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It's not queasy being green: The role of disgust in willingness-to-pay for more sustainable product alternatives

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Abstract

Scholars differ in the extent to which they regard the "yuck factor" as an important predictor of sustainable consumption decisions. In the present decision experiment we tested whether people's disgust traits predicted relative willingness-to-pay (WTP) for sustainable product alternatives, including atypically-shaped fruit and vegetables; insect-based food products; and medicines/drinks with reclaimed ingredients from sewage. In a community sample of 510 participants (255 women), using path analyses we examined the extent to which effects of disgust traits on WTP were mediated by cognitive appraisals of perceived taste, health risk, naturalness, visual appeal, and nutritional/medicinal value. Further, we assessed whether these effects were moderated by the tendency to regulate disgust using reappraisal and suppression techniques. Across all product categories, when controlling for important covariates such as pro-environmental attitudes, we found a significant negative effect of trait disgust propensity on WTP. In total, a 1 SD increase in participants' disgust propensity scores predicted between 6% and 11% decrease in WTP. Appraisals of perceived naturalness, taste, health risk, and visual appeal significantly mediated these effects, differing in importance across the product categories, and explaining approximately half of the total effect of disgust propensity on WTP. Little-to-no support was found for moderation of effects by trait reappraisal or suppression. Individual differences in disgust are likely to be a barrier for certain viable sustainable alternatives to prototypical products. Marketing interventions targeting consumer appraisals, including in particular the perceived naturalness and taste, of these kinds of products may be effective.

Keywords: consumer decisions; consumer emotion; disgust; path analysis; pro-environmental products; willingness to pay

1 Introduction

As a population, we are facing a crisis of resource sustainability. This predicament is driven in part by increasing levels of, and a socio-culturally defined selectivity in, consumption habits within developed societies. Contributing to this challenge are rigid consumer and resultant market preferences for a prototypical kind of product, at the expense of otherwise perfectly viable alternatives (Roth, 2007).

Western consumers want their protein from creatures with four legs, not six (e.g., Looy, Dunkel, & Wood, 2014); their foods and medicines to be natural, not manufactured (e.g., Rozin et al., 2004); and their apples to be shiny, not blemished (e.g., Bolos, Lagerkvist, & Kulesz, 2019; de Hooge et al., 2017). Such selective consumption habits come at a cost; research in the US has estimated that as much as 50% of all food produce is thrown away due to a "cult of perfection" (Goldenberg, 2016). The potential impacts of selective consumption are multifarious and, over time, it will become no longer optional but necessary for consumers to embrace more sustainable alternatives to prototypical products. Accordingly, getting "ahead-of-the-curve", via a deeper understanding of the psychology that contributes to consumers' shunning of viable yet atypical alternatives, is essential for informing proactive intervention.

1.1 Disgust and sustainable consumption

While less selective and more sustainable consumer behaviours are desirable at multiple levels, securing widespread and sustained engagement in such behaviours has proven difficult. The reasons for this difficulty are complex; however, it is worth noting that while many "green" practices involve exposure to the elicitors of strong emotions, the role of emotions in deterring sustainable lifestyle choices has been largely ignored. Strategies in pro-environmental research frequently appeal to logic, reason, or responsibility, without clear success (Deroy, Reade, & Spence, 2015). However, both theory and data also suggest that

emotions are integrally involved at multiple stages of the decision process (Ibanez, Moureau, Roussel, 2017). In this context, consumer behaviours such as eating aesthetically imperfect produce and consuming atypical protein sources, may be environmentally and economically positive, yet often elicit a visceral affective reaction inhibiting their widespread uptake.

While emotional responses to selective consumer behaviours of this kind are complex, both research and theory suggest the emotion of disgust to be of core importance. Disgust is a basic emotion that evolved to reduce the threat posed by potential contaminants (Davey, 2011). Phenotypically, within humans, disgust manifests in a pattern of functional expressive changes in which the nostrils narrow, salivation increases, the throat constricts, and the tongue protrudes (Angyal, 1941). Disgust responses are broadly characterized by action tendencies, experiential and cognitive states, and physiological changes that facilitate rejection and avoidance (Reynolds, Consedine, Pizarro, & Bissett, 2013). Like other emotions (Consedine & Moskowitz, 2007), disgust also motivates anticipatory avoidance, enabling us to deal with possible health threats preventatively (Consedine, Reynolds, & Borg, 2018; Schaller & Duncan, 2007).

Of importance to the current work, disgust likely has special relevance to the willingness-to-pay (WTP) for and consume (i.e., ingest) sustainable alternatives to traditional food and medicinal products due to its origins in preventing the oral incorporation of contaminants (Cochran, Kydd, Lee, Walker, & Consedine, 2018; Haidt, Rozin, McCauley, & Imada, 1997). While the range of stimuli that elicit disgust is broad, disgust has specific relevance to consumption behaviours as it originally evolved to decrease contamination risk by reducing the tendency to place things in the mouth (Cochran et al., 2018). Because the cost of failing to avoid a possible threat can be severe, the disgust system is prone to false positives (Tybur, Lieberman, Kurzban, & DeScioli, 2013), creating avoidance where no objective threat is present (Kupfer & Le, 2018; Rouel, Stevenson, & Smith, 2018). Such

"red-herring" avoidance and rejection rules can be, and have been, further developed and transmitted socio-culturally, using disgust as an affective and motivational conduit, including social practices around restrictive food habits (e.g., Kosher diets; Nemeroff & Rozin, 1992).

There are several different typologies of disgust stimuli. Some recent views suggest classes of elicitor that reflect primary pathogen vectors – atypical appearance, lesions, sex, hygiene, food, and animals (Curtis & de Barra, 2018) – while others advocate for delineation as a function of the risks associated with consumption, contact, and sex (Lieberman, Billingsly, & Patrick, 2018). Historically, some have focused more on pathogens (e.g., Haidt, McCauley, & Rozin, 1994; Rozin & Fallon, 1987) while others incorporated socio-moral elements (e.g., Haidt et al., 1997; Tybur, Lieberman, & Griskevicius, 2009). Among the more common is a measurement-based typology that suggests three classes of elicitor – core disgust elicitors (evoked by stimuli that threaten oral incorporation), contamination elicitors (e.g., poor hygiene), and animal-reminder elicitors that cue us to our animalistic nature (e.g., mortality or deformity). The combination of an "oral" function, coupled with the reliable elicitation of disgust via characteristics that typify many sustainable alternative products, create a prima facie case for its involvement.

Research in consumption that addresses the role of disgust remains sparse. On the one hand, theory suggests disgust is likely to deter the willingness to ingest food or medicinal products that "map" onto the classes of stimuli that elicit disgust (Rozin & Fallon, 1987). On the other hand, some studies have previously found that the self-reported relevance of disgust may not be that great. In one study, for example, only 2% of participants self-identified "disgust" as important to their decisions about recycled water (Wester, Timpano, Cek, & Broad, 2016). Leveraging findings of this kind, it has been argued that discourse regarding the so called "yuck factor" is of limited value (House, 2016; Russell & Lux, 2009).

There is, however, competing evidence linking disgust to sustainable consumption behaviours. Evidence suggests disgust may contribute to excessive sanitation and food waste (Ammann, Siegrist, & Hartmann, 2019); less re-use (e.g., of wastewater, second-hand, and reusable products; Rozin, Haddad, Nemeroff, & Slovic, 2015); "irrational" objections to GM solutions (as "Frankenfoods"; Scott, Inbar, & Rozin, 2016); and the use of reclaimed materials (e.g., from biowaste; Herbes, Beuthner, & Ramme, 2018). While causality remains unclear (Fessler et al., 2003), disgust is clearly implicated in eating behaviours (Houben & Havermans, 2012), notably vegetarianism (Hamilton, 2006), as well as in the willingness to eat "riskier" foods (e.g., Olsen, Rossvoll, Langsrud, & Scholderer, 2014). Disgust may also motivate dietary and intake behaviours at both interventional, public health (White et al., 2016), and experimental levels (Legget, Cornier, Rojas, Lawful, & Tregallas, 2015; Shaw et al., 2016). Of particular relevance to the current report, studies have shown disgust predicts lower willingness to eat insect-based proteins (Gmuer, Guth, Hartmann & Siegrist, 2016; Menozzi, Sogari, Veneziani, Simoni, & Mora, 2017), and/or attend programmes where insects are served as food (Hamerman, 2016).

1.2 Limitations of existing research

A number of factors could limit the confidence we have in the findings of prior studies. While some recent research has explored people's disgust towards and willingness to buy and consume imperfect fruits (Jeagar et al., 2018), most prior work examining whether disgust might be implicated in the avoidance of environmentally friendly alternative products has concentrated on foods that differ in multiple ways from the traditional sourcing and diet. For example, although a recent study found that disgust regarding insects was a substantially better predictor than food neophobia in predicting intention to consume insects (La Barbera et al., 2018), the novelty of many products may, in itself, deter consumption. Equally, prior

studies have lacked ecological validity insofar as consumers have not been making WTP decisions for atypical alternatives relative to the value of prototypical products.

Second, the range of products that have been considered in previous studies has been limited. Individual studies have implicated disgust in a reluctance to consume certain foods, including insects (above); recycled water (e.g., Kecinski, Keisner, Messer, & Schulze, 2016; Rozin et al., 2015; Wester et al., 2016); and soft drinks (Shaw et al., 2016). However, other technologically viable alternatives, such as consuming medications recycled from human waste have yet to be considered. Examining how disgust may predict the willingness to consume recycled medications is both environmentally significant – between 3% and 7% of medications are wasted annually in North America (Tchen, Vaillancourt, & Pouliot, 2013) – as well as conceptually important (being orally consumed and explicitly health-related).

Third, while disgust has been implicated in decisions that are relevant to sustainable consumption (e.g., recycled water; Rozin et al., 2015), scarce work has explored the explanatory or "mediating" factors that may help to explain the predictive mechanism of disgust traits on decision-making. Experiential disgust has been shown to alter cognitive evaluations and appraisals, such as how much an individual likes a product (e.g., Motoki & Sugiura, 2018), and it is equally conceivable that dispositional disgust tendencies may alter the way that atypical (i.e., "yuck factor") products are evaluated on relevant dimensions known to be important in purchase decisions (e.g., perceived taste, health risk, visual appearance, "naturalness", and/or nutritional/medicinal value). Such dimensions can be leveraged by marketers and other stakeholders to be better promote their products; however, as yet, the relative effect of disgust on these dimensions of product evaluation is unexplored.

Fourth, studies have yet to evaluate whether dispositional patterns of regulating disgust may be relevant. The propensity to feel repulsed may reduce engagement with the natural world (Bixler & Floyd, 1997) and it has been suggested that unregulated disgust may

impede pro-environmental and sustainable policy initiatives (Schmidt, 2008). Although it has yet to be considered in the context of environmental behaviour, evidence from other domains suggests that disgust may impact behaviour differently depending on personality and baseline attitudinal characteristics. In one study, conditioned disgust was shown to reduce soda drinking, but only among those with pre-existing negative attitudes (Shaw et al., 2016). Similarly, an experimental study in colorectal cancer scenarios found that disgust motivated avoidance but only among those with higher trait disgust (Reynolds, McCambridge, Bissett, & Consedine, 2014).

1.3 The present research

The current study addresses the limitations outlined in section 1.2, by: (a) contrasting relative WTP between traditional and sustainable variants of everyday consumables, side-by-side; (b) evaluating how disgust may predict WTP for a range of stimuli, including atypical fruit and vegetables, drinks, manufactured foodstuffs, and medicines; (c) assessing directly how much of the effect of underlying disgust traits on WTP is explained (or "mediated") by differences in cognitive product appraisals; and (d) testing whether the dispositional tendency to regulate disgust adjusts (or "moderates") the effect of disgust traits on reducing WTP for environmentally-friendly variants on basic consumables. The following three hypotheses were made (see Figure 1):

1) After controlling for statistically important covariates (e.g., demographic background, weekly spend on consumables, pro-environmental identity, left-right political identity, risk-taking, social desirability), disgust traits would predict a reduced WTP for atypical (i.e., sustainable, "yuck factor") alternatives versus typical products.
2) A significant proportion of the effect of disgust traits on WTP would be mediated by cognitive evaluations regarding product taste, perceived health risk, visual appearance, "naturalness", and/or nutritional/medicinal value.

3) The self-reported trait propensity to regulate disgust (by reappraisal and suppression) would moderate the effect of disgust on WTP for "yuck factor" product alternatives.

2 Method

2.1 Stimuli Selection

To select the stimuli for use in the WTP paradigm, a pilot survey-based study was conducted. From a broader set of stimuli, those with the highest disgust ratings in the pilot study were selected for inclusion. Full details of this process are presented in the online appendices (Appendix A). All other details in section 2.1 refer to the main study.

2.2 Participants

Five hundred and ten community volunteers (n = 255 women, 50%) participated, recruited from the Prolific Academic panel (https://www.prolific.ac). The following inclusion filters were applied: 50/50 gender split; aged between 18 and 100 years; current residence in the UK; and a minimum approval rate for submissions in prior studies of 90%. Participants' ages ranged from 18 to 70 years (M = 34.33, SD = 9.89). The majority were White British (n = 414, 81.2%). Full demographic characteristics are in Table 1.

2.3 Materials and measures

2.3.1 Willingness-to-pay (WTP) task

Based on the pilot study, 15 stimuli product-pairs were selected for use in the WTP task, with 3 products in each of five categories: (1) atypically-shaped fruit; (2) atypically-shaped vegetables; (3) insect-based foods; (4) drinks with ingredients reclaimed from sewage; and (5) medicines with ingredients reclaimed from sewage (see Table B.1 in Appendix B). The fruit and vegetable stimuli were sourced from Berlin artist Uli Westphal (https://www.uliwestphal.de/), who granted copyright permission for their use. A product photo was presented with two written details underneath, describing what the product was and an ingredient it contained (which may be typical or atypical). For the fruit and vegetable

stimuli, which varied in visual appearance, these two details were held constant for each product pair. For the remaining stimuli, the image was held constant for each product pair, while the text was varied systematically (with bold text indicating key differences). The full list of pilot and study stimuli is included in Table B.1 in Appendix B.

An example WTP task is presented in Figure 2, while examples of the study stimuli from the fruit and vegetable category are included in Figure 3. On each trial, participants were first informed of the type of product involved (e.g., apples). They were then asked whether or not this product would be something they would consume (i.e., "do you consume x?" yes / no) and, where the participant responded "yes", how often they typically consumed the product, using a 5-point scale (1 = less than once a month, 5 = more than once a week). Next, all participants were asked how much they liked the product in general on a 5-point scale (1 = dislike a great deal, 5 = like a great deal).

