 1						
Text	0.43 (0.31)	0.55 (0.24)	0.52 (0.25)	-0.12 (0.02)	-0.10 (0.03)	0.02 (0.03)
				<0.001	**<0.001**	0.35
				[-0.17 - -0.07]	[-0.15 - -0.05]	[-0.03 - 0.08]
Hashtag	0.45 (0.21)	0.64 (0.17)	0.53 (0.21)	-0.88 (0.09)	-0.33 (0.09)	0.55 (0.10)
				<0.001	**<0.001**	**<0.001**
				[-1.07 - -0.69]	[-0.51 - -0.15]	[0.36 - 0.74]
Study 2						
Hashtag	0.44 (0.22)	0.57 (0.21)	0.50 (0.23)	-0.60 (0.06)	-0.22 (0.07)	0.39 (0.06)
				<0.001	**0.003**	**<0.001**
				[-0.73 - -0.48]	[-0.36 - -0.07]	[0.27 - 0.50]

2.4.1.3. Consumption Situation Words in Text (Study 1 Only)

In Study 1, we predicted that there would be a higher proportion of consumption situation text words in meat posts versus plant-based and vegetarian posts (H3). Unlike our hashtag results, we did not find an overall effect of food type on consumption situation proportions in the text, $F(2, 679) = 0.21$, $p = .81$ (see Figure 3). Pairwise comparisons showed no differences between the consumption situation proportions of meat posts, plant-based posts or vegetarian posts (see Table 5).

Figure 3

Proportion of Consumption Situation Text Words by Food Type

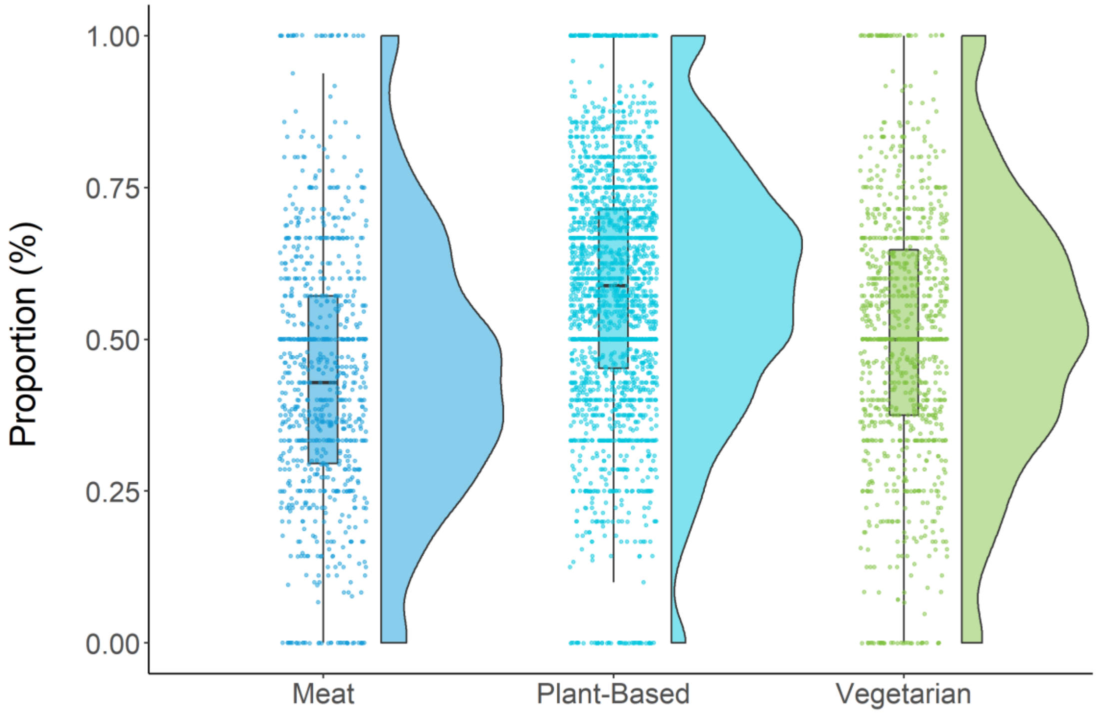


2.4.1.4. Situation-Independent Words in Text (Study 1 Only)

In Study 1, we hypothesized that the text words used in vegetarian and plant-based posts would have a higher proportion of situation-independent language than meat posts (H4). Results showed a significant overall effect of food type on situation-independent word proportions in the text, $F(2, 679) = 13.3$, $p < .001$, $R^2 = 0.04$ (see Figure 4). Pairwise comparisons (see Table 6) revealed that plant-based posts had a higher proportion of situation-independent text words than meat posts. Vegetarian posts also had a higher proportion of situation-independent text words than meat posts. There was no difference in the proportion of situation-independent text words between plant-based posts and vegetarian posts.

Figure 4

Proportion of Situation-Independent Text Words by Food Type



2.4.2. Exploratory Analyses

2.4.2.1. Non-Consumption Situation Words in Hashtags

We explored differences between food types in non-consumption situation proportion means for both hashtag and text words in Studies 1 and 2, again using binomial mixed-effects models. For hashtag words, we did not find an effect of food type in Study 1, $F(2, 849) = 0.39$, $p < .001$, or Study 2, $F(2, 2894.2) = 0.77$, $p = 0.46$ (see Figure 5), and no differences were found between meat, plant-based and vegetarian posts (see Table 7).

Figure 5

Proportion of Non-Consumption Situation Hashtag Words by Food Type

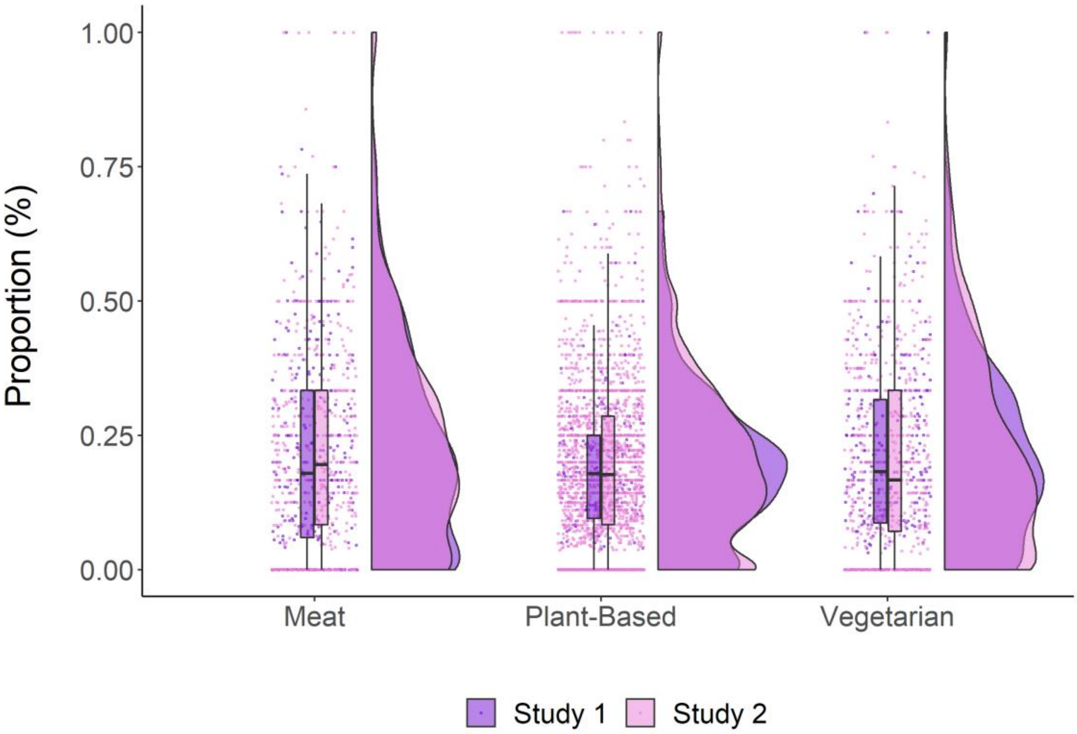


Table 7

Pairwise Comparisons of Non-Consumption Situation Words Between Food Categories

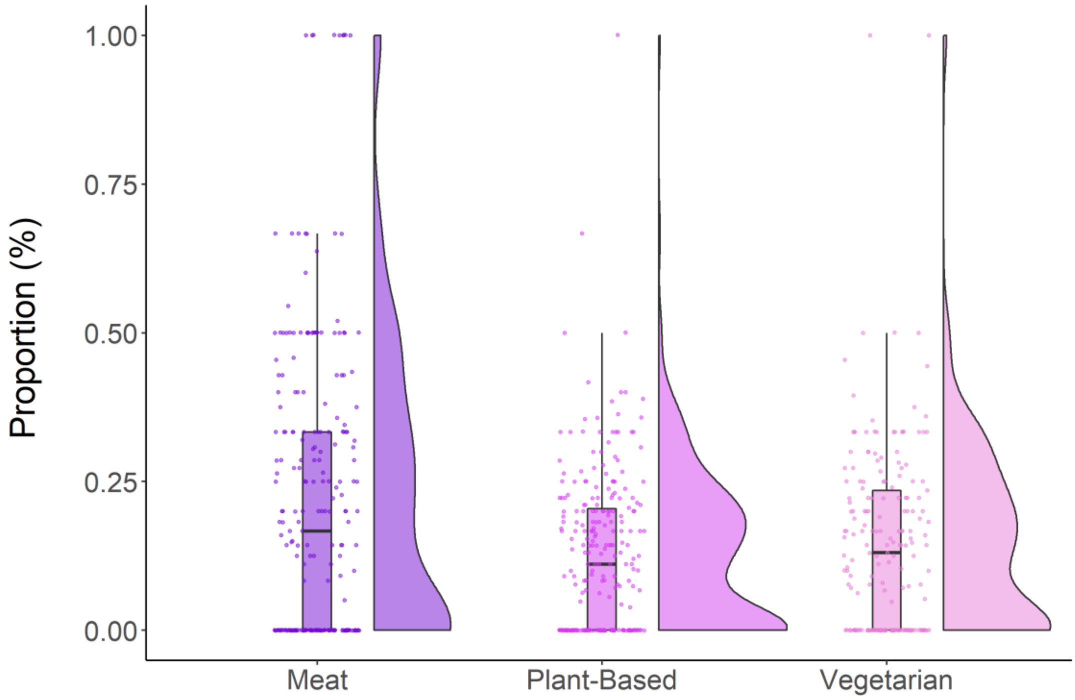
	Meat	Plant-based	Vegetarian	Meat vs. Plant-based	Meat vs. Vegetarian	Plant-based vs. Vegetarian
	M (SD)	*M (SD)*	*M (SD)*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*
Study 1						
Text	0.22 (0.25)	0.13 (0.14)	0.14 (0.16)	0.45 (0.14) **0.001** [0.18 – 0.72]	0.36 (0.15) **0.01** [0.07 – 0.65]	-0.09 (0.15) 0.54 [-0.37 – 0.19]
Hashtag	0.21 (0.18)	0.19 (0.14)	0.21 (0.17)	0.01 (0.10) 0.88 [-0.19 – 0.22]	-0.07 (0.10) 0.48 [-0.26 – 0.12]	-0.08 (0.10) 0.42 [-0.29 – 0.12]
Study 2						
Hashtag	0.23 (0.20)	0.20 (0.17)	0.21 (0.19)	0.01 (0.07) 0.84 [-0.11 – 0.14]	0.08 (0.08) 0.29 [-0.07 – 0.23]	0.07 (0.06) 0.26 [-0.05 – 0.19]

2.4.2.2. Non-Consumption Situation Words in Text (Study 1 only)

For text words, which we only collected in Study 1, there was an overall effect of food type on non-consumption situation proportions, $F(2, 679) = 5.85$, $p = .003$, $R^2 = 0.02$ (see Figure 6). Meat posts had a higher proportion of non-consumption situation text words than plant-based posts and vegetarian posts. There were no differences in non-consumption situation text words between vegetarian and plant-based posts (see Table 7).

Figure 6

Proportion of Non-Consumption Situation Text Words by Food Type



2.4.2.3. Analyses of Additional Categories

We explored the effects of food type on the novel identity and social and political context subcategories, which we added within the situation-independent main category to accommodate some of the language specific to the social media data we had collected. 6,838 identity words (20% unique), and 1,529 social and political context words (29% unique) were coded across the three datasets. We ran two binomial effects models to test the differences in identity features with the Study 1 and 2 hashtag data. There was a small number of identity text words, and there were few social and political context hashtags and text words overall. Therefore, we did not analyse these.

There was an overall effect of food type on identity proportions in Study 1, $F(2, 849) = 9.62$, p <.001, $R^2 = 0.02$, and Study 2, $F(2, 2851.1) = 48.68$, p <.001, $R^2_m = 0.03$, $R^2_c = 0.07$ (see Table 8). In Study 1, plant-based posts and meat posts had a higher proportion of identity hashtag words than vegetarian posts, but there was no difference between plant-based and meat posts. In

Study 2, plant-based posts had a greater proportion of identity language than meat posts and vegetarian posts. No difference in identity proportions was found between meat posts and vegetarian posts when correcting for multiple comparisons (p = 0.04).

Table 8

Pairwise Comparisons of Identity Words Between Food Categories

	Meat	Plant-based	Vegetarian	Meat vs. Plant-based	Meat vs. Vegetarian	Plant-based vs. Vegetarian
	M (SD)	*M (SD)*	*M (SD)*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*
Study 1						
Hashtag	0.09 (0.11)	0.11 (0.11)	0.07 (0.12)	-0.15 (0.09) 0.10 [-0.34 - 0.03]	0.25 (0.09) **0.01** [0.08 - 0.43]	0.41 (0.09) **<0.001** [0.22 - 0.59]
Study 2						
Hashtag	0.09 (0.11)	0.15 (0.15)	0.08 (0.11)	-0.37 (0.06) **<0.001** [-0.49 - -0.25]	0.15 (0.07) 0.04 [0.01 - 0.29]	0.52 (0.06) **<0.001** [0.41 - 0.63]

2.5. Discussion

In two observational studies, we examined whether social media posts about meat dishes use more language reflecting eating simulations than posts about vegetarian and plant-based dishes. In line with our hypotheses, results consistently showed that hashtags in meat posts contained more eating simulation language than plant-based posts, whereas plant-based posts had more situation-independent language than meat posts.

We also found that vegetarian posts had more eating simulation and fewer situation-independent hashtags than plant-based posts, and had fewer eating simulation and more situation-independent hashtags than meat posts. Considering the associations found between simulation language and perceived attractiveness (Papies et al., 2020b; Papies et al., 2021), our findings suggest that meat dishes are framed as more appealing than vegetarian dishes, and vegetarian dishes are framed as more appealing than plant-based dishes.

In contrast to the hashtags, results from the text data in Study 1 showed no significant differences in eating simulation language use across meat, plant-based and vegetarian dish posts, although effects were in the predicted direction. Specifically, the caption text in posts about plant-based and vegetarian dishes included more situation-independent language than meat dishes, but this was a much weaker effect than seen in the hashtags. The difference in results between our hashtag and text data may be due to processing the caption text with a feature listing coding scheme intended to categorise one-word descriptions or small phrases of a particular product. Therefore, our methodological approach seems suitable for hashtags, but less so for captions. Reducing free text into the smallest meaningful units may have resulted in a loss of important semantic context, meaning intended by the users, and statistical power. Thus, different qualitative analysis methods may be more suitable for text caption data. In addition, the variability and inconsistency of feature frequencies in the text data, in comparison to the hashtag data, may have contributed to the small effects seen. Nonetheless, these results add to our understanding of how the language used to caption content on image-centric social media platforms varies from the ‘searchable talk’ of hashtags (Zappavigna, 2015), and thus differ in function.

From our exploratory analyses, we discovered that the text captions of meat posts in Study 1 had higher proportions of non-consumption situation language than plant-based posts. This may mean that food origins and production, in addition to cultural elements, are potentially more salient with meat foods than plant-based foods. This is not surprising, as meat dishes have high status and traditional importance across a majority of cultures (Fiddes, 2004), and the authenticity of a meat dish is often derived from its provenance (Monahan et al., 2018; Wise & Vennard, 2019). Importantly, we also found that plant-based posts had a greater proportion of identity focused language than meat posts in Study 2, which suggests the salience of food identity within descriptions of sustainable foods.

2.5.1. Theoretical Implications and Future Research

These findings are largely consistent with our predictions derived from the grounded cognition theory of desire and motivated behaviour, and with previous research showing language differences between food categorise in food service settings. Papies and colleagues found that descriptions for meat supermarket ready-meals tended to use more eating simulation language than those for sustainable, plant-based alternatives (Papies et al., 2020b), and Turnwald and colleagues (2017b) found that restaurants described healthy items with less appealing terms than unhealthy items. These language differences matter, because they have the potential to influence food choices and the development of food preferences over time (Papies et al., 2020b; Turnwald et al. 2017a; Turnwald & Crum, 2019). Indeed, using taste-focused labelling instead increased the purchasing of healthy foods by 38% (Turnwald & Crum, 2019). In line with the grounded cognition theory, these findings suggest that simulation-focused language taps into mechanisms that lead to desire (Papies et al., 2022a).

The findings reported here extend research on language differences between more and less appealing foods to the increasingly important domain of food communication on social media. Notably, this language bias appears even when users are assumed to "advocate" for certain foods, i.e., on Instagram. While the grounded cognition theory of desire and previous research suggest that people describe liked foods in terms of consumption simulations, the current findings suggest that this may be less the case for foods where eating motives other than taste and enjoyment play a major role, for example social identity (Judge et al., 2022). Future research should examine the interplay between social identity and the degree to which consumption simulations play a role in food representations and communication.

We assume that the patterns of language found in our research across different dishes on social media reflect an attempt by users to connect and interact with others in their food identity communities (Potnis & Tahamtan, 2021). Previous research has found that language on social media is generated strategically to construct knowledge and share experiences (Lewis, 2009). Our results suggest that consumers use language to display food attitudes, which seemed more enjoyment oriented for meat foods, and more health and identity-oriented for plant-based foods. These attitudes in turn are likely to be reinforced over time from repeated exposure to users' social media feeds and habitual platform usage (Ohme, 2021). These attitudes displayed by members of the same online food ingroup can then influence users' eating motivations (Blundell & Forwood, 2021), which may motivate some users to change their eating behaviour, for example by replacing meat with more sustainable alternatives (Pop et al., 2020). Thus, we assume that the language strategically used to describe food posts in our study reflects attitudes and may affect subsequent behaviour.

In addition, our results have implications for research on food-related identities. Plant-based posts had a larger proportion of identity language, making up 17% of all situation-independent language in Study 1, and 26% in Study 2, in comparison to meat posts, suggesting that emphasising shared values and identities in the descriptions of plant-based foods is crucial to vegan communication. This may be due to the fact that vegans are a minority group, who use social media as a way to tap into their 'identity bubble' (Kaakinen et al., 2020), create a sense of group membership and community, and defend their consumption practices against the omnivorous status quo (Costa et al., 2019; Wehbe et al., 2021). For example, 47% of Study 1 and 50% of Study 2 plant-based posts included the hashtag '#veganfood', which demonstrates the homogeneous identity language used frequently to describe plant-based foods online in order to connect with other vegan users. On the other hand, those that follow the normative omnivorous culture do not have to justify their dietary choices or consider their diet as a central identity (Rosenfeld & Burrow, 2018; Vestergren & Uysal, 2022). Although vegan and vegetarian communities have been typically grouped together in psychological research to date (Rosenfeld, 2018; Rosenfeld et al., 2020), the differences found in identity-focused language for vegetarian and plant-based foods suggest that clear distinctions between these food types exist, and therefore should be treated separately in future studies.

The identity language in plant-based food posts may contribute towards the polarisation between meat-eating and vegan communities (Buddle et al., 2018), who adopt different linguistic strategies that may not appeal to the food 'outgroup' (De Groeve et al., 2019). Such polarisation may not be helpful for realising the global transition to more sustainable diets that is required to keep the planet inhabitable (Fielding & Hornsey, 2016). Future studies should investigate whether these results are consistent across social media platforms, and whether these different language strategies affect the attitudes and eating intentions of other users that see their posts. An interesting theoretical question is whether emphasising shared identities can increase the appeal of foods to certain groups of consumers (see also Hackel et al., 2018), and again how the mechanisms of driving such an effect would relate to the eating simulations proposed by the Grounded Cognition Theory of Desire (Papies et al., 2020a). Understanding how food posts are seen and received by varying food identity groups may help to understand the gatekeeping culture of online meat-eater and vegan communities (Malinen & Koivula, 2020).

2.5.2. Strengths and Limitations

A key strength of our studies is the collection of real-world data in a natural setting. Furthermore, the use of a comprehensive food language coding scheme provides a more detailed understanding of the semantic differences between meat, vegetarian and plant-based food descriptions than traditional valence ratings, where words are rated as positive or negative. Another strength is the very close replication of results across Study 1 and 2, which used datasets collected four months apart, indicating the robustness of our findings (Francis, 2012). This suggests that these differences in online language use are stable across time and samples (Jebb et al., 2015). Our mixed-effects models also showed a similar distribution of proportions across datasets when controlling for multiple dish types, suggesting that the type of food is a greater predictor of eating simulation language than the dish, such as burger, pizza or salad.

One limitation of this research is that we did not reach our planned sample sizes, due to underestimating the posts excluded from our criteria in Study 1, and data accessibility issues in Study 2. Despite this, our models generated on average medium effect sizes, which supports the explanatory power of our findings (Funder & Ozer, 2019). Nonetheless, our vegetarian results need to be replicated with a larger sample to determine whether the proportional differences seen between vegetarian and plant-based posts, and vegetarian and meat posts, display a true effect.

Another potential issue with our data is that we only included English-language posts. However, considering the dominance of English language use in internet settings, and the subsequent development of 'internet English', which includes linguistic features specific to an online environment (Seargeant & Tagg, 2011), measuring an English-only sample may capture a majority of the discourse and nuance found across social media communities. In addition, another limitation is that we did not collect information about the identity of the post creators, due to the observational nature of our data collection. However, considering the amount of identity language included across meat, plant-based and vegetarian food posts, we assume that the food type of the post aligned with the users' own food identity and ingroup attitudes.

2.6. Conclusion

We found that more eating simulation language was used for meat than for plant-based foods on social media, while more situation-independent language was used for plant-based foods, particularly identity language. Thus, communication about meat foods was characterised by a focus on short-term enjoyment, while communication about more sustainable foods reflected the salience of long-term shared values and identities. Food marketing teams should be conscious of these language trends when describing plant-based foods, and the potential effects that using situation-independent language might have on their appeal and subsequent purchasing likelihood by main-stream consumers. Policymakers should aim to prevent polarisation between meat-eaters and vegans by focusing on food attractiveness and shared eating experiences, in order to break down food identity barriers and encourage the global shift towards sustainable diets that is needed to maintain the planet inhabitable for humans.

3. Chapter 3: Both Omnivores and Vegans Represent Ingroup Foods with Eating Simulations

This chapter is an exact copy of the following submitted manuscript:

Davis, T., Harkins, L., & Papies, E. K. (2022). *Polarising Plates: Both Omnivores and Vegans Represent In-Group Foods with Eating Simulations*. OSF Preprints. https://doi.org/10.31219/osf.io/p5k2v

3.1. Abstract

In two pre-registered experiments, we assessed how people cognitively represent meat and plant-based foods, to examine processes underlying dietary polarisation in society. Food descriptions from UK-based omnivores ($N_{Exp. 1}$ = 109; $N_{Exp. 2}$ = 436) and vegans ($N_{Exp. 1}$ = 111; $N_{Exp. 2}$ = 407) were coded for features about consumption and reward (e.g. 'rich', 'indulgent', 'treat'), or features independent of the consumption situation (e.g. 'healthy', 'protein', 'eco-friendly'). Participants used more consumption and reward features for diet-congruent dishes (meat dishes for omnivores; plant-based dishes for vegans) than for diet-incongruent dishes (vice versa). Omnivores focused on abstract, long-term consequences of plant-based foods, whereas vegans focused on the socio-political associations with meat foods. Consumption and reward features also positively predicted attractiveness ratings, the likelihood of ordering a dish, and eating intentions. These findings indicate the cognitive processes of polarised dietary groups that may hinder the mainstream transition to more sustainable food choices.

Keywords: Language, Food, Diet, Grounded Cognition, Sustainability

3.2. Introduction

Current mainstream consumption behaviour is unsustainable. In particular, global temperatures are estimated to exceed the Paris Agreement 1.5°C target between 2053-2061 based on emissions from the food system alone (Clark et al., 2020). Without substantial immediate action, the current trajectory of global warming will likely result in more frequent and extreme weather events, a dramatic loss of biodiversity and increased poverty worldwide (Hoegh-Guldberg et al., 2019). Moving away from carbon-intense diets, such as those high in meat and dairy intake, is considered crucial for minimising greenhouse gas emissions in high-income countries (Intergovernmental Panel on Climate Change, 2019; Macdiarmid, 2021). However, despite levels of climate crisis awareness being at over 90% (Lee et al., 2015b), and public agreement that plant-based diets are good for the environment (Bryant, 2019), mainstream consumers are reluctant to change their eating behaviour for environmental reasons (Sanchez-Sabate & Sabaté, 2019). In fact, only 1 in 6 omnivores intend to reduce their meat intake (Bryant, 2019).

