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RECEIVED 10 October 2023

ACCEPTED 10 November 2023

PUBLISHED 29 November 2023

CITATION

Xiao M, Jiang Y and Cao B (2023) The beauty in imperfection: how naturalness cues drive consumer preferences for ugly produce and reduce food waste.
Front. Sustain. Food Syst. 7:1313814.
doi: 10.3389/fsufs.2023.1313814

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The beauty in imperfection: how naturalness cues drive consumer preferences for ugly produce and reduce food waste

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Purpose: An important reason for food waste is the rejection of ugly produce by consumers. Most previous research has examined the absolute negative impacts of ugly produce on consumers' preferences, no research has examined the conditions in which consumers prefer ugly (vs. typical) produce instead. This research investigates the circumstances under which these aesthetic imperfections become advantageous.

Methods: We conducted two between-subject design randomized experiments featuring two produce categories to examine when and why consumers prefer ugly produce.

Results: We found that naturalness cues boost and even reverse consumers' preferences for ugly produce when combining ugly appearance with naturalness cues. The subtyping effect mediates the interaction of appearance (typical vs. ugly) of produce and naturalness cues (present vs. absent) on produce's evaluations.

Discussion: Our findings provide more cost-effective strategies for retailers to reduce food waste. This paper fills in the research gaps on tapping into the novel condition in which consumers prefer ugly (vs. typical) produce and the psychological mechanism behind this process. Based on schema incongruity theory, we argue that naturalness cues, as an enabler corresponding to the incongruous features of ugly produce, facilitate consumers to resolve the schema incongruity triggered by the ugly appearance and, in turn, boost consumers' preferences for ugly produce.

KEYWORDS

ugly produce, enablers, food waste, schema incongruity, naturalness cues, preference reversal

1 Introduction

Food waste has recently emerged as a threat with negative economic, social, and environmental consequences (Aka and Buyukdag, 2021). More than 1.3 billion tons of food are wasted along the supply chain each year (Amicarelli et al., 2020). Among the various causes of food waste at the consumer level, consumers' esthetic nitpicking and prejudices about the appearance of produce contribute to significant avoidable food waste and environmental pressures (Adel et al., 2022). Retailers waste a large number of fruits and vegetables (Obuobi et al., 2022), as one of the results of retailers' striving to provide consumers with perfect-looking produce (Loebnitz et al., 2015). Consumer rejection of unattractive produce, as well as retailers'

practices that are not conducive to sustainable consumption and development, has resulted in a considerable volume of produce appropriate for human consumption being wasted for deviating from these esthetic criteria (Tsalis, 2020).

Ugly produce is defined as having a significant natural deviation from prototypicality, whereas typical produce has a limited deviation from prototypicality if any at all (Grewal et al., 2019). Following previous studies on imperfect produce, we exclude deviations in appearance caused by damage, disease, or other external esthetic divergences that may influence the objective taste, flavor, or food quality (Grewal et al., 2019). Ugly produce is generally unpopular with consumers, who also tend to have the lay belief that “beauty is good and ugly is risky,” even though this is not justified because ugly produce does not differ in nutritional quality and safety from typical produce (Castagna et al., 2021; Pfeiffer et al., 2021). However, for ugly produce, unattractive appearance generally stems from nature (Grewal et al., 2019); In addition, previous research has shown that product attributes and extrinsic cues can interact (Bezençon et al., 2020). Therefore, we have a preliminary reason to anticipate that an ugly appearance is not always a negative attribute of produce; namely, there are external conditions in which an ugly appearance might become a “positive” attribute of produce instead.

Consumers prefer products that are typical of the category and use typical products as cognitive benchmarks when evaluating atypical products (Scarpi et al., 2019). Similarly, consumers prefer typical produce and reject ugly produce. To address this problem, prior research has mainly focused on price discounts and marketing communication strategies to reduce food waste. Mere price discounts are not sustainable strategies, because consumers view businesses selling ugly food at low prices as engaging in “abusive” commercial activities and may even lead to unintended food waste (Qi et al., 2022). Scholars have further investigated more cost-effective strategies. For example, anthropomorphizing unattractive produce (Chen et al., 2021), using external cues to enhance consumers’ positive self-perceptions (Grewal et al., 2019), and implementing ugly labels (Mookerjee et al., 2021) are examples of strategies that promote ugly produce. However, most of these previous studies on marketing strategies considered ugly appearance as an absolutely negative attribute of produce (for a last review, see Varese et al., 2023) and therefore proposed marketing strategies mainly in terms of price discounts and weakening consumers’ negative perceptions toward produce. No research has been conducted to examine the conditions under which the ugly appearance can be a positive attribute such that consumers prefer ugly (vs. typical) produce instead and the underlying psychological mechanisms by which this process occurs. Thus, our research question is: when does this negative appearance feature instead become a positive advantage for it? If so, what would be the psychological mechanism that explains such consumer behavior?