Following this, participants were presented with a specific product-pair ("Product A" and "Product B"), and were given the median supermarket cost of the typical product (taken from prices at the three biggest supermarkets in the UK in August 2017) in pence underneath the product. Participants were then asked "What is the highest price you would be willing to pay at the supermarket to buy and consume **Product X** <u>yourself</u>?" (where Product X was always the atypical product). The two response options were: "I would not buy and *consume Product X at any price" (coded as "0")*; and "I would buy and consume Product X. The <u>most</u> I would be willing to pay (in pence) is: ___". Participants choosing the latter were required to enter a value (see Figure 2).

Following the WTP task, on a new page with the product stimuli still on display but with the pricing information removed, participants were asked to comparatively rate the product-pairs across five dimensions: (1) taste ("will taste worse"); (2) health risk ("will make me unwell"); (3) naturalness ("is more natural"); (4) visual appeal ("looks visually less

appealing"); and (5) nutritional/medicinal value ("has less nutritional/medicinal value"). All ratings were made using a 100-point slider (−50 = product A, 0 = product A and B are equal, 50 = product B). All of the product stimuli and ratings were presented in a randomised order. The presentation of the prototypical and atypical variants of the product-pairs as "Product A" and "Product B" was counterbalanced, so that approximately half of the participants viewed the atypical alternative on the left ("Product A"), and half on the right ("Product B").

2.3.2 Trait measures

2.3.2.1 Disgust propensity

Participants' trait disgust propensity was measured using the Disgust Scale – Revised (DS-R; Haidt, McCauley, & Rozin, 1994, modified by Olatunji, Williams et al., 2007).[1] It is a 25-item measure, which asks participants to rate the extent they agree with 14 statements about their proneness to disgust-elicitors on a 5-point Likert scale (0 = strongly disagree, 4 = strongly agree), and how disgusting they would find 11 disgust-eliciting experiences (0 = not disgusting at all, 4 = extremely disgusting). An example item is: "If I see someone vomit, it makes me sick to my stomach". Cronbach's α for the total score was .87.

2.3.2.2 Disgust sensitivity

Trait disgust sensitivity (i.e., how negative one finds experiencing disgust) was assessed with the 6-item disgust sensitivity subscale of the Disgust Propensity and Sensitivity Scale – Revised (DPSS-R; van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006; modified by Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007). Participants rate how true 6 statements are about them on a 5-point scale (1 = never, 5 = always). An example item is: "I think feeling disgust is bad for me". Cronbach's α was .82.

2.3.2.3 Disgust regulation

[1] We also collected data using the disgust propensity subscale of the DPSS-R, but the DS-R was shown to have a stronger relationship with the outcome variable, and thus the disgust propensity portion of the DPSS-R was omitted as a duplicate measure of disgust propensity.

Participants' use of two common emotion regulation strategies, cognitive reappraisal and expressive suppression, for disgust was measured using a 4-item disgust regulation measure based on the Emotion Regulation Questionnaire (ERQ for disgust [ERQ-D]; Gross & John, 2003, modified by Feinberg, Antonenko, Willer, Horberg, & John, 2014). The measure has two 2-item scales with 7-point scales (1 = strongly disagree, 7 = strongly agree). An example item for reappraisal is: "When I want to feel less disgust, I change the way I'm thinking about the situation". An example item for suppression is: "I keep my feelings of disgust to myself". Cronbach's α were .78 (reappraisal), and .91 (suppression).

2.3.2.4 Control variables

Participants' pro-environmental identity was assessed with the 4-item Pro-Environmental Self-Identity scale (PESI; Whitmarsh & O'Neill, 2010). Participants indicate the strength of their agreement on a 5-point scale (1 = strongly disagree, 5 = strongly agree). Cronbach's α was .66. To assess the tendency for socially desirable responding, we included the 13-item short form of the Marlowe-Crowne Social Desirability Scale (MCSDS, Reynolds, 1982). Participants respond with a binary response scale (0 = false, 1 = true). Cronbach's α was .71. Risk taking was measured using a single question (from Dohmen et al., 2011) that asked "How do you see yourself? Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?" Participants responded on an 11-point scale (0 = not at all willing to take risks, 10 = very willing to take risks). Participants' political orientation was assessed using a single item (from Kroh, 2007) that said "In politics people sometimes talk of left and right. Where would you place yourself on a scale from 0 to 10, where 0 means the left and 10 means the right?" on an 11-point scale (0 = left, 10 = right).

We also collected data on participants' gender (0 = male, 1 = female); age; ethnicity (recoded as 0 = other ethnicity, 1 = White British), highest educational qualification completed (0 = none of the above, 1 = GCSE or equivalent secondary school qualification, 2

= A-level or equivalent post-secondary level qualification, 3 = Bachelors or equivalent first degree level qualification, 4 = Masters or equivalent higher degree level qualification, 5 = PhD or equivalent doctoral level qualification); primary employment status (recoded as 0 = not in employment, 1 = employed); typical spend on food, drink, and medicinal products in grocery stores per week (to the nearest pound); dietary preferences (recoded as 0 = other diet, 1 = omnivore), and participants' primary grocery shop (see Table 1).

2.4 Procedure

Participants completed the survey online via the panel company Prolific Academic. Participants gave their informed consent, before being given instructions to the WTP task (see Appendix C). Participants completed the WTP task detailed in section 2.3.1, before answering demographic questions, and then completed the DS-R, DPSS-R, ERQ-D, PESI, MCSDS, and the politics and risk questions in a randomised order. Finally, participants were thanked and debriefed. Each participant was paid £2.25, with a median duration of 22.36 minutes for the survey.

2.5. Data analysis

The free-text WTP responses were cleaned prior to analysis. Implausible values (i.e., those that contained decimal points) were omitted. Extreme values were censored at a maximum of double the value of the typical comparison product. In order to facilitate comparisons across product stimuli with differential base values, raw values on the WTP task were transformed into percentage WTP of the comparison price (from the typical product), giving a possible $WTP_{percentage}$ score of 0-200%. Responses to the comparative product ratings were transformed to be consistent, so that higher values always indicated greater agreement with that dimension for the atypical product.

Given that the survey included 15 product-pairs, to facilitate dimension reduction a principal components analysis (PCA) using direct oblimin rotation was conducted on the

$WTP_{percentage}$ responses. Kaiser's criterion suggested the optimal extraction of three correlated factors with no evidence of cross-loadings. The pattern matrix is available in Table D.1 in Appendix D. The three factors used for analysis were: atypical fruit and vegetables (k = 6), insect products (k = 3), and reclaimed products from sewage (k = 6). Averages were computed for each factor, as well as an overall average $WTP_{percentage}$. Average frequency of consumption ratings and liking of the products were also computed for each factor.

An initial correlation matrix (rank coefficients) was computed between independent variables (except participants' primary shop) and the overall average product ratings and $WTP_{percentage}$ score (see Table 2). Trait predictors pertinent to the study hypotheses (disgust propensity, disgust sensitivity, disgust reappraisal, and disgust suppression), as well as covariates demonstrating a significant bivariate relationship with the overall average $WTP_{percentage}$ score in these correlations, were included in subsequent modelling.

Path models were used to test the study hypotheses, based on the theoretical model outlined in the Introduction (see Figure 1). Separate models were run for the three factors identified in the PCA, and Wald z-tests were used to compare coefficient estimates across models. Bootstrapping (10,000 bootstrap estimates; Wood, 2005) was used to estimate the significance of indirect paths in the mediation model, and to account for outcome variables (and thus model residuals) that deviated from the normal distribution (Fox, 2008; Hayes & Scharkow, 2013). In order to appropriately scale the variables, all continuous variables were z-standardised prior to analysis (except $WTP_{percentage}$, which provided a meaningful outcome scale for interpreting the sizes of the effects). In the path models, error terms for the mediating product ratings were permitted to correlate to account for shared residual and measurement variance at each stage of the model. To test hypotheses (1) and (2), an initial path model was estimated where the regression parameters on interaction terms between the disgust traits and disgust regulation techniques were constrained to zero. To test hypothesis

(3), these constraints were removed. Model fit was compared between the two models. Analyses were conducted in SPSS v. 22 (IBM Corp., Armonk, NY, USA) and AMOS v. 24 (IBM Corp., Armonk, NY, USA), using custom estimands.

3 Results

3.1 Descriptive and correlational results

The full results for all products used in the study can be found in Appendix E. Table 2 demonstrates initial descriptive data and inter-variable correlations. Of the traits assessed, disgust sensitivity had a small, $rs = -.18$, and disgust propensity a medium, $rs = -.40$, significant negative relationship with $WTP_{percentage}$. The disgust regulation variables were not significantly correlated with $WTP_{percentage}$. Of the covariates, pro-environmental identity, political orientation, risk-taking, highest educational qualification, average frequency of consumption, and average liking of the products had small, significant correlations with the overall average $WTP_{percentage}$ for the atypical products (ranging from $rs = -.12$ to $rs = .20$), and thus were included in subsequent path models as important covariates.

3.2 Path models

The overall model fit of the first path model (with constraints on the interaction terms) was excellent, $\chi^2(72) = 1.01$, $p = .452$, RMSEA = .003, 95% CI [.000, .015], $p = 1.00$, AIC = 1188.788. Estimates from the path model are shown in Table 3 and Table 4.

3.2.1 Atypical fruit and vegetables

For the fruit and vegetables category, the variables in the model explained 36% of the variance in $WTP_{percentage}$. Of the covariates included in the model (results not shown), only average liking of the products had a significant (direct) effect on $WTP_{percentage}$, $b = 0.064$, 95% BCa [0.023, 0.108], $p = .002$. Regarding hypothesis (1), disgust propensity had a significant direct effect on $WTP_{percentage}$, when controlling for all other variables in the model, $b = -0.038$, 95% BCa [-0.063, -0.010], $p = .010$, and a significant overall indirect effect via

the product appraisals, b = -0.033, 95% BCa [-0.050, -0.018], p < .001. Overall, a 1 SD increase in disgust propensity score predicted a 7.1% decrease in $WTP_{percentage}$. Regarding hypothesis (2), around half of the total effect of DS-R on $WTP_{percentage}$ was indirect via the product appraisals. In this category, this significant indirect effect was driven by appraisals of taste, b = -0.017, 95% BCa [-0.036, -0.005], p = .002, naturalness, b = -0.005, 95% BCa [-0.012, 0.000], p = .034, and visual appeal, b = -0.014, 95% BCa [-0.024, -0.006], p < .001. In order to test hypothesis (3), the path model was re-estimated removing the constraints on the parameters associated with the interaction terms, this model did not fit significantly better than the first model, $\chi^2(72) = 1.01$, p = .452. The only estimates that were statistically significant were an indirect effect of the disgust propensity*disgust suppression interaction via visual appeal, b = 0.008, 95% BCa [0.002, 0.017], p = .009, and an indirect effect of the disgust sensitivity*disgust suppression interaction via visual appeal, b = -0.008, 95% BCa [-0.016, -0.001], p = .021, on $WTP_{percentage}$. These interactions imply that as reported disgust suppression increased: (1) the effect of having greater trait disgust propensity on lower visual appeal ratings increased; and (2) the effect of having greater trait disgust sensitivity on higher visual appeal ratings decreased.

3.2.2 Insect-based products

The variables included in the model explained 23% of the variance in $WTP_{percentage}$ for the insect-based products. Having higher educational qualifications had a significant positive indirect effect on $WTP_{percentage}$ via the product appraisals, b = 0.017, 95% BCa [0.005, 0.031], p = .006. A more right-wing political identity was associated with a lower $WTP_{percentage}$ in this category, b = -0.029, 95% BCa [-0.057, -0.003], p = .026. Disgust propensity had a significant direct effect on $WTP_{percentage}$, b = -0.051, 95% BCa [-0.083, -0.021], p = .001, and a significant overall indirect effect via the appraisal variables, b = -0.055, 95% BCa [-0.074, -0.039], p < .001. In the insect category, a 1 SD increase in disgust propensity predicted a

10.6% decrease in $WTP_{percentage}$. The overall significant mediation effect was driven by significant indirect effects of disgust propensity on WTPpercentage by taste, b = -0.034, 95% BCa [-0.054, -0.018], p < .001, and naturalness, b = -0.012, 95% BCa [-0.023, -0.004], p = .004. No statistically significant interactions of the disgust traits with self-reported disgust reappraisal and suppression were observed.

3.2.3 Products with reclaimed ingredients

For the products with reclaimed ingredients from sewage, 23% of the variance in $WTP_{percentage}$ was explained. Average liking of the product had a significant negative indirect effect on $WTP_{percentage}$ via its effect on the product appraisal variables, b = -0.019, 95% BCa [-0.032, -0.006], p = .004. Having higher educational qualifications had a significant positive indirect effect on $WTP_{percentage}$ via the product appraisals, b = 0.012, 95% BCa [0.002, 0.023], p = .013. A stronger pro-environmental identity was directly associated with paying less for the atypical products, b = -0.023, 95% BCa [-0.045, -0.002], p = .035. A significant direct effect of disgust propensity on $WTP_{percentage}$ was observed, b = -0.032, 95% BCa [-0.055, -0.009], p = .009, as was an overall indirect effect via the cognitive appraisals, b = -0.026, 95% BCa [-0.040, -0.015], p < .001. A 1 SD increase in disgust propensity predicted a 5.8% decrease in $WTP_{percentage}$. The indirect effect of disgust propensity on $WTP_{percentage}$ was driven by health, b = -0.016, 95% BCa [-0.029, -0.007], p < .001, and naturalness, b = -0.004, 95% BCa [-0.010, 0.000], p = .029, appraisals. No significant interactions between the disgust traits and disgust regulation variables were found.

4 Discussion

The need to promote less selective and more sustainable consumer behaviour is growing in urgency. This is, in turn, increasing the importance of developing a greater understanding of the individual differences that contribute to consumers' decisions to shun viable, but atypical, alternatives to prototypical products. The disgust evoked by the visual

appearance of, or cognitive associations with, these atypical products has been identified as one such barrier. In view of this, the current study sought to experimentally investigate the role that the "yuck factor" might have in determining consumers' willingness-to-pay (WTP) for an array of atypical, yet viable, products for oral consumption. In so doing we addressed a number of limitations in the extant literature.

The study investigated three central hypotheses: (1) that disgust traits would predict a reduced WTP for atypical (i.e., "yuck factor") products; (2) that a significant proportion of the effect of disgust on WTP would be explained (or mediated) by consequent cognitive appraisals of the product; and (3) that self-reported trait propensity to regulate disgust would moderate the effect of disgust on WTP.