Social psychology research has a key role to play in the transition towards reduced meat consumption. Indeed, increasing evidence shows that vegans who exclusively consume plant-based foods are seen as a minority group, and experience stigma because of their diets (MacInnis & Hodson, 2015; Markowski & Roxburgh, 2019). In addition, omnivores have been found to derogate vegetarians (Minson & Monin, 2012) and vegans (De Groeve et al., 2022) for displaying more environmentally-friendly dietary behaviours. This suggests polarisation between the typical omnivorous consumer and those that follow plant-based diets, which may hinder the mainstream transition to more sustainable lifestyles. In this paper, we examine whether dietary group polarisation is reflected in how omnivores and vegans cognitively represent meat and plant-based foods, as this may influence their motivation to consume them.

Why are cognitive representations important? According to the Grounded Cognition Theory of Desire (Papies & Barsalou, 2015; Papies et al., 2020a), when people think about foods, they non-consciously simulate what it is like to eat them, and if the simulation is rewarding, this can increase desire for those foods. These cognitive, multi-modal simulations are partial re-enactments, which draw upon memories of earlier appetitive experiences and convey vivid sensory detail affecting neural, physiological and behavioural responses (Krishna & Schwarz, 2014). For example, the same brain regions within the 'core eating network', linked to the sensory processing of taste and reward (Kaye et al., 2009), are activated when presented with a visual food cue as when eating (Chen et al., 2016). Furthermore, asking participants to simulate eating a food induces salivation (Keesman et al., 2016) and increases desire for future consumption (Muñoz-Vilches et al., 2020). Similarly, situations that are congruent with consuming a food, such as a cinema for popcorn, can cue simulations of eating that food, which increases expected liking and desire (Papies et al., 2022c). Thus, cognitively representing foods in terms of rewarding consumption may be important for understanding the transition to sustainable diets, because the expected enjoyment from eating meat is often the most prominent barrier to reducing consumption (Corrin & Papadopoulos, 2017).

Previous research has found that people use a higher proportion of words referring to sensory, hedonic and contextual features (i.e. consumption and reward features) when describing more attractive foods and drinks, while less attractive foods are described with greater reference to visual features, ingredients and the long-term consequences of consumption (Keesman et al., 2018; Papies, 2013; Papies et al., 2022a). In addition, more consumption and reward features are used for more frequently consumed foods and drinks, and also predict desire to consume as well as actual intake in laboratory settings (Papies et al., 2022b). This suggests that attractive and frequently consumed foods are represented through simulations, or re-experiences, of the taste, texture, context and enjoyment of eating. These simulations reflect previous eating experiences, which shape desire, eating intentions and actual food choices (Higgs, 2016).

3.2.1. Current Research

We examined how omnivores (i.e., consumers whose diet includes animal-products) and vegans (i.e., consumers whose diet excludes all animal products) cognitively represent meat and plant-based foods, and how these representations relate to consumption motivation and behaviour. Using a feature listing task to capture the richness of cognitive representations via natural language descriptors (McRae et al., 2005), we asked participants to list the features of a given dish, and then analysed the language used (Wu & Barsalou, 2009). Experiment 1 assessed representations and examined how these representations are associated with ratings of attractiveness and eating motivation judgements. Experiment 2 aimed to replicate the findings from Experiment 1 with a larger sample, and also addressed how representations predict consumption intentions and consumption over a 30-day follow-up period.

3.3. Experiment 1

We assessed how omnivores and vegans represent diet-congruent dishes (meat dishes for omnivores; plant-based dishes for vegans) and diet-incongruent dishes (plant-based dishes for omnivores; meat dishes for vegans). Although eating plant-based foods is not incompatible with an omnivorousness, in practice omnivores tend to follow meat-centric or meat-rich diets (Michel et al., 2021), and the consumption of specifically plant-based dishes, like those used in the current experiment, is typically infrequent (Dagevos, 2021). Therefore, for simplicity, we refer to plant-based foods as diet-incongruent for omnivores, and to meat foods as diet-incongruent for vegans.

We hypothesised that omnivores would use more consumption and reward features for meat foods than for plant-based foods (H1), and more situation independent features for plant-based foods than meat foods (H2). Given that vegans' dietary choices are motivated by ethical, environmental and health concerns (Ghaffari et al., 2022), we also hypothesised that vegans would use more situation independent features than consumption and reward features for both types of food (H3), and would use more situation independent features than omnivores overall (H4). With regard to the relationship between food representations and desire, we also hypothesised that across foods and groups, listing more consumption and reward features would be associated with finding a food more attractive (H5).

We also assessed eating motivations across the dietary groups, and examined how these relate to their representations of foods. We hypothesised that across groups, using more consumption and reward features would be associated with higher scores on the Liking, Pleasure, Affect Regulation and Need and Hunger subscales (H6a), and that omnivores would score higher on these subscales (H6b). Finally, we hypothesised that across groups, using more situation independent words would be associated with higher scores on the Health and Ethical Motivation subscales (H7a), and that vegans would score higher on these subscales (H7b).

3.3.1. Methods

3.3.1.1. Design and Sample Size

The experiment had a mixed 2 x 2 design to investigate features listed by two groups (omnivores and vegans) in response to two sets of stimuli (meat and plant-based food dishes). The dependent variables were consumption and reward features, situation-independent features, and dish attractiveness ratings. All variables, measures, and exclusions are reported, and sample sizes were determined before data analysis. Experiment 1 was approved by the University of Glasgow College of Science and Engineering Ethics committee on 9th November 2020. Both Experiment 1 and 2 were pre-registered, with all materials available here: https://osf.io/m2t4q. All pre-registered analyses are reported, along with any deviations from the pre-registered analysis plan.

To determine our sample size, we used G*Power (v3.1; Faul et al., 2009). Our group proportion parameters were set at 0.24 and 0.34, based on the meat

(M = 0.34) and plant-based (M = 0.17) consumption situation means from Davis and Papies' (2022) study, but accounting for a 10% rather than a 17% difference. To find a 10% difference in proportions with a minimum of 80% power at the adjusted 0.01 alpha error probability, we needed a minimum of 213 participants. To control for potential exclusions and missing data, we aimed to recruit an additional 5% of participants, totalling 224 participants, or 113 per group.

3.3.1.2. Participants

Participants were recruited through Prolific Academic (www.prolific.co). We used custom pre-screening to select eligible participants, who had to confirm that they were: (1) over 18 years old, (2) living in the UK, (3) fluent in English and (4) either had no dietary restrictions (omnivore) or followed a vegan diet. 231 participants completed our experiment, and 11 participants were excluded: 5 failed attention checks, 1 gave insufficient responses for the feature listing task and 5 gave inconsistent dietary information. Due to a screening error, 38 participants were not currently residing in the UK ($N_{omnivore}$ = 7; N_{vegan} = 31).

Our final sample consisted of 109 omnivores (52% female, M_{age} = 34, SD_{age} = 12.27) and 111 vegans (61% female, M_{age} = 31, SD_{age} = 10.26). All participants received £2.50 for their participation.

3.3.1.3. Materials

Unless otherwise specified, apart from the feature listing task, all responses were given on a 100-point visual analogue slider (VAS) scale.

Current State. We asked participants to report their current level of hunger and thirst (0 = '*not at all*', 50 = '*somewhat*', 100 = '*extremely*') separately.

Feature Listing Task. All participants were presented with the same 20 dishes: 10 plant-based and 10 meat, matched on dish category (see Table 9). Each dish was presented as follows: *'how would you describe this dish right now?'*, and participants were asked to list at least 5 features (open text entry).

Table 9

List of Dishes

Dish Category	Meat Dish	Plant-based Dish
Burger	Beef Burger	Falafel Burger
Pizza	Pepperoni Pizza	Vegan Pizza
Curry	Chicken Tikka Masala	Lentil Daal
Roast	Roast Lamb	Nut Roast
Pasta	Beef Lasagne	Vegan Lasagne
Salad	Chicken Caesar Salad	Mixed Vegetable Salad
Fajitas	Chicken Fajitas	Vegetable Fajitas
Ramen	Pork Ramen	Tofu Ramen
Tagine	Lamb Tagine	Chickpea Tagine
Steak	Sirloin Steak	Cauliflower Steak

Note: Dishes were chosen to represent a range of cuisines, ingredients and categories

Dish Attractiveness. We asked participants 'please rate how attractive each meal sounds to you' for each of the 20 dishes (0 = *'not attractive'*, 50 = '*somewhat attractive'*, 100 = '*very attractive*').

Dish Experience. We asked participants '*please tell us whether you have tried each meal before*' for each of the 20 dishes, measured on a 3-point scale (0 = '*no*', 1 = '*yes, once*', 2 = '*yes, multiple times*').

Eating Motivations. We used the brief version of The Eating Motivation Survey (TEMS; Renner et al., 2012) to measure eating motivations. The brief TEMS is a 45-item questionnaire that covers 15 different food motivations, including: Liking, Need and Hunger, Pleasure, Affect Regulation, Sociability, Habits, Health, Visual Appeal, Natural Concerns, Price, Social Norms, Social Image, Traditional Eating, Convenience and Weight Control. Participants were asked '*I eat what I eat…*' and then presented with the scale items (e.g. '*…because it tastes good*', '*…because it is inexpensive*'), measured on a 7-point scale (1 = '*never*', 7 = '*always*').

We also added an Ethical Motivation dimension to the brief TEMS to account for motivations of particular importance among those who follow a plant-based diet, consisting of 3 items from the Food Choice Questionnaire (FCQ; Onwezen et al., 2019) as follows: '*…because it is environmentally friendly*', '*…because it is animal friendly*', '*…because it is fairly traded*'. The 3 Ethical Motivation items showed good internal consistency (α = 0.80). Therefore, our final scale consisted of 48 items.

Dietary Information. We asked participants to define what dietary group best describes their diet and how long they had followed this diet, measured on a 4-point scale ('*within the last year*', '*within the last 5 years*', '*within the last 10 years*', '*I've always followed this diet*'). We also gathered information on meat consumption frequency by asking participants '*in a typical week, on how many days do you eat meat?*', measured on an 8-point scale (0 = '*none*', 7 = '*everyday*'), and '*on a typical day that you eat meat, during how many meals do you eat meat?*', measured on a 4-point scale (0 = '*I never eat meat*', 3 = '*every meal*'). Omnivore participants included those that defined themselves as omnivores, meat and/or dairy reducers, or flexitarians who reported consuming meat at least once per day and once per week. Vegan participants included those that defined themselves as vegans, who reported never consuming meat on the daily and weekly meat consumption frequency measures. Participants who did not fulfil these criteria were excluded from analysis.

Demographics. We collected demographic information from participants, including their age (*M* = 32.55, *SD* = 11.37), gender (57% female), nationality (80% UK nationals), first language (79% English), country of residence (83% UK residents) and subjective socio-economic status (SES), using the MacArthur Scale of Subjective Social Status (Adler & Stewart, 2007) on a 10-point scale (1 = lowest SES, 10 = highest SES; *M* = 5.59, *SD* = 1.64). Further details can be found in the SOM.

3.3.1.4. Procedure

Data was collected via Qualtrics software (https://www.qualtrics.com) between 12:00 and 19:00 on 4th December 2020. Participants were required to read the experiment information form and give informed consent before participation. Participants first responded to the current state measures and then completed the feature listing task, after being given detailed instructions. We then asked participants to rate dish attractiveness and dish experience for each of the 20 dishes. Following this, participants completed the eating motivations items, and recorded their dietary and demographic information. Participants were fully debriefed at the end of the survey, which took 24 minutes on average to complete.

3.3.1.5. Data Coding

Feature listing responses were coded using the Feature Listing Manual (Papies et al., 2020c). Consumption situation features correspond to any aspect of the situation in which the food is consumed, including the subcategories of sensory and action features (e.g. “creamy”, “crispy”, “cold”), internal or external context (e.g. “summer”, “restaurant”, “hungry”), and any immediate positive or negative consequences experienced at the time of consumption (e.g. “tasty”, “disgusting”, “satisfied”). Situation independent features include aspects separate to the consumption situation, such as the ingredients or content of the product (e.g. “tomatoes”, “carbohydrates”, “dairy-free”), general valence expressions (e.g. “great”, “terrible”, “awful”), food categories (e.g. “burger”, “fast food”, “Quorn”), and long-term health consequences (e.g. “healthy”, “fattening”, “good for your health”). Non-consumption situation features refer to any aspect of a situation where the food is present but not (yet) consumed, including the purchase (e.g. “expensive”, “not available”, “on a budget”), production (e.g. “free range”, “processed”, “slow cooked”) and preparation (“freeze”, “leftovers”, “microwave”) of the product. Ambiguous features, i.e. those that could be coded into 2 or more sub-categories (e.g. “tea”, “dish”, “wicked”), and non-word features, such as syncategorematic words that could not be identified as a food word (e.g. “this”, “very”, “know”), in the experiment language (i.e. English) were coded in a separate category.

We decided to add a social and political context subcategory within the main situation independent category, to capture the many listed features that referred to general social norms or political references. This largely consisted of features surrounding the ethics of a dish (e.g. “animal abuse”, “bad for the environment”, “unjust”), the production of the dish that hold emotional or explicit imagery (e.g. “carcass”, “born to die”, “pigs screaming”) and social-political discourse relating to dietary practices (e.g. “stop killing animals”, “why kill for pleasure”, “people are barbaric”). These responses seemed important to code separately, as they communicate attitudes relating to the intersection between (vegan) identity and food representations. We also added the inexperience subcategory to the non-word category, to capture any features relating to not knowing or having an experience of a dish (e.g. “clueless”, “never tried”, “unfamiliar”). Therefore, 5 main categories and 44 subcategories in total were used during coding.

Features that consisted of several words were divided into the smallest meaningful units and coded separately. For example, “dinner with friends” became “dinner” (consumption situation: time setting and frequency) and “with friends” (consumption situation: social setting). For more details on the coding procedure and associated ShinyApp, see Papies et al. (2020c).

LH coded all features, and secondary coding was completed by TD to test for interrater reliability (McHugh, 2012). The secondary coding sample size was calculated as 10% of the total unique words coded. Results from secondary coding a randomised sample of 427 words showed moderate agreement (κ = .69, % agreement = .79) at the main category level on which our hypotheses focused, which was deemed adequate for our analyses.

3.3.1.6. Analysis Plan

We calculated the key dependent variable of consumption and reward features as the proportion of sensory and action features, context features, and immediate positive consequence features, divided by all features coded across the three main categories (consumption situation, situation-independent and non-consumption situation features). The proportion of situation-independent features was calculated by dividing the number of situation-independent features by that same total. For example, if a participant used 3 situation independent features out of 5 coded features total when describing a dish, the situation-independent proportion for that response would be 0.60. Ambiguous and non-word categories were excluded from analysis, as these were considered separate to the food language of interest.

All analyses were conducted in R (version 4.2.2; R Core Team, 2022), with data cleaning and visualisation processed using the *tidyverse* library and associated packages (version 1.3.2; Wickham et al., 2019), except for our raincloud plots (Allen et al., 2019) and wordclouds (version 2.6; Fellows, 2018). For H1 - H5, and our H6a and H7a models, we fitted linear mixed effects models with the *lmer* function of the *lme4* package (version 1.1-31; Bates et al., 2014). For H6b and H7b, we ran independent samples *t*-tests. Across all of our confirmatory models, we employed a maximal random effects structure (Barr et al., 2013). For our exploratory H1 (vegan) model and H3 model, we included random intercepts and slopes for each participant and dish. For our H1, H2, H5 (vegan) and exploratory social and political context models, we included random intercepts and slopes for each participant, and random intercepts for each dish.

For our H4, H5 (omnivore), H6a, H7a and exploratory demographics models, we included random intercepts only for each participant and dish.

We predicted proportions (logit transformed) with a fixed effect of diet for our H1 – H4 models, and a fixed effect of TEMS subscales (standardised) for our H6a and H7a models. For our H5 model, dish attractiveness (standardised) was predicted with a fixed effect of consumption and reward proportions (logit transformed). We decided to measure omnivore and vegan responses separately for the H5, H6a and H7a models, and focused on diet-congruent dishes only. As such, omnivore and vegan responses were rescaled.

To control for familywise error rate from multiple testing across H1 – H5, we adjusted our alpha level in Experiment 1 to $\alpha = .01$ using the Bonferroni correction (.05/5 = .01). Model diagnostics were assessed using the *DHARMa* package (version 0.4.6; Hartig, 2022). Our models showed small deviations from the expected distribution (Kolmogorov–Smirnov test). However, these results are unlikely to influence Type 1 error rate, standard error or empirical power estimates, and therefore we decided to run models without corrections.

Finally, we obtained an estimate of variance explained with the *r.squaredGLMM* function from the *MuMIn* package (version 1.47.1; Bartoń, 2022). Marginal and conditional R-squared coefficients were calculated, with marginal R-squared (R^2_m) representing the variance explained by just the fixed effects, and conditional R-squared (R^2_c) representing the variance explained by the entire model, including both fixed and random effects (Nakagawa & Schielzeth, 2013).

3.3.2. Results

A total of 23,869 features, 3,910 (16%) unique, were coded. Omnivores generated 11,552, or 1,283 unique (11%), features, whereas vegans generated 12,317, or 1,729 unique (14%), features. Omnivores (M = 5.30, SD = 1.32) listed fewer features than vegans (M = 5.55, SD = 1.01), $t(4074.5) = -7.10$, $p < .001$, d =

-0.21. In addition, 12,020 features, 1,468 unique (12%), were used to describe meat dishes, and 11,849 words, 1,552 unique (13%), were used to describe plant-based dishes. On average, more features were used to describe meat dishes (*M* = 5.47, *SD* = 1.18) than plant-based dishes (*M* = 5.39, *SD* = 1.18), but this was not significant with the corrected alpha, $t(4397) = 2.26$, $p = .02$. Proportion means for the feature listing categories can be found in Table 10.

Overall, participants had not tried 6 out of 20 dishes (*M* = 6.33, *SD* = 3.16). Both omnivores (*M* = 5.17, *SD* = 2.30) and vegans (*M* = 4.73, *SD* = 2.96) had not tried 5 diet-incongruent dishes, and 2 diet-congruent dishes ($M_{Omnivore}$ = 1.90, $SD_{Omnivore}$ = 1.08; M_{Vegan} = 2.32, SD_{Vegan} = 1.40). A visualisation of feature frequencies can be found in Figure 7. For further descriptives, see the Supplementary Online Materials (SOM) on the project OSF page.

Table 10

Experiment 1 Feature Listing Category Means and Standard Deviations by Diet and Dish Type

Diet	Dish Type	Consumption and Reward		Situation Independent		Non-Consumption Situation	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Omnivore							
	Meat	0.45	0.27	0.37	0.26	0.16	0.18
	Plant-based	0.28	0.24	0.49	0.26	0.13	0.16
	Total	0.37	0.27	0.43	0.27	0.14	0.17
Vegan							
	Meat	0.25	0.23	0.48	0.25	0.17	0.18
	Plant-based	0.37	0.24	0.44	0.25	0.15	0.16
	Total	0.31	0.24	0.46	0.25	0.16	0.17

Figure 7

Wordclouds of Feature Frequencies by Diet and Dish Type across Experiments 1 and 2

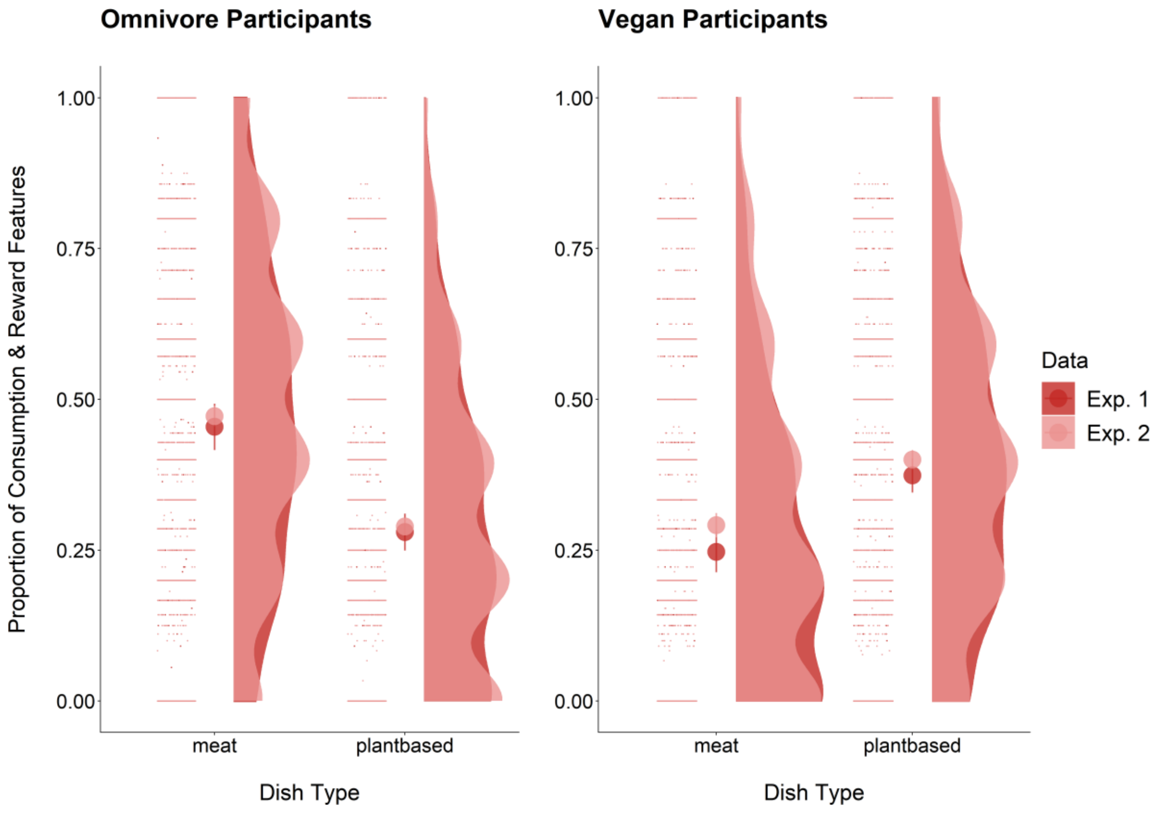
Note: Situation independent features are shown in green, consumption and reward features are shown in red, and non-consumption situation features are shown in blue.

3.3.2.1. Confirmatory Analyses

Consumption and Reward Features (H1). In line with our hypothesis, omnivores listed more consumption and reward features for meat dishes than plant-based dishes, $b = 0.55$, $SE = 0.10$, $p < .001$, $R^2_m = 0.10$, $R^2_c = 0.45$ (see Figure 8). Exploratory analyses revealed the reverse effect among vegans, who used fewer consumption and reward features for meat dishes than plant-based dishes, $b = -0.41$, $SE = 0.08$, $p < .001$, $R^2_m = 0.07$, $R^2_c = 0.37$.

Figure 8

Raincloud Plot of Experiment 1 and 2 Mean Values of Consumption and Reward Features by Diet and Dish Type

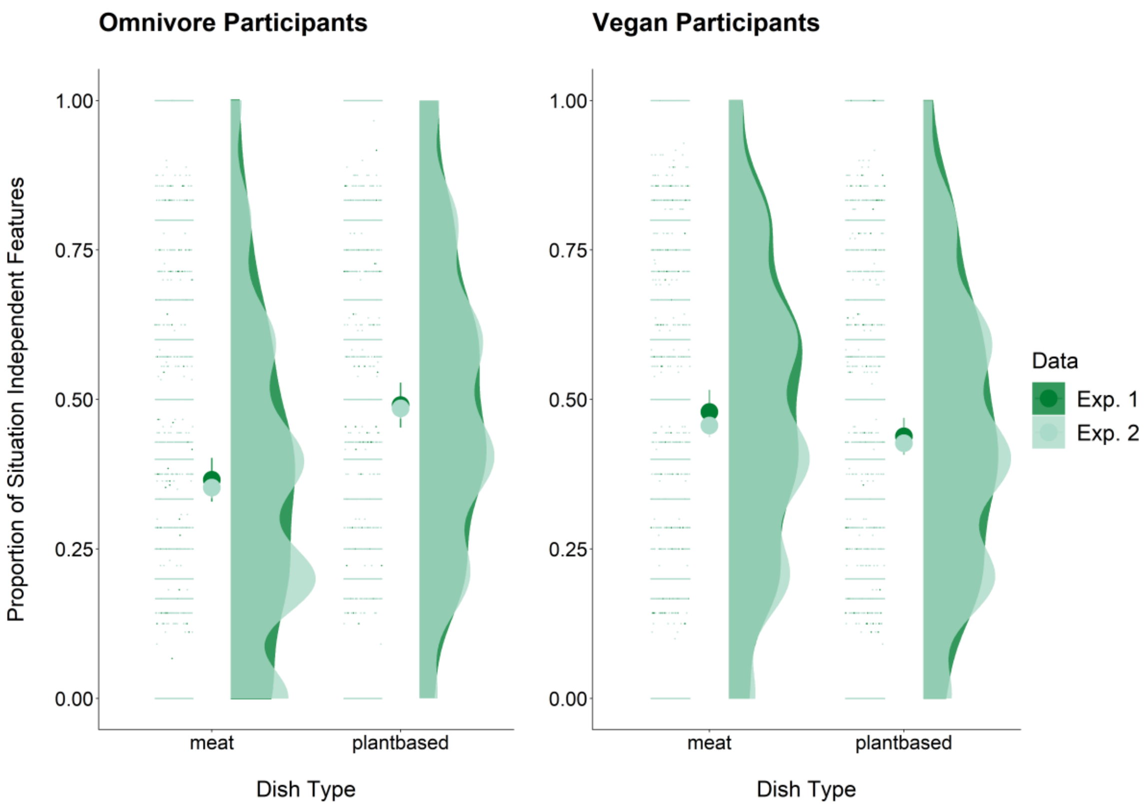


Situation Independent Features (H2 - H4). As predicted in Hypothesis 2, omnivores used fewer situation independent features for meat dishes than plant-based dishes, $b = -0.38$, $SE = 0.10$, $p = .002$, $R^2_m = 0.05$, $R^2_c = 0.45$ (see Figure 9). Additionally, in line with Hypothesis 3, vegans used fewer consumption and reward features than situation independent features in general, $b = -0.45$, $SE =$

0.11, $p < .001$, $R^2_m = 0.08$, $R^2_c = 0.35$. We also hypothesised that vegans would use more situation independent features than omnivores overall (H4). Contrary to our predictions, there was no difference in the use of situation independent words between vegans and omnivores, $b = -0.08$, $SE = 0.06$, $p = .17$.

