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How consumption and reward features affect desire for food, consumption intentions, and behaviour

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ABSTRACT

Understanding the mechanisms that underlie desire and intentions may assist in the search for strategies to promote the selection and consumption of more sustainable and healthier products. Therefore, we conducted two experiments to examine how cognitive representations influence desire and intentions for various savoury dishes. In Experiment 1, 1000 participants were allocated to one of five conditions, listing either the typical, sensory, context, hedonic, or health features of 20 popular dishes to assess cognitive representations, before rating their present moment desire to consume each dish. Although there was no direct effect of condition on desire, there was a significant mediating effect of condition on desire through the proportion of consumption and reward features listed (i.e., sensory, context, and hedonic words). In Experiment 2, 892 participants were allocated to one of four conditions, listing either the typical, sensory, context, or health features for the same 20 dishes, before rating their intention to consume each dish over the next four weeks. At a 4-week follow-up, participants rated how often they had consumed each dish. Again, there was no direct effect of condition on intentions, although there was a significant mediating effect of condition on intentions through consumption and reward features. This suggests that mentally simulating a previous consumption experience increases intentions to consume the dish in mind. The results also showed a positive indirect effect of consumption and reward features on behaviour through an increase in intentions. Describing healthy and sustainable products in terms of the rewarding consumption experience may increase desire and intentions to consume them, improving the health of both people and the planet.

1. Introduction

1.1. Research overview

What mechanisms underlie the motivation to select and consume certain foods? Are these decisions influenced by the specific thoughts and images that come to mind? What role do past experiences play in the foods selected on a daily basis? These are important questions given the fact that not all foods have the same environmental impact or long-term health consequences for the consumer. Research has shown that agriculture is one of the leading contributors to climate change with the production of food accounting for 26% of all global greenhouse gas emissions (Poore & Nemecek, 2018). A large proportion of this is attributable to animal agriculture which produced 340 million tonnes of meat in 2018, an increase of 300% over the last 50 years (Ritchie et al., 2019). Although much research has examined the cognitive processes that drive eating behaviour (Cohen & Babey, 2012; Higgs, 2015; van't Riet et al., 2011), far less has analysed how cognitive representations of food can influence eating motivations and decisions. Therefore, in this paper, we will examine the content of cognitive representations of various food items, and its role in motivating eating behaviour. More specifically, we will test whether focusing on particular aspects of savoury dishes can influence motivation and predict consumption behaviour.

1.2. The grounded cognition theory of desire and eating behaviour

Desire has been defined as "a psychological state of motivation for a specific stimulus or experience that is anticipated to be rewarding" (Papies & Barsalou, 2015, para. 3). According to the grounded cognition theory of desire (GCTD) (Papies & Barsalou, 2015; Papies, Barsalou, et al., 2022), every eating episode leads to the formation of a detailed memory that consolidates key components of the experience, referred to as a 'situated conceptualisation' (Barsalou, 2009). These components

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can include context factors such as the location and time of the eating episode and the presence of other people, they can include internal factors like the individual's bodily state (e.g., feeling hungry or satiated), or emotional state (e.g., feeling happy or sad), and they can include specific sensory and reward aspects of the eating experience (e.g., how the food smells, tastes, feels, and makes one feel). Future encounters with a food cue or any element that was encoded as part of the situated conceptualisation, can lead to a detailed re-experience of all the factors encoded during the initial eating episode through pattern completion inferences, based on the best available information from previous, similar consumption experiences. This also means that for unfamiliar foods, experiences of eating similar foods in the past may be used to simulate what eating the novel food might be like.

Based on previously encoded situated conceptualisations, elements of the eating episode can be simulated, including the sensory, contextual, and hedonic aspects of consumption. For example, exposure to the word 'Beef Burger' may elicit a simulation of the sensory features, such as the meaty taste, of specific actions, such as grabbing and picking up a burger with one's hands, the contextual features, such as sitting in a beer garden with friends, and the hedonic features, such as the pleasure experienced. As a result, these simulations may lead to expectations of pleasure and enjoyment, creating desire in the present moment and ultimately leading to goal-directed behaviour. Throughout this paper, consumption and reward features refer to these aspects of a consumption situation, specifically, actions and sensory experiences, the context in which the food is consumed, and the immediate positive consequences of consumption.

The GCTD is compatible with other dominant theories that can be applied to the regulation of eating behaviour and adds that value or motivation are often determined through the simulation of relevant outcomes, including long-term and short-term goals (Papies, Barsalou, et al., 2022). As an example, the GCTD explains self-control (Ainslie, 1975; Schelling, 1978; Thaler & Shefrin, 1981) as a result of simulating a desired outcome, such as weight loss, that allows the individual to engage in behaviours that will lead to goal achievement. However, where the desire for immediate gratification outweighs the goal of losing weight, such as simulating the reward experienced when eating a rich chocolate cake, this can lead to a self-control conflict. In that respect, both short-term and long-term goals are represented through the simulation of outcomes. In a similar way, the GCTD is also compatible with theories on value-based choice (Hall & Davis, 2007; Slovic, 1995). Here, the GCTD suggests that simulating each option allows the individual to predict the value of each choice in relation to a specific goal - this may be to experience immediate gratification or the achievement of a long-term goal. Consequently, the option that has the greatest value for the goal in mind is the most likely to be chosen. Lastly, the GCTD is compatible with the Theory of Planned Behaviour (Ajzen, 1991) and proposes that simulating a behaviour can lead to the formation of an intention to perform the behaviour. In addition, however, the GCTD can also explain unplanned behaviours, such as habits and impulses, which occur without conscious deliberation. In this instance, the GCTD would propose that a given context can trigger a mental simulation of performing a behaviour, and when this behaviour is evaluated as rewarding, it is subsequently enacted by the individual, without requiring conscious thought (Papies, Barsalou, et al., 2022).

Recent research has started to examine cognitive representations within the framework of the GCTD. One study by Keesman et al. (2018) examined the cognitive representations of beverages by asking participants to complete a feature listing task where they listed the 'typical' features of various alcoholic and non-alcoholic drinks. The results showed that although both types of drink were largely described in terms of consumption and reward features, the alcoholic drinks that participants consumed regularly were primarily described in terms of social drinking situations. Furthermore, the proportion of social drinking features listed was positively associated with intrusive alcohol thoughts, alcohol cravings, and alcohol choices in a laboratory setting. A similar finding has also been reported in the domain of sugar-sweetened beverages (SSBs), whereby participants listed more consumption and reward features for SSBs than for neutral drinks (i.e., bottled and tap water) when presented with drink words, drink images, or actual drinks (Papies, Claassen, et al., 2022). Furthermore, participants with stronger consumption habits listed a higher proportion of consumption and reward features, implying that consumption behaviour influences the way appetitive stimuli are cognitively represented. In addition, these representations shape behaviour, as listing a higher proportion of consumption and reward features was associated with higher desire for the respective drink, and with higher intake in a laboratory setting. These findings suggest that when participants are asked to list the typical features of various drinks, they automatically simulate consuming the drinks, especially if they consume them more frequently (see also Papies, 2013). However, as these studies merely measured, rather than manipulated the cognitive representations that were active, it was not possible to examine whether cognitive representations have a causal effect on motivation and decision making.

1.3. Cognitive representations and consumption behaviour

A number of studies indirectly suggest that cognitive representations may play a role in eating behaviour. Turnwald and Crum (2019) manipulated the descriptive labels of various savoury dishes in a series of field studies and compared the effect of health-focused and taste-focused labels on the selection and enjoyment of healthy plant-based dishes. The results showed that the taste-focused labels increased the selection of healthy foods by an average of 38% (Studies 1-3). These labels also enhanced the taste experience of healthy foods (Study 4), whereby vegetables were rated as significantly more delicious and indulgent when labelled with taste-focused descriptions. A similar study by Papies, Johannes, et al. (2020), examined the effect of sensory, context, and hedonic features on self-reported eating simulations and the attractiveness of plant-based foods. Overall, the labels with the sensory, context, and hedonic features led to stronger eating simulations and increased the attractiveness of the dishes, compared to control descriptions referring to the ingredients, food categories, and/or food composition. Indeed, the effect of the labels on attractiveness was found to be fully mediated by self-reported eating simulations. Although both these studies provide support for the role of cognitive representations in eating behaviour, as suggested by the grounded cognition theory of desire, the fact that cognitive representations were not assessed directly means it is not possible to determine whether they played a causal role in the effects of labels on behaviour.