To fill this research gap and address our research questions, we will examine a novel marketing communication strategy: applying naturalness cues to ugly produce so that in this case the ugly appearance becomes a positive attribute of the produce. We build on schema congruity theory to predict the joint effect of ugly appearance and naturalness cues on consumer preferences. We predict that applying naturalness cues to ugly produce can facilitate consumers to resolve schema incongruity evoked by ugly appearance through subtyping resolution and further bolster consumer preferences. Ugly appearance is the incongruous feature of ugly produce compared to typical produce (Loebnitz et al., 2015). However, consumers will favor

incongruent products over congruent products if they can make sense of the incongruent features (Noseworthy et al., 2018). In addition, consumers can resolve incongruous features by exploring the presence of other semantically related features—what the literature refers to as enablers (Noseworthy et al., 2014; Rehder, 2015). Moreover, people inherently hold that there are causal associations between product features (Ahn and Kim, 2000). In line with these insights, consumers associate the ugly appearance with the naturalness of produce (Yuan et al., 2019; Mookerjee et al., 2021). Therefore, we predicted that naturalness cues might act as an enabler corresponding to ugly appearance, which facilitates consumers to resolve schema incongruity and further boosts consumer preferences. This process occurs because the combination of semantically relevant features can improve consumers’ perception of the category typicality of ugly produce. This enables consumers to subtype the ugly produce as a subcategory of the corresponding produce category, thus resolving the schema incongruity triggered by the ugly appearance. Further, according to the schema congruity theory, consumers’ evaluations of ugly produce will not only be elevated but even higher than typical produce, thus making a negative feature of ugly produce instead become an advantage for it. Our findings provide practical implications and cost-effective management strategies for a more sustainable solution to the waste problem caused by ugly produce.

In the remainder of this article, we will first establish the theoretical background for our hypotheses by drawing on literature about ugly produce and consumer preferences, resolving schema incongruity through subtyping, the impact of “Enablers” on product category typicality, as well as the combination of naturalness cues and unattractive appearance. Then, the two experiments use different product categories to provide consistent empirical evidence. We discussed the theoretical and practical implications in the end.

2 Theoretical background and conceptual development

2.1 Schema incongruity and subtyping resolution

Schemas may be construed as organized cognitive structures that link a network of concepts (Magnusson et al., 2014). The activation of a particular object’s schema leads to various related concepts in the schema being active, making it easier for the individual to process new information that matches the active concept, and when the object does not match the activated schema, schema incongruity occurs (Meyers-Levy and Tybout, 1989). The ugly produce deviates from the corresponding schema of produce stored in the consumer’s mind, thus triggering schema incongruity for the consumer compared to typical produce (Loebnitz et al., 2015).

Consumers have psychological arousal to objects that elicit schema incongruity and will try to resolve the schema incongruity (Noseworthy et al., 2014). Thus, for ugly produce, consumers will also try to resolve the schema incongruity caused by ugly appearance. Previous research has shown that consumers can resolve schema incongruity through subtyping resolution (Noseworthy et al., 2018). The subtyping resolution refers to consumers’ integration of object stimuli into the existing category structure, thus treating object stimuli as exceptional cases or subcategories within the corresponding product category (Noseworthy et al., 2018). Namely, the subtyping