Figure 9

Raincloud Plot of Experiment 1 and 2 Situation Independent Means by Diet and Dish Type



Dish Attractiveness (H5). As hypothesised, for diet congruent dishes, listing more consumption and reward features was associated with higher attractiveness ratings among omnivores, $\beta = 0.11$, $SE = 0.02$, $p < .001$, $R^2_m = 0.03$, $R^2_c = 0.20$, and among vegans, $\beta = 0.17$, $SE = 0.02$, $p < .001$, $R^2_m = 0.06$, $R^2_c = 0.35$.

Eating Motivations. We predicted that using more consumption and reward features would be associated with higher scores on the TEMS Liking, Affect Regulation, Need and Hunger and Pleasure subscales (H6a). However, contrary to our predictions, there was no association between diet congruent consumption and reward features and these subscales for omnivores, or for vegans (see Table 11). For H6b, we did find that omnivores scored higher than vegans on Affect Regulation, $t(4397) = 3.39$, $p < .001$, $d = 0.10$, and Pleasure, $t(4392.7) = 12.64$, $p < .001$, $d = 0.38$, but not on Liking, $t(4327.9) = 1.74$, $p = .08$, or Need and Hunger, $t(4397) = -1.86$, $p = .06$.

We also hypothesised that using more situation independent features would be associated with higher TEMS Health and FIQ Ethical Motivation scores (H7a). Contrary to our predictions, we did not find any association between these subscales and situation-independent features for diet-congruent foods among omnivores or vegans (see Table 11). For H7b, we did find that omnivores scored lower than vegans on Health, $t(4245.1) = -15.06$, $p < .001$, $d = -0.46$, and Ethical Motivation, $t(4188.4) = -76.07$, $p < .001$, $d = -2.30$.

Table 11

Means, Standard Deviations and Model Statistics for Eating Motivation Models

	Omnivore		Vegan	
	M (SD)	*b (SE) p*	*M (SD)*	*b (SE) p*
Consumption and Reward				
Liking	6.06 (0.75)	0.14 (0.12) .25	6.02 (0.67)	0.05 (0.09) .59
Affect Regulation	2.67 (1.42)	-0.14 (0.11) .21	2.53 (1.34)	-0.07 (0.09) .45
Need and Hunger	5.34 (0.82)	-0.06 (0.11) .59	5.39 (0.79)	-0.09 (0.09) .30
Pleasure	5.02 (0.92)	0.12 (0.13) .35	4.67 (0.96)	0.13 (0.09) .17
Situation Independent				
Health	4.31 (1.27)	-0.18 (0.11) .11	4.84 (1.06)	<0.01 (0.09) .99
Ethical Motivation	3.21 (1.13)	-0.02 (0.16) .92	5.58 (0.92)	0.05 (0.09) .57

3.3.2.2. Exploratory Analyses

Social and Political Context Features. We explored the effects of diet and dish type on the novel social and political context subcategory, which we had added to our coding manual to accommodate uncategorised language in our dataset. 793 social and political context features, 283 unique (36%), were coded, with the majority being used by vegan participants (95.33%) to describe meat dishes (87.77%). 70% of vegan participants (*N* = 78) used at least one social and political context feature, in contrast to 24% (*N* = 26) of omnivores. In addition, we found that 10 vegan participants contributed to 41% (*N = 322*) of all social and political context features. The most popular social and political context feature used was 'cruel' (*N* = 69), followed by 'death' (*N* = 43) and 'cruelty' (*N* = 29). We ran a binomial mixed effects model among vegans to determine the effect of dish type on social and political context features. Vegans used more social and political context features for meat dishes (*M* = 0.12, *SD* = 0.20) than plant-based dishes (*M* = 0.01, *SD* = 0.05), *b* = 0.46, *SE* = 0.07, $p < .001$, R^2_m = 0.14, R^2_c = 0.66.

Demographics. We explored the effects of our demographic variables on features listed for meat and plant-based foods among omnivores and vegans. Controlling for age, gender, SES, nationality and first language, the effect of dish type on consumption and reward features and situation independent features for both omnivores and vegans remained unchanged (for further details, see the SOM). However, age was found to predict consumption and reward features among omnivores. Outcomes from pairwise comparisons show that omnivores aged between 35 – 44 used more consumption and reward features for both types of dish than omnivores aged 25 – 34, *b* = 0.58, *SE* = 0.23, 95% CI [0.13, 1.03], *p* = .01, and omnivores aged 65 and over, *b* = 1.29, *SE* = 0.52, 95% CI [0.26, 2.31], *p* = .01. Omnivores aged 45 – 54 also used more consumption and reward features than omnivores aged 25 – 34, *b* = 0.86, *SE* = 0.29, 95% CI [0.28, 1.45], *p* = .004, and omnivores aged 65 and over, *b* = 1.58, *SE* = 0.55, 95% CI [0.48, 2.67], *p* = .005, regardless of dish type.

3.3.3. Discussion

Our findings show that participants described diet-congruent foods with more consumption and reward features than diet-incongruent foods, and these features were positively associated with finding a diet-congruent dish attractive. In other words, 'ingroup' foods were represented more in terms of the pleasure of eating than 'outgroup' foods, reflecting dietary polarisation. Among omnivores, diet-incongruent foods were described with more features independent of the consumption situation than diet-congruent foods. Vegans used more of these features overall, especially social and political context features for meat foods. Although omnivores were more driven by pleasure and affect eating motives, and vegans by health and ethical eating motives, there was no strong pattern of associations between features used and self-reported eating motivations. To provide further insights into the consumption associations of these cognitive representations, we measured the effect of food representations on behaviour over time in Experiment 2.

3.4. Experiment 2

This study was designed to replicate findings from Experiment 1 with a larger sample, and extend our understanding of the relationship between consumption and reward features and behavioural outcomes. Hence, we added measures of typical consumption and consumption intentions, and actual consumption over a 30-day follow-up period. While previous research has shown that consumption and reward features predict intake in a laboratory setting (Papies et al., 2022b), no work so far has examined whether they predict intake outside the laboratory and over time. We were particularly interested to see whether simulations of consuming and enjoying a dish would predict consumption over and above typical consumption frequency, as this might reflect an effect of desire arising from consumption and reward simulations. In other words, past behaviour has consistently been found to predict both intentions and prospective behaviour (Dean et al., 2012; McEachan et al., 2011), which is consistent with research exploring the strong role of habits within eating behaviour (see Riet et al., 2011). Here, we were interested in the unique effects of cognitively representing a food in terms of consumption and reward on both intentions and behaviour, even when controlling for typical, habitual consumption.

We again hypothesised that participants would use a higher proportion of consumption and reward features for diet-congruent dishes than diet-incongruent dishes (H1). We further predicted that participants would use a higher proportion of situation independent features to describe diet-incongruent dishes than diet-congruent dishes (H2). We also hypothesised that across groups, listing more consumption and reward features for a dish would predict the likelihood of ordering that dish (H4).

To assess whether consumption and reward simulations predict behavioural outcomes in a real-world context, we hypothesised that across groups, the proportion of consumption and reward features would predict both consumption intentions (H6a) and actual consumption (H5a), when controlling for how often participants typically consume a dish (H5b, H6b), which we expected to predict consumption and reward features separately (H3). In essence, when controlling for the effect of typical consumption, consumption and reward features would positively predict consumption intentions and actual consumption frequency at follow-up.

3.4.1. Methods

3.4.1.1. Design and Sample Size

The experiment again had a mixed 2 (omnivore, vegan) x 2 (meat dish, plant-based dish) design. Diet, dish type and typical consumption were the independent variables. Consumption and reward and situation independent features, ordering likelihood, consumption intentions and actual consumption were the dependent variables. The study was approved by the University of Glasgow College of Science and Engineering Ethics committee on 16th August 2022 (Application Number: 300210004).

We conducted a power analysis using G*Power. Our analysis was based on a generic binomial test, with group proportion parameters set at 0.45 and 0.50, based on the smallest proportional difference found in Experiment 1 between meat dish (*M* = 0.48) and plant-based dish (*M* = 0.44) situation independent features among vegan participants, but accounting for a 5% difference instead of a 4% difference. To detect a 5% difference in proportions between groups, with a minimum of 80% power and an adjusted alpha of 0.025, we need a minimum of n = 786 participants, or 393 per group. To account for potential exclusions, missing data and attrition, we recruited an extra 8% of participants, with the total sample size of n = 848 or 424 per group.

3.4.1.2. Participants

Participants were again recruited through Prolific Academic. We specified the same inclusion criteria as Experiment 1 and used custom pre-screening to select eligible participants, which excluded those who had taken part in Experiment 1. 911 participants completed our Time 1 questionnaire, and 74% of these participants completed at Time 2. 68 participants were excluded; 8 failed attention checks, 12 gave insufficient responses to the feature listing task and 48 gave inconsistent dietary information.

The final sample consisted of 843 participants, including 436 omnivores (71% female, M_{age} = 33.88, SD_{age} = 11.86) and 407 vegans (75% female, M_{age} = 32.21, SD_{age} = 10.77). Of these, 674 participants, including 351 omnivores and 323 vegans, had Time 2 data. Participants received £1.75 for their participation at Time 1, and £0.33 for their participation at Time 2.

3.4.1.3. Materials

Unless otherwise specified, all responses were given on a 100-point visual analogue slider (VAS) scale.

Current State. Hunger and thirst were measured the same as in Experiment 1.

Feature Listing Task. This was the same as in Experiment 1, with the addition that participants were prompted to imagine that they were in a restaurant setting, presented with a menu visualisation with the dish name included. Examples of the menu visualisations can be found in the SOM.

Ordering Likelihood. We asked participants '*how likely is it that you would order* [DISH NAME] *from the menu?*' for each of the 20 dishes (0 = '*very unlikely*', 100 = '*very likely*').

Consumption Behaviour. We measured participant's consumption behaviour for each of the 20 dishes. Typical consumption responses were collected at Time 1 by asking '*typically, how often do you consume the following dishes?*' (0 = '*never*', 100 = '*very often*'). Consumption intentions were also measured at Time 1, where participants were asked '*to what extent do you agree with the following statement for each food below: I intend to consume this food in the next month*' (0 = '*strongly disagree*', 100 = '*strongly agree*'). At Time 2, we collected actual consumption responses, with the question '*in the past month, how often have you consumed the following dishes?*' (0 = '*never*', 100 = '*very often*').

Dietary Information. We collected the same dietary information as in Experiment 1. However, we added the response '*within the last 3 years*' to the diet length question, and also gathered information on control over household food decisions, by asking '*to what degree do you decide what is consumed as the main meals in your household?*' (0 = '*I never decide*', 100 = '*I always decide*').

Demographics. We collected the same demographic information as in Experiment 1, including age (*M* = 33.07, *SD* = 11.39), gender (73% female), nationality (91% UK nationals), first language (95% English) and subjective SES (*M* = 5.30, *SD* = 1.66).

3.4.1.4. Procedure

Responses were gathered across 2 separate surveys. Data was again collected via Qualtrics from midday between 6th September 2021 and 28th September 2021 for Time 1, and from midday between 7th October 2021 and 5th November 2021 for Time 2. Subjects were required to read the Experiment information form and give informed consent before participation in both surveys.

At Time 1, participants first responded to the current state measures and completed the feature listing task after being given detailed instructions. Participants then completed the ordering likelihood measure for each of the 20 dishes. After this, participants completed the typical consumption, consumption intentions and both dietary information and demographic measures. At Time 2, at least 1 month (30 days) later, participants were asked to complete the actual consumption measure, and indicated if their dietary behaviour had changed. Participants were fully debriefed at the end of both surveys. Time 1 took 22 minutes on average to complete, and Time 2 took 3 minutes on average.

3.4.1.5. Data Coding

Participant responses were coded using the same coding procedure and categories as in Experiment 1. TD coded all features.

3.4.1.6. Analysis Plan

Our analyses followed the same procedures as in Experiment 1. We fitted linear mixed effects models using the *lmer* function of the *lme4* package. Models for H3, H4, H6a (omnivore) and exploratory consumption intentions (omnivore) included random intercepts and slopes for each participant and dish. Models for H1, H2 (omnivore), H5a, H6a (vegan), H6b (vegan), exploratory social and political context features and exploratory consumption intentions (vegan) included random intercepts and slopes for each participant, and random intercepts for each dish. Models for H2 (vegan), H5b, H6b (omnivore) and exploratory demographics included random intercepts only for each participant and dish.

We predicted proportions (logit transformed) with a fixed effect of diet for H1 – H2, and a fixed effect of typical consumption (standardised) for H3. We predicted ordering likelihood (standardised) with a fixed effect of consumption and reward proportions (standardised) for H4. We also predicted actual consumption (standardised) for H5, and consumption intentions (standardised) for H6, with fixed effects for typical consumption (standardised) and consumption and reward proportions (logit transformed). We again decided to run separate models for omnivores and vegans throughout our analysis, and focused on diet-congruent dishes only for H3 – H6.

To control for familywise error rate from multiple testing across H1 – H2, we adjusted our alpha level in Experiment 1 to $\alpha = .025$ using the Bonferroni correction ($.05/2 = .025$). Model diagnostics for all models showed small deviations from the expected distribution (Kolmogorov–Smirnov test) and outlier violations. We decided to run models, like in Experiment 1, without corrections.

3.4.2. Results

A total of 91,363 features, 7,346 (8%) unique, were coded. Omnivores generated 46,581, or 2,423 unique (5%), features, whereas vegans generated 44,782, or 2,772 unique (6%) features. Like in Experiment 1, omnivores (M = 5.34, SD = 1.48) reported fewer features than vegans (M = 5.50, SD = 1.31), $t(16803) = -7.39$, $p < .001$, $d = -0.11$. In addition, 45,869 features, 2,769 unique (6%), were used to describe meat dishes, and 45,494 words, 2,685 unique (6%), were used to describe plant-based dishes. On average, more features were used to describe meat dishes (M = 5.44, SD = 1.24) than plant-based dishes (M = 5.40, SD = 1.55), but like in Experiment 1, this was not significant with our corrected alpha, $t(16857) = 2.03$, $p = .04$. Proportion means for the feature listing categories can be found in Table 12.

Overall, participants reported a typical consumption score of 0 for 9 out of the 20 dishes presented (*M* = 8.53, *SD* = 4.09). Omnivores did not typically consume 5 diet-incongruent dishes (*M* = 4.92, *SD* = 3.10) and 2 diet-congruent dishes (*M* = 1.77, *SD* = 1.90), whereas vegans did not typically consume 9 diet-incongruent dishes (*M* = 9.31, *SD* = 2.16) and 1 diet-congruent dish (*M* = 1.21, *SD* = 1.59).

Table 12

Experiment 2 Feature Listing Category Means and Standard Deviations per Diet and Dish Type

Diet	Dish Type	Consumption and Reward		Situation Independent		Non-Consumption Situation	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Omnivore							
	Meat	0.47	0.26	0.35	0.26	0.15	0.17
	Plant-based	0.29	0.24	0.49	0.26	0.11	0.15
	Total	0.38	0.27	0.42	0.27	0.13	0.16
Vegan							
	Meat	0.29	0.25	0.46	0.26	0.16	0.17
	Plant-based	0.40	0.25	0.43	0.24	0.12	0.15
	Total	0.35	0.26	0.44	0.25	0.14	0.16

3.4.2.1. Confirmatory Analyses

Consumption and Reward Features (H1). As predicted, more consumption and reward features were used by omnivores for meat dishes than plant-based dishes, $b = 0.54$, $SE = 0.09$, $p < .001$, $R^2_m = 0.10$, $R^2_c = 0.39$, and fewer were used by vegans for meat dishes than plant-based dishes, $b = -0.35$, $SE = 0.07$, $p < .001$. $R^2_m = 0.05$, $R^2_c = 0.42$ (see Figure 8).

Situation Independent Features (H2). In line with our predictions, omnivores used fewer situation independent features for meat dishes than plant-based dishes, b = -0.40, SE = 0.09, p < .001, R^2_m = 0.06, R^2_c = 0.42, but vegans did not use more of these features for meat dishes than plant-based dishes, b = 0.08, SE = 0.06, p = .19 (see Figure 9).

Ordering Likelihood (H4). In line with our hypothesis, listing more consumption and reward features for diet congruent dishes was associated with a higher likelihood of ordering among omnivores, β = 0.16, SE = 0.02, p < .001, R^2_m = 0.06, R^2_c = 0.36, and among vegans, β = 0.17, SE = 0.02, p < .001, R^2_m = 0.06, R^2_c = 0.37 (see Figure 10).

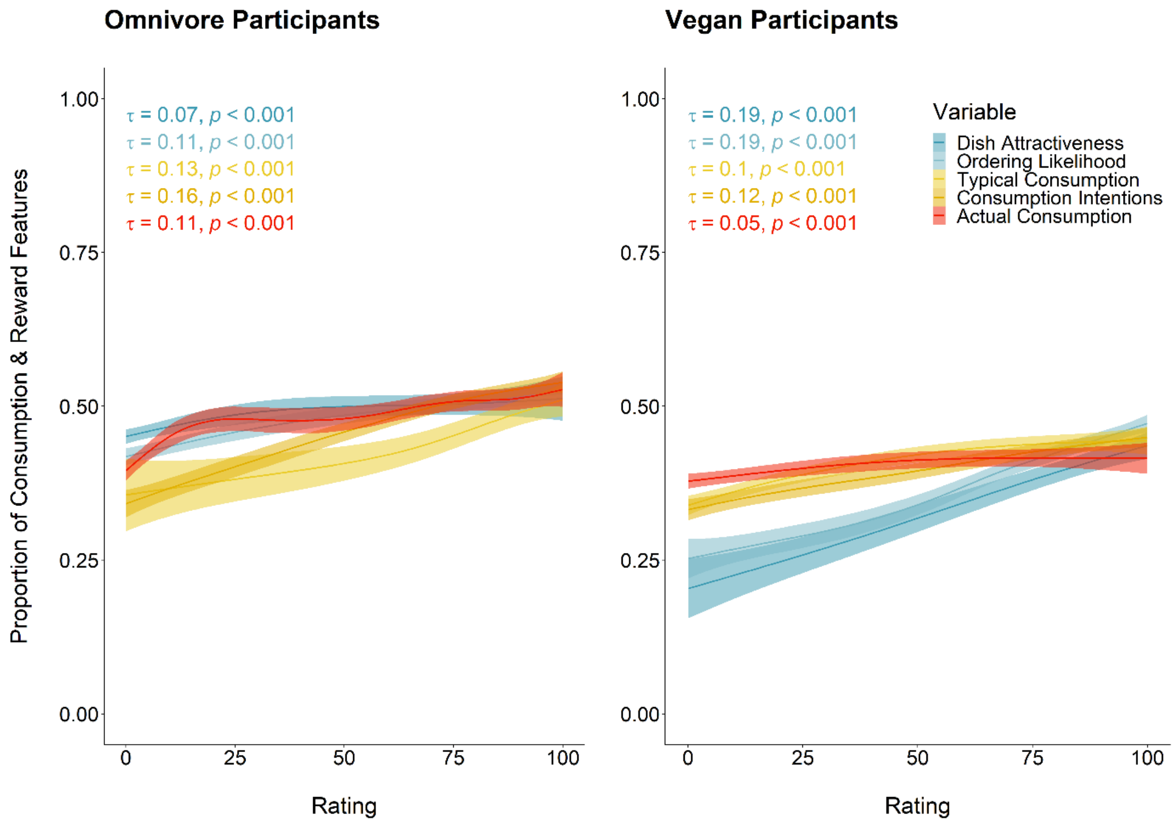
Consumption Behaviour. As hypothesised (H3), the typical consumption frequency of a diet congruent dish was associated with greater proportion of consumption and reward features used to describe that dish, for omnivores, β = 0.27, SE = 0.04, p < .001, R^2_m = 0.03, R^2_c = 0.38, and for vegans, β = 0.26, SE = 0.04, p < .001, R^2_m = 0.03, R^2_c = 0.33 (see Figure 10).

We hypothesised that the proportion of consumption and reward features would predict actual consumption (H5a), in addition to typical consumption (H5b). We found that consumption and reward features positively predicted actual consumption for diet congruent dishes, among omnivores, β = 0.06, SE = 0.01, p < .001, R^2_m = 0.01, R^2_c = 0.48, and among vegans, β = 0.06, SE = 0.01, p < .001, R^2_m = 0.01, R^2_c = 0.50. However, contrary to our predictions, when controlling for typical consumption, consumption and reward features were not associated with actual consumption for omnivores, β = 0.01, SE = 0.01, p = .64, or for vegans, β = 0.01, SE = 0.01, p = .44. This is likely due to a strong relationship between typical consumption and actual consumption in the model, for omnivores, β = 0.51, SE = 0.01, p < .001, and for vegans, β = 0.48, SE = 0.01, p < .001. The overall model explained a large amount of the variation in actual consumption for omnivores, R^2_m = 0.29, R^2_c = 0.56, and for vegans, R^2_m = 0.27, R^2_c = 0.57 (see Figure 10).

We hypothesised that the proportion of consumption and reward features would predict consumption intentions (H6a) when controlling for typical consumption (H6b). We found a positive relationship between consumption and reward features and consumption intentions for diet congruent dishes, among omnivores, *ß* = 0.10, *SE* = 0.01, $p < .001$, $R^2_m = 0.02$, $R^2_c = 0.42$, and among vegans, *ß* = 0.06, *SE* = 0.02, $p < .001$, $R^2_m = 0.01$, $R^2_c = 0.50$. In line with our predictions, higher consumption and reward features also predicted consumption intentions, *ß* = 0.02, *SE* = 0.01, $p < .001$, when controlling for typical consumption frequency, *ß* = 0.81, *SE* = 0.01, $p < .001$, for omnivores. We found the same relationship between consumption and reward features and consumption intentions for vegans, *ß* = 0.04, *SE* = 0.01, $p < .001$, when controlling for typical consumption, *ß* = 0.71, *SE* = 0.01, $p < .001$. The overall model explained a very large amount of the variation in consumption intentions, for omnivores, $R^2_m = 0.68$, $R^2_c = 0.75$, and for vegans, $R^2_m = 0.55$, $R^2_c = 0.71$ (see Figure 10).

Figure 10

LOESS Lines and Correlation Coefficients (Kendall's Tau) between Consumption and Reward Proportions and Key Outcome Variables in Experiments 1 and 2 for Diet Congruent Dishes



Note: Dish attractiveness was measured in Experiment 1. Ordering likelihood, typical consumption, consumption intentions and actual consumption were measured in Experiment 2.

3.4.2.2. Exploratory Analyses

Social and Political Context Features. We wanted to replicate findings from Experiment 1 exploring the effect of diet and dish type on social and political context features. 2,941 social and political context features, 572 unique (19.45%), were coded in Experiment 2, again with the majority being used by vegan participants (90.62%) to describe meat dishes (82.31%). 67% of vegan participants (N = 273) used at least one social and political context feature, in contrast to 25% (N = 108) of omnivores. In addition, we found that 10 vegan participants contributed to 16% (N = 462) of all social and political context features. Like in Experiment 1, the most popular social and political context feature used was 'cruel' (N = 139), followed by 'death' (N = 210) and 'unethical' (N = 108). We ran a binomial mixed effects model among vegans to determine the effect of dish type on social and political context features. Vegans used more social and political context features for meat dishes (*M* = 0.11, *SD* = 0.19) than plant-based dishes (*M* = 0.01, *SD* = 0.05), *b* = 0.44, SE = 0.06, p <.001, $R^2{}_m$ = 0.13, $R^2{}_c$ = 0.67.

Consumption Intentions and Actual Consumption. We wanted to explore whether consumption and reward features indirectly predict consumption via intentions. Looking at diet congruent dishes only, we found a positive relationship between consumption intentions and actual consumption, for omnivores, *Β* = 0.49, *SE* = 0.04, *p* < .001, $R^2{}_m$ = 0.27, $R^2{}_c$ = 0.62, and for vegans, *Β* = 0.45, *SE* = 0.02, *p* < .001, $R^2{}_m$ = 0.22, $R^2{}_c$ = 0.59. We then ran a model with consumption intentions mediating the relationship between consumption and reward features and actual consumption. Indeed, consumption and reward features indirectly predicted actual consumption through consumption intentions, for omnivores, *Β* = 0.06, 95% CI [0.05, 0.07], *p* < .001, and for vegans, *Β* = 0.07, 95% CI [0.06, 0.08], *p* < .001.