Research has also examined the importance of context in making foods appealing to consumers. Several studies by Papies, van Stekelenburg, et al. (2022) examined whether presenting foods in a congruent versus incongruent situation impacts on desire, expected liking, and actual liking during consumption. The results showed that when foods were presented in a congruent situation (e.g., a bowl of soup in a kitchen) participants reported higher levels of desire and expected liking than the same foods presented in an incongruent situation (e.g., a bowl of soup in a cinema). Furthermore, this effect was moderated by self-reported eating simulations, where congruent images increased eating simulations, which in turn increased desire and expected liking. This suggests that presenting foods in a congruent situation is more likely to trigger a re-experience, or simulation, of a previous consumption episode than presenting foods in an incongruent situation. Although the direct effects on actual liking were non-significant, there was a significant indirect effect through eating simulations, where stronger eating simulations were associated with higher reported liking.

There is further evidence from neuroimaging research that suggests cognitive representations play a central role in motivation and behaviour. A review by Chen et al. (2016) found that many areas of the brain that are active during consumption are also active during the presentation of food images, leading to the proposition of a 'core eating

network' that governs both the experience of eating and the cognitive response to food cues. This is supported by Simmons et al. (2005) who found that viewing pictures of food led to the activation of brain areas associated with taste and reward, suggesting that exposure to a single food cue leads to the activation of features that were present during the initial eating episode. Consequently, individuals are able to predict the reward value of different foods and drinks in the present moment, leading to an increase in desire for those that would result in the greatest experience of reward. This is attested by the finding that sensory and reward areas show different levels of activation depending on level of hunger and the calorie content of the food (Siep et al., 2009).

In contrast to consumption and reward features, research has shown that health features are far less prominent in the cognitive representation of various foods and beverages and may actually lead to a decrease in desire. One study by Papies (2013) found that the percentage of health-related features listed for unhealthy tempting foods, as well as healthy neutral foods, was as low as 8% and 7% respectively. A similar finding was reported by Papies, Claassen, et al. (2022) who found that across three studies, health features accounted for just 1–9% of the features listed for sugar-sweetened beverages and as little as 5–9% of the features listed for water. The fact that water is not represented in terms of health features seems particularly surprising, given the numerous physical and mental health benefits that are associated with drinking water on a regular basis. However, assuming that motivation and decision making are driven by mentally simulating a previous consumption experience, this finding is in line with the grounded cognition account as the health benefits are experienced some time after the consumption episode, meaning they are not part of the consumption and reward simulations initially triggered when one thinks about water. Furthermore, evidence suggests that describing foods in terms of the health features actually reduces the selection and consumption of healthy food products. Turnwald and Crum (2019) found that health-focused labels actually led to a 45.1% decrease in the sales of a healthy entrée over a two month period. This reduction in desire may be due to the simulation of a non-rewarding consumption experience as healthy foods are often perceived to be less tasty than unhealthy foods.

1.4. The present research

The research discussed above provides initial evidence that foods and drinks are heavily represented in terms of previous consumption experiences and that these representations predict motivation and behaviour. However, no studies so far have directly manipulated and measured participants' cognitive representations of foods and their role in eating motivation and behaviour. Therefore, in the present paper, we examine the role of cognitive representations of various foods, and we aim to assess whether they play a causal role in eating motivation and can also predict eating behaviour. Cognitive representations are accessed and measured through the completion of a feature listing task, also known as a "property generation task". This usually involves asking participants to list the "typical" features of an object and leads to a detailed mental simulation of previous experiences with that object (Wu & Barsalou, 2009). However, this task can easily be adapted to encourage a more specific focus, in this case, the sensory, context, hedonic, and heath features of various savoury dishes. We focus on this manipulation specifically as the research discussed above implies that focusing on certain representations has implications for the way a food is viewed, influencing eating motivation and behaviour.

We tested whether focusing participants on these particular aspects of savoury dishes influenced desire, intentions, and associations with consumption behaviour. We decided to focus on savoury dishes rather than sweet dishes as these generally have a far greater environmental impact, particularly those that are meat-based. Consequently, we believe that understanding the motivation to consume savoury dishes is more important, as it may ultimately help in reducing the greenhouse gas emissions associated with the consumption of meat-based foods. In Experiment 1, participants were asked to list the "typical" features of 20 savoury dishes, or to list specifically the sensory, context, hedonic, or health-related features. They then reported their desire to consume each dish in the present moment. We expected that participants listing features from the consumption and reward subcategories (i.e., sensory, context, or hedonic) would report higher levels of desire for each dish, while those listing the health features would report lower levels of desire, compared to the "typical" control condition. In Experiment 2, participants were asked to list either the typical, sensory, context, or health features of the same savoury dishes before rating their intention to consume each dish over the next four weeks. At a four-week follow-up, participants were asked to rate their actual consumption of each dish since completing the first part of the experiment. Here we expected that participants listing the sensory and context features would report greater intentions to consume each dish than participants listing the typical or health features. We also expected that the proportion of consumption and reward features listed would predict actual consumption behaviour. Furthermore, as individuals high in health consciousness are more likely to engage in healthy eating practices, we measured this construct in both experiments to control for any confounding effect on motivation and behaviour.

2. Experiment 1

2.1. Experiment 1 overview

In this experiment, participants were asked to list either the typical, sensory, context, hedonic, or health features of 20 savoury dishes that are regularly consumed in the UK. Following this, each participant rated their present level of desire for each dish, the healthiness of each dish, and the frequency with which they consume each dish, on a 100-point visual analogue scale. We predicted that participants in the sensory, context, and hedonic conditions would report higher levels of desire than participants in the control condition (Hyp. 1), while participants in the health condition would report lower levels of desire than participants in the control condition (Hyp. 2). Our final prediction was that the effect of the sensory, context, and hedonic conditions on desire would be mediated by the proportion of consumption and reward features listed (i.e., the sensory, context, and positive hedonic features combined) (Hyp. 3).

2.2. Method

The study was pre-registered on the Open Science Framework (OSF) where all the study materials have also been uploaded (https://osf.io/jznea). Ethical approval was granted by the Ethics Committee of the College of Science and Engineering at the University of Glasgow.

2.2.1. Participants

As our study employed mixed-effects models, the sample size required relies on running a data simulation (DeBruine & Barr, 2021). This indicated that 1000 participants would be required to detect a small effect of condition on desire and achieve a 0.8 level of power with alpha at 0.05. To account for potential dropouts and exclusions, the required sample size was increased by 10%, resulting in a target sample size of 1100 participants (for further details see the supplementary online materials). The inclusion criteria stated that participants must be aged between 18 and 70 years, currently live in the UK, have a proficient understanding of the English language, have no food allergies or specific dietary needs (i.e., do not identify as pescatarian, vegetarian or vegan), and have no diagnosed eating disorders or a history of eating disorders. Participant exclusions followed the pre-registered plan except for participants who failed both attention checks or completed the study on a mobile phone or tablet. The submissions from these participants were rejected and further participants were recruited until the target sample size had been reached.

Overall, a total of 1104 participants were recruited through the online platform Prolific, with 104 participants excluded for the following reasons: 48 reported having specific dietary needs; 25 reported having an eating disorder or a history of eating disorders; 12 gave the same or a similar response on either the desire ratings, the health ratings, or the frequency ratings; 11 reported being unfamiliar with more than half of the dishes presented; 5 completed the experiment three times faster than the average participant; and 3 reported technical difficulties. This left a final sample size of 1000 participants which included 507 males, 486 females, and 7 participants who identified differently. The sample had a mean age of 37.6 years ($SD = 13.5$) and a mean BMI of 26.0 ($SD = 5.6$). The experiment took approximately 20 min to complete and participants were paid £2.50 for taking part.

2.2.2. Design

The experiment was completed online and employed a between-subjects design with five conditions: typical (control), sensory, context, hedonic, and health. The main dependent variable was the level of desire reported for each dish. The proportion of consumption and reward features listed in each condition was examined as a potential mediating variable.

2.2.3. Manipulation

During the feature listing task, participants were asked to list three to five words or phrases for each dish. Specifically, participants in the sensory condition were asked to describe the taste, texture, and temperature of each savoury dish. Participants in the context condition were asked to describe the situations in which they consume each savoury dish, including when, where, and with whom. Participants in the hedonic condition were asked to describe the pleasure or displeasure experienced when eating each savoury dish, including both physical and mental effects. Participants in the health condition were asked to describe the positive or negative health outcomes of each savoury dish. Lastly, participants in the control condition were simply asked to describe the words or phrases that describe each savoury dish (see the supplementary materials for the full task instructions for each condition). Participants were told to focus on their own experience of each dish throughout the task and that the responses given should reflect whatever naturally comes to mind. The instructions also stated that it was fine for participants to repeat themselves by using the same words or phrases across dishes.