effect appears in consumers' categorical inferences about incongruent objects (Meyers-Levy and Tybout, 1989). In the subtyping process, individuals automatically categorize those incongruent target objects using a distinct set of beliefs, and subtyped instances are treated as exceptions and placed into a subcategory (Sujan and Bettman, 1989). For example, when consumers perceive green vitamin-enhanced coffee as a subtype of coffee, such as a healthier type of coffee, it leads to positive product evaluations (Noseworthy et al., 2018). Another example, the rarity of the product-harm crises can lead consumers to excuse an otherwise well-regarded brand by considering the crisis event an exception that is unrepresentative of the brand's normal behavior, thus, the subtyping effect emerges in the context of consumers constructing attributions of product-harm crises (Lei et al., 2012). From these examples, we know that the subtyping process can increase the evaluations of certain things that would otherwise be considered unfavorable. Likewise, people tend to disfavor ugly produce that elicit schema incongruity due to atypical appearance. Then, based on the aforementioned discussion of the subtyping effect and schema incongruity, we hold that if consumers can resolve the schema incongruity and make the subtyping effect arise in consumers' category inferences about ugly produce, this process will increase consumers' evaluations of ugly produce. So, along this line of thought, in the next section, we will expound on how to make the subtyping effect appear in consumers' category inferences about ugly produce.

2.2 Enablers and product category typicality

The emergence of the subtyping effect requires external enablers that correspond to the incongruent features of the stimulus objects (Noseworthy et al., 2018). Enablers are semantically related to product incongruent features and facilitate the understanding of the presence of incongruent features (Cheng and Novick, 1991). For example, if consumers were told that the transparent Pepsi was made from natural spring water, then they may regard transparent Pepsi as a special subtype of Pepsi, that is, the subtype effect arises in consumer's category inferences toward colorless and transparent Pepsi (Noseworthy et al., 2018). This process occurs because of the semantic association between the "natural spring water" and "transparent" features, where the product made from natural spring water are enablers corresponding to transparent color features, and the combination of the incongruent features and enablers enhances the consumers' perceptions of the category typicality of the product, thus contributing to the subtyping effect (Noseworthy et al., 2018). In addition, the typicality of the incongruent entity has been identified as crucial to determining whether a subtyping category is created (Noseworthy et al., 2018). Therefore, we predict that if the enablers provided to ugly produce make the combination of enablers and ugly appearance improve consumers' judgments of the category typicality of ugly produce, then the subtyping effect may arise in consumers' category inferences about ugly produce.

Products' enablers can have considerable impacts on the product category typicality judgments (Noseworthy et al., 2018). To improve product category typicality judgments, enablers do not have to be causal, they only need to preserve semantic associations with incongruent features of the product (Cheng and Novick, 1991). On the one hand, this is because consumers inherently believe that there is a natural causal relationship between product features, where one

feature naturally induces another feature (Ahn and Kim, 2000). These linked features enable consumers to make causal inferences through conjunctions (Rehder, 2015). On the other hand, and more importantly, enablers are features that are semantically associated with product incongruent features, and semantic associations provide a more coherent and consistent representation of object stimuli, stimulating more category consistency in combinations of features of object stimuli (Hayes and Rehder, 2012), thus improving consumer judgments of product category typicality (Noseworthy et al., 2018). Following these lines, we predicted that applying an enabler semantically associated with the ugly appearance might improve the typicality judgments of produce.

Then, combined with the above, in the case of ugly produce, the ugly appearance of produce triggers schema incongruity among consumers (Loebnitz et al., 2015). If the external enablers corresponding to the incongruent feature of ugly produce are provided as marketing communication cues, we can expect them to enhance consumers' judgments of the category typicality of ugly produce.

This, in turn, contributes to the subtyping effect on consumers' category inferences about ugly produce and helps resolve the schema incongruity caused by its unattractive appearance.

2.3 Combination of naturalness cues and ugly appearance

Naturalness cues of ugly produce can influence consumers' feature inferences and consumption choices about produce (Yuan et al., 2019; Qi et al., 2022). Consumers associate the semantic meaning of cues indicating the naturalness of food with natural-related attribute inferences (Berry et al., 2017). Furthermore, consumers spontaneously associate the ugly appearance of produce with the naturalness of the produce (Yuan et al., 2019; Mookerjee et al., 2021). Thus, naturalness cues that are semantically associated with ugly appearance can be enablers corresponding to ugly appearance features of produce. The combination of an enabler with a corresponding incongruent feature can improve consumers' judgments of the category typicality of a product and lead to the product being perceived as more typical of the category than if the features were shown independently. Higher product category typicality is more likely to enable consumers to filter out incongruent features of products and makes the object stimulus more likely to be perceived as a special case in the corresponding product categories, which in turn enables products that trigger schema incongruity to be integrated by consumers into the existing corresponding product category, thus prompting consumers to subtype incongruent product into a subcategory of the corresponding product category (Sujan and Bettman, 1989). That is, the subtyping effect appears in consumers' category inferences about products that trigger schema incongruity (Noseworthy et al., 2018). Thus, when the enablers corresponding to the incongruent features of ugly produce—the naturalness cues discussed above—are provided as marketing communication cues, this will facilitate consumers to resolve the schema incongruity triggered by ugly appearance through the subtyping resolution. This is, the subtyping effect emerges in consumers' category inferences about ugly produce. Whereas, when the enablers are absent, and since consumers subtype an object that triggers schema incongruity requires the external provision of the corresponding enablers (Noseworthy et al., 2018), then it can be predicted that the subtyping effect will not arise in the consumers' category inferences about ugly produce in the absence of the enablers situation.