4.1 Disgust traits as predictors of WTP

Support was found for hypothesis (1). Initial correlational analyses revealed that average WTP for this selection of atypical products was directly (and negatively) associated with participants' disgust propensity and sensitivity, as well as political conservativeness. By contrast, people with a higher pro-environmental self-identity, higher educational attainment, and who consume/like products more, showed a higher WTP for the atypical products. These correlational findings make sense. The relationships with disgust aside, young, well-educated, politically liberal individuals typically report greater concern for the environment (e.g., Dunlap et al., 2000; Newman & Fernandes, 2016). Moreover, not only has political conservatism been found to be associated with more conventional thinking and a lack of openness to new experiences (Carney, Jost, Gosling, & Potter, 2008), but there is evidence that political conservatives are more easily disgusted than liberals (e.g., Inbar et al., 2009).

Subsequent multivariate path modelling, used to identify an independent relationship between disgust traits and WTP, indicated that disgust propensity (but not disgust sensitivity) had significant direct and indirect effects on WTP. The indirect effects were mediated by

cognitive appraisals of the products (discussed in section 4.2). In total, a 1 SD increase in participants' disgust propensity scores predicted between 6% and 11% decrease in WTP for the atypical products. The path analyses confirm that a person's dispositional propensity to react with feelings of disgust is a potential key factor in driving people away from selecting atypical products while shopping. As such, our findings sit broadly in line with studies that identify the "yuck factor" as being an important determinant of consumption decisions (e.g., Rozin et al., 2015; Siegrist, Sütterlin, & Hartmann, 2018) and run counter to studies claiming that the "yuck factor" is overstated (e.g., Wester et al., 2016).

The finding that disgust sensitivity (i.e., a person's tendencies to experience disgust as distressing) was not identified as a predictor of WTP is interesting. While this finding may affirm the importance of separating dispositional sensitivity and propensity toward disgust within research (e.g., van Overveld et al., 2006), in the absence of additional investigation, we argue against concluding that disgust sensitivity has a limited role in determining "real-world" consumption decisions for atypical products. Specifically, while the decision-making scenario was sufficient to evoke disgust responses, its hypothetical nature meant that the level of disgust evoked may have been insufficient to allow disgust sensitivity to emerge as a unique predictor of WTP. This possibility is dealt with further in section 4.4.

4.2 Cognitive mediators of disgust traits and WTP

Support for hypothesis (2) was observed. Initial correlational data illustrated that disgust propensity and disgust sensitivity were related to more negative product evaluations. Furthermore, the findings of the path analyses revealed that approximately half (between 44.8% to 51.9%) of the total effect of disgust propensity on WTP observed could be accounted for via these appraisals. Specifically, for the fruit and vegetables products, this mediational effect was driven by evaluations of anticipated taste, visual appeal, and perceived naturalness. For the reclaimed sewage-based products, the mediation effect was driven by

perceived health risk, and perceived naturalness. Finally, for the insect-based products, the mediation effect was driven by perceived taste and naturalness.

Perceived naturalness was thus identified as a common, important mediator of the relationship between disgust and WTP in all product categories. This finding is congruent with previous research, where perceived naturalness has been found to relate to disgust and willingness to consume a variety of non-traditional products, including insects (Lensvelt & Steenbekkers, 2014), cultured meat (Bryant & Barnett, 2018; Siegrist et al., 2018) and 3D printed foods (Lupton & Turner, 2018; see also Hartmann & Siegrist, 2017). Moreover, (un)naturalness has been found to be an important construct underpinning many people's objections to the growth and consumption of genetically modified foods (e.g., Lull & Scheufele, 2017; Scott, Inbar, Wirz, Brossard, & Rozin, 2018). The perceived naturalness of a product is often negatively associated with perceived human intervention. This could be an important consideration within the context of promoting acceptance of products derived from ingredients reclaimed from sewage, which necessitate human processing. Indeed, having a stronger pro-environmental identity was directly associated with a lower WTP solely in the reclaimed ingredients category, potentially reflecting their perceived processed nature.

Perceived taste was also a significant mediator of the links between disgust and WTP for both fruit and vegetables and insect-derived foodstuffs. As an emotion that has an oral origin, disgust is intimately linked to taste (Rozin, Haidt, & Fincher, 2009). However, while the perceptions of taste of atypical fruit and vegetables may be driven by memories of actual experiences, the same cannot be said of the insect-based products. It is unlikely that our UK sample were familiar with eating such products, and so inferences regarding taste would likely be based on cognitive evaluations. Indeed, the perceived taste of insects appears to differ among cultures where entomophagy is commonly practiced (e.g., East Asia), where opinions are based on memories, versus among newer consumers (e.g., Netherlands,

Germany) where opinions tend to be based on cognitive associations (e.g., Hartmann, Shi, Giusto, & Siegrist, 2015). This finding speaks to the potential value of direct experience in overcoming misperceptions (e.g., Jones & Eiser, 2014) and suggests efforts to encourage people to try consuming atypical products may act as a means of encouraging future consumption by, for instance, modifying perceptions of taste.

Finally, with regards to visual appeal, evaluations of this product attribute only mediated relationships between disgust and WTP for the atypical fruit and vegetables. This finding makes sense insofar as, of the three categories of product, only the fruit and vegetables varied in terms of visual appearance. Thus, one needs to be cautious when drawing strong conclusions about the importance of this dimension in relation to the other product categories. Indeed, as an example, the insect-derived products were not only similar in appearance to their prototypical analogues within this study but were also in a concealed form so as not to resemble insects. Varying the degree of visual dissociation in these product categories would be a key avenue for future study.

4.3 Trait propensity to regulate disgust as moderator

We found minimal support for hypothesis (3): trait dispositions towards regulating disgust (i.e., disgust suppression) moderated only two relationships within our path analyses within the fruit and vegetable category. One could take the general absence of significant results as evidence that self-reported dispositional disgust regulatory tendencies are broadly unimportant as moderators of the relationships between disgust traits and WTP for atypical products. However, in the absence of further testing, such a conclusion may be premature. Cognitive reappraisal has previously been shown to moderate the effects of trait disgust in other contexts (e.g., Feinberg et al., 2014; Olatunji, Berg, & Zhao, 2017), and so the current null results may be somewhat related to aspects of our study design. For example, the hypothetical nature of the decision-making context, while sufficient to activate disgust, may

not have been vivid enough to elicit responses that could delineate trait disgust suppression tendencies as a moderator. Nevertheless, it is also possible that alternative emotion regulation techniques, such as gradual exposure and habituation to target disgust elicitors, may be more appropriate for regulating disgust responses in product consumption decisions.

4.4 Limitations and future directions

There are certain limitations of the research that need to be considered. Most obviously, the decision to utilise stated WTP as the dependent measure could be seen as limiting. Although a popular and established method of gauging preferences towards a range of products and issues, including environmentally preferable food products (e.g., Hasselbach & Roosen, 2015; Tait, Saunders, Guenther, & Rutherford, 2016), some researchers have aired concerns about their use when assessing preferences for unfamiliar stimuli (e.g., Mould Quevado, Contreras Hernández, Espinosa, & Escudero, 2009). For example, participants were required to make judgements based upon the provision of only a small amount of information (i.e., a product image and key comparative product details). Our decision to present only a limited amount of information was purposeful, so has to foster greater experimental control and comparability of findings; however, one could critique this decision based upon the above-mentioned argument.

A related limitation is the hypothetical nature of the decision making context within the current study. Participants were not faced with a "direct" physical decision of whether to purchase atypical vs. traditional products; rather they were responding "indirectly" to images and descriptions of the products. While assessing socially-desirable responding permits some degree of control for the effect that such "distance" might have exerted upon preferences, we nonetheless assessed purchase "intentions" rather than actual consumption decisions. While this provides novel and important information on how people may likely behave, it remains an outstanding empirical question of the extent to which the current WTP estimates will

match observable, "real world" consumption decisions. Future complementary research might wish to combat some of these limitations by utilising more "realistic" study designs, comprising observable dependent measures (e.g., a taste test where people are exposed to or asked to handle or consume products before evaluation, e.g., Dohle, Rall, & Siegrist, 2016).

A final limitation is some of the restricted characteristics of the sample, they were relatively young on average, and dietary preferences were predominantly omnivore. While dietary preferences did not seem to have much of an effect on WTP in this study, this may have been due to the relatively small number of participants endorsing a non-omnivore diet. A recent Finnish study, for example, found a significant predictive role for dietary preferences on intention to eat insects (Elorinne, Niva, Vartiainen, & Vaisanen, 2019). Future studies could seek to explore how people with more diverse dietary preferences respond to the stimuli used in the current work.

4.5 Implications and conclusions

The current study has a number of potential implications. Most importantly, our findings emphasise the need to consider the "yuck factor" within sustainable consumption decisions, particularly for products that map onto evolved and socioculturally-established disgust elicitors (c.f. House, 2016; Russell & Lux, 2009). We have shown that WTP decisions for these kinds of products can be reliably predicted based on individuals' underlying propensity to disgust. First, being able to classify consumers based on individual difference factors is important in consumer psychology (e.g., Lin, 2002), and helps to identify, for example, people who may be "early adopters" of novel products within society, helping to establish them as normative targets for consumption (House, 2016).

Second, our findings identify at least two possible targets for marketing intervention, should one wish to increase WTP for the kinds of novel product stimuli used in this study. At the trait level, a slower, longer-term intervention (e.g., a repeated controlled exposure to

targeted disgust elicitors) can be used to modify disgust traits directly (e.g., Athey et al., 2015). While disgust traits are generally stable in people over time, they can be ultimately altered with repeated or sustained intervention (e.g., Rozin, 2008).

From a marketing perspective, one could also intervene more quickly at the state level, by targeting the cognitive mediators of the relationships between disgust propensity and WTP identified, including taste, perceived naturalness, and visual appeal (where applicable). Lessons can be learned about the value of how information about atypical products is presented to consumers. Evidence suggests the presentation or description of unfamiliar foodstuffs (e.g., cultured meat) is important in affecting willingness to consume (Siegrist et al., 2018) and prompting discussion about novel foodstuffs in order to counter misperceptions may also be important (Lull & Schuefele, 2017). In particular, our data suggest that efforts to enhance the perceived naturalness and taste of the atypical products could be a good place to start.

In conclusion, individual differences in disgust propensity appear to be an important predictor, over and above pro-environmental attitudes and other important covariates, of WTP for viable sustainable alternatives, including atypically-shaped produce, insect-based foods, and products with ingredients reclaimed from sewage. Trait disgust propensity predicts cognitive appraisals of these products, including taste and naturalness, that help to explain its effect on WTP. Longer-term interventions that target underlying disgust proneness and/or short-term manipulations of cognitive appraisals, in terms of taste and naturalness, are likely to increase WTP for the product types studied herein.

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7 Tables

Table 1. Participant characteristics.

Variable	M (SD) or N (%)
Gender	
Male	255 (50.0)
Female	255 (50.0)
Age	34.33 (9.89) years
Ethnicity	
English/Welsh/Scottish/Northern Irish/British	414 (81.2)
Irish	4 (0.8)
Gypsy or Irish Traveller	1 (0.2)
Any other White background	34 (6.7)
White and Black Caribbean	4 (0.8)
White and Black African	1 (0.2)
White and Asian	6 (1.2)
Any other Mixed/multiple ethnic background	4 (0.8)
Indian	12 (2.4)
Pakistani	4 (0.8)
Bangladeshi	1 (0.2)
Chinese	5 (1.0)
Any other Asian background	4 (0.8)
African	3 (0.6)
Caribbean	9 (1.8)
Any other Black/African/Caribbean background	1 (0.2)
Arab	0 (0.0)
Any other ethnic group	3 (0.6)
Highest qualification	
GCSE or equivalent secondary school qualification	101 (19.8)
A-level or equivalent post-secondary level qualification	157 (30.8)
Bachelors or equivalent first degree level qualification	178 (35.0)
Masters or equivalent higher degree level qualification	61 (12.0)
PhD or equivalent doctoral level qualification	8 (1.6)
None of the above	5 (1.0)
Employment status	
Student	39 (7.7)
Employed	365 (71.6)
Unemployed	90 (17.6)
Retired	16 (3.1)
Weekly spend	£69.19 (£44.65)
Dietary preferences	
Omnivore	445 (87.3)
Vegetarian	39 (7.6)
Vegan	11 (2.2)
Other (please specify)	15 (2.9)
Primary shop	
Tesco	161 (31.6)
Sainsburys	61 (12.0)
Asda	90 (17.7)
Morrisons	48 (9.4)
Waitrose	10 (2.0)
Marks & Spencer (M&S)	6 (1.2)
The Co-operative (CO-OP)	8 (1.6)
Aldi	76 (14.9)
Lidl	41 (8.0)
None of the above	7 (1.4)

Note. N = 510.

Table 2. Means (M), standard deviations (SD), and inter-correlations of trait predictors and averaged state outcome variables.

	Average (M) state outcome variables for "yuck factor" variant						
Trait variables	% WTP[a]	Taste worse	Make unwell	More natural	Less visual appeal	Less nutrition	M (SD)
Disgust propensity (DS-R)	-.398***	.379***	.316***	-.253***	.269***	.337***	2.06 (0.64)
Disgust sensitivity (DPSS-R)	-.175***	.245***	.256***	-.109*	.100*	.242***	13.84 (4.97)
Disgust reappraisal (ERQ-D)	.077	-.002	-.010	-.017	.094*	.031	9.31 (2.38)
Disgust suppression (ERQ-D)	.024	.012	.043	-.064	.010	.034	8.39 (2.88)
Pro-environmental identity (PESI)	.155**	-.174***	-.190***	.098*	-.131**	-.207***	15.34 (2.73)
Social desirability (MCSDS)	-.004	-.006	-.053	-.036	-.047	-.034	6.61 (2.91)
Political orientation (left-right)	-.123**	.118**	.113*	-.087	.031	.110*	2.34 (5.68)
Risk-taking	.092*	-.018	.012	-.032	-.029	.066	5.68 (2.35)
Gender (1=female)	-.060	.033	.061	.075	-.020	.041	0.50 (0.50)
Age	.054	-.188***	-.149**	.049	-.185***	-.166***	34.33 (9.89)
Highest qualification	.196***	-.229***	-.208***	.154***	-.166***	-.230***	2.42 (1.02)
Employed (1=yes)	-.021	-.032	-.027	.013	-.073	-.018	0.72 (0.45)
White British (1=yes)	.023	-.018	-.029	.134**	.007	-.034	0.81 (0.39)
Omnivore diet (1=yes)	-.028	.039	.014	-.025	.022	.024	0.87 (0.33)
Weekly spend	.009	.012	.018	.049	-.040	.004	69.19 (44.65)
M frequency consumption	.145**	.010	.037	.020	-.029	-.014	3.63 (0.99)
M like products	.179***	-.013	.001	.027	-.012	-.051	3.57 (0.44)
M (SD)	0.32 (0.22	13.48 (11.35)	11.80 (11.33)	-4.05 (14.16)	14.61 (10.56)	6.82 (10.02)	-

Note. N = 510. [a]N = 475, due to missing data as a result of implausible values on the WTP task. Correlations are Spearman's rho (rs), rank-biseral (r_{rb}), or phi (r_{Φ}) coefficients. DS-R = Disgust Scale-Revised; DPSS-R = Disgust Propensity and Sensitivity Scale-Revised; % WTP = percentage willingness-to-pay for "yuck factor" variant based on cost of comparison typical product; ERQ-D = Emotion Regulation Questionnaire for disgust; PESI = Pro-Environmental Self-Identity Scale; MCSDS = Marlow-Crowne-Social Desirability Scale. $^{\dagger}p < .10$. $*p < .05$. $**p < .01$. $***p < .001$.