2.2.4. Procedure and measures

The experiment was setup in Qualtrics software (www.qualtrics.com) and eligible participants were recruited through the online recruitment platform Prolific (www.prolific.co). Participants completed the experiment between the hours of 1pm and 9pm on one of two consecutive weekdays. Participants were instructed to complete the experiment on either a desktop pc or laptop and to refrain from consuming any food or drink while taking part. All participants were briefed on the procedure and provided informed consent before starting the experiment.

Participants were initially asked to state their age, gender, highest level of education attained, and their present level of hunger. Following this, participants were randomly allocated to one of the five feature listing conditions described above, where the names of 20 savoury dishes were presented one at a time in a random order. Five empty text boxes were shown below the name of each dish and participants were asked to list a minimum of three words and/or phrases.

On completion of the feature listing task, participants were asked to rate their present level of desire for each dish ("How much would you like to eat a beef burger right now?"), followed by the healthiness of each dish ("How healthy would you rate a beef burger from 'Extremely unhealthy' to 'Extremely healthy'?"), and finally, the frequency with which they consume each dish ("Typically, how often do you consume a beef burger?"). During each rating task, the names of the dishes were displayed individually with the order of presentation randomised. Participants rated each dish on a sliding scale from 0 to 100 with the labels 'Not at all'/'Extremely unhealthy'/'Never', and 'Very much'/'Extremely healthy'/'Very frequently'.

Participants were then asked to indicate if they were familiar with all 20 dishes by selecting one of the following response options: "I have eaten each dish on at least one previous occasion" or "There was at least one dish I have not eaten previously". Participants selecting the second option were then shown a list of all 20 dishes and asked to select all the dishes they had not consumed previously. After this, dietary information was collected by asking participants to indicate (1) if they have any specific dietary needs (e.g., follow a vegetarian diet), (2) on how many days they eat meat during a typical week, and (3) how many of their meals contain meat during a typical day. Participants were also asked if they had ever been diagnosed with an eating disorder by selecting either "Yes" or "No".

Finally, we measured health-conscious identity by asking participants to indicate agreement with the statements "I think of myself as someone who generally thinks carefully about the quality of the foods I consume", "I think of myself as someone who generally thinks carefully about the health consequences of my food choices", and "I think of myself as someone who generally thinks carefully about the long-term effects of my food choices" (7-point Likert scale from 'Strongly disagree' to 'Strongly agree'). Participants were then asked to self-report their height and weight which were later used to compute body mass index (BMI), as well as provide details of any technical difficulties experienced while taking part. Meta-data was also collected which provided information on the device type used. Participants were then debriefed, thanked, and redirect to Prolific for payment.

2.2.5. Dish selection

Twenty savoury dishes were selected from a database containing various food norms, including desirability ratings, for a large variety of foods that are regularly consumed in the UK (e.g., beef burger, chicken curry, pepperoni pizza, spaghetti bolognese, and steak pie) (Werner et al., 2022). Although it would have been preferable to select all 20 foods based on desire ratings alone, a large proportion of the most desirable foods were highly processed and therefore similar in terms of sensory, context, and hedonic features. As a result, we decided that selecting a variety of healthy and unhealthy foods would provide a greater range of features for the experiment (see the supplementary materials for a full list of the dishes presented).

2.2.6. Feature coding

The features listed by participants were coded using the feature listing manual developed by Papies, Tatar, et al. (2020), which distinguishes between three overarching categories of features. **'Consumption situation'** features include those that refer to the sensory experience (e.g., "meaty", "chewy") or an action (e.g., "biting", "messy"), the context of consumption (e.g., "at the pub", "with friends"), the immediate positive consequences (e.g., "tasty", "comforting"), or the immediate negative consequences (e.g., "awful", "disappointing"). **'Non-consumption situation'** features include those that refer to the production (e.g., "cow", "processed"), the packaging (e.g., "tinned", "wrapped"), the purchase and accessibility (e.g., "takeaway", "cheap"), the preparation and storage (e.g., "oven", "frozen"), or the cultural embeddedness (e.g., "British", "traditional"). **'Situation independent'** features include those that refer to the ingredients and content (e.g., "pasta", "protein"), the visual aspects of the product (e.g., "large", "round"), the long-term positive health consequences (e.g., "healthy", "weight loss"), the long-term negative health consequences (e.g., "unhealthy", "heart disease"), overall positive evaluations (e.g., "favourite", "love"), overall negative evaluations (e.g., "unimaginative", "hate"), category information (e.g., "fast food", "McDonald's"), or linguistic information (e.g., "bangers and mash", "Delia Smith"). Features that could be coded in more than one overarching category were coded as

"ambiguous".

Features that referred to any one of the five senses were coded as sensory features during the data coding procedure. However, the sensory feature category was subsequently recoded to include only those features that referred to the taste, texture, and temperature of each dish (further information on the coding process can be found in the supplementary materials). Once all the features had been coded, the proportion of sensory, context, hedonic, and health features listed was calculated by dividing the number of category features listed (i.e., sensory features) by the total number of features listed. The proportion of sensory, context, and positive hedonic features listed were summed to calculate the proportion of consumption and reward features listed.

The first author coded all the features listed by participants while the second author coded random subsamples of 50 features from each dish. Cohen's kappa across all 20 dishes ranged from 0.48 to 0.0.87 and had a mean of 0.7. As certain features could plausibly be coded in more than one category, this level of agreement was deemed acceptable by both authors.

2.2.7. Data analysis plan

Analyses were conducted using R, version 4.0.0 (RStudio Team, 2021) and followed the pre-registered plan, apart from the analysis of Hypothesis 1, which was examined as three separate mixed effects models. This was done as the full model was more likely to converge with just two conditions included (e.g., sensory and control) rather than all conditions. All analyses involved running mixed effects models with a maximal effects structure (Barr et al., 2013). Where each experimental condition was compared with the control condition, these were coded as 1 and 0 respectively. If the full model failed to converge, the following three steps were taken in the order listed below: the model was run with various optimizers, the number of iterations was increased, and the independent variable was sum coded. If none of these steps proved successful, one of the random effects was removed from the model and the process was repeated. These steps were based on recommendations by Brown (2021) and Barr et al. (2013).

The mediating effect of consumption and reward features was tested using the mediate package (Tingley et al., 2014) and involved running two statistical models. The first examined the effect of condition on the proportion of consumption and reward features listed, whereas the second controlled for the proportion of consumption and reward features listed, while examining the effect of condition on desire. For each model, only the by-participant random effects were included due to limitations of the software. The number of simulations was set at 10,000 for all mediation analyses. According to Ananth (2019), the statistic for the proportion mediated is considered unreliable when the direct and indirect effects are in opposite directions. As this was the case for all analyses, this statistic is not reported.

For consistency and ease of interpretation, the unstandardized coefficients are reported for all analyses. As a total of ten confirmatory analyses were conducted, the Bonferroni correction was applied to account for the familywise error rate, meaning that effects were only considered significant at alpha = 0.005 (0.05/10).

2.3. Results

The mean number of features listed across all 20 dishes was 3.55 (*SD* = 1.05). The variation in the mental representations of participants is shown by the number of unique features listed for each dish which ranged from 1237 to 1479 (mean number of unique features per dish: 1395).

2.3.1. Manipulation check

A manipulation check showed that the feature listing instructions were successful (see the supplementary materials for further information). The proportion of category features listed in each condition is shown in Fig. 1.

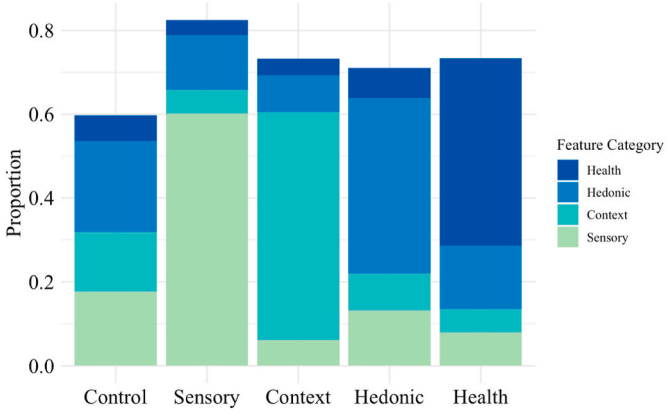

Fig. 1. The proportion of category features listed in each condition.