Incongruent object stimulus disrupts existing knowledge structures to some extent, and people will attempt to cope with this discrepancy by resolving the incongruity (Noseworthy et al., 2018). Similarly, the appearance of ugly produce triggers schema incongruity (Loebnitz et al., 2015), and consumers will try to resolve the schema incongruity. In this case, presenting naturalness cues, which are enablers corresponding to the appearance features of the ugly produce, prompts consumers to subtype the ugly produce into a subcategory of the corresponding agricultural product category, thus resolving the schema incongruity caused by the ugly produce. Then, according to schema congruity theory (Meyers-Levy and Tybout, 1989), if consumers can resolve the schema incongruity, which can be a satisfying experience and may activate positive affections, they will have higher product evaluations than the corresponding schema congruity product—that is the typical produce in our context. However, when consumers are unable to resolve the schema incongruity caused by the ugly appearance through subtyping resolution, they will have negative feelings and product evaluations (Jhang et al., 2012). Therefore, we propose that when the naturalness cues are absent, consumers evaluate ugly produce as lower than typical produce. Nonetheless, when the naturalness cues are present as a marketing communication cue, consumers evaluate ugly produce higher than typical produce.

In conclusion, we propose that naturalness cues, as enablers corresponding to the incongruity features of the ugly produce, enable consumers to resolve the schema incongruity triggered by the ugly appearance. Hence, this process not only improves consumers' evaluations of ugly produce but even brings about higher consumers' evaluations of ugly produce than typical produce according to schema congruity theory. The mechanism by which this process occurs is that the combination of enablers and the appearance of the ugly produce allows consumers to perceive the ugly produce as a subcategory of the corresponding produce category. That is to say, the subtyping effect emerges in consumers' category inferences about ugly produce, resolving the schema incongruity caused by the ugly appearance and further boosting consumers' evaluation of the ugly produce.

Based on the foregoing, the following three hypotheses are proposed for this article:

H1: When the naturalness cues are absent, consumers' evaluations of ugly produce are lower than that of typical produce. However, when the naturalness cues are present, consumers' evaluations of ugly produce are higher than that of typical produce.

H2: When the naturalness cues are absent, the subtyping effect is not significantly different between ugly produce and typical produce. However, when the naturalness cues are present, the subtype effect of consumers' category inferences about ugly produce is higher than that of typical produce.

H3: The subtyping effect mediates the interaction of appearance (typical vs. ugly) of produce and naturalness cues (present vs. absent) on produce's evaluations.

3 Overview of the studies

We conducted two experiments to support our hypotheses (Supplementary Table 1). In experiment 1, we chose ugly and typical

carrots as stimuli adapted from Chen et al. (2021), primarily testing the interaction effect between the appearance of the produce and the naturalness cues on the produce's evaluations (H1). To expand the external validity of experiments, we expanded our produce category and selected the fruit for experiment 2. Based on replicating the findings of experiment 1 (H1 is again supported), we first successfully developed stimuli through a pretest, then supported H2 and the mediation role of the subtyping effect (H3). Experiment 2 further increases the generalizability of our findings.

4 Experiment 1

The primary purpose of this experiment was to support H1. As we predicted, the combination of naturalness cues and the ugly appearance of produce boosted consumers' evaluations of ugly produce. In this experiment, we used typical and ugly carrots as stimuli adapted from Chen et al. (2021) to support H1 initially.