Table 3. Direct estimates from path models.

	Model estimates (B [BC 95% CI])			Estimates of difference		
Paths estimated	**1. Fruit and vegetables**	**2. Reclaimed (sewage)**	**3. Insects**	**(1) vs (2)**	**(1) vs (3)**	**(2) vs (3)**
DS-R → Taste	0.175 [0.074, 0.283]**	0.269 [0.177, 0.360]***	0.338 [0.247, 0.427]***	-0.094	-0.163*	-0.069
DS-R → Health	0.092 [-0.013, 0.200]†	0.203 [0.106, 0.299]***	0.312 [0.220, 0.405]***	-0.111	-0.220**	-0.109
DS-R → Naturalness	-0.187 [-0.299, -0.081]***	-0.170 [-0.277, -0.058]**	-0.285 [-0.392, -0.173]***	-0.017	0.098	0.115
DS-R → Visual appeal	0.179 [0.078, 0.277]**	0.181 [0.074, 0.290]***	0.284 [0.190, 0.386]***	-0.003	-0.105	-0.102
DS-R → Nutrition	0.116 [0.004, 0.234]*	0.234 [0.135, 0.332]***	0.325 [0.231, 0.418]***	-0.118	-0.209**	-0.091
DS-R → % WTP	-0.038 [-0.063, -0.010]*	-0.032 [-0.055, -0.009]**	-0.051 [-0.083, -0.021]**	-0.005	0.013	0.019
DPSS-R (S) → Taste	0.110 [-0.002, 0.242]†	0.071 [-0.025, 0.164]	0.030 [-0.067, 0.129]	0.040	0.080	0.040
DPSS-R (S) → Health	0.186 [0.067, 0.330]**	0.119 [0.022, 0.215]*	0.067 [-0.038, 0.171]	0.067	0.120	0.052
DPSS-R (S) → Naturalness	-0.030 [-0.143, 0.082]	0.024 [-0.085, 0.135]	0.074 [-0.035, 0.183]	-0.054	-0.104	-0.050
DPSS-R (S) → Visual appeal	-0.052 [-0.149, 0.045]	-0.025 [-0.141, 0.093]	-0.059 [-0.165, 0.048]	-0.027	0.007	0.033
DPSS-R (S) → Nutrition	0.140 [0.035, 0.260]**	0.069 [-0.040, 0.175]	0.007 [-0.096, 0.108]	0.071	0.132†	0.061
DPSS-R (S) → % WTP	0.001 [-0.034, 0.034]	0.012 [-0.012, 0.036]	0.013 [-0.016, 0.042]	-0.011	-0.012	-0.001
Taste → % WTP	-0.098 [-0.152, -0.036]**	-0.041 [-0.084, 0.003]†	-0.100 [-0.143, -0.055]***	-0.057	0.002	0.059†
Health → % WTP	-0.016 [-0.079, 0.044]	-0.078 [-0.114, -0.039]***	-0.007 [-0.048, 0.038]	0.061†	-0.010	-0.071*
Naturalness → % WTP	0.026 [-0.002, 0.052]†	0.022 [0.000, 0.045]†	0.041 [0.011, 0.071]**	0.005	-0.015	-0.019
Visual appeal → % WTP	-0.077 [-0.106, -0.049]***	-0.003 [-0.023, 0.016]	-0.004 [-0.026, 0.019]	-0.074***	-0.073***	0.002
Nutrition → % WTP	0.038 [-0.005, 0.082]†	0.021 [-0.011, 0.053]	-0.020 [-0.058, 0.018]	0.017	0.057†	0.040
Taste R^2	.104*	.175**	.166**	-	-	-
Health R^2	.090*	.153*	.159**	-	-	-
Naturalness R^2	.081*	.058*	.109*	-	-	-
Visual appeal R^2	.072*	.049†	.104*	-	-	-
Nutrition R^2	.076†	.140*	.186**	-	-	-
% WTP R^2	.357**	.234*	.293*	-	-	-

Note. N = 485, N = 486, and N = 502 for models (1), (2), and (3), respectively, due to missing data as a result of implausible values on the WTP task. DS-R = Disgust Scale-Revised (a measure of disgust propensity); DPSS-R (S) = disgust sensitivity subscale of the Disgust Propensity and Sensitivity Scale-Revised; % WTP = percentage willingness-to-pay for "yuck factor" variant based on cost of comparison typical product; Taste = "will taste worse"; Health = "will make me unwell"; Naturalness = "is more natural"; Visual appeal = "Looks visually less appealing"; Nutrition = "Has less nutritional/medicinal value"; BC 95% CI = bias-corrected bootstrapped 95% confidence intervals (10,000 replications). Significance estimates based on bootstrapped data. Estimates conditioned on: left-right political orientation, risk-taking, pro-environmental self-identity, highest educational qualification, reappraisal of disgust, suppression of disgust, average frequency of product consumption, and average liking of products. †p < .10. *p < .05. **p < .01. ***p < .001.

Table 4. Indirect (mediation) estimates and total effects from path models.

	Model estimates (B [BC 95% CI])			**Estimates of difference**		
Indirect paths	**1. Fruit and vegetables**	**2. Reclaimed (sewage)**	**3. Insects**	**(1) vs (2)**	**(1) vs (3)**	**(2) vs (3)**
DS-R → Taste → % WTP	-0.017 [-0.036, -0.005]**	-0.011 [-0.026, 0.000]†	-0.034 [-0.054, -0.018]***	-0.006	0.017	0.023*
DS-R → Health → % WTP	-0.002 [-0.012, 0.003]	-0.016 [-0.029, -0.007]***	-0.002 [-0.015, 0.012]	0.014*	0.001	-0.014†
DS-R → Naturalness → % WTP	-0.005 [-0.012, 0.000]*	-0.004 [-0.010, 0.000]*	-0.012 [-0.023, -0.004]**	-0.001	0.007	0.008†
DS-R → Visual appeal →% WTP	-0.014 [-0.024, -0.006]***	0.000 [-0.005, 0.003]	-0.001 [-0.007, 0.006]	-0.013**	-0.013*	0.001
DS-R → Nutrition →% WTP	0.004 [0.000, 0.015]†	0.005 [-0.002, 0.014]	-0.006 [-0.020, 0.005]	-0.001	0.011	0.011
DS-R →ALL →% WTP	-0.033 [-0.050, -0.018]***	-0.026 [-0.040, -0.015]***	-0.055 [-0.074, -0.039]***	-0.007	0.022†	0.029**
DPSS-R (S) → Taste → % WTP	-0.011 [-0.029, 0.000]*	-0.003 [-0.011, 0.001]	-0.003 [-0.015, 0.006]	-0.008	-0.008	0.000
DPSS-R (S) → Health → % WTP	-0.003 [-0.017, 0.008]	-0.009 [-0.020, -0.002]*	0.000 [-0.006, 0.002]	0.006	-0.003	-0.009*
DPSS-R (S) → Naturalness → % WTP	-0.001 [-0.006, 0.002]	0.001 [-0.002, 0.004]	0.003 [-0.001, 0.010]	-0.001	-0.004	-0.003
DPSS-R (S) → Visual appeal →% WTP	0.004 [-0.003, 0.012]	0.000 [-0.001, 0.002]	0.000 [-0.001, 0.004]	0.004	0.004	0.000
DPSS-R (S) → Nutrition →% WTP	0.005 [0.000, 0.016]*	0.001 [-0.001, 0.007]	0.000 [-0.004, 0.002]	0.004	0.005†	0.002
DPSS-R (S) → ALL → % WTP	-0.005 [-0.025, 0.012]	-0.010 [-0.021, 0.001]†	0.000 [-0.015, 0.015]	0.005	-0.005	-0.010
Total effects						
DS-R → WTP	-0.071 [-0.099, -0.040]***	-0.058 [-0.083, -0.034]***	-0.106 [-0.138, -0.075]***	-0.012	0.036†	0.048*
DPSS-R (S) → WTP	-0.004 [-0.039, 0.028]	0.002 [-0.023, 0.028]	0.013 [-0.018, 0.044]	-0.006	-0.017	-0.011

Note. N = 485, N = 486, and N = 502 for models (1), (2), and (3), respectively, due to missing data as a result of implausible values on the WTP task. DS-R = Disgust Scale-Revised (a measure of disgust propensity); DPSS-R (S) = disgust sensitivity subscale of the Disgust Propensity and Sensitivity Scale-Revised; % WTP = percentage willingness-to-pay for "yuck factor" variant based on cost of comparison typical product; Taste = "will taste worse"; Health = "will make me unwell"; Naturalness = "is more natural"; Visual appeal = "Looks visually less appealing"; Nutrition = "Has less nutritional/medicinal value"; BC 95% CI = bias-corrected bootstrapped 95% confidence intervals (10,000 replications). Significance estimates based on bootstrapped data. Estimates conditioned on: left-right political orientation, risk-taking, pro-environmental self-identity, highest educational qualification, reappraisal of disgust, suppression of disgust, average frequency of product consumption, and average liking of products. †p < .10. *p < .05. **p < .01. ***p < .001.

8 Figures

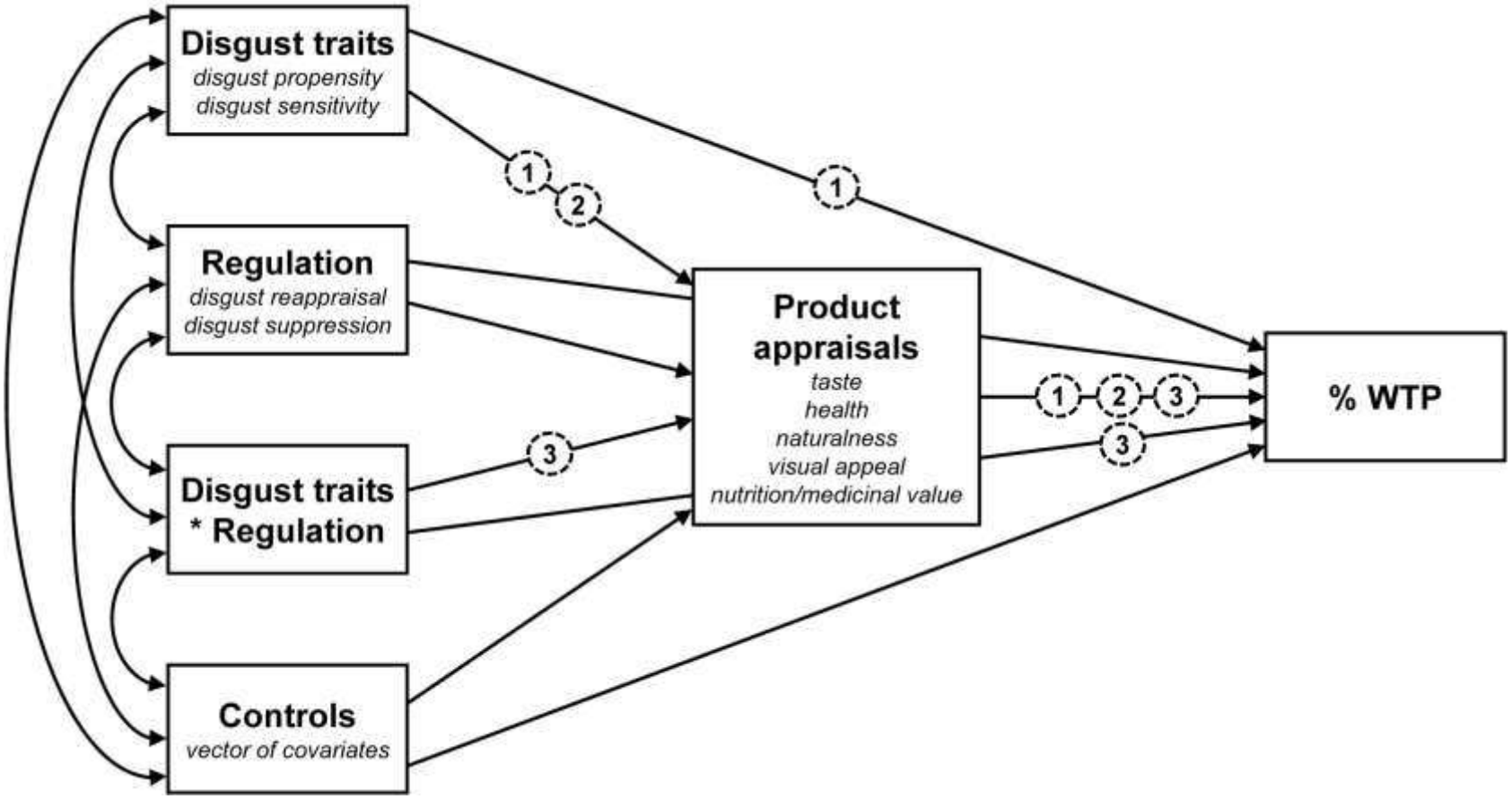

Figure 1. Theoretical path model tested in this study, numbers in dashed circles represent parameters estimated to test hypotheses 1, 2, and 3, respectively. Disgust traits * Regulation = interaction terms between the disgust traits and disgust regulation variables modelled to test hypothesis 3; % WTP = percentage willingness-to-pay for "yuck factor" variant based on cost of comparison typical product.