To give an impression of the words listed, the most frequently listed words for a beef burger by participants in the control, sensory, context, hedonic and health conditions are shown in the five word clouds in Fig. 2. Only words that were listed at least three times are included in the word clouds, and the frequency with which each word was listed is associated with its displayed size. These figures show that in each condition there were several features frequently reported by participants. Any idiosyncratic features listed likely reflect the more personal experiences of each participant when consuming a beef burger.

2.3.2. The effect of condition on desire (Hyp. 1 & 2)

We predicted that participants in the sensory, context, and hedonic conditions would report higher levels of desire than participants in the control condition (Hyp. 1), and that participants in the health condition would report lower levels of desire than participants in the control condition (Hyp. 2). However, none of the conditions showed a main effect on desire ratings: sensory versus control, $b = 1.87$, $SE = 1.59$, $p = 0.12$; context versus control, $b = 2.65$, $SE = 1.66$, $p = 0.06$; hedonic versus control, $b = 0.99$, $SE = 1.66$, $p = 0.28$; and health versus control, $b = -0.93$, $SE = 0.99$, $p = 0.17$. This shows that focusing on specific aspects of a dish has no direct effect on desire to consume the dish in the present moment. The desire ratings (Hyp. 1 and 2) are shown visually in Fig. 3.

Each raincloud plot includes a boxplot to the left, which is overlaid with the raw data points, and a 'cloud' to the right which is a half-density plot. Each plot shows the desire ratings given for each of the 20 dishes.

2.3.3. The mediating effect of consumption and reward features (Hyp. 3)

Our third prediction was that the effect of the sensory, context, and hedonic conditions on desire ratings would be mediated by the proportion of consumption and reward features listed (i.e., the sensory, context, and positive hedonic features combined). In line with this prediction, results showed an indirect effect of the three experimental conditions on desire ratings through consumption and reward features (see Table 1). In other words, focusing on sensory, context, or hedonic features indirectly increased desire through increased consumption and reward features being listed.

As shown in Table 1, the sensory, context and hedonic conditions all showed full mediation effects. In other words, participants in these conditions who listed a higher proportion of consumption and reward features, reported higher levels of desire. However, we should note that the indirect effect for the hedonic condition was not significant when applying the Bonferroni correction.

Interestingly, the sensory condition showed a significant negative direct effect on desire ratings. This may be due to some of the features referring to undesirable sensory experiences, such as 'dry' and 'tough'. This may have triggered a simulation of an unrewarding consumption

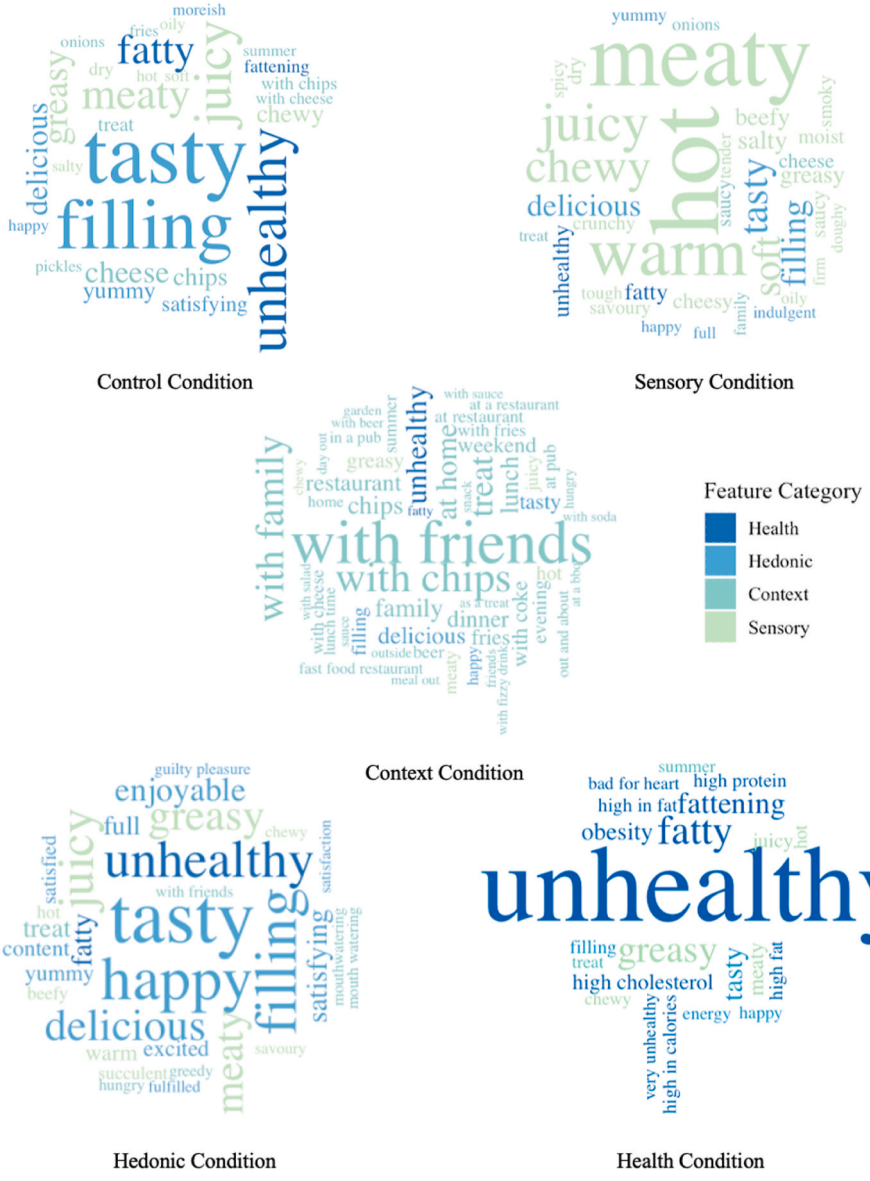

Fig. 2. A Word Cloud showing Features Listed for the dish "Beef Burger" in Each Condition.

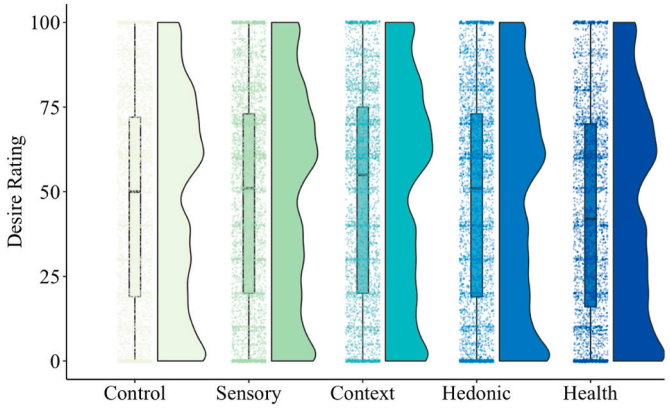

Fig. 3. The effect of condition on desire ratings.

experience, ultimately leading to a decrease in desire. However, as the indirect effect was significant and positive, this suggests that consumption and reward features acted as a suppressor variable, reversing the effect of condition on desire ratings.

Exploratory analyses showed that the indirect effects of condition on desire remained virtually unchanged when controlling for consumption frequency. Exploratory analyses further showed a significant indirect negative effect of the health condition on desire through consumption and reward features (see OSF for details).

2.4. Discussion

The results of Experiment 1 showed that, in contrast to our expectations, there was no main effect of condition on desire ratings. However, we found the predicted indirect effect whereby the proportion of consumption and reward features listed fully mediated the effect of the sensory, context, and hedonic instructions on desire ratings. This finding implies that consumption and reward features play a key role in the experience of desire, as participants in the sensory, context, and hedonic conditions listed a higher proportion of consumption and reward features than participants in the control condition. Therefore, it is likely

Table 1
The indirect effects of condition on desire ratings through consumption and reward features.