Demographics. As in Experiment 1, we explored the effects of our demographic variables on features used for meat and plant-based foods among omnivores and vegans. Controlling for age, gender, SES, nationality and first language, the effect of dish type on consumption and reward features and situation independent features for both omnivores and vegans again remained unchanged (for further details, see the SOM). Nonetheless, age was found to predict consumption and reward features and situation independent features among vegans, and nationality was found to predict situation independent features among omnivores.

Outcomes from pairwise comparisons show that vegans aged between 18 – 24 used more consumption and reward features for both meat and plant-based dishes than vegans aged 25 – 34, *b* = 0.27, *SE* = 0.10, 95% CI [0.06, 0.47], *p* = .01, vegans aged 35 – 44, *b* = 0.33, *SE* = 0.14, 95% CI [0.06, 0.59], $p = .02$, and vegans aged 45 - 54, *b* = 0.55, *SE* = 0.15, 95% CI [0.25, 0.86], $p < .001$. Furthermore, vegans aged between 45 - 54 used more situation independent features than vegans aged 18 - 24, *b* = 0.59, *SE* = 0.15, 95% CI [0.30, 0.87], $p < .001$, and vegans aged 25 – 34, *b* = 0.41, *SE* = 0.14, 95% CI [0.14, 0.68], $p = .003$, regardless of dish type. Additionally, omnivores with UK nationality used fewer situation independent features for meat and plant-based dishes than omnivores with non-UK nationality, *b* = -0.56, *SE* = 0.18, 95% CI [-0.91, -0.20], $p = .002$.

3.4.3. Discussion

Similar to Experiment 1, participants described diet-congruent foods with more consumption and reward features than diet-incongruent foods, and these features were positively associated with the self-reported likelihood of ordering a dish. Again, omnivores described diet-incongruent foods with more features independent of the consumption situation, and vegans with more social and political context features, than diet-congruent foods, reflecting the polarisation also observed in Experiment 1. Frequently consuming a diet-congruent dish was positively associated with consumption and reward features. These features predicted intentions to consume a dish, but not actual consumption (over a 30-day period), even when controlling for typical consumption frequency. Nonetheless, describing a diet-congruent dish with more consumption and reward features indirectly predicted actual consumption through intentions.

3.5. General Discussion

Across two experiments, we investigated differences in the representation of meat and plant-based foods between omnivores and vegans, and whether these representations predict desire and consumption behaviour. In line with our hypotheses, participants consistently used more consumption and reward features to represent diet-congruent ‘ingroup’ foods than diet-incongruent ‘outgroup’ foods. These features, directly associated with typical consumption, were related to the perceived attractiveness and likelihood of ordering a diet-congruent dish, and also predicted consumption intentions (when controlling for typical consumption), which in turn influenced actual consumption. This provides evidence for the relationship between cognitive representations and consumption outcomes for two distinct dietary groups.

Furthermore, we discovered that omnivores use more situation independent features, and vegans use in particular more social and political context features, for diet-incongruent dishes than diet-congruent dishes. Although there were differences in eating motivations among omnivores (pleasure and affect regulation) and vegans (health and ethical motivations), these were not associated with how diet-congruent foods were described. This suggests that conscious motivations for consumption as measured by self-report scales are not reflected in how foods are represented cognitively when assessed in a free production task, i.e., feature listing. These findings characterise the similarities and differences between these groups in how they think about ‘outgroup’ foods, with a focus on abstract information, rather than on eating experiences and enjoyment.

3.5.1. Applied Implications

Our results correspond with previous findings that meat and plant-based foods are presented differently in both real-world and online contexts. Within supermarkets and on social media, meat foods have been found to be presented with more consumption and reward language than plant-based foods, while plant-based foods were described with more situation independent language than meat foods (Davis & Papies, 2022; Papies et al., 2020b). In other words, meat foods were presented more like ‘ingroup’ foods in the current experiment. This pattern of language may discourage mainstream consumers from making sustainable food choices, by framing meat foods as the more rewarding choice. Indeed, taste expectations are considered to have a much larger influence on food choice (Boesveldt & de Graaf, 2017) than other factors, such as environmental concerns.

The current findings also show that mainstream consumers associate plant-based foods with more situation independent features than meat foods, which are instead described with more consumption and reward features. Considering the positive relationship found between consumption and reward features and behavioural outcome measures, this suggests that appealing representations of meat foods can predict subsequent food choice. Future approaches to promote plant-based foods should therefore avoid heavy use of situation independent features, which do not draw upon previous rewarding experiences that motivate consumption. In fact, research has found that taste-focused labelling, in comparison to health-focused labelling, can increase plant-based food selection by 29% (Turnwald et al., 2019), or even 38% (Turnwald & Crum, 2019). By presenting plant-based foods in terms of their rewarding features, eating simulations are more likely to occur - increasing desire and the probability of consumption. This could thus strengthen the associations of enjoyment with these foods; contributing to more sustainable eating habits.

3.5.2. Theoretical Implications and Future Research

Our research provides support for a grounded cognition perspective on the relationship between food representations and consumption behaviour (Papies & Barsalou, 2015). The frequency of typical consumption is likely to increase the number of consumption episodes to draw upon when cued, which may impact the production of rewarding food representations. Our findings are consistent with the idea that retrieving rewarding memories of past consumption experiences increases the attractiveness, consumption intentions and actual consumption of a food product, which is likelier to occur for frequently consumed diet-congruent foods.

Additionally, an ingroup-outgroup dimension emerges in our research that exists between people with different dietary patterns (Rosenfeld, 2018). One important determinant of readiness to reduce one's meat intake is the social beliefs about people who do not consume meat (Branković & Budžak, 2021). Considering the salient vegan identity (Rosenfeld, 2019) attached to the consumption of plant-based foods, this may explain the reluctance to eat sustainable alternatives among mainstream consumers, and thus the lack of rewarding representations for these diet-incongruent foods. For vegans, research has shown their attitudes towards omnivores are significantly more negative than vice-versa (Pabian et al., 2022), which manifests in our findings through the number of negative, socio-political features used by vegans for meat foods. This suggests that the polarisation between omnivores and vegans is conveyed even when presenting participants with dish names alone.

However, our research also provides evidence for dietary inter-group similarities. Previous literature suggests that health, animal welfare, and environmental concerns are common eating motivations among vegans (Hopwood et al., 2020). Despite this, Cliceri and colleagues (2018) found that vegans value the dimension of food pleasure as equally important as omnivores despite opposing dietary behaviours. Our findings confirm that vegans are not 'taste martyrs'; like omnivores, they use more rewarding features when asked to generate representations for diet-congruent foods that they frequently consume. Highlighting the similarities between these polarised groups, and their shared expectation of pleasure from eating, may help bridge the gap and remove barriers from mainstream consumers shifting towards sustainable diets.

Future research should consider examining the learning of food representations from the perspective of grounded cognition. Participants could be asked to list features before and after consuming a dish, to assess whether consumption and reward features are shaped by consumption. Furthermore, although measuring short-term consumption using a 1-month follow up is a popular method in the eating behaviour field (e.g. Amiot et al., 2018; Carfora et al., 2019; Wolstenholme et al., 2020), measuring actual dish consumption at different time points (e.g., 1 week, 1 month, 3 months) might give us a more accurate measure of the effects of consumption and reward feature generation on consumption behaviour over time. This may also help establish the causal mechanisms involved in the relationship between food representations and behavioural outcomes, which could not be addressed in our current study.

Future directions should also explore how these cognitive processes shift among consumers in the process of changing their dietary identities from omnivores to meat reducers, to flexitarians and beyond. Research could focus on how exposure to societal discourse about vegans shape food representations among mainstream consumers, in particular for plant-based foods. Other approaches investigating social influences on food representations, such as the influence of dietary intergroup contact, may reveal effective strategies to overcome negative perceptions of the outgroup and 'their' foods.

Research in this area should also consider the role of demographics on cognitive representations moving forward. We found that in Study 1, middle-aged omnivores (aged 35 – 54) used more consumption and reward features than younger (aged 25 – 34) and older omnivores (aged 65 and over). In Study 2, younger vegans (aged 18 – 24) used more consumption and reward features than older vegans (aged 25 -54), whereas middle aged omnivores (aged 45 – 54) used more situation independent features than younger vegans (aged 18 – 34). Furthermore, omnivores with UK nationality used fewer situation independent features than omnivores without UK nationality. Although some of these group sizes are small (e.g. Study 2: N_{UK} = 406, $N_{Non\text{-}UK}$ = 30), our findings suggest that age in particular could be an important factor in the transition towards sustainable diets, which aligns with previous literature (Cliceri et al., 2018), and should be investigated further.

3.5.3. Strengths and Limitations

This is the first experiment of its kind to measure feature listing responses, desire and consumption behaviour among different dietary groups. However, we were only able to gather self-reports of retrospective consumption behaviour, which may have been prone to inaccuracy or biases (Hagger et al., 2015), compared to observational field data. Future research should investigate the relationship between diet, food representations and consumption behaviour without relying on retrospective self-report. Furthermore, we included the same 20 foods for all participants, some of which participants had not consumed before. Future research could improve on this by presenting idiosyncratically-selected stimuli, such that participants are familiar with all stimuli. Additionally, the plant-based dish names were chosen in order to be representative of how plant-based foods are often labelled in real-world settings, i.e. ‘plant-based’, ‘meat-free’ or ‘vegan’ (Bacon et al., 2018). Consequently, some of our plant-based dish names were less specific than others (e.g. ‘vegan lasagne’ versus ‘lentil daal’), which may have prompted participants to list more situation independent features, especially ingredient and content information. Nonetheless, we controlled for individual dishes in our models and saw no significant influence on our results. Lastly, our research only included data from UK residents, which may limit the generalisability of our findings to other populations. However, the strong societal polarisation within the UK (Duffy et al., 2019) made this a suitable context for this project. Researchers with the capacity to measure representations of food among non-English speaking consumers could provide necessary insights for this field.

3.6. Conclusion

In this paper, we found that participants use more consumption and reward features to describe diet-congruent foods than diet-incongruent foods, and these features predict desire, intentions and future consumption. Representations of ingroup foods for both omnivores and vegans were characterised by short-term reward, while representations of plant-based foods focused on abstract information and long-term consequences among omnivores, and social and political factors among vegans. Conceptualising plant-based foods in terms of features independent of the consumption situation may impact mainstream consumer willingness to try sustainable alternatives. This work provides insights into the cognitive representations of foods that contribute to societal polarisation around shifting diets to mitigate the climate emergency.

4. Chapter 4: More appealing language used to promote foods to mainstream than to vegan consumers

This chapter is an exact copy of the following pre-print:

Davis, T., Silberhorn, L., & Papies, E. K. (2023, January 31). *'Who says a salad can't taste good?': More appealing language used to promote foods to mainstream than to vegan consumers*. OSF Preprints. https://doi.org/10.31219/osf.io/p8g53

4.1. Abstract

Polarisation between mainstream consumers and vegans has been shown to hinder communication about plant-based foods in a way that makes them appealing to the general public. Here, we examined mechanisms underlying this polarisation in popular food discourse, by exploring how these groups communicate with each other about meat and plant-based foods. In Experiment 1 ($N_{omnivore}$ = 41, N_{vegan} = 41), we developed omnivore and vegan valence indexes from participant ratings of words from popular hashtags used in meat and plant-based food posts on Instagram. In Experiment 2 ($N_{omnivore}$ = 473, N_{vegan} = 441), we asked participants to create hypothetical Instagram posts about food for omnivore and vegan consumer audiences separately. We used the indexes from Experiment 1 to assess valence of the words used in these posts, and also coded the words according to whether they refer to consumption and reward experiences or not. Findings showed that more words related to rewarding consumption, and rated more positive on the omnivore valence index, were used to promote food to an omnivore audience, in particular meat foods. We also found that vegans did not differ from omnivores in terms of how plant-based foods were presented to a vegan audience, which included fewer features related to consumption and reward, but instead more features related to dietary identity. These results show shared assumptions between omnivores and vegans of what is considered appealing to the ingroup or outgroup, which stands at odds to previous findings related to how vegans represent plant-based foods, namely in terms of rewarding consumption. Our findings can offer insights into how omnivore-vegan polarisation manifests within online discourse about food.

Keywords: Language, Food, Diet, Polarisation, Sustainability

4.2. Introduction

Global food systems play a substantial role in the climate crisis. Food production is the largest contributor to biodiversity loss, and is responsible for 30% of total anthropogenic greenhouse gas (GHG) emissions, 80% of deforestation and more than 70% of fresh water use (Nelson et al., 2016). In particular, meat production has the greatest impact on GHG emissions and agricultural land use (Bonnet et al., 2020; Godfray et al., 2018; Nelson et al., 2016). Producing 1 kilogram of beef protein requires 18 times more land, 10 times more water, 12 times more fertilizers and 10 times more pesticides than producing 1 kilogram of bean protein (Sabaté et al., 2015). Therefore, a significant global transition towards plant-based choices is needed to reduce the effects of climate change on population and planetary health (Hemler & Hu, 2019). The EAT-Lancet Commission proposes that by 2050, consumers in industrialised societies should more than double their intake of fruits, vegetables and legumes, and halve their consumption of red meat, to maintain a sustainable and healthy diet (Willett et al., 2019). Without a substantial change in mainstream eating behaviours, the environmental impact of the food system could increase by 50 – 90% over the next 30 years (Springmann et al., 2018), and contribute towards irreversible climate outcomes (Clark et al., 2020).

Although researchers acknowledge that reducing meat consumption is necessary to curb the effects of climate change (Graça et al., 2019a), a majority of consumers are not willing to make any changes to their meat consumption (Hartmann & Siegrist, 2017; Lentz et al., 2018; Malek et al., 2019). In industrialised countries, meat consumption has grown steadily since the 1960s (Ritchie et al., 2017; Sans & Combris, 2015), and current Western food consumption patterns are characterised by an excessive intake of animal-based products that surpasses dietary health recommendations (Richi et al., 2015). Despite a large majority of people reporting awareness of the negative environmental impacts of meat production (Bryant, 2019), most consumers are not motivated to reduce their meat consumption for climate-related reasons (Austgulen et al., 2018; Happer & Wellesley, 2019; O’Keefe et al., 2016). Instead, mainstream consumers consider purchasing locally grown produce, avoiding the consumption of air-freighted foods and reducing food waste as having high environmental benefit, but are less willing to replace meat with plant-based proteins (Culliford & Bradbury, 2020). In other words, consumers are unlikely to consider substituting meat with sustainable alternatives in their food purchasing decisions (Lemken et al., 2019).

Social norms have a significant influence over consumer food choices. In particular, meat eating is treated as a culturally embedded social practice that is maintained through economical, ecological, and institutional factors (Stubbs et al., 2018). From this, resistance to the idea of reducing one's meat consumption is rooted in the cultural values surrounding meat eating (Macdiarmid et al., 2016). Indeed, previous research has shown polarisation between those that conform to socially-accepted meat consumption practices (i.e. omnivores), and those that do not (i.e. vegans), especially within social media discourse (Buddle et al., 2018; Gregson et al., 2022; Sanford & Lorimer, 2022). However, it is important to explore how omnivores and vegans communicate to each other about meat and plant-based foods, to identify whether omnivore-vegan polarisation manifests in conversations with the outgroup. More specifically, how do consumers present foods in an attractive way to members of their ingroup and outgroup? This paper will examine how omnivores and vegans promote both meat and plant-based foods in a hypothetical social media setting to make them appealing to an omnivore or vegan target audience. This will allow us to establish whether normative communication about particular kinds of foods could play a role in mainstream consumers' reluctance to switch to plant-based diets.

Recent findings show significant differences in the way that meat and plant-based foods are presented in both commercial settings and on social media (Papies et al., 2020b; Davis & Papies, 2022). In a study analysing the language used in descriptions of 240 ready-meals in the UK, Papies and colleagues (2020b) found that meat foods were described with more rewarding consumption language than plant-based foods. Specifically, meat foods were presented with more features related to the contextual, sensory and hedonic aspects of consumption (e.g. 'treat', 'smooth', 'satisfying') than plant-based foods, which instead were presented with more features related to content information, health consequences and visual properties (e.g. ‘protein’, ‘healthy’, ‘white’). Similarly, the same pattern was found when analysing food posts on Instagram (Davis & Papies, 2022). Specifically, posts about meat foods were tagged with more consumption and reward features than posts about vegan foods, which instead were tagged with more situation independent features, in particular identity-related information (e.g. ‘ukvegan’) and socio-political commentary (e.g. ‘thefutureisvegan’).

In a related set of experiments, Davis and colleagues (2022) investigated how omnivores and vegans cognitively represent meat and plant-based foods. Here, participants were asked to simply describe 10 meat and 10 plant-based dishes using five or more features, and descriptions were coded according to whether they represented rewarding consumption or not. Results showed that participants represented diet-congruent foods (i.e. meat foods for omnivores; plant-based foods for vegans) with more consumption and reward features than diet-incongruent foods (i.e. plant-based foods for omnivores; meat foods for vegans). In other words, each group represented their ‘ingroup’ foods in more appealing ways than ‘outgroup’ foods. Furthermore, greater use of consumption and reward features for a dish was associated with higher attractiveness ratings, intentions to consume and the actual consumption of that dish. In sum, despite both omnivores and vegans representing ‘ingroup’ foods in terms of rewarding consumption, plant-based foods are described publicly in terms of aspects independent of the consumption situation.

Why are rewarding consumption representations important for a mainstream shift towards sustainable diets? According to the Grounded Cognition Theory of Desire (Papies et al., 2022a; Papies & Barsalou, 2015), stored memories of past consumption episodes can be activated via cue exposure, such as the language used to describe a food product (e.g. ‘tasty’). This leads to multi-modal, non-conscious simulations of earlier eating experiences related to the cue (Papies et al., 2020a), and if positive, can increase desire for further consumption of the target food product (Papies et al., 2017). From this perspective, we can understand how the language we use to describe food reflects the automatic, non-conscious processes that motivate our daily eating behaviours (Graça et al., 2019a; Roberto, 2020; Stajcic, 2013). This means that when plant-based foods are described with less rewarding consumption language than meat foods in public discourse (Davis & Papies, 2022), they are less likely to trigger positive eating simulations that increase desire to consume among mainstream consumers.

Indeed, researchers have found that promoting sustainable food choices through appealing language strategies can be an effective approach. For example, Turnwald and colleagues (2017a) found that in a real-world cafeteria setting, labelling vegetables with indulgent descriptors (e.g. ‘Slow-roasted caramelized zucchini bites’) significantly increased consumption compared to basic (e.g. ‘Zucchini’), health restrictive (e.g. ‘Lighter-choice zucchini’) and health positive labelling (e.g. ‘ Nutritious green zucchini’). Multiple follow-up field studies not only replicated these findings, but also showed that taste-focused labelling sustained vegetable purchases over a two month period and improved ratings of vegetable deliciousness (Turnwald & Crum, 2019). Similarly, Gavrieli et al. (2022) found that in comparison to basic dish names (e.g. ‘Collard Greens Vegetable Soup’), using appealing dish names (e.g. ‘Sweet Velvety Soup with Collard Greens’) increased the consumption of plant-rich dishes by 43.9% in multiple self-service, buffet-style cafeterias. This effect was also replicated in field experiment conducted in a popular, UK-based chain of cafés (Bacon et al., 2018). Not only can reward-focused language provide an easy, cost-effective and low-effort intervention strategy to promote sustainable food choices, but also alters the taste expectations of plant-based foods through rewarding eating simulations which drive desire for consumption (Elder & Krishna, 2010; Papies, 2013; Papies et al., 2020a; Piqueras-Fiszman & Spence, 2015).

Despite this, sustainable diets continue to be associated with more long-term, abstract features than rewarding ones. In particular, on social media, plant-based foods are typically tagged with identity-focused language (Davis & Papies, 2022). Previous research has found that online communication can aid in connecting, establishing and maintaining social relationships with members of their dietary identity ingroup (Blackwood, 2019; Potnis & Tahamtan, 2021;

Sneijder & te Molder, 2006). As a result, omnivores and vegans adopt different linguistic strategies to communicate which may not appeal to the outgroup (De Groeve et al., 2019). Considering that social media exposure has been found to influence food preferences (Blundell & Forwood, 2021; Hawkins et al., 2021), highlighting the salient vegan identity attached to the consumption of plant-based foods can deter mainstream consumers from making sustainable food choices (Rosenfeld, 2019), due to explicit associations with a minority group that is subject to stereotyping, stigma and do-gooder derogation by omnivores (De Groeve et al., 2022; MacInnis & Hodson, 2017; Markowski & Roxburgh, 2019). As a result, exposure to identity language descriptors for plant-based foods on social media can reinforce the ingroup-outgroup dimension between people with different dietary patterns (Rosenfeld, 2018), instead of making plant-based foods appealing to non-vegan consumers.

4.2.1. Current Research

To encourage engagement with sustainable eating, communication about plant-based food needs to be made socially relevant to the mainstream consumer (Macdiarmid et al., 2016). The present research examines how vegans and omnivores strategically describe meat and plant-based foods when trying to make these appealing to both dietary groups in a hypothetical social media setting. The aim of this research is to investigate the language participants use to make foods appealing to their respective ingroup and outgroup, to better understand consumer assumptions of what is desirable to mainstream and vegan consumers.

In Experiment 1, we examined how polarised dietary groups rated language associated with diet-congruent and diet-incongruent foods. To achieve this, we presented omnivore and vegan participants with words from popular hashtags used to describe meat and plant-based foods on Instagram. We then measured the valence of these words in order to create omnivore and vegan valence indexes of food descriptors. In Experiment 2, we used these valence indexes alongside feature listing measures (Papies et al., 2020c), which categorises food descriptors into features related to the consumption situation, and features independent of the consumption situation. This way, we could evaluate whether the type of language generated by omnivores and vegans for meat and plant-based food differs dependent on whether it is made to appeal to an omnivore audience or a vegan audience. Specifically, we could assess whether omnivores use more positive and more consumption and reward-focused language in hypothetical social media posts for meat foods than plant-based foods when trying to appeal to omnivore audiences.

4.3. Experiment 1

Experiment 1 follows a similar methodology to the Glasgow Norms (Scott et al., 2019) and the Lancaster Sensorimotor Norms (Lynott et al., 2020) research, by measuring valence (i.e. negative to positive) ratings for a number of food words. In particular, we measured the valence of the top 40 most popular hashtags used for meat and plant-based posts in Davis and Papies' (2022) paper. Going beyond previous norms research, however, we were particularly interested in examining how valence ratings for words used to describe meat-based and plant-based foods differed across dietary groups. We predicted that omnivore participants would rate words about meat foods, which are congruent with their diet, more positively than words about explicitly plant-based foods, which are largely incongruent with their diet (H1). Likewise, we predicted that vegan participants would rate words about plant-based foods more positively than diet-incongruent words about meat foods (H2).

4.3.1. Methods

4.3.1.1. Design and Sample Size

Experiment 1 had a mixed 2 x 2 design to investigate valence ratings given by two groups (diet: omnivores and vegans) in response to two sets of stimuli (word type: meat food words and plant-based food words). Diet and word type were the independent variables, and valence rating was the dependent variable. For both experiments, all variables, measures and exclusions are reported, and sample sizes were determined before data analysis. Experiment 1 was approved by the University of Glasgow College of Science and Engineering Ethics committee on 1st November 2021. Both Experiment 1 and Experiment 2 were pre-registered, with all materials available here: https://osf.io/y5vda/.

To determine sample size, we conducted a power analysis for H1 using the *mixedpower* function in the *mixedpower* package (version 2.0; Kumle et al., 2021) on simulated data in R (version 4.2.2; R Core Team, 2022). Valence rating means of 52.51 for meat words and 48.58 for plant-based words were generated randomly for omnivore participants; a difference of 3.93 points on a 100-point visual analogue slider (VAS) scale. Based on a linear mixed-effects model with 80 hashtag ratings (40 meat words and 40 plant-based words), with a minimum of 97% power of the smallest effect size of interest (SESOI), and a critical value of 2 equivalent to an alpha of 0.05 (Baayen et al., 2008), we needed a minimum of 40 participants per group or 80 participants in total. To control for potential exclusions and missing data, we aimed to recruit an additional 10% of participants (N = 88 in total, 44 per group).

However, we noticed an error with our sample size calculation after data collection, such that our power analysis was likely underestimated due to the simulated data having no mixed-effects structure. To check the reliability of our findings, we ran a post-hoc sensitivity analysis on our H1 model using the *simr* package (version 1.0.7; Green & McLeod, 2016).

4.3.1.2. Participants

Participants were recruited through Prolific (www.prolific.co) and among first year undergraduate psychology students via the University of Glasgow's School of Psychology and Neuroscience research participation SONA system (https://www.glasgow.sona-systems.com/). We used custom pre-screening to select eligible participants, who had to confirm that they were: (1) between 18 – 65 years of age, (2) currently living in the UK, (3) fluent in English and (4) either had no dietary restrictions (omnivore) or followed a vegan diet. In total, 90 participants completed our study, and 8 participants were excluded due to following diets other than omnivorous or vegan. The final sample consisted of 41 omnivores (71% female, M_{age} = 33.51, SD_{age} = 11.29) and 41 vegans (78% female, M_{age} = 35.59, SD_{age} = 11.91). All participants received £1.50 for their participation.