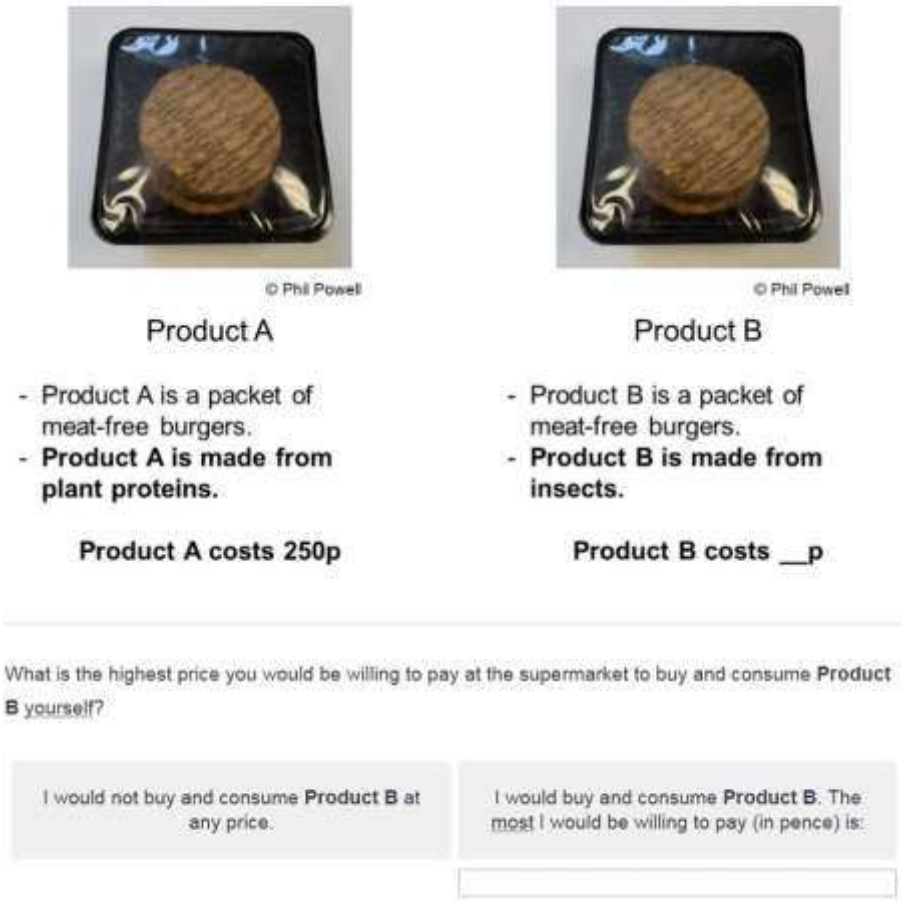

Figure 2. Example of a willingness-to-pay task from the online survey using insect-based stimuli.

Figure 3. Fruit and vegetable stimuli used in the study.

9 Highlights

- The “yuck factor” may be an important psychological barrier to sustainable products
- Path analyses explored the effects of disgust traits on cognitive appraisals and WTP
- Differences in disgust propensity predict WTP for atypical product alternatives
- Cognitive appraisals of taste and naturalness mediated between disgust and WTP
- Altering perceived taste and naturalness of “yuck factor” products may be effective

10 Online Appendices

Appendix A – Pilot Study Methods

This supplement describes the pilot study and how the stimuli were selected for the main study reported in the manuscript.

Participants. The participants were 20 (10 were women) staff and students from the host research institution. The sample included academic staff (n = 5), non-academic staff (n = 7), and students (n = 8). Ages ranged from 21 to 52 years (M = 30.3, SD = 8.56). Participants completed the study on a range of devices, including smartphones (n = 4), tablets (n = 4), and laptops (n = 12), in the presence of the lead researcher.

Materials and methods. Participants were presented with 42 pairs of photos of products (stimuli) depicted side-by-side, with a prototypical product on the left ("Product A") and the atypical (i.e., "yuck factor") product on the right ("Product B"). These stimuli were drawn from five product categories thought to a priori invoke the "yuck factor": atypically-shaped fruit (k = 8); atypically-shaped vegetables (k = 7); insect-based foods (k = 9); drinks made from ingredients reclaimed from sewage (k = 9); and medicines made from ingredients reclaimed from sewage (k = 9).

The fruit and vegetable stimuli were sourced from a Berlin artist, Uli Westphal (https://www.uliwestphal.de/), who granted copyright permission for their use. The remaining stimuli were generated by the research team. Branding information was removed from product photos wherever possible. Underneath each product photo were two key written details about the product, describing what the product is and an ingredient it contains (which may be typical or atypical). For the fruit and vegetable stimuli, which varied in visual appearance, these two additional written details were held constant for each product pair. For the remaining stimuli, the depicted image was held constant for each product pair, while the text underneath the products was systematically varied (with bold text indicating key

differences). The full list of pilot and study stimuli and text used is included within the supplementary materials associated with this article, Table B.1.

Procedure. On each trial, participants were first informed of the type of product that would be considered within the trial (e.g., apples). They were then asked whether or not this product would be something that they would consume (i.e., "do you consume x?" yes / no) and, where the participant responded 'yes', how often they typically consumed the product, using a 5-point scale (1 = less than once a month, 2 = about once a month, 3 = about twice a month, 4 = about once a week, 5 = more than once a week). Next, all participants were asked how much they liked the product on a 5-point scale (1 = dislike a great deal, 2 = dislike somewhat, 3 = neither like nor dislike, 4 = like somewhat, 5 = like a great deal).

Participants were then presented with a product-pair stimulus (e.g., prototypical and atypical apple), including the written description, and were asked to comparatively rate the products on six qualitative dimensions. All responses were made using a 100-point slider (0 = product A more so, 50 = product A and B are equal, 100 = product B more so), with participants required to rate: (1) likely taste ("will taste better"); (2) perceived effect on health ("will make me unwell"); (3) naturalness ("is more natural"); (4) disgustingness ("is more disgusting"); (5) visual appeal ("looks visually more appealing"); and (6) nutritional or medicinal value ("has less nutritional[/medicinal] value"). All of the product-pair stimuli and the rating scales for each product-pair were randomly presented to participants in order to reduce any order effects.

In order to help inform the design of the main experiment, participants were finally asked to provide qualitative feedback on their experience of completing the survey and to outline any suggestions for improvements they might have.

The purpose of the pilot study was to select a reduced set of photographic and corresponding textual information to use in the full study. Full pilot results are in Table B.2

in the supplementary materials. After removing statistical outliers (M +/− 2 SD), the three products (or textual variant) that had the highest disgust ratings in each category were selected for inclusion in the full study.[2]

Several refinements were made to the full study as a result of participant feedback in the pilot, including a recommendation (but not mandate) for using a tablet-sized device or larger to complete the study; providing a clearer definition of "consume" as "(i.e., eat, drink, or use in cooking)"; simplification of the sliders to reduce measurement error, by rewording responses so that approval for positively correlated attributes was indicated by sliding in the same direction (the dimensions of taste, "will taste worse", and visual appeal, "looks visually less appealing", were reworded from the pilot study to try and minimise measurement error in the direction of responding), and setting the slider midpoint at zero; and, finally, to provide context for the WTP questions, the inclusion of a specified context (i.e., "at the supermarket").

[2] The only exception to this was in the insects category, where one pilot participant was unsure what a "cricket" was, and the use of the term "bugs", although rated as more disgusting, was decided to be potentially problematic given its overlap with infectious disease; accordingly, we chose to use the term "insects" in the full study for simplicity (even though this had the lowest disgust rating overall in that category).

Appendix B – Pilot Study Stimuli and Results

Table B.1 Full list of piloted (and study) stimuli.

Category	Stimuli	Text of typical product	Text of "yuck factor" product
Fruit	Cucumber	– Product X is a cucumber. – Product X contains vitamin C.	– Product X is a cucumber. – Product X contains vitamin C.
Fruit	Green apple	– Product X is a green apple. – Product X contains vitamin C.	– Product X is a green apple. – Product X contains vitamin C.
Fruit	Lemon	– Product X is a lemon. – Product X contains vitamin C.	– Product X is a lemon. – Product X contains vitamin C.
Fruit	Orange	– Product X is an orange. – Product X contains vitamin C.	– Product X is an orange. – Product X contains vitamin C.
Fruit	Pear	– Product X is a pear. – Product X contains vitamin C.	– Product X is a pear. – Product X contains vitamin C.
Fruit	Red apple	– Product X is a red apple. – Product X contains vitamin C.	– Product X is a red apple. – Product X contains vitamin C.
Fruit	Strawberry	– Product X is a strawberry. – Product X contains vitamin C.	– Product X is a strawberry. – Product X contains vitamin C.
Fruit	Tomato	– Product X is a tomato. – Product X contains vitamin C.	– Product X is a tomato. – Product X contains vitamin C.
Vegetable	Aubergine	– Product X is an aubergine. – Product X contains vitamin C.	– Product X is an aubergine. – Product X contains vitamin C.
Vegetable	Carrot	– Product X is a carrot. – Product X contains vitamin C.	– Product X is a carrot. – Product X contains vitamin C.
Vegetable	Courgette	– Product X is a courgette. – Product X contains vitamin C.	– Product X is a courgette. – Product X contains vitamin C.
Vegetable	Mushroom	– Product X is a closed cup mushroom. – Product X contains vitamin C.	– Product X is a closed cup mushroom. – Product X contains vitamin C.
Vegetable	Red pepper	– Product X is a red pepper. – Product X contains vitamin C.	– Product X is a red pepper. – Product X contains vitamin C.
Vegetable	Red potato	– Product X is a red potato. – Product X contains vitamin C.	– Product X is a red potato. – Product X contains vitamin C.
Vegetable	White potato	– Product X is a white potato. – Product X contains vitamin C.	– Product X is a white potato. – Product X contains vitamin C.
Insects	Meat-free burger (insect)	– Product X is a packet of meat-free burgers. – **Product X is made from plant proteins.**	– Product X is a packet of meat-free burgers. – **Product X is made from insects.**
Insects	Meat-free burger (cricket)	– Product X is a packet of meat-free burgers. – **Product X is made from plant proteins.**	– Product X is a packet of meat-free burgers. – **Product X is made from crickets.**
Insects	Meat-free burger (bugs)	– Product X is a packet of meat-free burgers. – **Product X is made from plant proteins.**	– Product X is a packet of meat-free burgers. – **Product X is made from bugs.**
Insects	Cookies (insect)	– Product X is a packet of cookies. – **Product X contains flour made from plants.**	– Product X is a packet of cookies. – **Product X contains flour made from insects.**
Insects	Cookies (crickets)	– Product X is a packet of cookies.	– Product X is a packet of cookies.

		– **Product X contains flour made from plants.**	– **Product X contains flour made from crickets.**
Insects	Cookies (bugs)	– Product X is a packet of cookies. – **Product X contains flour made from plants.**	– Product X is a packet of cookies. – **Product X contains flour made from bugs.**
Insects	Protein bar (insect)	– Product X is a protein bar. – **Product X contains whey protein.**	– Product X is a protein bar. – **Product X contains insect protein.**
Insects	Protein bar (crickets)	– Product X is a protein bar. – **Product X contains whey protein.**	– Product X is a protein bar. – **Product X contains protein from crickets.**
Insects	Protein bar (bugs)	– Product X is a protein bar. – **Product X contains whey protein.**	– Product X is a protein bar. – **Product X contains protein from bugs.**
Drinks	Dark fizzy drink (biological waste)	– Product X is a 500ml bottle of a dark fizzy drink. – **Product X contains freshly manufactured carbon dioxide (CO_2).**	– Product X is a 500ml bottle of a dark fizzy drink. – **Product X contains treated carbon dioxide (CO_2) from biological waste.**
Drinks	Dark fizzy drink (sewage)	– Product X is a 500ml bottle of a dark fizzy drink. – **Product X contains freshly manufactured carbon dioxide (CO_2).**	– Product X is a 500ml bottle of a dark fizzy drink. – **Product X contains treated carbon dioxide (CO_2) from sewage.**
Drinks	Dark fizzy drink (recycled sewage)	– Product X is a 500ml bottle of a dark fizzy drink. – **Product X contains freshly manufactured carbon dioxide (CO_2).**	– Product X is a 500ml bottle of a dark fizzy drink. – **Product X contains recycled carbon dioxide (CO_2) from sewage.**
Drinks	Clear fizzy drink (biological waste)	– Product X is a 500ml bottle of a clear fizzy drink. – **Product X contains freshly manufactured carbon dioxide (CO_2).**	– Product X is a 500ml bottle of a clear fizzy drink. – **Product X contains treated carbon dioxide (CO_2) from biological waste.**
Drinks	Clear fizzy drink (sewage)	– Product X is a 500ml bottle of a clear fizzy drink. – **Product X contains freshly manufactured carbon dioxide (CO_2).**	– Product X is a 500ml bottle of a clear fizzy drink. – **Product X contains treated carbon dioxide (CO_2) from sewage.**
Drinks	Clear fizzy drink (recycled sewage)	– Product X is a 500ml bottle of a clear fizzy drink. – **Product X contains freshly manufactured carbon dioxide (CO_2).**	– Product X is a 500ml bottle of a clear fizzy drink. – **Product X contains recycled carbon dioxide (CO_2) from sewage.**
Drinks	Water (biological waste)	– Product X is a 500ml bottle of a still water. – **Product X contains fresh water.**	– Product X is a 500ml bottle of a still water. – **Product X contains treated water from biological waste.**
Drinks	Water (sewage)	– Product X is a 500ml bottle of a still water. – **Product X contains fresh water.**	– Product X is a 500ml bottle of a still water. – **Product X contains treated water from sewage.**
Drinks	Water (recycled sewage)	– Product X is a 500ml bottle of a still water. – **Product X contains fresh**	– Product X is a 500ml bottle of a still water. – **Product X contains recycled**

		water.	**water from sewage.**
Medicines	Vitamin tablets (biological waste)	− Product X is a tub of vitamin tablets. − **Product X contains freshly manufactured vitamins.**	− Product X is a tub of vitamin tablets. − **Product X contains treated vitamins from biological waste.**
Medicines	Vitamin tablets (sewage)	− Product X is a tub of vitamin tablets. − **Product X contains freshly manufactured vitamins.**	− Product X is a tub of vitamin tablets. − **Product X contains treated vitamins from sewage.**
Medicines	Vitamin tablets (recycled sewage)	− Product X is a tub of vitamin tablets. − **Product X contains freshly manufactured vitamins.**	− Product X is a tub of vitamin tablets. − **Product X contains recycled vitamins from sewage.**
Medicines	Paracetamol (biological waste)	− Product X is a packet of paracetamol tablets. − **Product X contains freshly manufactured paracetamol.**	− Product X is a packet of paracetamol tablets. − **Product X contains treated paracetamol from biological waste.**
Medicines	Paracetamol (sewage)	− Product X is a packet of paracetamol tablets. − **Product X contains freshly manufactured paracetamol.**	− Product X is a packet of paracetamol tablets. − **Product X contains treated paracetamol from sewage.**
Medicines	Paracetamol (recycled sewage)	− Product X is a packet of paracetamol tablets. − **Product X contains freshly manufactured paracetamol.**	− Product X is a packet of paracetamol tablets. − **Product X contains recycled paracetamol from sewage.**
Medicines	Cough syrup (biological waste)	− Product X is a bottle of cough syrup. − **Product X contains freshly manufactured glycerin.**	− Product X is a bottle of cough syrup. − **Product X contains treated glycerin from biological waste.**
Medicines	Cough syrup (sewage)	− Product X is a bottle of cough syrup. − **Product X contains freshly manufactured glycerin.**	− Product X is a bottle of cough syrup. − **Product X contains treated glycerin from sewage.**
Medicines	Cough syrup (recycled sewage)	− Product X is a bottle of cough syrup. − **Product X contains freshly manufactured glycerin.**	− Product X is a bottle of cough syrup. − **Product X contains recycled glycerin from sewage.**

Note. Grey highlighted rows are stimuli used in the full study.