Sensory vs Control				
	Estimate	95% Confidence Intervals		p value
		Lower	Upper	
Total effect	1.87	−1.47	5.22	0.277
Direct effect	−5.09	−8.38	−1.84	0.002
Indirect effect	6.96	5.86	8.15	<0.001
Context vs Control				
	Estimate	95% Confidence Intervals		p value
		Lower	Upper	
Total effect	2.70	−0.75	6.19	0.120
Direct effect	−1.78	−5.13	1.55	0.290
Indirect effect	4.48	3.51	5.51	<0.001
Hedonic vs Control				
	Estimate	95% Confidence Intervals		p value
		Lower	Upper	
Total effect	0.89	−2.52	4.39	0.620
Direct effect	−0.61	−3.84	2.65	0.713
Indirect effect	1.51	0.26	2.70	0.019

that focusing on consumption and reward features triggers a mental simulation of a previous consumption experience, which in turn increases desire.

As all three experimental conditions show a significant indirect effect of consumption and reward features, this suggests that focusing on one specific aspect of the consumption situation (e.g., only sensory features), can trigger a comprehensive mental simulation of consuming the food, which then brings to mind features from other aspects of the situation (e.g., context and hedonic features). In other words, there seems to be a "spillover" from focusing on one aspect of the eating experience to other kinds of aspects. Interestingly, the hedonic condition showed a weaker indirect effect than both the sensory and context conditions, which may have been due to the hedonic condition listing a slightly lower proportion of consumption and reward features than the sensory and context conditions (shown in Fig. 1). Alternatively, it may be the case that the sensory and context features lead to higher levels of desire because they trigger a more comprehensive re-experience of the rewarding consumption episode, while the hedonic features may describe the immediate consequences in a more superficial way.

In Experiment 2, we aimed to build on these findings by examining whether consumption and reward features also mediate the effect of condition on intentions to eat a food, given that intentions may predict and even affect actual eating behaviour. Hence, we also tested whether consumption and reward features predicted actual consumption behaviour over a four week period, through eating intentions. Although Experiment 2 was largely a replication and extension of Experiment 1, we decided to simplify it by removing the hedonic condition, given that it may lead to participants simply listing hedonic words without triggering a deeper simulation of the consumption experience.

3. Experiment 2

3.1. Experiment 2 overview

Participants were asked to list either the sensory, context, health, or typical features for the same 20 dishes as in Experiment 1. Following this, participants rated their intention to consume each dish over the following four weeks, as well as their past frequency of consumption. Four weeks later, we contacted participants again and asked them how often they had consumed each dish since completing the initial questionnaire, as well as how often they had been in a situation in which each dish could have been consumed ("dish accessibility"). Based on the findings of Experiment 1, we predicted that participants who listed a higher proportion of consumption and reward features would report greater intentions to consume each of the specified dishes (Hyp. 1). Again, based on Experiment 1, we predicted that the effect of the sensory and context conditions on intentions to consume the specified dishes would be mediated by the proportion of consumption and reward features listed (Hyp. 2). Similarly, we predicted that the effect of the health condition on intentions to consume each of the specified dishes would be mediated by the proportion of consumption and reward features listed, when controlling for health conscious identity (Hyp. 3). Finally, we predicted that the association between consumption and reward features and consumption behaviour would be mediated by intentions (Hyp. 4), and that the association between intentions and consumption behaviour would be moderated by accessibility (Hyp. 5). As accessibility refers to the extent to which foods are obtainable, we expect this construct to play a key role in the food choices made on a daily basis. Therefore, in order for consumption and reward features to be associated with intentions and behaviour, the participants must have access to the savoury dishes that are examined.

3.2. Method

The study was pre-registered on the Open Science Framework (OSF) where all the study materials have also been uploaded (https://osf.io/z3bs7). Ethical approval was granted by the Ethics Committee of the College of Science and Engineering at the University of Glasgow.

3.2.1. Participants

A power analysis through data simulation established that a sample size of 800 participants was required to detect a mediating effect of consumption and reward features. An extra 80 participants (10%) were recruited to account for exclusions and an extra 20 participants were recruited to account for attrition at the follow-up, resulting in a target sample size of 900 participants (for further details see the supplementary online materials). The inclusion criteria stated that participants must be aged between 18 and 70 years, classed as a British national, currently live in the UK, have a proficient understanding of the English language, have no food allergies or specific dietary needs (i.e., do not identify as pescatarian, vegetarian or vegan), and have no diagnosed eating disorders or a history of eating disorders. Participant exclusions were based on the pre-registered plan, except for participants who failed both attention checks or completed the study on a mobile phone or tablet. These participants were rejected and further participants were recruited.

A total of 897 participants were recruited through the online platform Prolific, with 37 participants excluded for the following reasons: 26 reported having an eating disorder or a history of eating disorders, 10 gave the same or a similar response on either the intention ratings or the frequency ratings, and 1 completed the experiment three times faster than the average participant. This left a final sample size of 860 participants which included 437 males, 418 females, and 5 participants who identified differently. The sample had a mean age of 40.4 years (SD = 13.2) and a mean BMI of 26.7 (SD = 6.7). A total of 720 participants who completed the first part of the experiment also completed the second part of the experiment. The follow-up sample had a mean age of 41.6 years (SD = 13.2) and a mean BMI of 27.0 (SD = 6.9). The first part of the experiment took approximately 20 min to complete while the second part took around 4 min to complete. Participants were paid £1.80 and £1 on completion of the first and second parts of the experiment respectively.

3.2.2. Design

The experiment was completed online and employed a between-subjects design with the following four conditions: sensory, context, health, and control. The main dependent variables were intentions and

consumption behaviour, while consumption and reward features were a potential mediating variable and accessibility a potential moderating variable.

3.2.3. Procedure and measures

The experiment was setup in Qualtrics and the online recruitment platform Prolific was used to recruit eligible participants. Data collection was completed over two consecutive weekdays between the hours of 1pm and 9pm. Participants were asked to refrain from consuming any food or drink while taking part and to complete the experiment on either a desktop pc or laptop. All participants were briefed on the procedure and provided informed consent before starting the first part of the experiment.

Participants answered demographic questions (age, gender, highest level of education attained), and indicated their present level of hunger. Following this, participants were randomly allocated to one of the four feature listing conditions and completed the same task as in Experiment 1 for the same 20 dishes. Next, participants were asked to rate their intention to consume each dish over the next month (e.g., "Over the next month, how often do you intend to eat a beef burger"), as well as past frequency of consumption (e.g., "Typically, how often do you eat a beef burger"). Both intentions and frequency were rated on a sliding scale from 0 to 100 with the labels 'Never' and 'Very often'. The name of each dish was displayed individually and the order of presentation was automatically randomised.

Participants then completed the same measures of dish familiarity, dieting information, meat consumption, past or present eating disorders, health-conscious identity, and self-reported height and weight as in Experiment 1. Lastly, participants provided details of any technical difficulties experienced, while meta-data was also collected to provide information on the device used by participants. Participants were then debriefed as to the purpose of this part of the study, thanked for taking part, and redirected to Prolific for payment.

Four weeks after completing the first part of the experiment, all participants were sent an email with an invitation to participate in the follow-up study. After providing informed consent, participants were asked to rate their how often they had consumed each dish since completing the first part of the experiment (consumption behaviour), before rating how often they had been in a situation where they could have consumed each dish (accessibility); both on a sliding scale from 0 to 100 from "Never" to "Very often", again in a random order. Participants were then asked to indicate if they had changed their diet over the last four weeks and to select which option best describes their new diet ("Omnivore", "Meat or dairy reducer", "Pescatarian", "Vegetarian", "Vegan", or "Other"). Then, participants were debriefed as to the overall purpose of the experiment, thanked for taking part, and redirected to Prolific for payment.

3.2.4. Feature coding

Coding and inter-rater reliability checks followed the same procedure as in Experiment 1. Cohen's kappa had a mean of 0.61 across all 20 dishes and ranged from 0.43 to 0.83.

3.2.5. Data analysis plan

The data analysis followed the pre-registered plan. As a total of ten confirmatory analyses were conducted, the Bonferroni correction was applied, meaning effects were only considered significant at alpha = 0.005 (0.05/10). The same analysis procedure used for Experiment 1 was employed for all analyses. All analyses were conducted using R, version 4.0.0 (RStudio Team, 2021).

3.3. Results

Across all 20 dishes, the mean number of features listed was 3.67 (*SD* = 1.23). The number of unique features listed for each dish ranged from 1193 to 1410 (mean number of unique features per dish: 1310), showing the large variation in the mental representations of the dishes held by participants.