4.1 Participants and procedure

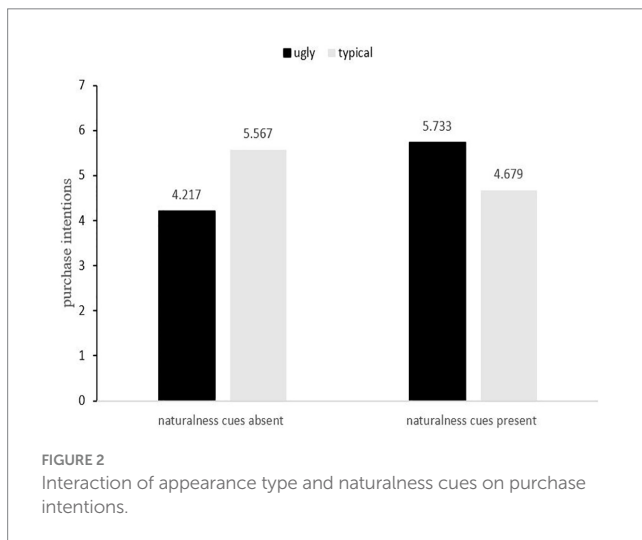
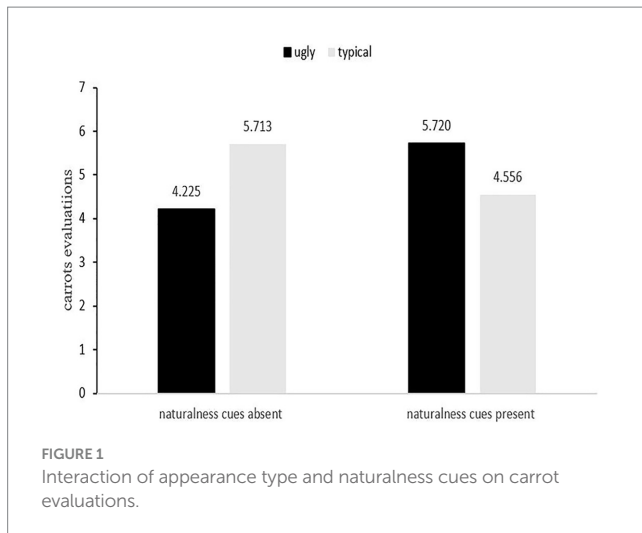
Two hundred participants were recruited through the online questionnaire survey platform: <https://www.credamo.com>.¹ Twenty-seven participants who failed the attention check were removed, leaving us with a valid sample of 173 participants ($M_{age} = 29.86$, $SD = 7.153$; female 63.0%).

Participants were randomly assigned to one of 2 (produce appearance: ugly vs. typical) \times 2 (naturalness cues: present vs. absent) between-subjects design conditions. Participants were asked to imagine themselves shopping in a fresh food supermarket and then seeing some carrots in the vegetable aisle. The manipulation of ugliness was limited to their natural shape variation consistent with Grewal et al. (2019). Thus, under typical conditions, participants were shown an image of a carrot shelf filled with typical-shaped carrots. Correspondingly, under ugly conditions, participants were shown an image of a carrot shelf filled with abnormal-shaped carrots. We manipulated naturalness cues adapted from Berry et al. (2017). Specifically, in the naturalness cues present groups, participants in the ugly conditions saw ugly carrots on the vegetable shelf with the words “naturally grown, all-natural” written on the vegetable shelf. Accordingly, participants in the typical conditions saw typical carrots on the vegetable shelf and the same naturalness cues. There were no naturalness cues on the vegetable shelf in the naturalness cues absent groups, and then participants were randomly assigned to the ugly conditions and the typical conditions (Appendix A).

4.2 Measures

After being shown random scenario stimulus information, participants indicated their carrots evaluations on three seven-point items anchored by “unfavorable/favorable,” “unappealing/appealing,” and “bad/good,” with higher values indicating more positive evaluations (Cronbach's $\alpha = 0.900$; Jhang et al., 2012). We measured purchase intentions with three items: “I would consider buying some of these carrots,” “I would like to

¹ The <https://www.credamo.com> is one of the most popular online survey platforms in China.