Table B.2 Full pilot results.

PRODUCT	BACKGROUND VARS			RATINGS M (SD)					
	consume	**how often**	**like**	**disgust**	**taste**	**unwell**	**natural**	**visual**	**nutrition**
FRUIT	85.63%	3.29 (0.85)	4.06 (0.59)	60.37*** (7.94)	45.56 (12.26)	53.17*** (3.55)	56.39 (21.05)	21.45*** (18.93)	50.85 (3.87)
		without outliers (M +/− 2 SD):		59.34*** (6.64)	44.76*** (5.53)	52.71*** (2.98)	54.29 (10.94)	18.22*** (12.59)	50.85 (3.87)
		range, rounded (without outliers):		50-80 (50-76)	20-86 (35-53)	50-62 (50-59)	5-100 (35-67)	0-83 (0-41)	43-58 (43-58)
cucumber	90%	3.72 (1.56)	3.95 (1.36)	54.55* (9.45)	47.10 (21.39)	52.25 (8.92)	65.20** (29.64)	29.90** (29.64)	51.45 (7.88)
		without outliers (M +/− 2 SD):		51.61* (2.87)	46.78 (14.70)	50.26 (0.81)	68.11** (20.17)	22.61*** (20.41)	49.11 (3.36)
		range (without outliers):		49-82 (49-60)	0-100 (11-73)	49-90 (49-53)	10-100 (30-100)	0-100 (0-69)	41-74 (41-53)
green apple	90%	3.33 (1.33)	4.15 (0.67)	57.95** (9.32)	47.00 (12.01)	53.05* (6.18)	53.90 (26.98)	23.55*** (23.35)	47.35 (12.73)
		without outliers (M +/− 2 SD):		57.95** (9.32)	46.39* (5.75)	51.89* (3.48)	53.90 (26.98)	19.52*** (15.29)	49.84 (6.33)
		range (without outliers):		41-75 (41-75)	20-85 (34-53)	49-75 (49-60)	0-100 (0-100)	0-100 (0-50)	0-65 (28-65)
lemon	70%	2.71 (1.38)	3.80 (1.06)	67.60*** (13.40)	45.00 (16.19)	55.30** (7.63)	50.30 (25.33)	19.75*** (23.20)	53.35† (8.05)
		without outliers (M +/− 2 SD):		65.89*** (11.32)	42.26** (10.89)	54.00** (5.08)	50.30 (25.33)	15.68*** (14.97)	51.84† (4.52)
		range (without outliers):		50-100 (50-90)	20-97 (20-52)	49-80 (49-67)	0-100 (0-100)	0-97 (0-47)	40-82 (40-60)
orange	90%	3.22 (1.26)	4.05 (1.05)	62.30*** (11.20)	42.35* (13.13)	54.70** (6.30)	58.30† (19.91)	15.15*** (11.95)	51.35 (3.83)
		without outliers (M +/− 2 SD):		62.30*** (11.20)	42.35* (13.13)	53.63** (4.22)	53.67 (14.68)	13.84*** (10.70)	50.63 (2.14)
		range (without outliers):		50-80 (50-80)	19-68 (19-68)	50-75 (50-62)	27-100 (27-75)	0-40 (0-30)	45-65 (45-55)
pear	65%	2.31 (1.44)	3.75 (1.02)	57.40*** (6.10)	46.40* (5.90)	53.75* (5.95)	55.90 (22.30)	18.60*** (14.59)	50.25 (3.01)
		without outliers (M +/− 2 SD):		56.68*** (5.33)	47.26* (4.58)	52.74** (3.96)	58.84† (18.50)	18.60*** (14.59)	50.68 (2.36)
		range (without outliers):		50-71 (50-66)	30-53 (35-53)	50-73 (50-60)	0-100 (20-100)	0-40 (0-40)	42-56 (47-56)
red apple	95%	3.63 (1.38)	4.15 (0.75)	65.10*** (16.34)	47.40 (22.53)	52.70* (4.79)	54.70 (24.28)	19.60*** (23.26)	49.85 (4.45)
		without outliers (M +/− 2 SD):		61.22*** (11.81)	41.56* (14.34)	51.39* (2.68)	57.58 (21.15)	15.37*** (13.89)	50.11 (1.75)
		range (without outliers):		50-100 (50-90)	10-100 (10-59)	49-66 (49-60)	0-100 (27-100)	0-100 (0-40)	35-60 (45-54)
strawberry	95%	2.63 (1.16)	4.45 (0.69)	60.00** (13.19)	41.75† (20.36)	52.80* (4.44)	59.65† (23.71)	20.65*** (23.96)	51.25 (4.38)
		without outliers (M +/− 2 SD):		57.89** (9.49)	40.83** (12.66)	52.16* (3.48)	62.79* (19.63)	16.47*** (15.41)	51.89* (3.38)
		range (without outliers):		50-100 (50-80)	0-100 (10-60)	49-65 (49-60)	0-100 (30-100)	0-100 (0-44)	39-60 (49-60)
tomato	90%	4.44 (0.86)	4.15 (1.18)	58.05** (9.37)	47.50 (14.54)	50.80 (2.55)	53.20 (23.46)	24.40*** (22.87)	51.95† (4.93)
		without outliers (M +/− 2 SD):		56.68*** (7.30)	44.84* (8.60)	50.32 (1.38)	56.00 (20.38)	20.42*** (14.76)	51.95† (4.93)
		range (without outliers):		50-84 (50-70)	25-98 (25-60)	47-60 (47-54)	0-100 (20-100)	0-100 (0-50)	44-61 (44-61)

PRODUCT	BACKGROUND VARS			RATINGS M (SD)					
	consume	how often	like	disgust	taste	unwell	natural	visual	nutrition
VEG	76.45%	3.42 (0.70)	3.80 (0.66)	55.14*** (4.86)	51.15 (11.09)	50.98* (1.62)	59.04† (19.81)	25.64*** (21.23)	49.41 (3.92)
			without outliers (M +/− 2 SD):	54.47*** (3.95)	48.95 (5.30)	50.80* (1.44)	59.33* (14.65)	22.00*** (13.98)	49.88 (2.09)
			range, rounded (without outliers):	50-68 (50-61)	38-93 (38-64)	49-54 (49-54)	13-100 (26-93)	0-95 (0-44)	41-58 (47-56)
aubergine	50%	2.70 (1.49)	3.15 (1.14)	59.30** (12.31)	52.55 (14.13)	51.10 (2.92)	59.70 (26.91)	23.50*** (23.88)	50.70 (4.65)
			without outliers (M +/− 2 SD):	57.16*** (7.94)	48.28 (4.52)	50.74 (2.49)	62.84* (23.58)	19.47*** (16.11)	49.67 (3.58)
			range (without outliers):	50-100 (50-78)	37-100 (37-53)	47-60 (47-60)	0-100 (10-100)	0-100 (0-50)	38-60 (38-58)
carrot	100%	3.60 (1.35)	4.20 (1.01)	56.95*** (7.88)	50.00 (16.64)	51.55 (4.50)	58.30 (24.10)	19.15*** (21.99)	50.05 (6.06)
			without outliers (M +/− 2 SD):	56.95*** (7.88)	45.28* (8.41)	50.11 (0.83)	61.37* (20.36)	15.05*** (12.50)	49.26 (5.06)
			range (without outliers):	50-71 (50-71)	20-97 (20-53)	49-65 (49-53)	0-100 (15-100)	0-97 (0-40)	35-65 (35-60)
courgette	55%	3.10 (1.38)	3.35 (1.35)	54.15** (5.98)	52.25 (13.80)	50.35 (13.80)	54.40 (18.92)	31.55** (24.88)	49.05 (6.97)
			without outliers (M +/− 2 SD):	53.37** (4.98)	49.79 (8.55)	50.06 (0.87)	54.33 (12.72)	27.95*** (19.47)	47.95† (5.06)
			range (without outliers):	50-69 (50-66)	30-99 (30-68)	48-53 (48-52)	10-100 (24-80)	0-100 (0-55)	32-70 (32-53)
mushroom	80%	3.63 (1.09)	3.85 (1.23)	54.50* (7.07)	51.70 (11.80)	52.10* (3.43)	59.80* (20.90)	32.05** (23.69)	49.45 (6.68)
			without outliers (M +/− 2 SD):	52.72* (4.73)	49.16 (3.25)	51.17* (1.98)	59.80* (20.90)	28.47*** (17.95)	48.42 (4.98)
			range (without outliers):	50-71 (50-65)	40-100 (40-56)	50-61 (50-56)	27-100 (27-100)	0-100 (0-60)	30-69 (30-52)
red pepper	85%	4.06 (1.03)	4.00 (1.12)	54.30* (7.36)	49.10 (11.58)	50.25 (0.91)	63.55* (22.94)	25.05*** (24.41)	49.75 (2.77)
			without outliers (M +/− 2 SD):	52.95** (4.30)	48.83 (4.97)	50.22* (0.43)	63.55* (22.94)	21.11*** (17.34)	49.67 (1.88)
			range (without outliers):	49-80 (49-64)	19-84 (35-59)	48-53 (50-51)	20-100 (20-100)	0-100 (0-50)	44-57 (45-53)
red potato	70%	2.57 (1.45)	3.65 (0.75)	54.55** (7.03)	53.15 (10.57)	50.85† (1.98)	59.10† (22.27)	23.45*** (19.80)	48.45 (4.38)
			without outliers (M +/− 2 SD):	52.56** (3.58)	52.89† (6.91)	50.28 (0.96)	61.68* (19.56)	21.05*** (17.10)	49.05 (3.55)
			range (without outliers):	50-74 (50-60)	30-81 (44-70)	50-56 (50-54)	10-100 (15-100)	0-69 (0-50)	37-54 (40-54)
white potato	95%	4.00 (0.58)	4.40 (0.60)	52.20* (3.71)	49.30 (13.46)	50.65 (1.76)	58.45† (21.17)	24.75*** (23.99)	48.40 (5.50)
			without outliers (M +/− 2 SD):	51.17* (1.95)	46.63* (6.39)	50.42 (1.46)	61.00* (18.32)	20.89*** (18.32)	49.37 (3.48)
			range (without outliers):	49-63 (49-55)	30-100 (30-54)	48-55 (48-54)	10-100 (30-100)	0-98 (0-50)	30-55 (40-55)
DRINKS	76.67%	3.00 (1.29)	3.70 (0.69)	73.83*** (14.65)	35.12*** (14.53)	64.71*** (16.61)	46.22 (11.85)	45.18* (8.39)	56.58* (11.55)
			without outliers (M +/− 2 SD):	73.83*** (14.65)	35.12*** (14.53)	64.71*** (16.61)	47.59 (10.43)	46.26* (7.05)	54.90* (9.00)
			range, rounded (without outliers):	52-100 (52-100)	13-50 (13-50)	50-97 (50-97)	20-67 (33-67)	25-51 (31-51)	47-89 (47-78)

PRODUCT	BACKGROUND VARS			RATINGS M (SD)					
	consume	how often	like	disgust	taste	unwell	natural	visual	nutrition
drk/sewage	65%	3.38 (1.50)	3.60 (1.19)	74.15*** (18.41)	40.70* (14.62)	64.35** (18.57)	53.55 (15.72)	46.40† (9.06)	54.20 (11.03)
		without outliers (M +/− 2 SD):		74.15*** (18.41)	42.74* (11.75)	64.35** (18.57)	55.21 (14.23)	49.17 (2.66)	51.95† (4.62)
		range (without outliers):		50-100 (50-100)	2-50 (12-50)	49-100 (49-100)	22-82 (26-82)	16-51 (41-51)	50-97 (50-69)
drk/bwaste	65%	3.38 (1.50)	3.60 (1.19)	73.65*** (17.24)	43.05† (17.66)	63.30** (17.33)	55.25† (12.91)	47.45 (6.92)	55.55† (13.18)
		without outliers (M +/− 2 SD):		73.65*** (17.24)	40.53** (13.95)	61.37** (15.44)	57.16** (9.96)	49.56 (2.43)	51.83 (6.91)
		range (without outliers):		50-100 (50-100)	8-91 (8-51)	50-100 (50-90)	19-80 (49-80)	26-51 (40-51)	40-90 (40-76)
drk/recycle	65%	3.38 (1.50)	3.60 (1.19)	73.60*** (18.89)	37.20** (16.19)	63.85** (16.05)	53.75 (10.51)	47.50 (6.58)	55.65† (12.47)
		without outliers (M +/− 2 SD):		73.60*** (18.89)	39.16** (14.00)	63.85** (16.05)	53.78* (6.39)	50.18† (0.39)	51.94 (5.32)
		range (without outliers):		50-100 (50-100)	0-51 (10-51)	50-94 (50-94)	27-80 (45-67)	30-51 (50-51)	47-89 (47-67)
clr/sewage	85%	2.76 (1.15)	3.85 (0.88)	71.60*** (13.28)	36.50** *16.18)	61.45** (17.05)	51.15 (15.84)	48.55 (6.61)	54.20 (12.03)
		without outliers (M +/− 2 SD):		70.11*** (11.79)	38.42** (14.09)	59.47* (14.98)	49.47 (14.33)	50.00 (1.33)	50.67 (5.40)
		range (without outliers):		50-100 (50-94)	0-50 (10-50)	38-99 (38-95)	21-83 (21-80)	21-52 (45-52)	40-88 (40-70)
clr/bwaste	85%	2.76 (1.15)	3.85 (0.88)	74.20*** (16.22)	35.30** (17.19)	63.95** (17.48)	54.70 (18.99)	45.70 (12.35)	56.25† (15.03)
		without outliers (M +/− 2 SD):		74.20*** (16.22)	37.16** (15.46)	59.94** (13.10)	54.39 (13.77)	49.56 (2.96)	52.06 (7.86)
		range (without outliers):		50-100 (50-100)	0-50 (1-50)	50-100 (50-88)	15-100 (24-80)	5-55 (40-55)	40-100 (40-75)
clr/recycle	85%	2.76 (1.15)	3.85 (0.88)	73.55*** (15.85)	35.00** (18.22)	62.25** (16.53)	53.10 (16.44)	45.95 (11.56)	54.10 (10.81)
		without outliers (M +/− 2 SD):		73.55*** (15.85)	35.00** (18.22)	58.06** (10.91)	54.84 (14.87)	49.56 (3.20)	52.71† (5.88)
		range (without outliers):		50-100 (50-100)	0-51 (0-51)	50-100 (50-86)	20-85 (23-85)	10-55 (40-55)	31-79 (47-71)
wtr/sewage	80%	3.31 (1.54)	3.65 (0.93)	72.80*** (21.23)	30.65*** (19.89)	67.85*** (20.18)	32.75** (24.30)	43.15* (14.14)	58.10† (18.72)
		without outliers (M +/− 2 SD):		75.05*** (19.20)	30.65*** (19.89)	67.85*** (20.18)	30.16*** (21.95)	45.42† (10.10)	53.44 (12.7)
		range (without outliers):		30-100 (50-100)	0-51 (0-51)	50-100 (50-100)	0-82 (0-75)	0-54 (21-54)	35-100 (35-92)
wtr/bwaste	80%	3.31 (1.54)	3.65 (0.93)	73.05*** (16.05)	31.45*** (17.76)	66.05** (19.55)	29.60*** (22.32)	41.35* (16.10)	60.80* (21.67)
		without outliers (M +/− 2 SD):		73.05*** (16.05)	31.45*** (17.76)	66.05** (19.55)	26.84*** (19.12)	43.53* (13.17)	60.80* (21.67)
		range (without outliers):		51-100 (51-100)	0-50 (0-50)	50-100 (50-100)	0-82 (0-51)	0-51 (11-51)	26-100 (26-100)
wtr/recycle	80%	3.31 (1.54)	3.65 (0.93)	77.85*** (18.49)	26.25*** (19.65)	69.30*** (21.66)	32.15** (26.53)	40.55* (17.99)	60.40* (19.73)
		without outliers (M +/− 2 SD):		77.85*** (18.49)	26.25*** (19.65)	69.30*** (21.66)	32.15** (26.53)	45.06 (12.12)	53.41 (10.78)
		range (without outliers):		50-100 (50-100)	0-50 (0-50)	50-100 (50-100)	0-83 (0-83)	0-51 (5-51)	49-100 (49-94)