3.3.1. Manipulation check

A manipulation check showed that the feature listing instructions were successful (further information can be found in the supplementary materials). Fig. 4 shows the proportion of category features listed in each condition.

To provide an example again, the most frequently listed words for a pepperoni pizza by participants in the control, sensory, context, and health conditions can be seen in the four word clouds below (Fig. 5). The frequency with which each word was listed is associated with its displayed size and only words that were listed at least three times are included in the word clouds.

3.3.2. The association between consumption and reward features and intentions (Hyp. 1)

In line with our first hypothesis, the results showed that participants who listed a higher proportion of consumption and reward features (i.e., the sensory, context, and positive hedonic features combined) gave significantly higher ratings of intentions to eat each dish, $b = 11.19$, $SE = 1.58$, $p < 0.001$. Thus, listing more consumption and reward features is associated with higher consumption intentions.

3.3.3. The mediating effect of consumption and reward features (Hyp. 2 & 3)

We predicted that the effect of the sensory and context conditions on intention ratings would be mediated by the proportion of consumption and reward features listed (i.e., the sensory, context, and positive hedonic features combined) (Hyp. 2), and that the same would be true for the health condition, when controlling for health-conscious identity (Hyp. 3). The results showed an indirect effect of both the sensory and context conditions on intention ratings through consumption and reward features (see Table 2). In other words, focusing on the sensory or context features of a dish indirectly increased intentions to eat it in the future through increased salience of consumption and reward experiences. This implies that attending to the features present when consuming a food, leads to a mental simulation of a previous consumption episode, which is associated with consumption intentions.

Additionally, the health condition showed a full mediation effect of consumption and reward features, where participants in the health condition reported a significantly lower proportion of consumption and reward features (see Fig. 4) and significantly lower intention ratings than the control condition. As the health consequences are experienced some time after the consumption episode, listing health features would not be expected to trigger a mental simulation of the rewarding aspects of consumption, leading to a reduction in intentions. As this analysis controlled for the effect of health conscious identity on intention ratings,

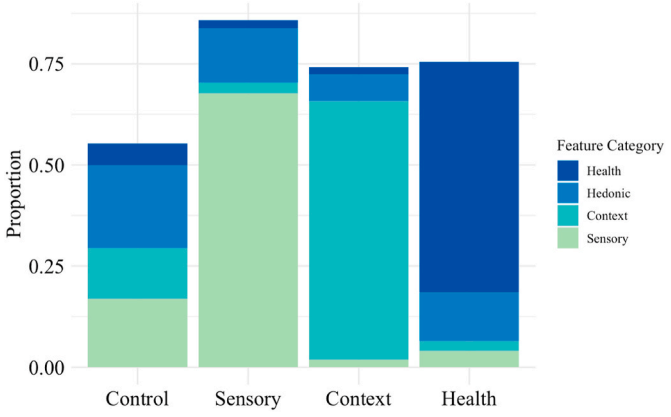

Fig. 4. The proportion of category features listed in each condition.

Fig. 5. The Words Listed for the dish "Pepperoni Pizza" in Each Condition.

Table 2
The indirect effects of condition on intention ratings through consumption and reward features.

Sensory vs Control				
	Estimate	95% Confidence Intervals		p value
		Lower	Upper	
Total effect	0.24	−3.02	3.43	0.870
Direct effect	−5.98	−9.28	−2.68	<0.001
Indirect effect	6.23	5.21	7.31	<0.001
Context vs Control				
	Estimate	95% Confidence Intervals		p value
		Lower	Upper	
Total effect	0.45	−2.82	3.67	0.781
Direct effect	−3.55	−6.90	−0.29	0.031
Indirect effect	4.00	3.26	4.80	<0.001
Health vs Control[a]				
	Estimate	95% Confidence Intervals		p value
		Lower	Upper	
Total effect	−1.81	−4.90	1.33	0.251
Direct effect	2.80	−0.38	6.03	0.085
Indirect effect	−4.60	−5.60	−3.67	<0.001

[a] The effects reported include controlling for health-conscious identity.

the role of this construct was explored in more detail. However, further analyses showed there was no direct effect of health conscious identity on intention ratings and removing this construct from the analysis had no effect on the results.

3.3.4. *The mediating effect of intentions (Hyp. 4)*

Our fourth prediction was that the association between consumption and reward features (i.e., the sensory, context, and positive hedonic features combined) and consumption behaviour would be mediated by intentions. As this analysis involved a particularly large dataset, the number of simulations had to be reduced to 1000 in order for the analysis to run to completion. Overall, the results showed a positive indirect effect where consumption and reward features were associated with higher levels of consumption through an increase in intentions (see Table 3). This suggests that mentally simulating a previous consumption

Table 3
The indirect effects of consumption and reward features on consumption behaviour through consumption and reward features.

	Estimate	95% Confidence Intervals		p value
		Lower	Upper	
Total effect	3.24	1.61	4.77	<0.001
Direct effect	−3.15	−4.48	−1.89	<0.001
Indirect effect	6.39	5.51	7.32	<0.001

experience is associated with increased intentions to consume the food, which is associated with consumption behaviour.

3.3.5. The moderating effect of accessibility (Hyp. 5)

Our final prediction was that the association between intentions and consumption behaviour would be moderated by accessibility. In line with our expectations, there was a significant moderating effect of accessibility, with further analyses showing that the effect of intentions on consumption behaviour became stronger as accessibility increased (see Fig. 6). A simple slopes analysis showed that when accessibility was low, there was only a weak association between intentions and consumption behaviour (mean −1 SD), $b = 0.04$, $SE = 0.01$, $p < 0.001$, compared to when accessibility was moderate (mean), $b = 0.23$, $SE = 0.01$, $p < 0.001$, or when accessibility was high (mean + 1 SD), $b = 0.41$, $SE = 0.01$, $p < 0.001$. This shows that strong intentions to consume a dish are less likely to translate into behaviour when accessibility of the dish is low, compared to when it is high.

3.4. Discussion

The results of Experiment 2 showed that participants who listed a higher proportion of consumption and reward features also reported higher intentions to consume the dishes over the next 4 weeks. We also found that the mediating effect of consumption and reward features extended to intention ratings, even though the strength of the effect was slightly reduced when compared with desire ratings as in Experiment 1. Furthermore, consumption and reward features were associated with consumption behaviour, mediated by intentions. Overall, the findings from Experiment 2 build on those from Experiment 1 by suggesting that consumption and reward features also play a key role in intentions, which in turn predict behaviour. This suggests that focusing on consumption and reward features activates a mental simulation of a previous consumption episode, which can increase the intention to consume the dish and actual consumption behaviour.

4. General discussion

4.1. Summary

We conducted two experiments to examine whether the way a food is cognitively represented can influence motivation to consume it and predict consumption behaviour. Overall, we found that participants who focused on the sensory, context, and hedonic features of various savoury dishes, reported a higher proportion of consumption and reward features, which mediated the effect of condition on both desire and intentions to eat the presented foods. This implies that focusing on these features triggered a mental simulation of consuming a dish, which brought to mind a variety of prominent features that are present during consumption, which are associated with an increased motivation to eat them. Mentally simulating a previous consumption experience may have allowed participants to predict the reward gained from consuming each dish, increasing present moment desire and intention to consume it.

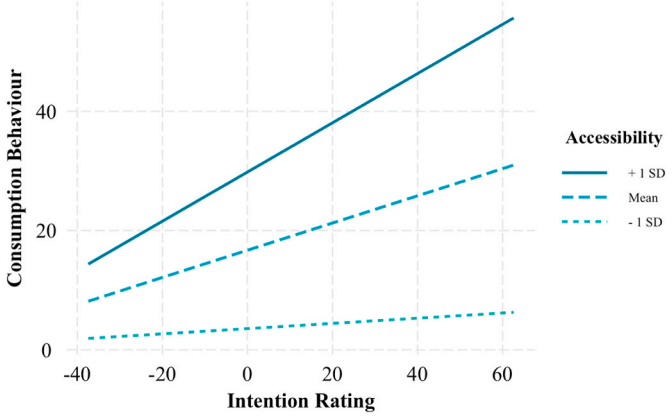

Fig. 6. The moderating effect of accessibility on consumption behaviour.