4.3.1.3. Materials

Valence Rating Task. All participants were presented with words collected from the top 40 most popular hashtags for meat and plant-based posts gathered from Davis and Papies' (2022) Instagram study. This resulted in 66 words displayed to participants in a random order: 26 unique to posts about plant-based foods, 26 unique to posts about meat foods, and 14 found in posts about both plant-based and meat foods (see Table 13). We asked participants to rate each of the 66 words on a 100-point VAS scale (-50 = '*very negative*', 50 = '*very positive*').

Open Questions. All participants were asked to '*please take a look at the following hashtags*' for each word group separately (i.e. meat, plant-based, both). They were then asked '*What thoughts and feelings come to mind when reading these hashtags?*' and asked to write at least 2 sentences and describe in as much detail as possible (open text entry).

Dietary Information. We asked participants to define what dietary group best describes their diet, and asked '*how long have you followed your current diet?*', with 6 choices ('*within the last year*', '*between 1 and 3 years*', '*between 3 and 5 years*', '*between 5 and 10 years*', '*more than 10 years*', '*I've always followed this diet*'). In addition, we gathered information on meat consumption frequency by asking participants '*in a typical week, on how many days a week do you eat meat?*', measured on an 8-point scale (0 = '*none*', 7 = '*everyday*'), and '*on a typical day that you eat meat, during how many meals do you eat meat?*', measured on a 4-point scale (0 = '*none*', 3 = '*every meal*'). We also measured dairy consumption in this way. Furthermore, we gathered information on control over household food decisions, by asking '*to what degree do you decide what is consumed as the main meals in your household?*' (0 = '*I never decide*', 100 = '*I always decide*').

Table 13

Words by Group

Meat words		Plant-based words		Both words
#meat	**#keto**	**#vegan**	#easy	#recipe
#delicious	#restaurant	**#plantbased**	**#meatfree**	#dinner
#bbq	#mushroom	**#veganfood**	**#veggie**	#meal
#egg	#tomato	**#vegetarian**	#glutenfree	#foodporn
#foodlover	#brunch	**#whatveganseat**	**#vegans**	#healthy
#cheese	#potatoes	**#veganlife**	**#veggies**	#lunch
#foodgasm	#vegetable	**#plantbaseddiet**	**#vegancommunity**	#food
#tasty	#homecooking	**#veganism**	**#veganuary**	#uk
#steak	**#pork**	**#dairyfree**	**#veganlifestyle**	#healthyfood
#beef	#spicy	**#govegan**	#comfortfood	#foodie
#sausage	**#chicken**	**#crueltyfree**	#avocado	#sunday
#eat	#grill	**#veganeats**	#inspiration	#homemade
#yum		**#veganfoodie**		#love
#cooking		#ideas		#yummy

Note: words categorised as specific (i.e. specific to a food, diet or dietary identity) are in bold

Demographics. We collected demographic information from participants, including their age, gender, nationality, first language and subjective socio-economic status (SES), using the MacArthur Scale of Subjective Social Status (Adler & Stewart, 2007).

Social Media Use. We asked participants whether they have an Instagram account, and asked '*on a typical day, how many hours do you spend on the* *social media?*', with 6 choices ('*I do not use social media*', '*0 mins – 30 mins*', '*30 mins – 1 hour*', '*1 hour – 2 hours*', '*2 hours – 3 hours*', '*3 hours or more*').

4.3.1.4. Procedure

All data was collected via Qualtrics (https://www.qualtrics.com). We initially recruited participants on SONA (N = 7) from midday between 24th November 2021 and 2nd December 2021, and then recruited our remaining participants on Prolific between 12:00 and 17:00 on 17th December 2021. Participants were required to read the study information form and gave informed consent before participation. Participants first completed the valence rating task, after being given detailed instructions on the task procedure. We then asked participants to complete the qualitative questions. Following this, participants recorded their dietary and demographic information, and responded to the social media use items. Participants were fully debriefed at the end of the survey, which took subjects 10 minutes on average to complete.

4.3.1.5. Analysis Plan

All analyses were conducted in R (version 4.2.2; R Core Team, 2022), with all data cleaning and visualisation processed using the *tidyverse* library and associated packages (version 1.3.2; Wickham et al., 2019), except for our raincloud plots (Allen et al., 2019). We fitted linear mixed-effects models with the *lmer* function of the *lme4* package (version 1.1-31; Bates et al., 2014) for H1 – H2, and generated F values for the overall main effects using the *anova* function of the *stats* package (version 4.2.2; R Core Team, 2022). We obtained an estimate of variance explained with the *r.squaredGLMM* function from the *MuMIn* package (version 1.47.1; Bartoń, 2022), with marginal R-squared statistic (R^2_m) representing the variance explained by just the fixed effects, and conditional R-squared statistic (R^2_c) representing the variance explained by both fixed and random effects (Nakagawa & Schielzeth, 2013). Across all confirmatory models, we employed a maximal random effects structure (Barr et al., 2013).

For every model, we included random intercepts and slopes for each participant, and random intercepts for each word.

To control for familywise error rate from multiple testing across two hypotheses, we adjusted the alpha level to $\alpha = .025$ using the Bonferroni correction (.05/2 = .025). Model diagnostics were assessed using the *DHARMa* package (version 0.4.6; Hartig, 2022a). Our models showed small deviations from the expected distribution (Kolmogorov-Smirnov test). It is unlikely that these small violations violate Type 1 error rate, standard error or empirical power estimates estimates. We did not find alternative model structures or re-scaling variables changed the model fit outputs. We therefore decided to run models without corrections and interpreted the cause of these violations being due to the high number of observations in our data, of which the *DHARMa* package is sensitive to (see Hartig, 2022b).

4.3.2. Results

4.3.2.1. Descriptives

General valence rating means and standard deviations can be found in Table 14, and valence rating means for each word can be seen in Table 15. Visualisations of valence rating means by diet and group can be found in Figures 11 and 12. There was no difference in the overall valence rating mean for all words between omnivores (*M* = 13.94, *SD* = 25.84, *Mdn* = 16, *IQR* = 31) and vegans (*M* = 14.63, *SD* = 27.74, *Mdn* = 17, *IQR* = 36), $t(6525.4) = -1.04$, $p = .30$. Words with the highest ratings by omnivores were ‘homecooking’, ‘homemade’ and ‘comfortfood’, whereas the words with the lowest rating were ‘govegan’, ‘veganuary’ and ‘vegancommunity’. For vegans, words with the highest rating included ‘vegan’, ‘plantbased’ and ‘veganfood’, and words with the lowest rating included ‘pork’, ‘meat’ and ‘beef’. For further descriptives, please see the Supplementary Online Materials (SOM).

Table 14

Valence Rating Means and Standard Deviations by Word Type, Diet and Group

	Plant-based		Meat		Both
	All	Unique	All	Unique	
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Omnivore	8.59 (27.27)	2.87 (27.50)	19.29 (23.14)	19.34 (23.01)	19.20 (23.39)
Vegan	23.84 (21.75)	28.29 (19.72)	5.42 (29.95)	-0.04 (31.82)	15.56 (22.90)
All	16.21 (25.81)	15.58 (27.09)	12.36 (27.64)	9.65 (29.41)	17.38 (23.21)

Note: All = words used in posts about meat foods or plant-based foods, Unique = words used in posts about meat foods or plant-based foods only (i.e. does not include words that feature both in posts about meat foods and plant-based foods).

Table 15

Experiment 1 Omnivore and Vegan Mean Valence Ratings for Each Word

Word	Mean Valence Rating		Word (cont'd)	Mean Valence Rating	
	Omnivore	Vegan		Omnivore	Vegan
avocado	10.54	21.66	meat	20.56	-40.37
bbq	25.51	3.05	meatfree	3.41	33.78
beef	18.44	-37.37	mushroom	10.37	18.49
brunch	23.93	16.15	plantbased	3.51	37.46
cheese	28.05	-12.22	plantbaseddiet	-2.59	34.20
chicken	26.15	-33.32	pork	13.07	-40.61
comfortfood	29.68	21.24	potatoes	24.41	24.59
cooking	21.15	18.63	recipe	23.51	19.85
crueltyfree	26.41	36.73	restaurant	22.44	9.46
dairyfree	5.93	31.73	sausage	19.54	-13.59
delicious	26.41	24.02	spicy	22.76	19.00
dinner	27.22	16.80	steak	24.07	-35.46
easy	19.37	18.59	sunday	16.85	9.02
eat	14.95	7.05	tasty	27.20	19.39
egg	18.95	-27.22	tomato	14.80	18.88
food	20.41	12.83	uk	13.12	5.59
foodgasm	-5.54	-5.83	vegan	0.71	39.98
foodie	10.90	9.39	vegancommunity	-10.27	28.56
foodlover	21.76	13.44	veganeats	-7.59	31.02
foodporn	0.59	-1.34	veganfood	-3.63	36.90
glutenfree	4.17	10.10	veganfoodie	-7.73	26.88
govegan	-14.76	30.27	veganism	-6.20	33.90
grill	25.10	4.90	veganlife	-8.37	32.10
healthy	23.51	27.78	veganlifestyle	-7.63	31.93
healthyfood	23.17	27.49	vegans	-4.95	31.73
homecooking	32.00	29.32	veganuary	-10.46	31.63
homemade	30.93	29.20	vegetable	16.05	23.66
ideas	15.05	14.44	vegetarian	8.00	22.98
inspiration	19.24	20.54	veggie	10.93	25.00
keto	-8.15	-20.85	veggies	11.46	26.66
love	19.76	18.29	whatveganseat	-9.51	25.56
lunch	24.20	16.63	yum	18.85	15.78
meal	14.80	9.88	yummy	19.83	16.44

Note: ordered alphabetically

Figure 11

Visualisation of Mean Valence Ratings for Each Word, Ordered by Group, Diet and Participant

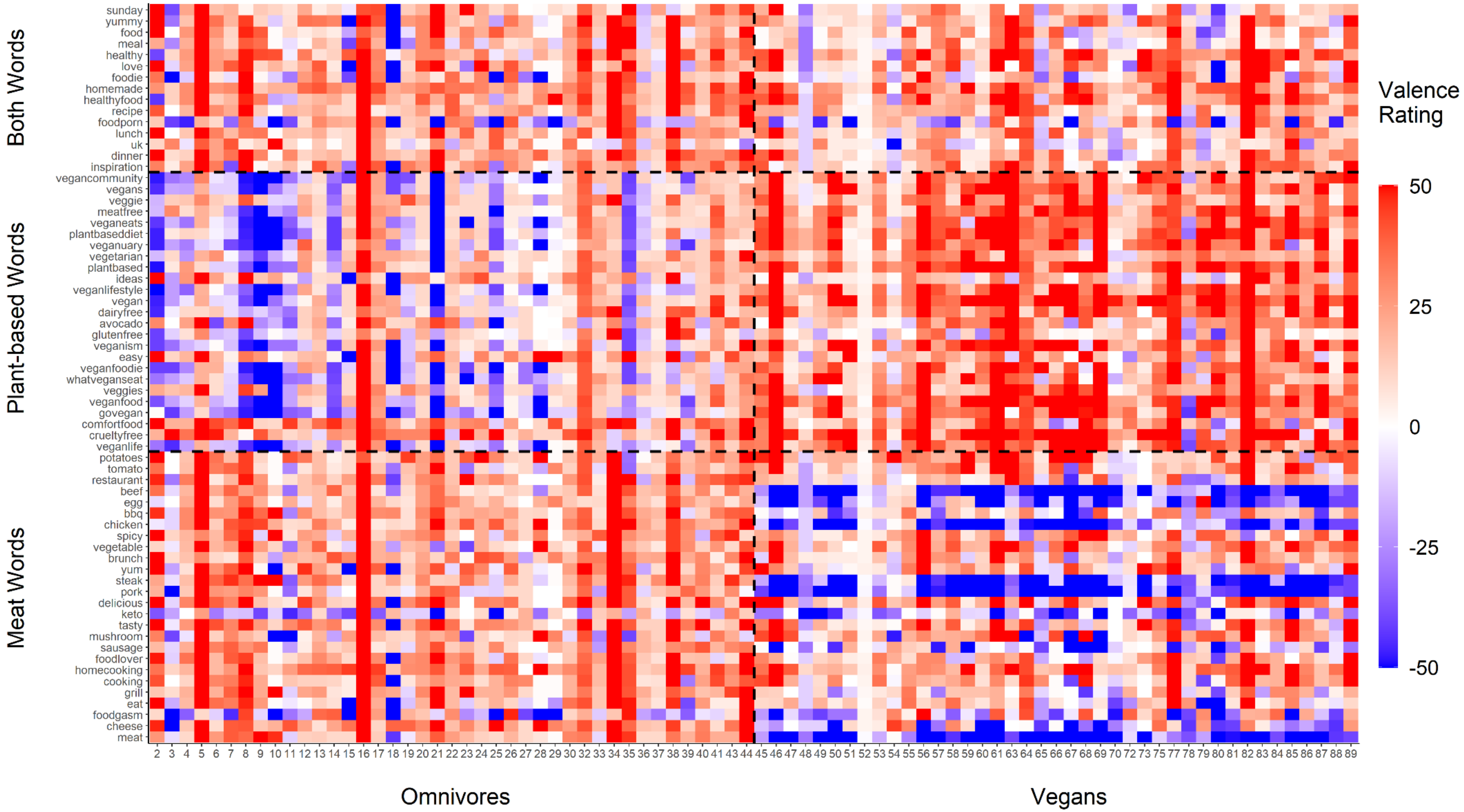
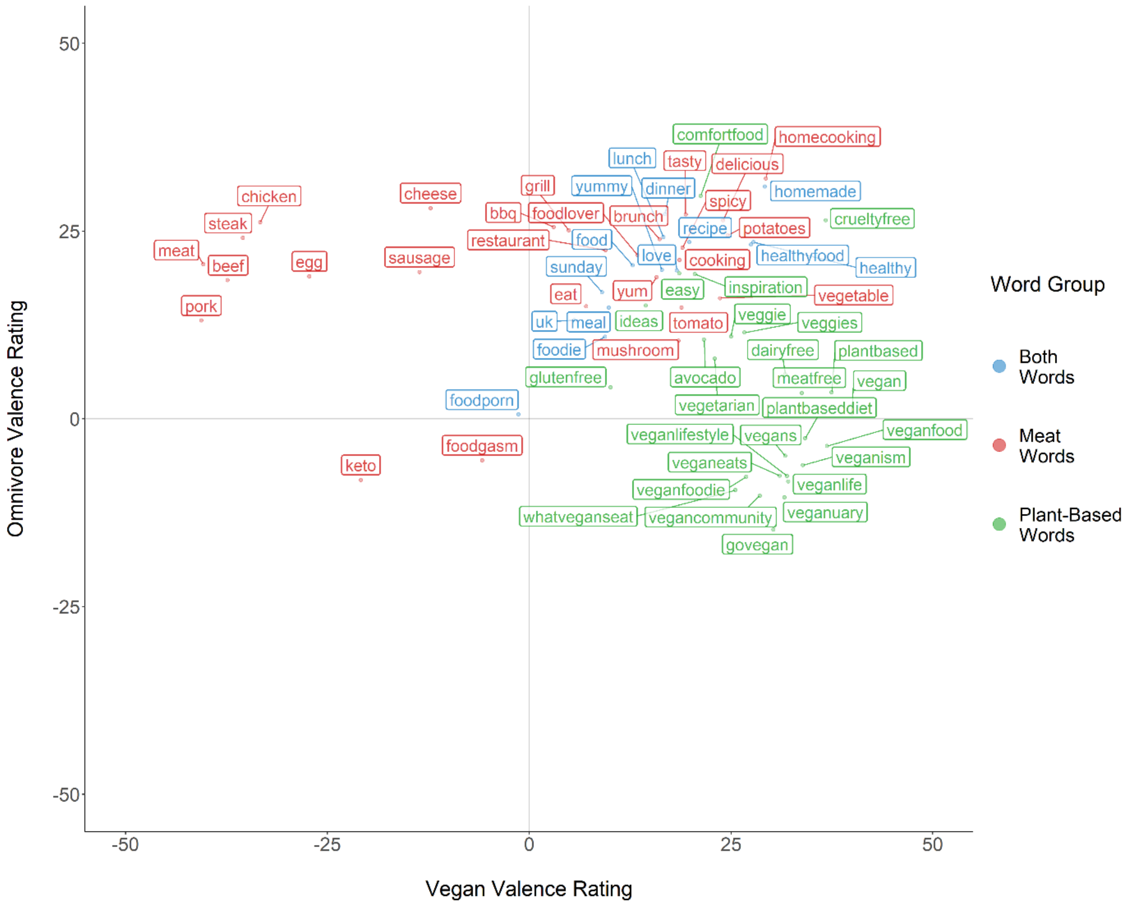


Figure 12

Plot of Omnivore and Valence Ratings for Each Word by Group



4.3.2.2. Confirmatory Analyses

Omnivore Participants (H1). Contrary to our predictions, we did not find that omnivores rated words used for meat foods differently to those used for plant-based foods, $B = 0.69$, $SE = 0.96$, $p = .48$.

Vegan Participants (H2). Again, contrary to predictions, we did not find that vegans rated words used for plant-based foods differently than words used for meat foods, $B = -0.48$, $SE = 0.75$, $p = .52$.

4.3.2.3. Exploratory Analyses

Unique Words. We wanted to explore whether there was any difference in valence ratings among omnivores and vegans by group, by categorising words used for meat foods only (unique meat words), words used for plant-based foods only (unique plant-based words), and words that were used for both meat and plant-based foods (both words) separately. We found that the overall effect of unique words on valence ratings was significant among omnivores, $F(2, 75.04) = 10.12$, $p < .001$, $R^2_m = 0.09$, $R^2_c = 0.58$, and among vegans, $F(2, 73.79) = 17.50$, $p < .001$, $R^2_m = 0.16$, $R^2_c = 0.64$. To investigate this further, we ran pairwise comparisons using the *emmeans* package (version 1.6.0; Lenth, 2021). Results are displayed in Table 16. For omnivores, there was no difference in ratings for unique meat words and both words. However, both words and unique meat words were rated more positive than unique plant-based words. For vegans, unique plant-based words and both words were rated more positive than unique meat words. Unique plant-based words were also rated more positive than both words.

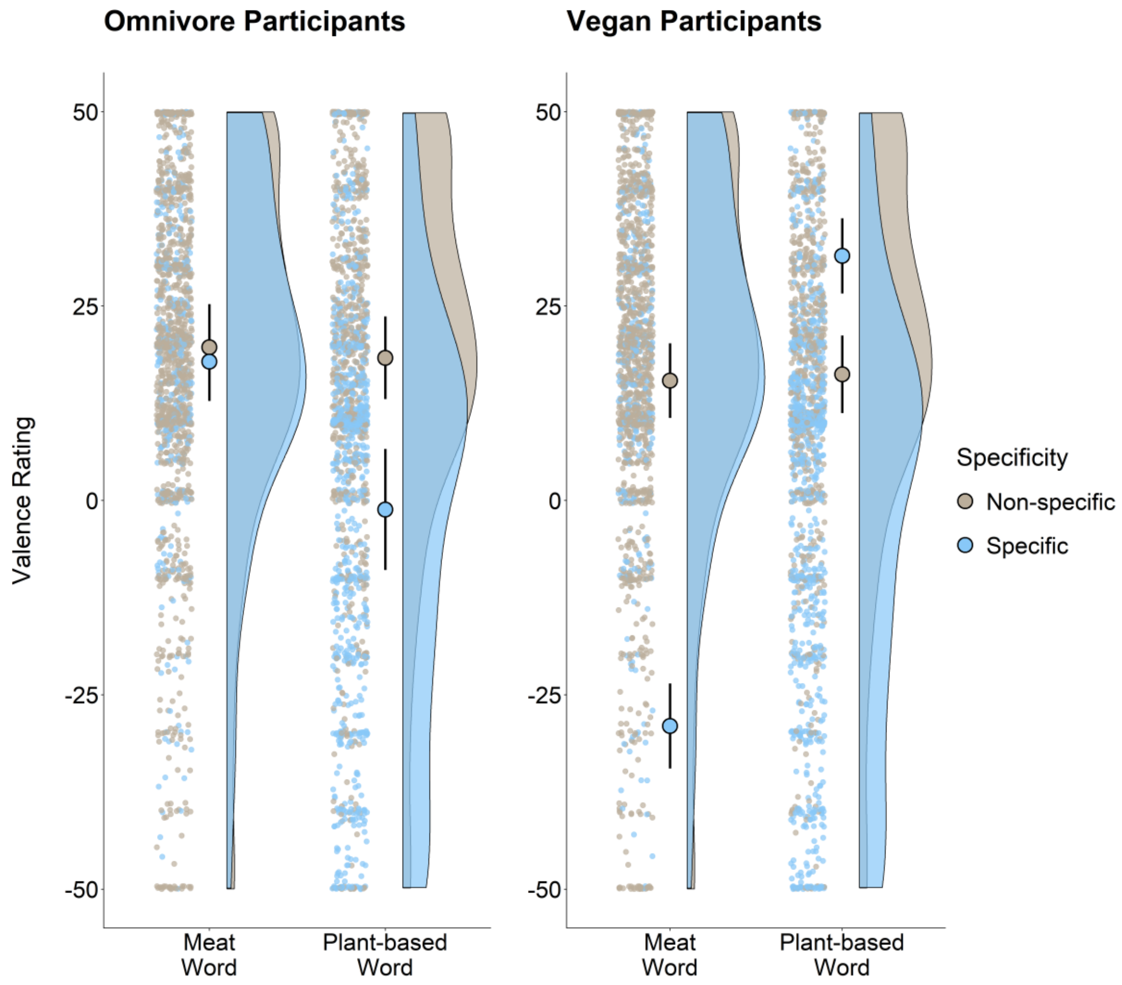
Table 16

Pairwise Comparisons of Valence Ratings for Word Groups by Diet

	Meat vs. Plant-based	Meat vs. Both	Plant-based vs. Both
	b (SE) *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*	*b (SE)* *p* *[95% CI]*
Omnivore	16.47 (3.84) **< .001** [8.93 – 24.00]	-0.14 (3.38) .97 [-6.77 – 6.49]	-16.33 (4.25) **< .001** [-24.65 – -8.00]
Vegan	-28.30 (4.79) **< .001** [-37.73 – -18.93]	-15.60 (5.47) **< .01** [-26.32 – -4.88]	12.70 (5.47) **.02** [2.01 – 23.45]

Figure 13

Raincloud Plot of Valence Rating Means by Diet, Word Type and Specificity



Specific Words. We explored whether there were any differences in the ratings of diet, food and identity specific (e.g. 'steak', 'veganism', 'dairyfree') words used for meat and plant-based foods. Means for specific and non-specific words (e.g. 'cooking', 'spicy', 'comfortfood') by word type and diet can be found in Table 17, and a visualisation of valence means by diet, word type and specificity can be found in Figure 13. We found that omnivores rated specific plant-based words more negative than specific meat words, $B = -9.51$, $SE = 2.65$, $p < .001$, $R^2_m = 0.10$, $R^2_c = 0.72$. For vegans, we found the opposite effect: specific meat words were rated more negative than specific plant-based words, $B = -30.23$, $SE = 2.33$, $p < .001$, $R^2_m = 0.66$, $R^2_c = 0.85$. We also found that participants rated diet-congruent specific words more positive than diet-congruent non-specific words, $B = 4.27$, $SE = 1.17$, $p < .001$, $R^2_m = 0.03$, $R^2_c =$

0.53, and diet-incongruent specific words more negative than diet-incongruent non-specific words, B = -14.71, SE = 1.72, p < .001, R^2_m = 0.24, R^2_c = 0.66.

Table 17

Valence Rating Means and Standard Deviations by Diet, List and Specificity

	Plant-based		Meat	
	Specific	Non-Specific	Specific	Non-Specific
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Omnivore	-1.17 (27.13)	18.34 (23.68)	17.85 (21.83)	19.71 (23.50)
Vegan	31.45 (18.20)	16.22 (22.34)	-29.00 (23.52)	15.41 (23.52)
All	15.14 (28.28)	17.28 (23.04)	-5.57 (32.61)	17.56 (23.60)

Intra-class Correlations. We wanted to assess the stability of the means within omnivore and vegan valence ratings to ensure that these ratings are generalisable enough as representative indexes for the same populations, and for use in our next experiment. Therefore, we ran intraclass correlation coefficient (ICC) analyses using the *ICC* function in the *psych* package (version 2.2.9; Revelle, 2022), which estimates the difference in agreement among omnivore and vegan participants in how they rate words from high to low for each word group (de Vet et al., 2017; Shrout & Fleiss, 1979). We found high inter-rater agreement in our ICC2K results, which suggests sufficient stability of means for the omnivore and valence indexes (see Table 18). The ICC2 results also capture significant variation in agreement across diets and word groups (~.10 to ~.50), which accounts for large individual differences across ratings.