try some of these carrots,” and “I would not be inclined to buy some of these carrots” (reverse encoded; 1 = “completely disagree,” and 7 = “completely agree,” Cronbach’s $\alpha = 0.868$; Cooremans and Geuens, 2019). For the manipulation check, participants were asked to rate the ugliness on a seven-point Likert scales (i.e., “ugly,” “unattractive”; 1 = “completely disagree” and 7 = “completely agree”). To check the awareness of the presence of the naturalness cues, participants were asked: “Did the carrots that you viewed point that the carrots were natural?” with endpoints of “definitely not/definitely yes” (seven-point scale; Berry et al., 2017). To rule out the confounding factor, participants indicated their perceived health risk with two items: “these carrots are unhealthy/risky,” (1 = “completely disagree,” and 7 = “completely agree,” $r = 0.855$; Chen et al., 2021). At the end of the experiment, all participants answered demographic information.

4.3 Results

4.3.1 Manipulation check

The one-way ANOVA results showed a significant difference between the ugly conditions and the typical conditions rating of

ugliness, with the ugly conditions scoring significantly higher than the typical conditions [$M_{\text{ugly}} = 4.578$, $SD = 1.626$; $M_{\text{typical}} = 2.494$, $SD = 1.188$; $F(1,171) = 88.590$, $p = 0.000$, partial $\eta^2 = 0.341$]. Furthermore, we found no significant effect of ugliness manipulation on perceived health risk [$F(1,171) = 1.516$, $p = 0.220$, partial $\eta^2 = 0.009$]. These results suggest that ugliness manipulation was effective. These results suggest that ugliness manipulation was effective.

For naturalness cues, the one-way ANOVA revealed a significant difference in awareness of the presence of the naturalness cues. Participants exposed to naturalness cues indicated greater awareness of the cues than participants who were not ($M_{\text{present}} = 6.180$, $SD = 1.364$; $M_{\text{absent}} = 3.320$, $SD = 1.744$; $F(1,171) = 138.737$, $p = 0.000$, partial $\eta^2 = 0.448$), suggesting naturalness cues manipulation was successful.

4.3.2 Carrots evaluations

The two-way ANOVA results showed a significant interaction between appearance and naturalness cues [$F(1,169) = 50.162$, $p = 0.000$, partial $\eta^2 = 0.229$]. Simple effect analysis showed that in naturalness cues absent groups, those in the ugly conditions reported lower carrots evaluations than those in the typical conditions [$M_{\text{ugly}} = 4.225$, $SD = 1.744$; $M_{\text{typical}} = 5.713$, $SD = 0.987$; $F(1,169) = 37.374$, $p = 0.000$, partial $\eta^2 = 0.181$]. However, a notable point is that, in naturalness cues present groups, those in the ugly conditions reported higher carrots evaluations than those in the typical conditions [$M_{\text{ugly}} = 5.720$, $SD = 0.733$; $M_{\text{typical}} = 4.556$, $SD = 1.059$; $F(1,169) = 16.733$, $p = 0.000$, partial $\eta^2 = 0.090$; Figure 1]. This result offers support to H1 (Supplementary Table 1).

4.3.3 Purchase intentions

The two-way ANOVA results showed that the interaction effect between appearance and naturalness cues was significant [$F(1,169) = 34.086$, $p = 0.000$, partial $\eta^2 = 0.168$]. In naturalness cues absent groups, simple effect analysis showed that those in the ugly conditions reported lower purchase intentions than those in the typical conditions [$M_{\text{ugly}} = 4.217$, $SD = 1.788$; $M_{\text{typical}} = 5.567$, $SD = 1.230$; $F(1,169) = 25.419$, $p = 0.000$, partial $\eta^2 = 0.131$]. However, in naturalness cues present groups, it is noteworthy that simple effect analysis revealed participants in the ugly conditions reported higher purchase intentions than those in the typical conditions [$M_{\text{ugly}} = 5.733$, $SD = 0.794$; $M_{\text{typical}} = 4.679$, $SD = 1.259$; $F(1,169) = 11.358$, $p = 0.001$, partial $\eta^2 = 0.063$; Figure 2]. This result is consistent with H1, indicating that when ugly produce and naturalness cues are combined, consumers instead have higher choice preferences (produce evaluations and purchase intentions) for ugly produce compared to naturalness cues are absent.