PRODUCT	BACKGROUND VARS			RATINGS M (SD)					
	consume	how often	like	disgust	taste	unwell	natural	visual	nutrition
ALL/sewage	76.67%	3.00 (1.29)	3.70 (0.69)	72.85*** (14.68)	35.95*** (14.48)	64.55*** (16.55)	45.82 (12.66)	46.03* (7.92)	55.50* (11.36)
			without outliers (M +/− 2 SD):	72.85*** (14.68)	35.95*** (14.48)	60.83** (12.65)	45.82 (12.66)	48.15 (4.69)	53.56† (7.54)
			range, rounded (without outliers):	52-100 (52-100)	8-50 (8-50)	50-98 (50-82)	21-71 (21-71)	25-51 (32-51)	47-92 (47-73)
ALL/bwaste	76.67%	3.00 (1.29)	3.70 (0.69)	73.63*** (14.62)	36.60*** (14.45)	64.43** (16.99)	46.52 (12.72)	44.83* (9.50)	57.5* (14.56)
			without outliers (M +/− 2 SD):	73.63*** (14.62)	36.60*** (14.45)	62.56** (15.19)	48.04 (11.05)	46.19* (7.49)	53.98 (10.14)
			range, rounded (without outliers):	52-100 (52-100)	12-55 (12-55)	50-100 (50-97)	18-67 (24-67)	19-51 (30-51)	43-92 (43-86)
ALL/recycle	76.67%	3.00 (1.29)	3.70 (0.69)	75.00*** (16.67)	32.82*** (16.54)	65.13*** (17.20)	46.33 (12.48)	44.67* (9.33)	56.72* (11.18)
			without outliers (M +/− 2 SD):	75.00*** (16.67)	32.82*** (16.54)	65.13*** (17.20)	46.33 (12.48)	45.86* (7.87)	53.70* (6.55)
			range, rounded (without outliers):	53-100 (53-100)	4-50 (4-50)	50-94 (50-94)	22-71 (22-71)	22-51 (30-51)	48-86 (48-70)
INSECTS	60%	2.58 (0.89)	3.58 (0.56)	72.09*** (14.15)	39.72** (14.39)	59.28* (15.31)	52.02 (8.42)	46.31 (13.13)	49.02 (11.81)
			without outliers (M +/− 2 SD):	72.09*** (14.15)	39.59*** (10.86)	55.66* (11.11)	52.02 (8.42)	48.75 (7.52)	45.65** (5.95)
			range, rounded (without outliers):	53-100 (53-100)	10-72 (19-57)	43-93 (43-87)	37-65 (37-65)	0-71 (31-71)	35-82 (35-56)
brger/insect	50%	1.70 (1.06)	3.05 (1.10)	73.70*** (16.98)	33.80*** (16.09)	60.50* (16.97)	48.40 (13.14)	44.75† (13.31)	49.20 (14.63)
			without outliers (M +/− 2 SD):	73.70*** (16.98)	37.56*** (11.83)	56.22* (11.31)	49.89 (11.62)	48.72 (4.61)	45.50† (9.72)
			range (without outliers):	50-100 (50-100)	0-58 (21-58)	40-100 (40-83)	20-73 (23-73)	0-51 (32-51)	25-83 (25-60)
brger/cricket	50%	1.70 (1.06)	3.05 (1.10)	73.50*** (18.82)	46.10 (15.16)	59.30* (16.96)	49.60 (15.10)	45.65 (13.17)	48.05 (13.80)
			without outliers (M +/− 2 SD):	73.50*** *18.82)	44.32† (13.25)	52.53* (4.02)	47.89 (13.39)	49.67 (3.53)	44.33** (8.01)
			range (without outliers):	50-100 (50-100)	20-80 (20-70)	49-100 (49-60)	20-82 (20-74)	0-58 (39-58)	30-86 (30-55)
brger/bugs	50%	1.70 (1.06)	3.05 (1.10)	75.05*** (17.80)	33.25*** (14.86)	63.15** (18.92)	52.25 (12.09)	44.90† (12.12)	49.75 (16.28)
			without outliers (M +/− 2 SD):	75.05*** (11.80)	36.94*** (10.12)	63.15** (18.92)	49.22 (8.12)	47.26† (6.10)	45.17* (8.14)
			range (without outliers):	50-100 (50-100)	0-54 (19-54)	40-100 (40-100)	30-81 (30-63)	0-51 (32-51)	27-99 (27-55)
ckies/insect	95%	3.21 (1.13)	4.65 (0.75)	71.85*** (15.14)	39.70† (23.19)	57.55† (16.16)	47.25 (13.63)	46.70 (18.50)	49.35 (17.15)
			without outliers (M +/− 2 SD):	71.85*** (15.14)	36.53** (18.84)	53.17 (9.35)	49.05 (11.29)	46.33 (9.34)	44.50* (8.81)
			range (without outliers):	50-100 (50-100)	0-100 (0-70)	30-100 (30-73)	13-71 (20-71)	0-100 (20-52)	20-97 (20-55)
ckies/cricket	95%	3.21 (1.13)	4.65 (0.75)	73.90*** (14.50)	40.45† (21.88)	57.85* (13.72)	46.30 (14.89)	46.50 (18.68)	48.50 (15.30)
			without outliers (M +/− 2 SD):	73.90*** (14.50)	37.32** (17.26)	55.79* (10.45)	48.74 (10.42)	46.11 (9.71)	48.11 (7.25)
			range (without outliers):	50-100 (50-100)	0-100 (0-60)	49-97 (49-82)	0-67 (20-67)	0-100 (18-51)	10-94 (39-69)

PRODUCT	BACKGROUND VARS			RATINGS M (SD)					
	consume	how often	like	disgust	taste	unwell	natural	visual	nutrition/medicine
ckies/bugs	95%	3.21 (1.13)	4.65 (0.75)	73.65*** (17.25)	42.00* (16.63)	59.45* (19.57)	48.70 (13.32)	46.25 (15.89)	52.10 (18.83)
		without outliers (M +/− 2 SD):		73.65*** (17.25)	44.21† (13.73)	52.29 (9.59)	51.00 (8.70)	46.67 (8.23)	47.00 (10.98)
		range (without outliers):		50-100 (50-100)	0-69 (10-69)	30-100 (30-77)	5-68 (30-68)	0-85 (20-51)	20-100 (20-70)
bar/insect	35%	1.86 (1.07)	3.05 (0.60)	67.50*** (14.06)	38.50* (19.13)	57.25* (11.85)	57.05* (14.07)	47.45 (12.45)	49.90 (13.60)
		without outliers (M +/− 2 SD):		65.79*** (12.12)	42.78† (14.67)	55.95* (10.61)	57.06** (9.24)	49.95 (5.64)	46.17* (7.59)
		range (without outliers):		50-100 (50-87)	0-76 (19-76)	50-82 (50-80)	23-91 (49-78)	0-67 (39-67)	26-87 (26-60)
bar/cricket	35%	1.86 (1.07)	3.05 (0.60)	68.60*** (15.72)	43.40 (18.02)	58.05* (14.26)	58.75* (13.81)	46.45 (14.51)	47.05 (11.44)
		without outliers (M +/− 2 SD):		68.60*** (15.72)	45.68 (15.25)	56.11* (11.60)	57.16* (12.16)	48.89 (9.81)	46.44** (5.06)
		range (without outliers):		49-100 (49-100)	0-79 (20-79)	48-95 (48-86)	42-89 (42-84)	0-73 (18-73)	21-84 (35-51)
bar/bugs	35%	1.86 (1.07)	3.05 (0.60)	71.10*** (17.72)	40.25* (18.66)	60.40* (18.47)	59.90* (16.72)	48.15 (12.34)	47.25 (10.76)
		without outliers (M +/− 2 SD):		71.10*** (17.72)	44.72 (13.31)	58.32* (16.38)	57.79* (14.18)	50.68 (5.02)	45.89† (9.13)
		range (without outliers):		44-100 (44-100)	0-72 (17-72)	49-100 (49-96)	36-100 (36-92)	0-68 (39-68)	27-73 (27-60)
ALL/insect	60%	2.58 (0.89)	3.58 (0.56)	71.02*** (13.73)	37.33** (17.16)	58.43* (14.58)	50.90 (9.01)	46.30 (13.10)	49.48 (12.98)
		without outliers (M +/− 2 SD):		69.49*** (12.24)	37.43*** (13.13)	54.72† (9.58)	51.95 (7.90)	48.74 (7.46)	47.40 (9.31)
		range, rounded (without outliers):		50-100 (50-90)	0-73 (9-58)	40-92 (40-77)	31-61 (34-61)	0-70 (31-70)	34-89 (34-74)
ALL/cricket	60%	2.58 (0.89)	3.58 (0.56)	72.00*** (14.78)	43.32† (14.76)	58.40* (14.00)	51.55 (8.96)	46.20 (14.11)	47.87 (11.95)
		without outliers (M +/− 2 SD):		72.00*** (14.78)	42.85** (9.91)	54.57* (8.00)	51.55 (8.96)	47.06† (6.34)	45.75* (7.51)
		range, rounded (without outliers):		50-100 (50-100)	13-82 (22-59)	50-93 (50-82)	34-67 (34-67)	0-77 (29-51)	32-88 (32-65)
ALL/bugs	60%	2.58 (0.89)	3.58 (0.56)	73.27*** (16.16)	38.50** (13.59)	61.00* (18.59)	53.62† (9.17)	46.43 (12.42)	49.70 (12.51)
		without outliers (M +/− 2 SD):		73.27*** (16.16)	40.35** (11.08)	56.74† (13.93)	52.65 (8.30)	48.88 (6.06)	47.54 (8.20)
		range, rounded (without outliers):		55-100 (55-100)	3-60 (17-60)	40-100 (40-94)	37-72 (37-68)	0-66 (34-66)	35-91 (35-69)
MEDICINE	60%	2.89 (1.10)	2.85 (0.48)	75.66*** (14.72)	38.43*** (12.83)	66.01*** (17.07)	49.62 (12.43)	42.83* (11.27)	61.12** (15.25)
		without outliers (M +/− 2 SD):		75.66*** (14.72)	39.81** (11.55)	66.01*** (17.07)	47.95 (10.19)	44.64** (8.06)	61.12** (15.25)
		range, rounded (without outliers):		51-98 (51-98)	12-50 (15-50)	50-92 (50-92)	26-81 (26-68)	8-52 (24-52)	49-89 (49-89)
vmin/sewage	45%	3.11 (1.83)	3.05 (0.51)	76.65*** (16.25)	36.60** (16.34)	64.90** (17.45)	51.05 (13.22)	43.60† (13.91)	61.90** (16.60)
		without outliers (M +/− 2 SD):		76.65*** (16.25)	40.61** (11.32)	64.90** (17.45)	50.89 (8.41)	47.83† (4.91)	59.89** (14.36)
		range, rounded (without outliers):		50-100 (50-100)	0-50 (17-50)	50-97 (50-97)	20-85 (35-72)	1-53 (34-53)	50-100 (50-93)