The proportion of consumption and reward features listed was also found to predict consumption behaviour. As hypothesised, participants who represented a dish more in terms of consuming and enjoying it reported higher intentions to consume it, which in turn was associated with higher consumption at the four-week follow-up. This is in line with previous research showing that processing food in terms of consumption and reward features increased preferences for tasty foods a day later (Dutriaux et al., 2021). Finally, an expected but important finding was the moderating effect of accessibility when examining the effect of intentions on consumption behaviour. In other words, intentions were more strongly associated with behaviour when participants had opportunities to consume the specified foods. This shows the importance of accounting for accessibility when conducting research on eating behaviour or implementing interventions that aim to change dietary habits, drawing attention to the wider food environment.

4.2. Theoretical implications and future research

The results of these experiments have implications for our understanding of the role of cognitive representations in desire and intentions to consume food. The results provide empirical evidence for the grounded cognition theory of desire by suggesting that cognitive representations play a causal role in the motivation to eat certain foods. To go beyond previous work that had merely measured the degree to which participants spontaneously use consumption and reward categories when describing foods and drinks (Papies, 2013; Keesman et al., 2018; Papies, Claassen, et al., 2022), here, we manipulated the degree to which participants used these categories by focusing them on certain aspects of consumption experiences through our feature listing instructions. In other words, we attempted to manipulate how participants temporarily represented the food items, in order to assess how this would affect their motivation to consume them. Although these instructions did not have a main effect on desire, they indirectly increased desire through increases in the use of consumption and reward features. Because of the correlational nature of the association between consumption and reward features and desire, we cannot conclude with any certainty from these findings that cognitive representations play a causal role in desire and intentions. However, we suggest this is plausible, especially given that it aligns with our theoretically grounded predictions on directionality, that the indirect effects remained significant when controlling for consumption frequency, that the mediator and outcome variable are highly distinct and that our experiments were well powered for theses mediation analyses (see Pieters, 2017). However, future research could examine this further, for example by using a stronger manipulation of cognitive representations. In addition, converging evidence from research using other methods to temporarily change representations aligns with the findings presented here (e.g., Dutriaux et al., 2021; Papies, Johannes, et al., 2020; Turnwald & Crum, 2019).

Contrary to our expectations, there was no direct effect of condition on desire in Experiment 1, which seems surprising given that participants in the sensory, context, and hedonic conditions listed a higher proportion of consumption and reward features than participants in the control condition. One possible explanation for this is that the desire ratings were not measured until after the feature listing task had been completed for all 20 dishes. Therefore, a direct effect may have been found if participants completed both the feature listing task and desire ratings for one dish before moving onto the next. Alternatively, it may be the case that the sample size recruited was too small or the measure employed for desire was not sensitive enough to detect an effect. This may occur when the direct effect is weaker than the indirect, meaning that a higher level of power is required to reveal an effect of the independent variable on the dependent variable. Despite this,

recommendations for mediation analyses argue that significant indirect effects in the absence of significant direct effects can still be meaningful and important (Rucker et al., 2011).

Further support for multimodal situated conceptualisations of eating experiences, as posited by the grounded cognition approach, is provided by the fact that participants allocated to one of the experimental conditions often listed features from other categories. For example, although participants in the sensory condition primarily listed sensory features (e.g., "meaty", "soft"), they also listed a number of context features (e.g., "ketchup", "pub") and hedonic features (e.g., "tasty", "delicious") for each dish. The most parsimonious explanation for this is that participants mentally simulated a previous consumption episode and reported the most prominent features that came to mind, even if they were from other modalities than the one they were instructed to list. This is also supported by the control condition, where participants reported approximately equal proportions of sensory, context, and hedonic features, suggesting that all three of these are important aspects of consumption episodes. However, future research could examine this by asking participants to think about specific aspects of various foods (e.g., sensory, context, hedonic, health, etc.) and then asking them to report to what extent they simulated consuming the dish. It is interesting to note that all four experimental conditions also reported features that referred to different aspects of the dish, such as the production, preparation, and ingredients. Whether or not these features are listed is likely dependent on the individual's personal experience with the dish. For example, someone who has made the dish themselves will likely know more about the ingredients and preparation than someone who has not.

The findings are also consistent with the results of neuroimaging research (Chen et al., 2016) which found that the same areas of the brain are activated when thinking about food and when actually consuming food. This is also in line with work showing that actively imagining the process of eating a food (akin to consumption and reward simulations) increases desire for "vice" foods, while actively imagining the outcome of eating a food increases desire for "virtue" foods (akin to considering health features; Muños-Vilches et al., 2020). Both these findings are supported by the implication that participants mentally simulated a previous consumption experience when listing the features for each of the savoury dishes. Furthermore, the results are consistent with research showing that pictures of food can activate areas of the brain associated with reward processing (Simmons et al., 2005), explaining how mental simulations lead to an increase in desire and intentions. In order to determine whether a causal effect of cognitive representations may apply to appetitive stimuli more generally, future research should examine the causal role of cognitive representations in other domains, such as smoking, drinking (building on Keesman et al., 2018), or even other behaviours such as physical activity or active travel behaviours.

Surprisingly, there was also a small negative effect of specific sensory features on desire and intentions. Although it was notable that many sensory features could have been viewed negatively in relation to the dishes presented, such as 'greasy', 'dry', and 'tough', there still appeared to be a large number of positive sensory features, such as 'meaty', juicy', and 'hot', as shown in the word clouds (Figs. 2 and 5). However, it may be the case that the negative features had a disproportionate effect on desire and intention ratings, where just one negative feature, such as 'gristly' is sufficient to reduce desire and intentions, even when listed along with several positive sensory features. Therefore, just one negative sensory feature may have triggered an unrewarding mental simulation of a previous consumption episode, reducing desire and intentions to consume the dish in mind. Despite this, the sensory condition in both experiments showed an indirect effect of increased motivation, such that participants listing a higher proportion of consumption and reward features, reported higher levels of desire and intentions. This may be because the consumption context is more consistent in terms of the reward experienced compared to the sensory aspects of the food. In other words, even if the food is unenjoyable, spending time with friends or family in a nice setting, such as in a pub or restaurant, or even having dinner at home alone while watching tv, may still be experienced as rewarding due to feelings of contentment, joy, and happiness. Future research should explore the role of such context effects in more detail, especially with regard to their potential to increase the appeal of sustainable foods (see also Papies, van Stekelenburg, et al., 2022).

However, it would also be beneficial for future research to examine the effect of sensory features in more detail. For example, future research could examine whether negative sensory features have a disproportionate effect on desire by asking participants to rate the extent to which various features are positive or negative in relation to each dish. Future research could also ask participants to focus on either the positive or negative sensory features of a dish and examine how this influences the proportion of context and hedonic features that are reported, as well as the mediating effect of consumption and reward features on desire and intention ratings. Although it would be possible to just code the sensory features as positive or negative, manipulating the focus of participants may be more accurate, as features that are perceived as positive for one person may be negative for another. For example, one person may like a curry to be spicy while another prefers it to be mild. Overall, the findings of the present research suggest that caution is required when using sensory features to increase the appeal of healthy and sustainable foods, and that manipulating the salience of context features may lead to more unequivocally positive results in terms of increasing desire.

Indeed, the experiments also support the findings of previous research (Papies, van Stekelenburg, et al., 2022), by demonstrating the role of context features in the experience of desire. Overall, the findings suggest that focusing on the context in which a food is usually consumed, gives rise to a mental simulation of the whole consumption experience, including the sensory and hedonic aspects of consumption, which increases desire. Although mental simulations may occur at a conscious level, the grounded cognition theory of desire also proposes they can occur at an unconscious level, increasing the ease and efficiency with which they can influence cognition and behaviour (Papies & Barsalou, 2015). This would explain how exposure to a contextual cue can automatically trigger a behaviour that is associated with that specific context, as demonstrated in the habit literature. Furthermore, the findings of the present research show the effect of context on desire was stronger than the sensory condition, suggesting that the consumption context has a very powerful and potentially under-researched role in food desire. Although the results were replicated in Experiment 2 when examining the effect on intentions, further research is required to determine whether this manipulation has the potential to alter actual behaviour, in terms of the food choices of individuals.