Table 18

Intra-class Correlations by Diet and Hashtag Group

	Inter-rater agreement of word ratings between participants (ICC2)				Stable mean word ratings across participants (ICC2K)			
	Meat Words	Plant-based Words	Both Words	All	Meat Words	Plant-based Words	Both Words	All
Omnivore	0.15	0.18	0.09	0.23	0.87	0.90	0.81	**0.92**
Vegan	0.52	0.13	0.13	0.48	**0.98**	0.85	0.86	**0.97**
All	0.20	0.04	0.11	0.13	**0.95**	0.77	**0.91**	**0.93**

Note: 0.75 – 0.90 = good reliability, > 0.90 = excellent reliability (ICC2K)

Sensitivity Analysis. We ran a post-hoc sensitivity analysis to determine if our findings were sufficiently powered with our collected data. Using the H1 model output, we set the target fixed effect size at B = 4.00. Results showed that with a sample size of 40 participants, we could reasonably detect an effect at 97.90% power with an adjusted alpha of 0.025 (for further details, see the SOM). This suggests that our main findings were above the minimum detectable effect threshold.

4.3.3. Discussion

In Experiment 1, we measured omnivore and vegan valence ratings for popular food words. We did not find any difference in how omnivores and vegans rated words about meat foods and plant-based foods in general. However, when looking into unique words (i.e. excluding words used for both meat and plant-based foods), we found that omnivores rated words for meat foods more positive than words for plant-based foods, and vice versa for vegans. Furthermore, when looking at words that were specific to a food, diet or dietary identity, we found that omnivores rated specific plant-based words lower than specific meat words, and vice versa for vegans. Therefore, it seems that across diets, positive and negative evaluations of food words depend on whether they are specific to a congruent diet or not.

4.4. Experiment 2

Experiment 2 was designed to examine how omnivores and vegans present food posts to ingroup and outgroup audiences. Specifically, we tested how vegans and omnivores strategically describe meat and plant-based foods when trying to make these appealing to both dietary groups in a hypothetical social media setting. To this end, we used the valence ratings collected in Experiment 1 to assess the valence of words that participants use to describe foods for different dietary groups. In addition, we assessed the use of consumption and reward features in these posts to examine the degree to which participants use language that can trigger eating simulations and increase desire for a target food (Papies et al., 2020b; Turnwald & Crum, 2019).

Previous research had shown that, in a spontaneous feature listing task, participants cognitively represent diet-congruent foods (i.e. meat foods for omnivores; plant-based foods for vegans) in terms of rewarding consumption (Davis et al., 2022). In line with this, findings also show that presenting meat and plant-based foods with labels that emphasise consumption and reward features increase the appeal of these foods for omnivores (Papies et al., 2020b). At the same time, evidence has found that on Instagram, plant-based foods were tagged with fewer consumption and reward words than meat foods (Davis & Papies, 2022). This suggests that social media users' strategic use of language to make foods appealing differs from people's cognitive representations of foods. This may be particularly evident for plant-based foods, which are less likely to be described with rewarding language that increases appeal.

It is likely that omnivore and vegan participants will take the assumed preferences of their target group into account when making posts about meat and plant-based foods. This may be influenced by processes of identity and dietary group polarisation, such that vegans are stereotyped to be health-conscious, radical and moralistic 'do-gooders' by the outgroup (De Groeve et al., 2022; Funk et al., 2020; Minson & Monin, 2012), and omnivores are, by contrast, stereotyped to be sociable, greedy and non-environmentally conscious 'pleasure seekers' (De Groeve et al., 2021; De Groeve & Rosenfeld, 2022b; Greenebaum, 2012). As such, the language used to appeal to audiences may align with the distinct, explicit dietary motivations for vegans (i.e. animal welfare) and omnivores (i.e. taste and enjoyment; North et al., 2021).

We predicted that omnivores would use more consumption and reward words when making a post about a meat dish than a plant-based dish for an omnivore audience (H1a), reflecting their own preference of meat foods with their ingroup audience. Similarly, we hypothesised that omnivores would use words with more positive omnivore valence when making a post about a meat dish than a plant-based dish for an omnivore audience (H1b). For vegan participants, we predicted that they would use more consumption and reward words (H2a), and words with more positive omnivore valence (H2b), when making a post about a plant-based dish for an omnivore audience than a vegan audience. This would reflect that vegan participants share the common assumption that omnivores value consumption and reward experiences more than vegans (North et al., 2021). Finally, we hypothesised that vegans would use more consumption and reward words than omnivores when making a post about a plant-based dish for a vegan audience (H3), reflecting their experience of eating and enjoying plant-based foods and their shared preference for plant-based foods.

4.4.1. Methods

4.4.1.1. Design and Sample Size

Experiment 2 had a mixed 2 (dietary group, between participants: omnivore, vegan) x 2 (dish type, within and between participants: meat dish, plant-based dish) x 2 (audience type, within and between participants: omnivore audience, vegan audience) design. This variability in response types (i.e. within, between) is due to collecting participants across a number of questionnaire conditions (see Table 19) to avoid response fatigue among our participants (Adigüzel & Wedel, 2008). We did not ask participants to make a meat food post appealing to vegans, as this seemed redundant and counterintuitive to our rationale. Therefore, we only gathered data from participants promoting a) a meat dish to an omnivore audience, b) a plant-based dish to an omnivore audience, and c) a plant-based dish to a vegan audience. Diet, dish type and audience type were the independent variables. Consumption and reward proportions, and omnivore and vegan valence index ratings were the dependent variables. The study was approved by the University of Glasgow College of Medical, Veterinary and Life Sciences Ethics committee on 19th September 2022 (Application Number: 200220015).

Table 19

Questionnaire Conditions

Questionnaire	Description
Plant-based dish	Omnivore and vegan participants make posts about 2 plant-based dishes for both an omnivore audience and a vegan audience
Omnivore audience	Omnivore and vegan participants make posts about 2 plant-based dishes and 2 meat dishes for an omnivore audience
Diet Congruent	Omnivore and vegan participants make posts about 2 plant-based dishes for a vegan audience, and 2 meat dishes for an omnivore audience

Like in Experiment 1, we determined our sample size for H1a using the *mixedpower* package on simulated data in R. Consumption and reward proportion means of 0.44 for meat dishes and 0.36 for plant-based dishes were generated randomly for omnivore participants and an omnivore audience; a difference of 0.08 (8%). Based on a binomial mixed-effects model, with a minimum of 81% power of the smallest effect size of interest (SESOI), and a critical value of 2.33 equivalent to an alpha of 0.01, we needed a minimum of 300 participants per dietary group or 600 participants in total.

Due to our questionnaire condition structure, we needed to collect 300 participants for each questionnaire, or 150 participants per group, to ensure our confirmatory comparisons were sufficiently powered. Data from omnivore participants in the omnivore audience questionnaire condition (N = 150) and the diet congruent questionnaire condition (N = 150) were used to run the H1a and H1b models (N = 300 required), whereas data from vegan participants in the plant-based dish questionnaire condition (N = 150) and diet congruent questionnaire condition (N = 150) were used to run the H3 model (N = 300 required). For the H2a and H2b models, data from vegan participants in all three questionnaire conditions were used (N = 300 required; 450 total). Therefore, we required a minimum of 900 participants across the three questionnaire conditions. To control for potential exclusions and missing data, we aimed to recruit an additional 48 participants, or 24 per group (5% margin). Thus, we planned to recruit a total of 948 participants.

Like in Experiment 1, we did not use a mixed-effects structure in our sample size calculation, so we ran a post-hoc sensitivity analysis on our H1a model to check whether our findings were sufficiently powered.

4.4.1.2. Participants

Participants were recruited through Prolific and data was again collected via Qualtrics. We specified the same inclusion criteria as Experiment 1 and used custom pre-screening to select eligible participants, which excluded those who had taken part in Experiment 1. In total, 957 participants completed our questionnaire, which included 317 from the plant-based dish questionnaire condition, 321 from the omnivore audience questionnaire condition and 319 from the diet congruent questionnaire condition. 34 participants were excluded; 2 participants gave insufficient responses to the feature listing task and 33 participants gave inconsistent dietary information. The final sample consisted of 913 participants, including 472 omnivores (67% female, M_{age} = 37.12, SD_{age} = 10.79) and 441 vegans (76% female, M_{age} = 33.47, SD_{age} = 9.84). Participants received £1.60 for their participation.

4.4.1.3. Materials

Post Creation Task. All participants were told they would be presented with several dish names, one at a time. Dependent on their questionnaire condition, participants were told that they would create hypothetical Instagram style posts 1) about plant-based foods that would either appeal to omnivores, or to vegans, 2) about plant-based foods or meat foods that would appeal to an omnivore audience, or 3) about meat foods that would appeal to omnivores, or plant-based foods that would appeal to vegans. Each dish was presented as follows: '*You are making an Instagram post about a [DISH NAME] that is designed to appeal to [AUDIENCE]*' and asked to create a caption (open text entry) and select suitable hashtags for this post from the words measured in Experiment 1 (see Table 13). They were also asked to include any additional hashtags not already listed (open text entry). Participants were randomly presented with 2 out of 10 plant-based dishes in the plant-based dish questionnaire condition. Participants in the omnivore audience and diet congruent conditions were presented with 2 out of 10 plant-based dishes, and 2 out of 10 meat dishes (see Table 20).

Table 20

List of Dishes

Dish Category	Meat Dish	Plant-based Dish
Breakfast	Full English Breakfast	Plant-based Breakfast
Burger	Lamb Burger	Vegan Burger
Burrito	Chicken Burrito	Vegan Burrito
Curry	Beef Curry	Vegetable Curry
Pizza	Chicken Pizza	Plant-based Pizza
Ramen	Chicken Ramen	Vegan Ramen
Roast	Roast Lamb	Vegan Roast
Salad	Beef Salad	Vegetable Salad

Note: Dishes were chosen from the Dish searchable labels in Davis & Papies' (2022) study

Dish Attractiveness. We asked participants 'please rate how attractive each meal sounds to you' for each dish presented (0 = '*not attractive*', 50 = '*somewhat attractive*', 100 = '*very attractive*').

Typical Consumption. We asked participants '*typically, how often do you consume the following dishes?*' for each dish presented (0 = '*never*', 100 = '*very often*').

Dietary Information. We asked participants the same dietary information items as in Experiment 1, except we did not collect data on daily and weekly dairy intake. We also slightly changed the wording for the Diet Length item as follow: '*when did you start following your current dietary pattern?*', with 6 choices ('*within the last year*', '*within the last 3 years*', '*within the last 5 years*', '*within the last 10 years*', '*I've always followed this diet*', '*other (please specify)*').

Demographics. We collected the same demographic information as in Experiment 1, except we did not collect data on subjective SES.

Social Media Use. We collected information on social media use as in Experiment 1.

4.4.1.4. Procedure

Data was collected from midday between 7th October 2022 and 31st October 2022. Participants were required to read the experiment information form and give informed consent before participation. Participants first completed the post creation task after being given detailed instructions. We then asked participants to rate the dish attractiveness and typical consumption for each dish presented to them. Following this, participants completed the dietary information, demographic and social media use information. Participants were fully debriefed at the end of the survey, which took 12 minutes on average to complete.

4.4.1.5. Data Coding

Words from Experiment 1 and any additional hashtags were coded using the Feature Listing Manual (Papies et al., 2020c) into 5 main categories and 44 subcategories. Consumption situation features include any aspect of a consumption episode, including sensory and action features (e.g. ‘spicy’, ‘hot’, ‘flavoursome’), internal or external context (e.g. ‘brunch’, ‘glasgow’, ‘hungry’), and any immediate positive or negative consequences experienced during the episode (e.g. ‘foodgasm’, ‘yummy’, ‘boring’). Situation independent features include any aspect separate to the consumption episode, such as the ingredients or content (e.g. ‘tomato’, ‘glutenfree’, ‘plantbasedprotein’), general positive or negative evaluations (e.g. ‘love’, ‘terrific’, ‘bad’), the category of the food consumed (e.g. ‘pasta’, ‘roastdinner’, ‘streetfood’), visual properties (e.g. ‘foodporn’, ‘allthecolours’, ‘square’) and the long-term health consequences of consumption (e.g. ‘unhealthy’, ‘goodforyou’, ‘wellness’). Non-consumption situation features include any aspect adjacent to consumption episode, such as the purchase or accessibility (e.g. ‘takeaway’, ‘moneysavingtips’, ‘sainsburys’), the production (e.g. ‘grill’, ‘recipe’, ‘homemade’), and the preparation (e.g. ‘bbq’, ‘sliced’, ‘intheoven’) of the food consumed. Categories excluded from analysis included ambiguous features, which include any features that could be coded into 2 or more subcategories (e.g. ‘fire’, ‘balance’, ‘tea’), and nonword features, which include any features, such as syncategorematic words (e.g. ‘and’, ‘if’, ‘from’), that could not be identified as a word relating to food in the experiment language (i.e. English).

Following the same coding practice as Davis and Papies (2022), we also included the identity subcategory and social and political context subcategory within the situation independent main category. The identity subcategory captures features referencing the group membership of the consumer in relation to the food they eat (e.g. ‘foodlover’, ‘veganfoodie’, ‘meatreducer’), whereas the social and political context subcategory captures any features surrounding the social-political discourse relating to dietary practices (e.g. ‘crueltyfree’, ‘govegan’, ‘animalsarefriendsnotfood’). Hashtags that consisted of several words were divided into the smallest meaningful units and coded separately. For example, “#meatfreebuttasty” became “meatfree” (situation independent: ingredients and content) and “tasty” (consumption situation: taste and flavour). TD coded all features. For more details on the coding procedure and associated ShinyApp, see Papies et al. (2020c).

4.4.1.6. Analysis Plan

To control for variation in the number of words in hashtags used by participants for each hypothetical post, proportions were calculated for each post by dividing the number of words coded per main category by the total number of words coded across all main categories, namely consumption situation, non-consumption situation and situation-independent features. We calculated consumption and reward proportions by dividing the total number of sensory and action, context and immediate positive consequence features for a post by all features for the post across the three main categories.

All analyses were conducted in R, and the same packages were used for data cleaning and visualisation as in Experiment 1. Similar to Experiment 1, we fitted linear mixed-effects models with the *lmer* function of the *lme4* package. Across all of our confirmatory models, we employed a maximal random effects structure (Barr et al., 2013). For our H1b and H2b models, we included random intercepts and slopes for each participant, and random intercepts for each dish and questionnaire condition. For our H1a, H2a, H3 and exploratory H3 models, we included random intercepts and slopes for each participant, and random intercepts for each dish.

To control for familywise error rate from testing five hypotheses, we adjusted our alpha level to $\alpha = .01$ using the Bonferroni correction (.05/5 = .01). Model diagnostics were measured the same as in Experiment 1. Most of our models displayed small deviations from the expected distribution (Kolmogorov-Smirnov test) and outlier violations. We decided to run models, like in Experiment 1, without corrections.

4.4.2. Results

4.4.2.1. Descriptives

Means and standard deviations for feature listing proportions and valence index ratings can be found in Table 21, and the highest frequency hashtags for each experimental condition can be found in Table 22. Vegans (*M* = 10.91, *SD* = 8.69) used more words to hashtag posts than omnivores (*M* = 10.19, *SD* = 7.96) overall, $t(3538.9) = 2.61$, $p = .01$, $d = 0.09$. In addition, participants used a greater proportion of consumption and reward words to hashtag omnivore audience posts (*M* = 0.28, *SD* = 0.20) than vegan audience posts (*M* = 0.14, *SD* = 0.14) in general, $t(3361.4) = 24.74$, $p < .001$, $d = 0.81$. Greater proportions of consumption and reward words were also used to hashtag meat dishes (*M* = 0.35, *SD* = 0.21) than plant-based dishes (*M* = 0.18, *SD* = 0.16), regardless of diet or audience, $t(1852.1) = 25.26$, $p < .001$, $d = 0.94$. For further descriptives, please see the SOM.

Table 21

Experiment 2 Dependent Variables by Diet, Dish Type and Audience Type

	Feature Listing Proportions			Valence Index Ratings	
	Consumption & Reward	Situation Independent	Non-Consumption Situation	Omnivore	Vegan
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Omnivore: Meat Dish					
Omnivore Audience	0.37 (0.20)	0.43 (0.21)	0.20 (0.18)	20.44 (4.48)	9.69 (9.02)
Omnivore: Plant-based Dish					
Omnivore Audience	0.22 (0.18)	0.54 (0.20)	0.24 (0.17)	12.46 (7.62)	23.04 (5.71)
Vegan Audience	0.14 (0.15)	0.61 (0.19)	0.25 (0.16)	7.31 (6.97)	26.23 (4.61)
Vegan: Meat Dish					
Omnivore Audience	0.33 (0.23)	0.46 (0.23)	0.21 (0.20)	19.25 (6.15)	7.88 (12.54)
Vegan: Plant-based Dish					
Omnivore Audience	0.20 (0.15)	0.57 (0.19)	0.22 (0.15)	12.48 (6.77)	23.31 (5.10)
Vegan Audience	0.14 (0.12)	0.63 (0.16)	0.23 (0.13)	7.39 (6.19)	26.80 (4.35)

Note: Omnivore = Omnivore Participant, Vegan = Vegan Participant

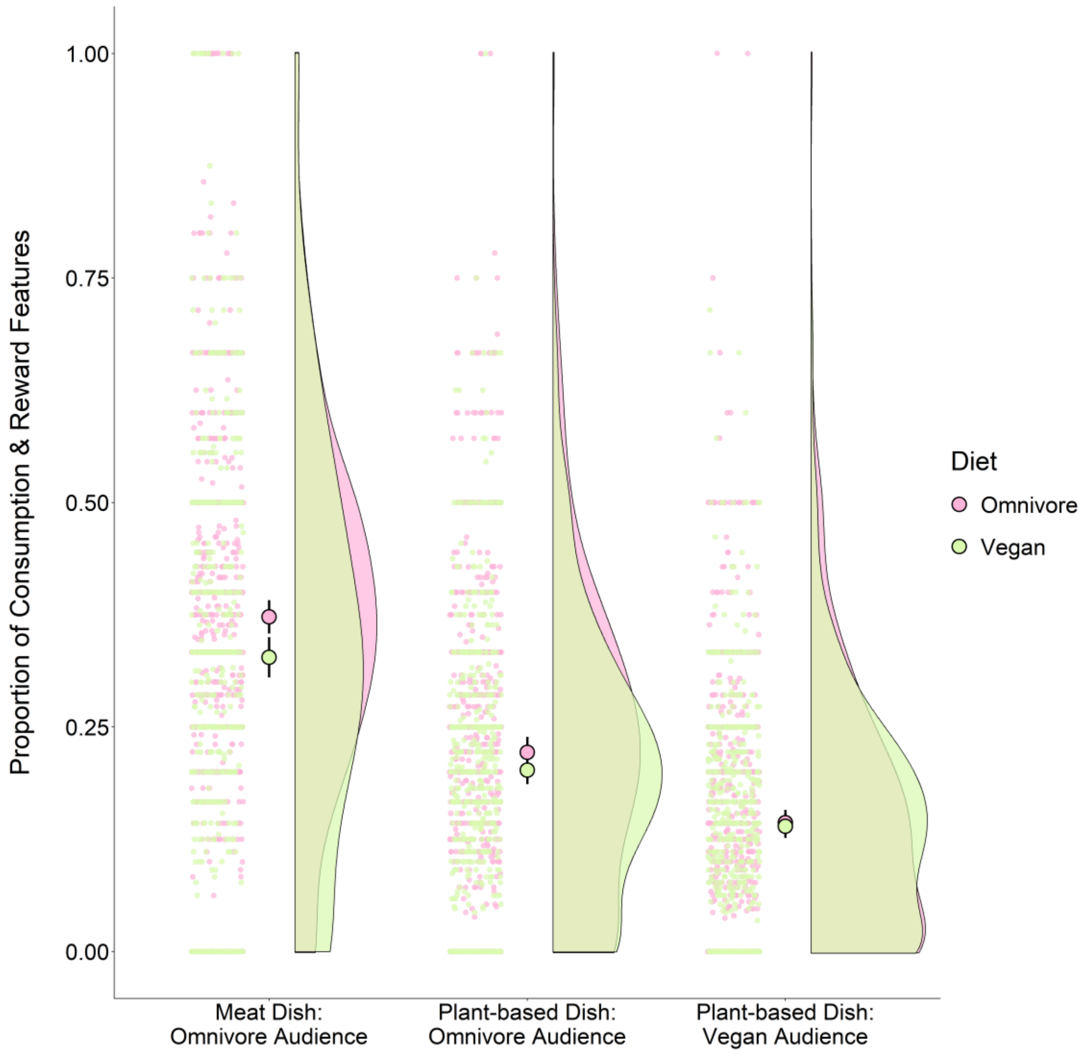
Table 22

Experiment 2 Highest Frequency Hashtags by Diet, Dish Type and Audience Type

Omnivore						Vegan					
Meat Dish		Plant-based Dish				Meat Dish		Plant-based Dish			
Omnivore Audience		Omnivore Audience		Vegan Audience		Omnivore Audience		Omnivore Audience		Vegan Audience	
Hashtag	*N*	*Hashtag*	*N*	*Hashtag*	*N*	*Hashtag*	*N*	*Hashtag*	*N*	*Hashtag*	*N*
tasty	280	healthy	229	veganlife	305	meat	179	plantbased	322	plantbased	394
foodie	251	plantbased	225	veganlifestyle	298	dinner	167	comfortfood	248	vegan	265
delicious	245	delicious	221	plantbased	282	comfortfood	160	meatfree	218	whatveganseat	240
meat	224	tasty	209	veganfoodie	276	food	147	delicious	216	veganfood	329
comfortfood	220	healthyfood	209	veganfood	275	tasty	156	tasty	205	plantbaseddiet	311
foodlover	214	meatfree	207	plantbaseddiet	269	meal	140	plantbaseddiet	205	veganlife	286
yummy	207	foodie	178	veganeats	257	foodie	136	foodie	195	veganeats	277
homecooking	193	inspiration	177	vegan	242	chicken	127	healthyfood	194	veganfood	268
dinner	178	foodlover	170	whatveganseat	239	eat	126	crueltyfree	184	veganlifestyle	247
meal	172	comfortfood	165	vegancommunity	230	cooking	118	foodlover	181	crueltyfree	244

Figure 14

Raincloud Plot of Consumption and Reward Proportion Means by Diet, Dish Type and Audience

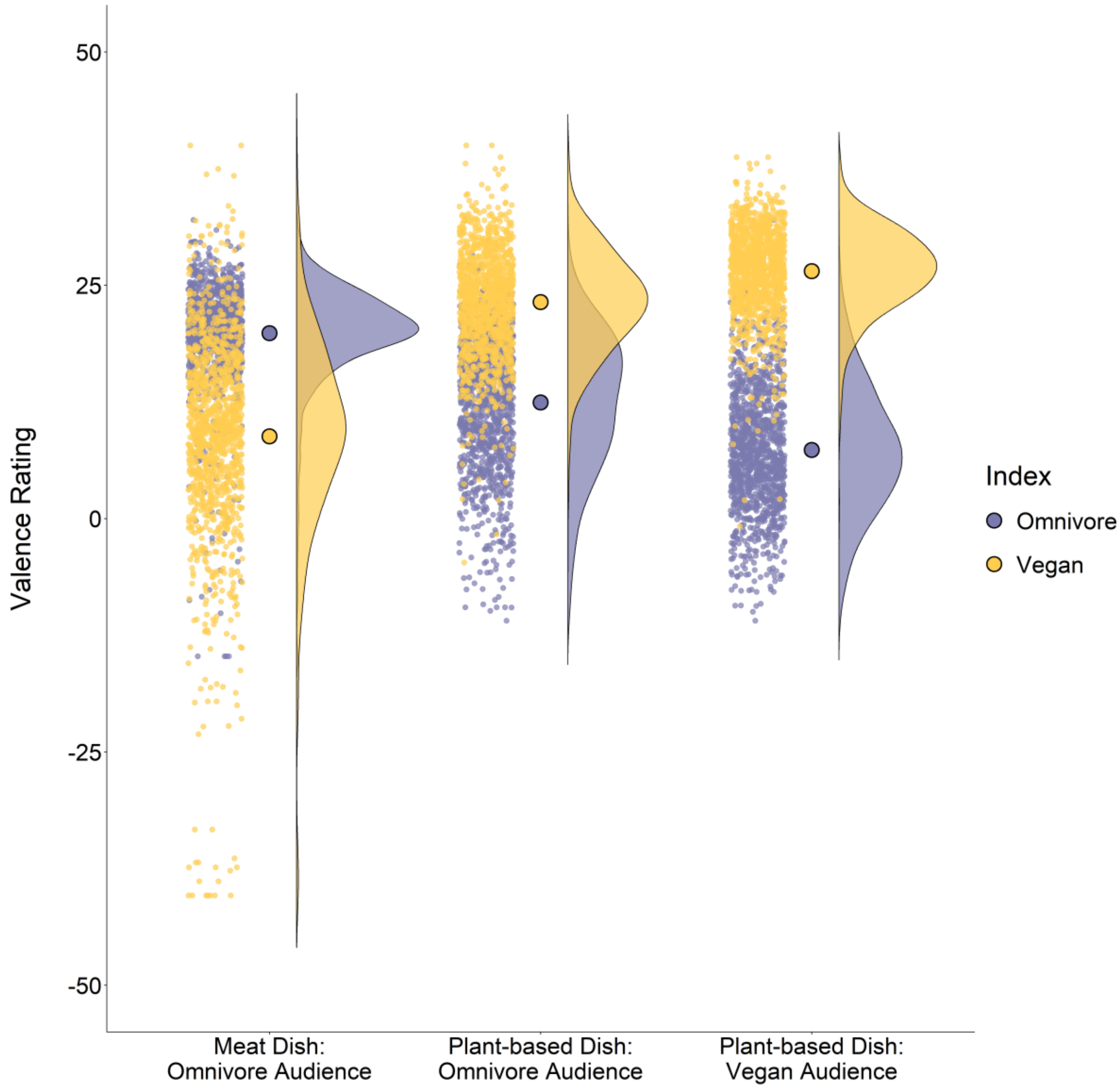


4.4.2.2. Confirmatory Analyses

Omnivore Participants (H1a and H1b). As predicted, omnivores used more consumption and reward words to hashtag a post about a meat dish than a plant-based dish for an omnivore audience (H1a), *B* = 0.45, *SE* = 0.05, $p < .001$, $R^2_m = 0.11$, $R^2_c = 0.29$ (see Figure 14). Furthermore, participants used words with more positive omnivore valence when tagging a post about a meat dish than a plant-based dish for an omnivore audience (H1b), *B* = 0.55, *SE* = 0.05, $p < .001$, $R^2_m = 0.30$, $R^2_c = 0.68$ (see Figure 15).