PRODUCT	BACKGROUND VARS			RATINGS M (SD)					
	consume	how often	like	disgust	taste	unwell	natural	visual	nutrition/medicine
vmin/bwaste	45%	3.11 (1.83)	3.05 (0.51)	77.7*** (15.52)	37.50** (17.41)	65.90*** (17.96)	50.10 (14.82)	44.65† (12.32)	63.20** (18.27)
		without outliers (M +/− 2 SD):		77.7*** (15.52)	41.61* (12.65)	65.90*** (17.96)	50.00 (11.51)	46.95† (6.98)	61.26** (16.53)
		range (without outliers):		50-100 (50-100)	0-50 (13-50)	50-100 (50-100)	20-82 (30-77)	1-51 (22-51)	50-100 (50-92)
vmin/recycle	45%	3.11 (1.83)	3.05 (0.51)	76.85*** (16.63)	36.90** (16.19)	67.75*** (19.57)	51.85 (16.05)	44.35† (12.17)	62.30** (18.69)
		without outliers (M +/− 2 SD):		76.85*** (16.63)	40.94** (10.95)	67.75*** (19.57)	50.11 (14.41)	46.63* (6.82)	58.11* (14.3)
		range (without outliers):		50-100 (50-100)	0-50 (20-50)	50-100 (50-100)	20-85 (20-83)	1-51 (28-51)	50-100 (50-93)
pmol/sewage	95%	3.26 (1.05)	2.90 (0.55)	76.70*** (17.05)	40.55* (18.57)	64.50** (19.88)	48.40 (15.81)	35.45** (20.52)	57.00 (18.38)
		without outliers (M +/− 2 SD):		76.70*** (17.05)	47.71 (6.84)	64.50** (19.88)	47.39 (7.49)	35.45** (20.52)	52.22 (11.66)
		range (without outliers):		50-100 (50-100)	0-53 (26-53)	45-100 (45-100)	15-100 (30-61)	0-54 (0-54)	21-100 (21-85)
pmol/bwaste	95%	3.26 (1.05)	2.90 (0.55)	73.75*** (15.78)	41.35* (16.44)	66.40** (19.27)	50.20 (12.94)	40.80* (16.06)	59.85* (18.14)
		without outliers (M +/− 2 SD):		73.75*** (15.78)	45.94† (8.85)	66.40** (19.27)	50.67 (5.69)	42.95* (13.23)	55.39† (12.53)
		range (without outliers):		50-100 (50-100)	0-52 (17-52)	49-100 (49-100)	10-82 (38-62)	0-53 (10-53)	40-100 (40-85)
pmol/recycle	95%	3.26 (1.05)	2.90 (0.55)	75.25*** (16.66)	42.65* (13.31)	66.10** (19.34)	47.80 (16.11)	39.70* (16.94)	61.60** (18.11)
		without outliers (M +/− 2 SD):		75.25*** (16.66)	44.84* (9.25)	66.10** (19.34)	49.79 (13.8)	43.94* (11.39)	59.58* (16.12)
		range (without outliers):		50-100 (50-100)	1-50 (19-50)	50-100 (50-100)	10-75 (20-75)	0-54 (15-54)	45-100 (45-95)
csrp/sewage	40%	1.63 (0.74)	2.60 (0.88)	73.25*** (21.80)	37.55*** (13.71)	67.70*** (19.98)	49.10 (12.27)	45.95† (9.32)	62.30** (17.6)
		without outliers (M +/− 2 SD):		76.05*** (18.32)	39.11** (12.14)	67.70*** (19.98)	47.53 (10.33)	47.58† (5.98)	60.32* (15.62)
		range (without outliers):		20-100 (50-100)	8-50 (15-50)	50-100 (50-100)	30-79 (30-65)	15-53 (30-53)	50-100 (50-93)
csrp/bwaste	40%	1.63 (0.74)	2.60 (0.88)	74.10*** (17.42)	35.65** (17.05)	63.55** (15.80)	49.20 (18.28)	46.30† (9.32)	61.40** (16.77)
		without outliers (M +/− 2 SD):		74.10*** (17.42)	39.61** (12.61)	61.63** (13.63)	49.78 (11.92)	47.95 (5.86)	59.37* (14.48)
		range (without outliers):		50-100 (50-100)	0-50 (15-50)	50-100 (50-87)	0-88 (20-74)	15-53 (27-53)	45-100 (45-88)
csrp/recycle	40%	1.63 (0.74)	2.60 (0.88)	76.70*** (17.32)	37.10*** (14.49)	67.30*** (19.81)	48.90 (15.14)	44.70† (12.07)	60.55** (14.65)
		without outliers (M +/− 2 SD):		76.70*** (17.32)	38.63** (13.12)	67.30*** (19.81)	48.90 (15.14)	48.00 (6.68)	59.00** (13.26)
		range (without outliers):		50-100 (50-100)	8-51 (10-51)	45-100 (45-100)	20-75 (20-75)	10-54 (24-54)	47-90 (47-87)
ALL/sewage	60%	2.89 (1.10)	2.85 (0.48)	75.53*** (16.55)	38.23** (13.75)	65.70*** (17.63)	49.52 (12.63)	41.67** (12.03)	60.40** (14.64)
		without outliers (M +/− 2 SD):		75.53*** (16.55)	39.72** (12.36)	65.70*** (17.63)	47.72 (10.01)	43.44** (9.30)	58.44** (12.04)
		range, rounded (without outliers):		44-100 (44-100)	10-50 (13-50)	50-95 (50-95)	27-84 (27-68)	8-53 (24-53)	50-98 (50-88)

PRODUCT	BACKGROUND VARS			RATINGS M (SD)					
	consume	how often	like	disgust	taste	unwell	natural	visual	nutrition/medicine
ALL/bwaste	60%	2.89 (1.10)	2.85 (0.48)	75.18*** (13.91)	38.17*** (13.11)	65.28*** (16.24)	49.83 (13.38)	43.92* (10.78)	61.48** (16.89)
			without outliers (M +/− 2 SD):	75.18*** (13.91)	39.74*** (11.37)	65.28*** (16.24)	48.12 (11.28)	45.77* (7.07)	61.48** (16.89)
			range, rounded (without outliers):	50-95 (50-95)	8-50 (20-50)	50-90 (50-90)	27-82 (27-71)	9-51 (28-51)	47-93 (47-93)
ALL/recycle	60%	2.89 (1.10)	2.85 (0.48)	76.27*** (15.61)	38.88*** (12.65)	67.05*** (18.06)	49.52 (12.83)	42.92* (11.77)	61.48** (15.7)
			without outliers (M +/− 2 SD):	76.27*** (15.61)	40.37** (11.06)	67.05*** (18.06)	49.56 (9.16)	46.19* (6.24)	59.81** (14.18)
			range (without outliers):	52-100 (52-100)	11-50 (18-50)	50-97 (50-97)	20-78 (34-66)	9-51 (33-51)	49-93 (49-90)
OVERALL	71.75%	3.04 (0.57)	3.60 (0.33)	67.42*** (7.94)	42.00*** (8.7)	58.83*** (9.46)	52.66 (10.29)	36.28*** (8.97)	53.40* (6.90)
			without outliers (M +/− 2 SD):	66.41*** (6.74)	43.08*** (7.41)	58.83*** (9.46)	53.84† (9.08)	36.18*** (5.68)	52.41† (5.44)
			range, rounded (without outliers):	54-86 (54-80)	21-58 (30-58)	49-75 (49-75)	30-72 (35-72)	15-59 (28-45)	47-72 (47-66)

Note. N = 20. T-tests used to assess whether mean ratings are significantly different from the baseline of 50. †p < .10. *p < .05. **p < .01. ***p < .001. Grey highlighted rows are stimuli used in the full study. Abbreviations used for stimuli: Drk = dark fizzy drink; Clr = clear fizzy drink; Wtr = water; Brger = burger; Ckies = cookies; Bar = protein bar; Vmin = vitamin tablets; Pmol = paracetamol; Csrp = cough syrup; Bwaste = biowaste.

Appendix C – Instructions for WTP Task

Please read the following instructions carefully: You will now be presented with **15 pairs of products**. For each product, you will be told what the product is, asked whether you typically consume the product (i.e., eat, drink, or use in cooking), and asked how much you like that product. You will then be presented with two different versions of the product. Both versions of the product will have a picture and key information about the products listed underneath. For each pair of products, you will be told the typical supermarket cost of the product on the [left ("Product A")/right ("Product B")], asked whether you would be willing to pay for and consume the product on the [right ("Product B")/left ("Product A")], and, if so, to indicate the highest price you would be willing to pay for [Product B/Product A], which may be the same, lower, or higher than [Product A/Product B]. We would also like you to comparatively rate Product A and Product B on five dimensions: likely taste, perceived effect on health, naturalness, visual appeal, and nutritional or medicinal value. For each product, the five rating scales will always be presented in a random order. Following the 15 products, we will ask you some background questions about yourself. It is estimated that this study will take between 20 to 25 minutes to complete, but there is a 4-hour time limit. **To ensure useful data it is really important that you try and be as honest and accurate as you can in your ratings.**

Please note that while this research features images of genuine products, attempts have been made to remove brand names wherever possible. No brands featured in this study are in any way affiliated with, or aware of, this research. All product examples provided in this study have been generated for academic research purposes and some are hypothetical.

While rating the pairs of products, we would like you to assume that:
1) All the products have been produced in the UK
2) All the products are not organic and not genetically-modified in any way
3) All the products are fit for human consumption

Appendix D – WTP PCA Results

Table D.1 Pattern matrix for the percentage WTP PCA.

			Component
% WTP for product	Sewage	Fruit and vegetables	Insects
Aubergine	-.028	**.729**	-.002
Carrot	.051	**.681**	.042
Courgette	-.159	**.696**	-.104
Lemon	.076	**.759**	-.006
Orange	.078	**.799**	.058
Apple	.011	**.769**	-.003
Dark fizzy drink	**.728**	.014	-.157
Clear fizzy drink	**.726**	-.031	-.186
Water	**.708**	.038	-.078
Burger	.060	.029	**-.844**
Cookies	.018	-.017	**-.860**
Protein	.005	.016	**-.881**
Vitamins	**.747**	-.040	.079
Paracetamol	**.744**	.037	.106
Cough syrup	**.777**	.023	-.005
% variance explained	32.25	18.30	10.33

Note. N = 475 due to missing data as a result of implausible values on the WTP task. Rotation method: direct oblimin with Kaiser Normalization. Bold loadings > ± .40.

Appendix E – Full Descriptive Results

Table E.1 Full descriptive results for all product stimuli.

Product	Product						"Yuck factor" variant of product				
	Consume	**Frequency**	**Like**	**Would buy**	**Price paid[1]**	**% WTP[1]**	**Taste (-)**	**Unwell (+)**	**Natural (+)**	**Visual (-)**	**Nutrition (-)**
Aubergine (cost: 70p)	217	4.09 (1.30)	2.83 (1.31)	356	35.43[a] (18.67)	50.62[a] (40.96)	2.85*** (10.83)	2.65*** (10.17)	4.92*** (21.55)	23.50*** (21.29)	1.08** (9.28)
Carrot (cost: 9p)	476	6.07 (0.97)	4.13 (0.87)	376	5.56[b] (4.81)	56.87[b] (46.39)	3.71*** (13.22)	2.58*** (11.79)	6.47*** (23.72)	27.85*** (20.88)	1.21* (12.12)
Courgette (cost: 37p)	293	4.81 (1.27)	3.14 (1.34)	358	21.04[c] (17.16)	61.77[c] (53.46)	2.89*** (11.11)	1.49** (10.03)	4.80*** (20.92)	20.38*** (21.49)	0.66 (10.42)
Apple (cost: 30p)	474	5.87 (1.17)	4.26 (0.81)	345	12.91[d] (11.55)	43.03[d] (38.49)	5.25*** (13.95)	4.02*** (11.50)	0.90 (22.77)	29.76*** (21.55)	2.38*** (12.08)
Lemon (cost: 35p)	368	4.74 (1.34)	3.65 (1.05)	349	16.50[d] (13.99)	47.15[d] (39.97)	5.10*** (13.10)	4.58*** (12.44)	1.28 (22.09)	27.40*** (21.94)	2.13*** (11.33)
Orange (cost: 30p)	448	5.30 (1.35)	4.15 (0.92)	327	12.74[e] (11.97)	42.46[e] (39.89)	7.09*** (15.29)	5.23*** (13.93)	1.29 (23.13)	29.17*** (21.84)	2.67*** (12.88)
Burger (cost: 250p)	162	4.43 (1.35)	2.82 (1.19)	139	44.20[f] (85.05)	17.68[f] (34.02)	21.11*** (21.98)	15.84*** (20.20)	−7.71*** (24.84)	7.03*** (15.86)	7.13*** (23.06)
Cookies (cost: 100p)	475	5.34 (1.27)	4.49 (0.74)	195	28.42[g] (43.72)	28.42[g] (43.72)	21.01*** (20.43)	15.42*** (19.96)	−9.87*** (24.37)	6.92*** (16.49)	6.08*** (22.30)
Protein bar (cost: 150p)	196	5.03 (1.43)	3.16 (1.01)	178	33.50[g] (55.18)	22.34[g] (36.79)	17.61*** (19.61)	12.52*** (18.54)	−4.01*** (24.42)	6.00*** (15.06)	5.42*** (19.91)
Cola (cost: 125p)	425	5.84 (1.27)	4.08 (1.20)	168	26.48[h] (43.73)	21.19[h] (34.98)	18.94*** (19.97)	17.66*** (20.56)	−5.35*** (21.93)	6.06*** (15.61)	8.99*** (18.30)
Lemonade (cost: 125p)	403	5.37 (1.32)	3.97 (1.05)	175	27.30[i] (44.81)	21.84[i] (35.85)	18.66*** (20.44)	17.70*** (20.78)	−6.48*** (22.74)	5.98*** (15.14)	9.60*** (18.38)
Water (cost: 38p)	432	5.95 (1.30)	4.00 (0.95)	145	6.65[j] (14.00)	17.50[j] (36.84)	24.53*** (20.74)	22.40*** (21.37)	−22.63*** (26.21)	7.84*** (17.25)	16.25*** (21.39)
Vitamins (cost: 150p)	245	6.13 (1.47)	3.19 (0.90)	120	20.16[j] (46.97)	13.44[j] (31.31)	17.70*** (20.72)	19.11*** (20.81)	−9.05*** (25.54)	6.85*** (16.76)	13.30*** (20.77)
Paracetamol (cost: 60p)	461	4.48 (1.32)	2.98 (0.84)	134	8.92[k] (19.65)	14.86[k] (32.74)	16.01*** (20.69)	17.89*** (21.41)	−8.23*** (23.73)	6.58*** (16.96)	12.92*** (20.34)
Cough syrup (cost: 150p)	270	2.59 (1.00)	2.69 (0.89)	127	22.02[j] (47.11)	14.68[j] (31.41)	19.77*** (20.75)	17.93*** (20.35)	−7.03*** (24.18)	7.88*** (16.50)	12.48*** (19.79)

Note. N = 510, except [a]N = 499, [b]N = 492, [c]N = 493, [d]N = 498, [e]N = 495, [f]N = 508, [g]N = 506, [h]N = 503, [i]N = 505, [j]N = 504, [k]N = 501 due to missing data as a result of implausible values on the WTP task. Values repesent frequencies for binary variables and M (SD) for continuous variables. [1]In pence, after data cleaning on implausible WTP values (see Methods), includes zeros. Taste = "will taste worse"; Unwell = "will make me unwell"; Natural = "is more natural"; Visual = "Looks visually less appealing"; Nutrition = "Has less nutritional/medicinal value". T-tests used to assess whether mean product ratings are significantly different from the baseline of 0. †p < .10. *p < .05. **p < .01. ***p < .001.