Indeed, an important implication of these findings is that context features appear to increase desire and intentions through the simulation of rewarding outcomes. Although previous research shows that a behaviour must be rewarding in order for a habit to develop (Judah et al., 2018; McCloskey & Johnson, 2019), there is still much debate as to whether reward also plays a role in habit maintenance (de Wit & Dickinson, 2009). However, the results reported in the present article suggest that reward continues to drive habitual eating behaviour even when it is strongly ingrained. This supports the grounded cognition account of habits which argues that exposure to a contextual cue automatically triggers a mental simulation of performing the behaviour, including the expected reward, which then motivates action (Papies, Barsalou, et al., 2022). This is also in line with research by Dutriaux et al. (2023), who examined the association between regularity, consistency, immediate reward, long-term reward, conflict, and automaticity for 80 habitual behaviours. The results showed that both immediate and long-term reward predicted the frequency with which participants performed each of the 80 behaviours. It was also found that behaviours that were rated as more rewarding, were also rated as being more habitual, again suggesting that rewarding outcomes continue to play a role once habits have formed. Future research should examine the role of simulations within situated conceptualisations for habitual behaviours

in domains other than eating.

The current results showed that focusing on the health aspects of a dish had a negative indirect effect on both desire and intention ratings. This supports previous research which found that describing a food in terms of the health benefits reduced selection and consumption of the food compared to describing the food in terms of taste or indulgent language (Turnwald et al., 2017, 2019; Turnwald & Crum, 2019). Overall, these findings imply that focusing on the health-related aspects of a dish is less likely to trigger a mental simulation of a previously rewarding consumption experience. Exploration of the descriptive statistics also showed that participants in the health condition reported a higher proportion of negative health features than positive health features. This backs up research showing that actively thinking about negative health consequences activates areas of the brain associated with response inhibition (Hollmann et al., 2012), which refers to the suppression of actions that interfere with goal-driven behaviour (Mostofsky & Simmonds, 2008).

However, research on goal priming has shown that focusing on the health benefits of a food, by activating a health goal, can actually lead to healthier food choices among overweight participants (Papies et al., 2014) or among participants motivated to pursue a dieting goal (Papies, 2016). This is supported by the exploratory analysis which showed that health conscious identity moderated the effect of condition on desire ratings when comparing the health condition with the control condition. Specifically, participants who reported being less health conscious had slightly higher desire ratings in the health condition than the control condition, whereas participants who reported being more health conscious had much lower desire ratings in the health condition than the control condition. This makes sense given that a large proportion of the health features were negative as shown in both word clouds, suggesting that the foods presented were seen as rather unhealthy. According to the grounded cognition approach, focusing on the positive health outcomes leads to a mental simulation of the rewarding aspects of better health, such as losing weight and feeling fitter, making the healthier option appear more desirable, but only among people who strongly value those outcomes and try to pursue them in their daily lives – and when healthier options are indeed present (Papies, 2016). As a result, it is important to take this into account when examining the effectiveness of descriptive labels to influence food choice, as they are unlikely to increase desire for all perceivers.

4.3. Applied implications

Our findings on the role of cognitive representations in desire and intentions have implications for increasing the selection and consumption of healthier and more sustainable products. Specifically, the findings build on research by Turnwald and Crum (2019), who found that describing healthy foods in terms of taste-related features led to an increase in the selection of these foods (see also Turnwald et al., 2019). Based on the findings of the present research, this was likely due to the taste-related features triggering a mental simulation of a previous rewarding consumption experience, which increased desire and intentions for the food, ultimately increasing selection. Critically, our findings also imply that describing foods in terms of the consumption and reward features may be more effective than describing them in terms of the taste-related features alone. This finding is further supported by research showing that simulation-enhancing advertisements significantly increased desire and willingness to pay for bottled water through consumption and reward features, compared with health-focused and control advertisements (Claassen & Papies, 2023-a).

Consumption and reward descriptions may have significant potential for behaviour change in the domain of sustainable diets, which is of critical importance given the catastrophic environmental effects of the current food system (Rockström et al., 2020; Springmann et al., 2018). This potential is highlighted by research showing that plant-based foods are less likely to be described with words related to the rewarding experience of consumption (Papies, Johannes, et al., 2020; Davis et al., 2022), suggesting there is potential to improve the communication currently used to promote plant-based foods. This may be done by developing rewarding descriptions to include on food packaging and menus that allow individuals to simulate consumption at the precise moment a food choice is made (see also Papies et al., 2023). Rewarding descriptions with a minimum of one sensory, one context, and one hedonic word, and that have between 5 and 7 rewarding words in total, led to higher appeal and order intention ratings than control descriptions that focused on the ingredients, food composition, and/or food category (e.g., burger patty) (Farrar & Papies, 2023). While these descriptions will facilitate the selection of these products in the moment, using more rewarding words on advertisements in the social environment, such as on television and social media adverts, may help further to alter the underlying cognitive representations of plant-based foods. As a result, plant-based products will automatically be perceived as rewarding by consumers, which will further increase the selection and consumption of these products. In addition, presenting plant-based foods in terms of enjoyment, rather than I terms of health or vegan identities, may help to counter stereotypes and social polarisation around food, which currently hinders a more comprehensive transition to sustainable diets (Wehbe et al., 2023).

4.4. Strengths and limitations

One of the main strengths of these experiments is that both sample sizes were determined through a data simulation, meaning that an appropriately large sample of participants was recruited to detect any effects present. However, the data simulation did not account for the Bonferroni correction, which was applied to account for multiple testing, or the attrition rate for the second part of Experiment 2, which was higher than expected. As key strengths, the large number of participants recruited also highlighted the variability in the way foods are cognitively represented through the number of idiosyncratic features listed (Davis et al., 2022), as well as identifying several features that appear to be consistent in food representations across individuals. Furthermore, the results contained internal conceptual replications and replicated previous research findings (Papies, Claassen, et al., 2022), providing further evidence for the role of cognitive representations in desire, as well as demonstrating the same effect on intentions.

One of the main limitations of this work is that we had to infer that participants simulated consuming the dishes while completing the feature listing task, as we were unable to measure simulations directly. However, the wide variety of idiosyncratic features that participants produced make a re-enactment, or simulation, or a previously encoded experience the most parsimonious explanation, as it would be hard to explain how participants would retrieve the variety of highly specific context and food features if not re-activating previous consumption episodes. A further limitation is that the measures of desire, intentions, and behaviour were based on self-report ratings. This might reduce the accuracy of these measures, particularly the measure of behaviour which was administered retrospectively. Although it was necessary to employ these measures in order to recruit a large sample of participants to test our hypotheses, future research could address this by using more direct measures, such as salivation as in implicit measure of desire and asking participants to keep a food record (Keesman et al., 2018), or ecological momentary assessment. Finally, as the participants recruited were limited to those living in the UK at the time of the study, the extent to which the findings can be generalised to other countries or cultural settings requires further research.

It is also important to acknowledge the limitations of the feature listing coding manual that was used to code the features for the analysis. As natural language does not completely reflect the cognitive processes at play, the coder can only infer the meaning of each feature listed. Although many features are unambiguous and have a clear meaning, such as “soft”, “creamy”, “spicy”, and “tasty”, certain features have far

less clarity, such as the word "strong", which could refer to either the dish having a strong taste, or to developing physical strength. In this case, the feature would be coded as ambiguous, as it could fall into more than one of the three overarching categories described in the feature coding section above. However, as each coder has their own unique cognitive representation of each dish, based on their own personal experiences, it is not always possible to account for discrepancies between coders. As an example, although "beef", "onions", and "potatoes" would surely be coded as ingredients of a cottage pie, peas could be perceived as either an ingredient (i.e., a situation independent feature) or as an accompaniment on the side (i.e., a consumption situation feature). Consequently, it is important for coders to consider all possible meanings of a feature when coding to reduce any errors in categorization.

4.5. Conclusion

This research has provided empirical evidence that cognitive representations act as an underlying mechanism for eating motivation and behaviour. Through two experiments, we have shown that focusing on the rewarding aspects of consumption increases eating motivation and also predicts consumption behaviour. Our findings show that focusing on the rewarding aspects of a savoury dish, triggers a mental simulation of a previous consumption experience, which in turn increases desire and intentions. These results imply that describing healthy and sustainable products in terms of the consumption and reward features, may increase desire and intentions to consume these products, improving the health of both people and the planet.

Ethical statement

Ethical approval for both experiments was granted by the Ethics Committee of the College of Science and Engineering at the University of Glasgow. All the participants recruited were required to give verbal consent before taking part. The authors have no declarations of interest to report.

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CRediT authorship contribution statement

Stephanie T. Farrar: Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing. **Esther K. Papies:** Conceptualization, Funding acquisition, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors have no declarations of interest to report.

Data availability

The data and code is available on the Open Science Framework with links provided in the article.

Acknowledgement

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2023.107184.

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