Figure 15

Raincloud Plot of Valence Rating Means by Index, Dish Type and Audience



Vegan Participants (H2a and H2b). In line with our predictions, vegans used more consumption and reward words when tagging a post about a plant-based dish for an omnivore audience than a vegan audience (H2a), $B = 0.23$, $SE = 0.03$, $p < .001$, $R^2_m = 0.04$, $R^2_c = 0.39$. Vegans also used words with more positive omnivore valence to hashtag a post about a plant-based dish for an omnivore audience than a vegan audience (H2b), $B = 0.31$, $SE = 0.03$, $p < .001$, $R^2_m = 0.10$, $R^2_c = 0.56$.

Omnivore Participants vs Vegan Participants (H3). Contrary to our hypothesis, we did not find that vegans used more consumption and reward words than omnivores when tagging a post about a plant-based dish for a vegan audience (H3), β = -0.02, *SE* = 0.05, *p* = .72. Exploring this further, we also did not find that vegans used words with more positive vegan valence than omnivores to hashtag a post about a plant-based dish for a vegan audience, β = -0.06, *SE* = 0.03, *p* = .06.

4.4.2.3. Exploratory Analyses

Qualitative Findings. Although running a thematic contents analysis of the text captions created by participants is beyond the scope of this paper, a selection of extracts can be found in Table 23. Participants' responses reflected trends in the quantitative data, such as using more consumption and reward features to promote a meat dish to an omnivore audience than a plant-based dish (e.g. P246, P722, P3, P479). Instead, plant-based dishes were promoted with reference to more situation independent features (e.g. P246, P893, P3, P479). We also saw hints of omnivore-vegan polarisation when participants were making a post about a diet-incongruent dish for an outgroup audience (e.g. P4, P647), with several vegan participants refusing to promote meat dishes at all (e.g. P797). In addition, we found that some participants referenced current socio-political affairs, like the UK cost of living crisis (e.g. P695), presented dishes as a business (e.g. P88), and were aware of outgroup values and attitudes (e.g. P34) in their responses.

Sensitivity Analysis. Like in Experiment 1, we ran a post-hoc sensitivity analysis to determine if our findings were sufficiently powered with our collected data. Using the H1a model, we set the target effect size at β = 0.20. Results showed that with a sample size of 450 participants, we could reasonably detect an effect at 97.90% power with an adjusted alpha of 0.01 (for further details, see the SOM). This suggests that our main findings were above the minimum detectable effect threshold.

Table 23

Experiment 2 Text Caption Extracts

Participant Number	Diet	Dish Type	Audience	Extract
P246	Omnivore	Meat	Omnivore	‘Finest cut of beef cooked in a delicious rich sauce = heaven’
P3	Omnivore	Plant-based	Omnivore	‘Love burritos? Pop veg into it for a healthy option’
P382	Omnivore	Plant-based	Vegan	‘I can't believe there is no meat - awesome’
P4	Omnivore	Plant-based	Vegan	‘Get some synthetic meat down you. Enjoy some processed gunk. You know it's good for you’
P34	Omnivore	Plant-based	Vegan	‘Replace the cruelty in your ramen with a delicious and healthy dose of vegan goodness!’
P88	Omnivore	Plant-based	Vegan	‘tasty and healthy - what other choice do you need?! Try our vegan curry today! For all customers’
P722	Vegan	Meat	Omnivore	‘Succulent roast lamb dinner! Delicious!’
P647	Vegan	Meat	Omnivore	‘All the goodness, none of the cancer’
P695	Vegan	Meat	Omnivore	‘Looking to save some cash in this current crisis? Try switching your protein source to a plant based option, like in this delicious vegan curry’
P797	Vegan	Meat	Omnivore	‘I don't feel comfortable doing this part of the task. I am a vegan and so don't agree with promoting dead animal flesh to anyone. It's sad and evil and disrespectful’
P479	Vegan	Plant-based	Omnivore	‘It's easy to keep eating foods you love whilst being kind to animals’
P893	Vegan	Plant-based	Vegan	‘Who said that vegans can't make a great roast!? Even includes yorkies!!’

4.4.3. Discussion

When describing foods to appeal to omnivores, participants used more words related to consumption and reward, and more 'omnivore positive' language, than when describing food to appeal to vegans. In fact, both omnivores and vegans used few words related to consumption and reward when trying to make a plant-based dish appealing to vegans. There was also no difference in the 'vegan positive' words used by participants when trying to promote plant-based dishes to vegans. This suggests that foods are presented to omnivores in terms of rewarding consumption, which is not the case when presenting foods to vegans, even by their fellow ingroup members.

4.5. General Discussion

Across two experiments, we investigated how omnivores and vegans perceive language about meat and plant-based foods, and how omnivores and vegans use this language to make communications about meat and plant-based foods appealing to different audiences. In Experiment 1, we found that participants rated words about diet-congruent foods more positive than words about diet-incongruent foods, but only when those words were specifically related to the dietary ingroup. In contrast, words that were specifically related to the dietary outgroup received negative ratings. In Experiment 2, we used these ratings, along with a measure of consumption and reward features, to examine key aspects of the language used to make a dish appealing to an ingroup or outgroup audience in a hypothetical social media setting. We found that irrespective of diet, participants used more consumption and reward features and words that were rated positively by omnivores in food posts made to appeal to omnivores than to vegans, especially posts about meat dishes. This suggests that communication about rewarding consumption is assumed to be more appealing to omnivores than to vegans.

In addition, we found that there was no difference in how omnivore and vegan participants presented plant-based foods to a vegan audience, in terms of consumption and reward proportions or valence index ratings. Specifically, participants used a large proportion of situation independent features to make a plant-based dish appealing to vegans. This is consistent with actual Instagram posts about vegan food (Davis & Papies, 2022) and actual ready-meal descriptions of vegan food (Papies et al., 2020b). These hypothetical social media findings suggest a shared perception of what is perceived as valued by omnivores and vegans among members of the ingroup and outgroup when it comes to promoting or advertising food. These findings can help contextualise how strategic descriptions of meat and plant-based foods can be perceived by different audiences, which is important when trying to promote sustainable food choices to mainstream consumers.

However, despite previous research suggesting that both omnivores and vegans think about ingroup foods in terms of rewarding consumption (Davis et al., 2022), our results show that plant-based foods are not publicly described in this way, even by vegans for vegan audiences. As reward expectations drive food choices (Higgs, 2016), and predicts desire and consumption (Papies et al., 2022a), this presentation of plant-based foods can discourage omnivore consumers from desiring sustainable alternatives. Specifically, there was a substantial 13 – 23% difference in consumption and reward proportions for meat dishes versus plant-based dishes across experimental conditions. This displays a distinct contrast in the way that vegans spontaneously think about diet-congruent foods, and how they present them online.

4.5.1. Applied Implications

Our results correspond with previous findings that suggest consumption and reward features can increase desire for foods (Davis et al., 2022; Papies et al., 2020a; Papies et al., 2020b). In particular, the most negatively rated hashtags by omnivores and vegans related to situation independent features that reference dietary identity, socio-political context and ingredients or content. Even though previous studies have found words like ‘vegan’ to be more favourable than ‘plant-based’ (Rosenfeld et al., 2022), our findings show that both of these descriptors are still rated negatively by omnivores, and should be avoided when trying to promote sustainable foods. This is especially important, considering that omnivorous identities, and omnivore-vegan polarisation, will likely gain greater prevalence due to the moralistic threat (Rothgerber, 2020) from increased climate change discourse.

These findings also provide insights into how consumers navigate promoting a food to a certain audience that they may not like or eat themselves (Hoek et al., 2011; Michel et al., 2021). This experience of appealing to the outgroup can directly confront the gatekeeping culture of omnivore and vegan ingroup communication (Malinen & Koivula, 2020) and encourage contact between members of different dietary groups (Hornsey & Fielding, 2020; Schultz & Fielding, 2014), albeit one-way. This process can help break down normative discourse rules of 'who-says-what' (Thürmer et al., 2022), and may encourage participants to adapt their eating behaviour accordingly to the eating behaviour of the audience they are appealing to. Therefore, this task could be utilised as an intervention method to encourage behaviour change.

4.5.2. Theoretical Implications

This research provides further evidence for the Grounded Cognition Theory of Desire (Papies et al., 2022a; Papies & Barsalou, 2015) within the food domain. Our findings show that meat foods were typically described with more consumption and reward (i.e. eating simulation) language than plant-based foods for omnivorous audiences, making meat foods the more desirable choice. This may be due to omnivores reflecting on what makes meat foods appealing to them in order to appeal to members of their ingroup, namely rewarding sensory and eating context experiences, which aligns with evidence that consumption and reward features often being used to describe more frequently consumed foods (Davis et al., 2022). Furthermore, vegans described plant-based foods with more consumption and reward language to make them appealing to omnivores rather than to vegans, which shows an implicit awareness that focusing on elements that simulate the eating experience can make foods attractive, even if they are diet-incongruent. This is consistent with previous findings where consumption and reward labels made plant-based foods more appealing than control labels, especially among more habitual omnivores (Papies et al., 2020b).

Our research also has implications for how people communicate when assuming the values of a social outgroup. Previous research on motivational message matching suggests that matching messaging to the motivational characteristics of a target audience can increase successful persuasion (for a meta-review, see Joyal-Desmarais et al., 2022). Participants demonstrated this in Experiment 2, where we positioned them to engage in an exercise that involved persuasive communication that aligned with the motivations, attitudes and values of the target audience. We found that both omnivores and vegans were more likely to use words for audiences that were independently rated as more positive by ingroup participants in Experiment 1. This suggests that both omnivores and vegans can bypass their negative attitudes towards the dietary outgroup in order to communicate persuasively to them in a way that represents their values.

However, this process of message matching highlights the differences in explicit dietary motivations between omnivores and vegans, despite evidence that they both share implicit motivations for rewarding consumption (Davis et al., 2022), which can drive omnivore-vegan polarisation. Previous literature has found that vegans consider health, animal welfare and sustainability as important factors for their dietary behaviour (Bryant, 2019; Silva Souza & O'Dwyer, 2022), and are often cited as the key reasons for switching to a vegan diet (Ghaffari et al., 2022; Wehbe et al., 2022). However, this does not mean that choices for individual dishes are always driven by these motives. Indeed, vegans represent plant-based foods in terms of rewarding consumption (Davis et al., 2022), and value hedonic pleasure as a goal for their food choices (Ghaffari et al., 2022; Hagmann et al., 2019; Wehbe et al., 2022). Even in Experiment 1, vegan participants rated consumption and reward words (e.g. 'delicious', 'tasty', 'yum') similarly to omnivores (i.e. < 5 point difference between groups). Despite this, in Experiment 2, both ingroup and outgroup members characterised vegan audiences as solely driven by higher-order, situation independent factors for every food decision. Therefore, when marketing plant-based foods, it is important not to confound the motivation for dietary change with the motivation for individual food preferences, even when those marketing the foods are vegans themselves.

Our findings also suggest the presence of meta-stereotypes among our vegan participants, in other words, vegan stereotypes about other vegans. Our results show that vegans present plant-based foods to ingroup members in a socio-political and identity focused way, which contrasts with evidence that suggests vegans themselves think about diet-congruent foods in terms of rewarding consumption (Davis et al., 2022). This may serve a function of showing ingroup members that they are an active and morally motivated member of the vegan community, committed to raising awareness of the benefits of veganism and encouraging others to adopt veganism in public spaces (Greenebaum, 2012; Judge et al., 2022); rather than merely eating for pleasure. This may also be a method of connecting to the vegan community on social media (Kaakinen et al., 2020) and strategically defending their dietary practices from the status quo (Costa et al., 2019). Nonetheless, adopting these vegan linguistic strategies online when presenting plant-based foods can both prevent omnivores from exposure to these posts, due to the 'searchable' function of hashtags (Zappavigna, 2015), but can also deter omnivores from trying more plant-based foods due to explicit associations with a 'dietary deviant' group (Boyle, 2011), rather than enjoyable consumption experiences.

4.5.3. Future Research

Future directions could consider whether the process of writing about diet-incongruent foods for ingroup audiences could have an effect on attractiveness ratings as a manipulation method. For example, asking an omnivore to create a post about a plant-based dish that appeals to their ingroup audience gives them an opportunity to focus on the appealing qualities of a plant-based dish that they would respond favourably to, and therefore increase attractiveness. This could be measured against within-participants attractiveness ratings of dishes pre-manipulation, and also against asking omnivore participants to create a post about a plant-based dish for an outgroup audience (i.e. vegans) and measure their attractiveness ratings of that dish. Longitudinal measures of intended or future consumption would also be valuable to measure the temporal effects of this manipulation. Asking participants to summarise their thoughts and feelings when making these posts could also generate interesting qualitative responses. This could be an effective ingroup contact intervention method to change attitudes about sustainable foods in a way that makes them attractive to an omnivore, while avoiding the omnivore-vegan dimension where plant-based foods are promoted to vegans only.

Furthermore, the current research could also be extended by measuring evaluations of the hypothetical food posts generated by participants in Experiment 2. This could be measured in terms of an overall valence rating of a post and the attractiveness rating of the promoted dish, but could also include measures of social media specific functions such as the probability of 'liking' the post, or a hypothetical 'comment' on the post. Assumptions about the post creators could also be assessed. This could help determine if the hypothetical posts created by omnivores and vegans in Experiment 2 are actually appealing to the intended audience. This research could also explore whether a meat or plant-based food post intended for the participant's ingroup is better received than a post aimed at the participant's outgroup, and could be accompanied with measures of group identification (e.g. Inclusion of Other in the Self Scale (IOS); Aron et al., 1992) as a potential mediation variable of these effects. These insights could be useful for generating marketing materials for sustainable food products to mainstream consumers and vegans alike.

Building on the omnivore and vegan rating indexes from Experiment 1, gathering additional valence ratings for more food-related hashtags, or other food words in general, could help expand this database of identity-specific evaluations of food language. This could then be used, alongside feature listing categories, when labelling plant-based foods to ensure they are described using 'omnivore-approved' language. Replicating our findings among participants from dietary identity sub-groups (i.e. meat reducers, flexitarians, health-vegans, lifestyle-vegans), could be interesting to understand reactions to diet-specific language in greater detail.

4.5.4. Strengths and Limitations

This research builds on previous findings by both providing a direct comparison between feature listing and valence rating responses, and also adds to research on the labelling of meat and plant-based foods by introducing an additional level of 'audience'. However, there are a number of limitations. Firstly, experiment 1 was powered to find an effect below an alpha of 0.05, not the adjusted alpha of 0.025. However, post-hoc analyses of the ICC analyses confirm that the valence-rating responses provided by participants are reliable to generalise to omnivore and vegan groups. Secondly, we were only able to measure valence means in Experiment 2 from the 66 hashtags used in Experiment 1. However, considering that the valence rating indexes were generated from the top 40 most popular hashtags for meat and plant-based food posts in a previous Instagram study (Davis & Papies, 2022), the omnivore and vegan valence means are likely to be representative as an evaluation of the typical language used on social media for these kinds of posts. Lastly, the plant-based dish names used were more identity focused than the meat dish names (e.g. 'vegan burger' versus 'roast lamb'), which may have influenced the proportion of situation independent features generated for plant-based foods. However, we found that these dish names did not seem to bias our results. Nevertheless, future studies in this area should investigate whether these findings would replicate for more specific plant-based dishes (e.g. 'mushroom burger').

4.6. Conclusion

In sum, we found that participants rated outgroup-specific hashtags more negatively, and ingroup-specific hashtags more positively, than non-diet specific hashtags. When participants were asked to promote diet-congruent and diet-incongruent foods to different audiences via hypothetical Instagram food posts, both omnivores and vegans tagged posts with more consumption and reward hashtags, and more 'omnivore approved' hashtags, when appealing to omnivores than to vegans. For vegan audiences, plant-based foods were promoted instead in terms of situation independent hashtags, even by vegans. Presenting plant-based foods in this way in public food discourse can drive omnivore-vegan polarisation, as it emphasises and possibly enhances food identities, rather than a shared interest in food enjoyment. This may hinder mainstream consumers in making sustainable food choices. This paper provides insights into how people speak about food to dietary ingroup and outgroup members, which may explain the resistance towards transitioning to more climate-friendly eating patterns among the general population.

5. Chapter 5: General Discussion

5.1. Overview

Across 3 projects, we explored the relationship between food representations, language and diet, in order to understand how meat and plant-based foods are represented by mainstream consumers, and to identify obstacles in shifting towards more sustainable diets. In Project 1, we found that meat foods are described with more rewarding consumption language than plant-based foods on social media. In Project 2, we found that both omnivores and vegans think about diet-congruent foods in terms of rewarding consumption. In Project 3, we found that consumers use more rewarding consumption language to appeal to omnivores than to vegans. Therefore, although people think about 'ingroup' foods in terms of rewarding consumption, plant-based foods are not publicly described in this way, even by vegans. We suggest that this presentation of plant-based foods can discourage consumers from making sustainable food choices. We will now present a summary of the key findings of this thesis, the overall contributions and implications of the results, the strengths and limitations of the research and further research directions for this work.

5.2. Summary of Key Findings

The aim of Project 1 (Chapter 2) was to identify how consumers present meat and plant-based foods in a real-world context. We found that across two observational studies, hashtags in Instagram posts about meat foods included more language reflecting rewarding consumption (i.e. sensory, contextual and hedonic features) than posts about plant-based foods. Instead, posts about plant-based foods included more language reflecting aspects independent of the consumption situation than posts about meat foods, such as ingredient and content information, visual properties, long-term health consequences, and related dietary identity. Findings regarding posts about vegetarian foods were underpowered, but comparisons between posts about meat and plant-based foods were closely replicated and sufficiently powered. In particular, posts about meat foods included on average between 11 – 17% more consumption situation hashtags, and 13 – 19% fewer situation independent hashtags, than posts about plant-based foods. In contrast, we did not find any differences in rewarding consumption content in the text captions of posts about meat, vegetarian and plant-based foods.

Our results suggest that communications about meat foods in public online discourse are characterised in terms of short-term enjoyment, whereas communications about plant-based foods are focused instead on more long-term factors. These associations can have implications for consumer assumptions about plant-based foods, which may deter omnivores from switching to more sustainable consumption. Previous research has shown that, in line with the Grounded Cognition Theory of Desire (Papies & Barsalou, 2015; Papies et al., 2020a), describing a food in terms of rewarding consumption can elicit pleasant memories of previous consumption episodes and can increase desire to consume that food (Papies et al., 2020b). Communicating about plant-based foods in terms of features independent from the consumption situation is less likely to have the same motivational effect. Instead, these features characterise plant-based consumption as a healthy yet deviant choice, with possibly less potential to satisfy, which may decrease the appeal of this food for mainstream consumers (i.e. omnivores). Finally, these distinctions in how meat and plant-based foods are described on social media can also drive polarisation between omnivores and vegans, by creating the impression that these groups have very different motives in their food choices.

For Project 2 (Chapter 3), we wanted to build on the findings from Project 1, by investigating how omnivores and vegans cognitively represent both meat and plant-based foods. Across two experiments, we found that participants used more rewarding consumption features to represent diet-congruent foods (i.e. meat foods for omnivores, plant-based foods for vegans) than diet-incongruent foods (i.e. plant-based foods for omnivores, meat foods for vegans). Diet-incongruent foods were instead associated with more features independent of the consumption situation for omnivores, and features related to the social and political context of consumption for vegans. Furthermore, we found that greater use of consumption and reward features was associated with a higher attractiveness rating for a food, and a higher likelihood of ordering that food from a restaurant. Rewarding consumption representations were also found to predict behavioural outcomes, such that the more a participant represented a food in terms of rewarding consumption, the more likely they were to report greater intentions to consume that food, even when controlling for how often they typically consumed that particular food. In turn, the greater the intentions to consume a food, the more likely a participant would report actually consuming that food within a 30-day period.

The findings suggest that members of polarised dietary groups think about ‘ingroup’ foods in terms of rewarding consumption, and ‘outgroup’ foods in terms of more abstract features. For omnivores, these results correspond to how meat foods were described in Project 1, which suggests that meat foods are publicly described in the same way that omnivores think about them, and reinforces the assumption that meat foods are enjoyable to eat. For vegans, these results contrast how plant-based foods were described in Project 1, presumably created by vegans. This suggests a difference between how vegans cognitively represent plant-based foods versus how they strategically present them in public. The ingroup-outgroup dimension in our data also suggests that dietary identities are salient in the consumption of meat and plant-based foods. This may present an obstacle of social polarisation for omnivores to overcome in the transition towards sustainable eating habits, as they will have to consume outgroup foods that they don’t associate with enjoyment.

Project 3 (Chapter 4) presented further evidence from two experiments on the communications about meat and plant-based foods between these dietary groups. We found that participants rated popular words used to describe diet-congruent foods on social media more positively than popular words used to describe diet-incongruent foods, but only when these words were specific to an associated food, diet or dietary identity. In the final experiment, we asked participants to create hypothetical social media posts about meat or plant-based foods for different audiences. We found that participants used more words rated positively by omnivores, and more words referring to rewarding consumption experiences, to promote food to an omnivore audience than to a vegan audience. This was especially the case for meat foods. In contrast, when appealing to a vegan audience, participants used more words rated positively by vegans, which typically conveyed situation independent information, such as identity features. Importantly, there was no notable difference in how omnivore and vegan participants presented meat and plant-based foods to ingroup and outgroup audiences.

From this, our results show that mainstream and vegan consumers promote foods in terms of rewarding consumption to appeal to omnivores, but not to vegans. Furthermore, regardless of intended audience, meat foods were described with more rewarding consumption features in general. This research corresponds with the findings from Project 1 where Instagram posts about meat foods included more consumption situation features than plant-based foods, but also contrasts the findings from Project 2 where vegans cognitively represented plant-based foods in terms of rewarding consumption. This suggests an important difference in how vegans implicitly represent plant-based foods, and how they explicitly present them to others. In addition, these findings indicate that both ingroup and outgroup members share similar assumptions about omnivores being hedonically motivated and vegans being identity motivated when it comes to food choice. This can strengthen stereotypes of vegans and drive omnivore-vegan polarisation in the public discourse. This phenomenon was also demonstrated within participants' valence ratings, where we found that food words specific to the dietary outgroup were rated between 19 – 60 points lower on average than words specific to the dietary ingroup.

Overall, this thesis shows the need to communicate about plant-based foods in terms of rewarding consumption, in order to break down food identity barriers between omnivores and vegans by emphasising what these groups have in common: a shared motivation to enjoy food. Our findings from Project 2 show that vegans are not ‘taste martyrs’, but cognitively represent enjoyment from eating just as much as omnivores. It is only when it comes to presenting plant-based foods in public that these foods are described less in terms of reward and more in terms of dietary identity, as our results from Project 1 show. According to the findings from Project 3, this may be a strategy to connect with other vegans and promote veganism to outgroup members via plant-based food communications. We suggest, however, that this can highlight omnivore-vegan polarisation and deter mainstream consumers from trying plant-based options.

5.3. Overall Contributions and Implications

5.3.1. Theoretical Implications

The results from this thesis provide further evidence for the role of grounded cognition in food representations (Papies et al., 2022a; Papies & Barsalou, 2015; Papies et al., 2020a). Essentially, our findings show that people think about foods that form part of their dietary identity in more rewarding ways than foods that do not (Project 2). For example, consumers that eat meat represent meat foods in more rewarding ways than consumers who do not eat meat. Considering that situated conceptualisations are grounded in memory processing (Barsalou, 2016), our results may suggest that rewarding eating simulations are more likely to be triggered by frequently (and recently) consumed foods. Consequently, this leads to mainstream consumers communicating about meat foods in terms of reward in public environments (Project 1), which conveys the strength of these implicit associations.

Moreover, our findings show that food representations predict subsequent consumption behaviour. Both the process of thinking about and communicating about foods in terms of reward can induce re-experiences of previous enjoyable consumption episodes, which can increase desire and intentions to consume these foods again (Project 2). This aligns with previous literature (Papies et al., 2020b), which suggests that consumption and reward language cues can induce eating (and drinking) simulations and impact behaviour (see also Keesman et al., 2018; Papies et al., 2020a; Papies et al., 2022b). This completed cycle creates a new consumption episode memory of a food, and if enjoyable, can influence the simulation of rewarding consumption again in the future.

This thesis also provides original findings on how consumers alter their strategic presentations of foods to suit the assumed values of a target audience. Our findings suggest that participants assume eating pleasure is more important for certain consumers than others (Project 3). Specifically, reward-focused words were considered to be more persuasive for omnivores than vegans, who were instead assumed to be driven by health, environment and animal welfare considerations. However, our previous findings suggest that vegan consumers' consumption motivation and behaviours are driven by reward representations for diet-congruent foods (Project 2). This suggests that people assume vegans are unresponsive to reward appeals, perhaps because they are resistant to them, or perhaps because these are superseded by other goals (Silva Souza & O'Dwyer, 2022). This can create feelings of 'otherness' towards vegans, because they are stereotyped as operating with different cognitive structures to the mainstream consumer (see Iacobbo & Iacobbo, 2004; Pabian et al., 2022). Thus, our research can demonstrate how external food presentations may diverge from internal food representations when social dynamics are present.

Our work also provides important evidence for dietary intergroup dynamics which separate vegans from omnivores. We found that omnivores cognitively represent and socially present meat foods more in terms of enjoyment and reward, which is in line with common motivations used to justify eating meat, such that it is nice, natural, necessary and normal (Piazza et al., 2015; see also Rothgerber, 2013). These meat-eating justifications are typically used when omnivores experience cognitive dissonance about their eating practices (i.e. the meat paradox: Bastian & Loughnan, 2017). Vegans reject these justifications and opt for a marginalised identity instead. This is highlighted in how plant-based foods are presented to vegan audiences within our studies, as well as the socio-political context features that emerge in vegan representations of meat foods. This ingroup-outgroup categorisation may lead to stereotyping of vegans as lacking warmth (MacInnis & Hodson, 2017), being overcommitted (De Groeve et al., 2022) and socially unattractive (De Groeve et al., 2021). Vegans are also stereotyped as moralistic, which despite being seen as a positive trait, leads to do-gooder derogation and stigma (i.e. the vegan paradox: De Groeve & Rosenfeld, 2022; Markowski & Roxburgh, 2019). Hence, our results are consistent with research on vegan stereotypes and provides rich detail into how this manifests in discourse about meat and plant-based foods. As the role of the active vegan and passive omnivores shift, with the omnivore identity becoming more pronounced in society due to moralistic threat (Rothgerber, 2020), it is important to continue work on how dietary stereotyping emerges within food communication, and how these processes can be channelled to support the societal dietary transitions needed.

In addition, our work may also provide important evidence for dietary intragroup dynamics which separate the individual from the group. Our findings show a key difference in how vegans think about plant-based foods and how they present their motivations for eating to other ingroup members. This may indicate a discrepancy between the feelings of the individual versus the role of a group member, especially for a minority, opinion-based group identity whose members assume a collective responsibility to promote plant-based diets in society (Judge et al., 2022). Specifically, vegans think about plant-based foods in terms of enjoyment, but may experience a need to communicate about them in terms of vegan identity and long-term outcomes related to the socio-political context. Similarly, we also see this pattern for omnivores, who use between 8 – 10% fewer consumption and reward features when publicly presenting meat foods (Project 1 & Project 3: 34 – 37%) than when cognitively representing meat foods (Project 2: 45 – 47%). It might be the case that people feel the need to describe social media posts about ingroup foods in terms of situation independent aspects in order to satisfy ingroup expectations, to disclose accurate information on ingredients and content (e.g. 'high in protein') to legitimise their post (Thomas Jr & Mills, 2006), or to simply to make their posts reach a wider audience by using frequently searched hashtags (see Zappavigna, 2015). It could be interesting to examine further why the difference in spontaneous and strategic representations of food occur among omnivore and vegan consumers.

A final theoretical implication of our work includes the distinction between what drives dietary behaviour versus momentary, situated food choice. It is important to differentiate between motivation for a dietary pattern, such as the 'vegan trinity' of health, environment and animal welfare (Trethewey & Jackson, 2019), and motivation for food choice in any given moment. The latter is often motivated by pleasure (Leng et al., 2017), even for those who follow a vegan dietary pattern (Cliceri et al., 2018). This corresponds to our findings in Project 2, whereby rewarding representations of certain dishes were not associated with self-reported responses to The Eating Motivation Survey (Renner et al., 2012) or Ethical Motivation items from the Food Choice Questionnaire (Onwezen et al., 2019). This may suggest that current eating motivation measures do not distinguish or meaningfully separate these conscious and non-conscious decisional factors as distinct underlying processes for food choice (Werner et al., 2022), and the development of a scale that can also capture motivations for specific eating occasions may be advantageous for future research in this area.

5.3.2. Applied Implications

Our findings align with previous work that shows rewarding features are also typically associated more with meat foods than plant-based foods in commercial settings, i.e. on ready meal packaging (Papies et al., 2020b). This suggests that the way food is marketed is mirrored in consumer responses (see also: Folkvord & Hermans, 2020). Therefore, the way that food is labelled could also reinforce consumer attitudes (Rödl, 2018). Hence, changing the way that plant-based foods are marketed could encourage mainstream consumers to have more positive and rewarding expectations of sustainable alternatives, and nudge them to try plant-based options (Bogueva et al., 2017). Avoiding identity or situation independent features in general should be a key consideration when advertisers are generating language for plant-based foods that will be published in the public domain, especially among vegan advertisers who may not use rewarding language by default. In other words, vegan foods should not be promoted as vegan, but with reference to their sensory and hedonic features (Gavrieli et al., 2022) and to salient eating contexts (see also: Attwood et al., 2020; Papies et al., 2022c). This is also important to include within choice architecture interventions that increase the availability of plant-based foods (Garnett et al., 2019) or reduce their costs relative to meat options (Garnett et al., 2021).

Our research also indicates how the inclusion of a dietary group measure can transform our understanding of cognitive representations, observations and associations related to meat and plant-based foods. These foods seem to act as symbols for distinct dietary communities, and policymakers, marketing teams and influencers should be careful when labelling meat and plant-based foods as to not drive these groups further apart. For example, categorising plant-based foods as 'vegan' can generate a range of negative impressions among omnivores (Corrin & Papadopoulos, 2017). In fact, omnivores may experience reactance from the word 'vegan' (Rothgerber, 2020) and simulate ingroup-outgroup conflict as a result (see Guerin, 2014). Furthermore, public debates pertaining to meat versus plant-based diets demonstrate the polarisation between omnivores and vegans in climate-diet discourses, specifically those related to political and social factors regarding the link between the meat industry and climate change (Sanford & Lorimer, 2022). It is vital that industry professionals are aware of this conflict potential when promoting foods that are indicative of these opposing dietary practices.

Outside of the research setting, those in the food sector could use our findings to inform strategies for promoting sustainable foods within their organisations. For example, workshop attendees could be asked to complete the post creation task for plant-based foods in Project 3, and then these posts would be evaluated and compared with our findings. The co-ordinators leading these proposed workshops would then address attendees about the psychology of food choice, the influence of reward labelling and our other results from Projects 1 and 2. Attendees could then return to the posts they created at the start of the session, and edit these to make the language more reward-focused for both omnivore and vegan audiences. The workshop could end with behavioural solutions, with an emphasis on the importance of considering dietary identities in food communications to encourage sustainable food choices among their customers. Thus, the novel work in this thesis has practical, research impact implications that can transfer across disciplines and have relevance both within and outside of academia.

5.4. Strengths and Limitations

5.4.1. Strengths

We now address the multiple overarching strengths of this thesis. The first of these relates to our novel, innovative and creative approach to the relationship between diet, behaviour and food representations, which can provide original perspectives to the field. In our work, we used feature listing measurements (Papies, et al., 2020c) previously implemented by Papies and colleagues (2020b; see also Keesman et al., 2018; Claassen & Papies, 2022), to measure representations of meat and plant-based foods within a new environment (i.e. social media; Project 1), using a new key variable (i.e. diet; Project 2) and across a new dimension (i.e. consumer interactions with the ingroup and outgroup; Project 3). This enhances understandings of how these foods are conceptualised through the lens of omnivore-vegan polarisation, which can be used by academics, industry professionals and policymakers alike. Our observational and experimental approaches can help to close the ‘green gap’ (ElHaffar et al., 2020) between the attitudes, intentions and behaviour of sustainable consumption among mainstream consumers in the domain of food choice. We would suggest that our research can make a small and specific yet hopefully significant contribution towards mitigating climate change.

Another strength pertains to the multi-method nature of the work, which provides a comprehensive account of food representations and their implications. Measuring language via feature listing (e.g. Papies et al., 2020c) allowed us to quantify the proportions of thematic categories within participant responses, but also provided us with key qualitative frequency data to diversify our findings. We also found that the coding approach developed for feature listing tasks can effectively capture both implicit cognitive representations but also explicit presentations of food language. Using feature listing data alongside eating motives scales (Onwezen et al., 2019; Renner et al., 2012), measurements of typical, intended and actual eating behaviour, demographics (e.g. Adler & Stewart, 2007), valence ratings and open-text qualitative questions demonstrates the multi-dimensional and extensive approaches used within this work. Thus, this thesis shows how feature listing methods of language categorisation can be integrated successfully alongside other attitudinal and behavioural measures to extend knowledge of a specific construct.

This thesis is also strengthened by the well-powered results of our projects. We were able to closely replicate our findings in Projects 1 and 2, even with datasets collected several months apart, which indicates the robustness of our findings over time and across samples (Francis, 2012; Jebb et al., 2015). We also collected large sample sizes (Total $N_{Project1}$: 3956, $N_{Project2}$: 1063, $N_{Project3}$: 995) based on thorough sample size calculations using G*Power (Faul et al., 2009) in Projects 1 and 2, and simulating mixed effects models (e.g. DeBruine & Barr, 2019) with ‘maximal’ structures (Barr et al., 2013). Our models generated on average medium effect sizes, and post-hoc sensitivity analyses and intra-class correlations displayed that our key findings were sufficiently powered, which supports the explanatory power of our results (Funder & Ozer, 2019).

Furthermore, we were able to gather responses from a substantial sample of a minority dietary group. Research predicts that around 1 – 2% of the UK population follow a vegan diet (Bryant, 2019), although some studies suggest prevalence in samples as little as 0.2 – 0.4% (Appleby & Key, 2016; Lonnie & Johnstone, 2020). Consistently across our projects, we were able to gather data from similarly sized groups of vegan and mainstream consumers. This is particularly noteworthy, considering research has typically grouped vegetarian and vegans together as one ‘v*gan’ population (Rosenfeld, 2018; Rosenfeld et al., 2020), which can misrepresent these groups with distinct dietary behaviours and values. Therefore, a key strength of our research is our ability to compare and contrast near-equal sized samples of two groups that represent opposite ends of sustainable food consumption.

Lastly, another strength of note is the open science practices adopted throughout this work. All of our studies and experiments were accompanied by pre-registered documentation, which are available along with the materials, datasets and analyses scripts on their respective OSF pages. This means that not only were our findings replicated within this thesis, but that they are also reproducible outside of this thesis (Open Science Collaboration, 2015). By following these open science principles from the onset, our research is more transparent, trustworthy and useful (McKiernan et al., 2016).

5.4.2. Limitations

The work in this thesis also has some limitations that are important to address. The first of these is our reliance on self-report measures, particularly for the behavioural measures in Project 2. Especially for online studies, self-report methods can be a popular strategy to gather participant’s subjective estimates of their own behaviour. However, these can be effected by recall difficulties, and conflated by social-desirability bias (Larson, 2019), i.e. the tendency for participants to answer in more socially acceptable ways, especially in research on climate-related behaviours (Kormos & Gifford, 2014) and when confronting highly-debated social topics (Grimm, 2010). This may suggest that the typical, intentional and actual consumption behaviour responses may be somewhat inaccurate (Hagger et al., 2015). However, we only collected retrospective data for specific dishes situated within a short timeframe, which should improve the ease of recalling and reduce the tendency for socially desirable responding, hence improving the reliability of our findings.

Furthermore, these results are also supported by previous evidence on the direct association between representations and consumption outcomes (Keesman et al., 2018; Papies et al., 2020a; Papies et al., 2022b). Thus, in line with guidance from Subar et al. (2015), we made sure to make the self-report dietary intake evaluation as clear as possible for participants, and to interpret the data appropriately in order to gather valuable, rich, and specific information about eating behaviour. Future research should investigate the relationship between food representations and more objective or immediate measures of eating behaviour, such as daily food diaries (e.g. Carfora et al., 2017), situated assessment methods (SAM[2]; Dutriaux et al., 2021) or tracking via a smartphone app (e.g. mFR; Harray et al., 2015).

There may have also been some clarification issues among participants which could have undermined our findings. For example, some vegan participants in Projects 2 and 3 mentioned in their survey feedback that they assumed meat dishes (e.g. Chicken Fajitas) contained a meat substitute rather than meat, which may have resulted in representing meat foods with more consumption and reward features than if they knew a dish contained animal products. We removed these participants from our analysis samples. However, this presents an unanticipated novel finding, such that some vegan participants are so removed from conventional ways of eating that they don’t recognise a dish name is referencing meat, despite having been informed in the task instructions that they would be describing both meat and plant-based foods. We also found during data coding that some omnivores would include features referencing dairy products for plant-based dishes, which may suggest that some mainstream consumers don’t understand what plant-based entails, or have trouble with sustainability product terms in general (Schiano et al., 2020). This points to a larger issue of categorisation in the food industry. Future research should investigate how participants represent the ingredients and contents of isolated dish names to understand consumer knowledge of sustainable alternatives.

Furthermore, we also did not separate vegetable-based foods from meat alternatives made from soy, wheat etc. across our projects. Our intention for the research was to give a broad understanding of plant-based foods representations as a whole, which drove the selection of our plant-based dish names. However, recent research has found that mainstream consumers in particular find meat alternatives to be boring and unappealing (Circus & Robison, 2018), and can provoke disgust (Michel et al., 2021) and neophobic affective responses (Onwezen et al., 2021), despite these foods being made and marketed in recent years primarily to appeal to omnivores (He et al., 2020). Furthermore, Lemken and colleagues (2019) found that some consumers prefer to directly substitute meat with specific legumes rather than having highly-processed products. We did control for each dish as a random effect in our models and found no significant influence. However, further research should directly measure how features differ for vegetable-based and meat alternative products to understand whether there are any implicit changes in the consumer representations for different types of sustainable foods.

Another limitation for our interpretation of dietary intergroup processes is that we did not study actual interactions or two-way communications between omnivores and vegans. Our work in Project 3 in particular was purely one-directional, despite collecting valence ratings representative of omnivore and vegan audience attitudes, and could have been improved by gathering actual responses to participant generated posts, or even some form of imagined contact (Crisp & Turner, 2012). However, this is an underdeveloped area in general, with research usually measuring discussions about food and dietary identities among participants of the same dietary group (e.g. Markowski & Roxburgh, 2019), rather than a mix of dietary ingroup and outgroup members. Nonetheless, our work still provides a critical foundation into dietary group food discourse, and can initiate a new sub-field of ingroup-outgroup communication within the sustainable eating behaviour literature.

An important limitation of our work is the relatively homogenous sample collected for this thesis. The inclusion of (mostly) UK, English-speaking participants can provide a detailed account of British food culture and context, especially in terms of the strong societal polarisation currently pervasive within the UK (Duffy et al., 2019). However, our findings cannot directly generalise to other countries, especially non-WEIRD (i.e. Western, Educated, Industrialised, Rich and Democratic; Henrich et al., 2010) individuals. Nevertheless, the UK diet is relatively high in meat intake compared to other diets (Audsley et al., 2010), and produces more GHG emissions than diets in developing nations (Pradhan et al., 2013). Due to the urgency of the food system transformations required, it is important to target populations who have a much larger magnitude of climate impact via their diets, and therefore the UK is a highly relevant context for this work.

Another related issue is that we did not specifically focus on gender, and gathered unequal gender group sizes in our studies. We did control for gender in our Project 2 models, but did not find an effect. Previous research suggests that male attitudes towards vegans may be especially negative (Modlinska et al., 2020), due to the strong link between meat-eating and hegemonic masculinity norms (De Backer et al., 2020; Ruby & Heine, 2011). On the other hand, a recent paper by Weber and Kollmayer (2022) found that male vegans self-reported the same amount of positive masculine attributes (e.g. ‘logical’, ‘rational’) as male omnivores, but ascribed fewer negative masculine attributes (e.g. ‘harsh’, ‘arrogant’) to themselves than male omnivores. Exploring attitudes between gendered vegan groups (i.e. male vegans, female vegans, non-binary vegans) and gendered omnivore groups (i.e. male omnivores, female omnivores, non-binary omnivores) would be an interesting direction to investigate. Although measuring the effect of gender differences on food representations is outside the scope of this thesis, this is another prominent social identity that future research may want to explore further.

Lastly, our participants were arguably not representative of the ethnic diversity present in the UK, which may modulate food representations and communications researched here. Previous research has found unique cultural influences and barriers to dietary lifestyle changes among minority ethnic groups (Nemeth et al., 2019; Patel et al., 2017). Again, although outside the scope of this thesis, using representative sampling (e.g. Castellini et al., 2021) could help expand knowledge on the cultural impacts on sustainable food choice.

5.5. Implications for Sustainability Research

Although this thesis concentrates on one element of the climate crisis, our findings can be valuable for many areas of sustainability research. One of the main takeaways of this work is the importance of underlying motivational processes for determining climate-related action (see also: Evans et al., 2013). Therefore, associating reward representations with other high-impact, individual behaviours could be an effective intervention method to encourage consumers to act in a sustainable way (Steg et al., 2014). For example, promoting cycling as a daily transport method in terms of pleasure and enjoyment (e.g. the positive immediate consequences of endorphins after exercise) could be more successful than a health-frame (e.g. the long-term benefits for your health) or an environmental frame (e.g. the long-term benefits for the planet). Thus, representing pro-environmental behaviours in terms of short-term reward could be an effective strategy to encourage sustainable consumption.

Moving forward, it is vital for sustainability researchers to consider that the general public are not a homogenous group, but instead consists of individuals with an array of social identities that can inhibit and encourage a range of climate-relevant behaviours (Barnett et al., 2021; Mackay et al., 2021). During an era of increasing polarisation, it is critical to account for ingroup influences and outgroup resistance when advocating for climate mitigation (Eker et al., 2019; Ferguson et al., 2016; Masson & Fritsche, 2021). Therefore, designing complex behaviour change interventions that can capture and control for differences among social groups may be the most effective in providing strategies to promote sustainable behaviours which also navigate complicated social systems (Nielsen et al., 2021). The insights from our three projects can be used to strengthen climate-related communications and evade alienating mainstream consumers from performing long-term sustainable behaviours in the domain of food. Our research indicates that further we explore the similarities and differences in grounded cognition between those with vastly different socio-political profiles, the better equipped we are to promote individual-level climate action across currently inactive groups.

To limit further climate change and loss of biodiversity, a food system transformation is urgently needed that includes shifting diets toward being predominantly plant-based (Willett et al., 2019). Hence, consumers need to substantially reduce their meat consumption, particularly in industrialised societies (Poore & Nemecek, 2018; Stoll-Kleemann & Schmidt, 2017). To achieve this, it is essential to understand the psychological aspects of consumer demand for meat and other animal-based products. However, our findings suggest that even these individual-level processes have to be understood within the social and economic systems that shape and reinforce them (Kemper, 2020; Steg, 2023; Webb et al., 2020). These systems encompass the educational and health institutions that shape the food environment and food norms, the marketing strategies of the food industry, social media platforms and algorithms, and the legislative and policy context (see also Sniehotta et al., 2017). Integrating a psychological, system-level approach to encourage widespread dietary change will be a fruitful next step for this research area to address how consumer demand for meat products can be reduced in a socially acceptable and sustained way.

5.6. Future Research Directions

Following the research presented in this thesis, there are multiple avenues for future research ideas. The first of these would be to replicate our findings among different populations. Although we demonstrated that our results across projects were reliable, it would be interesting to explore cross-culturally whether these findings replicate among non-English language speakers. Furthermore, measuring attitudes towards vegetarian foods (i.e. meat-free foods that contain dairy products), or representations among other dietary groups (e.g. meat reducers, flexitarians, pescatarians) may provide greater detail to contextualise our results. Another direction could be to measure communication about meat and plant-based foods during important calendar events (e.g. Christmas, Veganuary) to see whether polarisation between omnivores and vegans is more pronounced. For Project 3 in particular, measuring how food industry marketing professionals promote plant-based foods to omnivore and vegan audiences can highlight whether the same assumptions are made about these groups as consumers do. Lastly, gathering representations of additional meat and plant-based dishes, or valence ratings for other popular food descriptors, could be beneficial to replicate our findings among alternative stimuli and expand our catalogue of results.

Alternatively, future research could look to extending our work by exploring the relationship between diet and language further. For example, how and when do cognitive representations of meat and plant-based foods change among mainstream consumers who are actively transitioning towards sustainable consumption? Does this happen before, during or after the shift in behaviour, and what causes this to occur? Could developing negative representations of meat foods, such as disgust sensitivity (Becker & Lawrence, 2021), play a role? This research question would perhaps suit a longitudinal approach, by tracking representations of meat and plant-based foods over time among consumers who are considering reducing their meat intake, but have yet to take action. This could be coupled with measures of meat and plant-based consumption frequency over the course of 12 months to provide temporal markers of any changes in cognitive representations. In addition, retrospective qualitative accounts from those who transitioned from an omnivorous to a meat reducer diet, or even a vegetarian or vegan diet, could be a suitable approach to measure this construct (see also Wehbe et al., 2022).

Similarly, investigating how representations change with more frequent consumption of a dish could provide greater insight into the process of situated conceptualisations, grounded cognition and motivated behaviour more generally. One experimental direction could be to measure mainstream consumers' cognitive representations of certain plant-based dishes at baseline, and then expose participants to rewarding consumption descriptions of these dishes. We could then follow-up after multiple time points to see whether participants increase their consumption of these dishes and in turn generate more reward focused cognitive representations over time. Collecting data on feature listing for these dishes, but also for similar dishes, ingredients or even plant-based dishes in general could reveal whether increasing eating simulations for a particular plant-based dish can encourage plant-based consumption overall. Alternatively, following this same procedure, collecting cognitive representations from consumers for dishes or ingredients that they have never tried before and tracking representations after consumption episodes could provide valuable insights into consumption expectations for novel foods, especially novel plant-based foods. Gathering this data before and after the first consumption episode of a dish could establish whether people draw on adjacent situated conceptualisations to form representations for a dish they have never consumed before.

Future research could also focus on how consumers communicate about foods in different social contexts. We have investigated how consumers promote meat and plant-based foods to the ingroup and outgroup, but how are these foods presented to family members, romantic partners, close friends, or even strangers? Previous research has shown that focusing on relationships can boost (health) behaviour change (Latkin & Knowlton, 2015; Umberson & Karas Montez, 2010), but not specifically sustainable dietary behaviours. Exploring this using feature listing could reveal how communications about food are navigated within close personal relationships, and test social dimensions that may have a considerable influence on food choice. This could be conducted using a variety of methods (i.e. online survey, interviews, focus groups), measuring how meat and plant-based foods are presented in live conversations or imagined contact between consumers and those they have closer social relationships with, or not.

Our research also provides foundations for countless experimental approaches or behaviour change interventions. For example, one could present participants with a social media post about either a meat or plant-based food, with more or less consumption and reward features in the text caption and hashtags, to identify whether this affects attractiveness ratings and consumption intentions. There have been many studies conducted that measure the effect of taste-focused or health-focused language in food descriptions on menus (Bacon et al., 2018), adverts (Wang et al., 2020) and cafeteria settings (Turnwald et al., 2017a; Turnwald & Crum, 2019), but not in a social media setting, or more simply in communications between consumer and consumer. The dimension of whether the user who made this post is identifiable as an omnivore or a vegan could also add nuance to this approach. Another approach could be to present a vignette to participants outlining the similarities or differences between omnivores and vegans, and then measuring food choice from a list of meat and plant-based food options with various feature listing framings. This could determine whether strategies to encourage sustainable food choices should first minimise omnivore-vegan polarisation before presenting plant-based foods in a rewarding way. Overall, the work in this thesis has the potential to inspire multiple interdisciplinary approaches to move this research forward as an important subfield within the sustainable food consumption literature.

5.7. Conclusion

This thesis demonstrated how people think and communicate about both meat and plant-based foods. Through the lens of intergroup processes and grounded cognition, the findings provide evidence that meat foods are typically described in terms of their sensory and reward properties in order to appeal to omnivores. Alternatively, plant-based foods are typically described in terms of content, environmental impact and the vegan identity in order to appeal to vegans. However, in order to make sustainable consumption more attractive and desirable to mainstream, omnivore populations especially, plant-based foods should be described in terms of rewarding features that simulate the eating experience. This thesis offers insights into how the dynamics of omnivore-vegan polarisation should not be overlooked when developing strategies to promote sustainable eating among mainstream consumers. The more we understand how those that follow a sustainable diet differ from those that do not, the better equipped we are to promote plant-based foods in a way that is appealing to everyone. Thus, social identification is an important barrier to consider when trying to change individual consumer behaviours that can help tackle the climate crisis.

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