4.4 Discussion

The result of experiment 1 offered initial support for H1. The results showed that when naturalness cues were absent, consumers’ evaluations and purchase intentions for typical carrots were higher than those for ugly carrots. However, when naturalness cues were present, consumers’ evaluations and purchase intentions of ugly carrots were even higher than those of typical carrots. In the following experiment, we changed the agricultural product category to increase the experiment’s external validity. We first successfully developed

pears as a stimulus for the main experiment through the pre-experiment. Then we supported H2 and H3 and replicated the findings of experiment 1 at the same time.

5 Experiment 2

The purpose of experiment 2 was 2-fold. First, experiment 2 aims to support H2 and H3 based on replicating the findings of experiment 1. We attempt to support the mediating role of the subtyping effect in this experiment. Secondly, equally important, experiment 2 aims to increase the external validity of our studies by changing the categories of agricultural products and further improving the generalizability of our findings.

5.1 Pre-experiment

Before the main experiment, we conducted a pretest to develop the stimuli for the main experiment. We chose pears as the stimuli and ugly pears were processed using photo-editing techniques with a typical pear photo as the base image. The pretest was a 2 (pear appearance: ugly vs. typical) between-subject design. We recruited 70 participants ($M_{\text{age}} = 29.99$ years, $SD = 7.414$, 55.7% female) from credamo.com. Participants were asked to imagine being in a fruit supermarket and then seeing some pears in a fruit basket on the fruit shelf (Appendix B-1). Then, participants rated the ugliness of the pears using the same measurement items as in experiment 1. A one-way ANOVA revealed that participants in the ugly pear conditions significantly perceived pears as being more ugly than participants in the typical conditions [$M_{\text{ugly}} = 4.118$, $SD = 1.402$; $M_{\text{typical}} = 2.375$, $SD = 0.751$; $F(1,68) = 39.579$, $p = 0.000$, partial $\eta^2 = 0.368$]. The results of the pretest indicated that the ugly pears were successfully developed. Therefore, we selected the pears successfully developed in this pretest as the stimuli for the main experiment.

5.2 Main experiment

5.2.1 Participants and procedure

Three hundred and eighty participants were recruited from the same online survey platform as in experiment 1. Thirty-two participants who failed the attention check were removed. This left us with a valid sample of 348 participants ($M_{\text{age}} = 29.13$, $SD = 6.718$; female 66.1%).

Participants were randomly assigned to one of 2 (produce appearance: ugly vs. typical) \times 2 (naturalness cues: present vs. absent) between-subjects design conditions. Participants were asked to imagine that they were shopping in a fresh produce supermarket and then seeing some pears in a fruit basket on the fruit shelf. Consistent with experiment 1, in naturalness cues present groups, consumers in the ugly conditions saw some ugly pears in the basket with a sign saying “Naturally grown, all-natural” on the side of the fruit basket facing the participants. In contrast, consumers in the typical conditions saw some typical pears and signs with the same naturalness cues. In naturalness cues absent groups, consumers in the ugly

conditions only saw some ugly pears in the fruit basket. Relatively, consumers in the typical conditions saw only typical carrots (Appendix B-2).

5.2.2 Measures

We used the same measurement items as in experiment 1 to measure the ugliness manipulation check, the naturalness cues manipulation check, produce evaluation (Cronbach's $\alpha = 0.845$) and purchase intention (Cronbach's $\alpha = 0.820$), and participants' perceived health risk ($r = 0.810$) of pears. In addition, for the measurement of the subtyping effect, we use the item: “Regarding the appearance of the pears in the fruit basket, you feel that the pears in the fruit basket look like a subcategory of the pears” (1 = “strongly disagree,” and 7 = “strongly agree”; Meyers-Levy and Tybout, 1989). All participants answered demographic information at the end of the experiment.

5.3 Results

5.3.1 Manipulation check

The one-way ANOVA results revealed a significant difference between the ugly conditions and the typical conditions rating of ugliness, with the ugly conditions scoring significantly higher than the typical conditions [$M_{\text{ugly}} = 3.087$, $SD = 1.329$; $M_{\text{typical}} = 2.743$, $SD = 1.190$; $F(1,346) = 6.442$, $p = 0.012$, partial $\eta^2 = 0.018$]. In addition, equally important, we did not observe a significant effect of ugliness manipulation on perceived health risk [$F(1,346) = 0.000$, $p = 0.993$, partial $\eta^2 = 0.000$]. These results suggest that ugliness manipulation was effective. These results suggest that ugliness manipulation was effective.

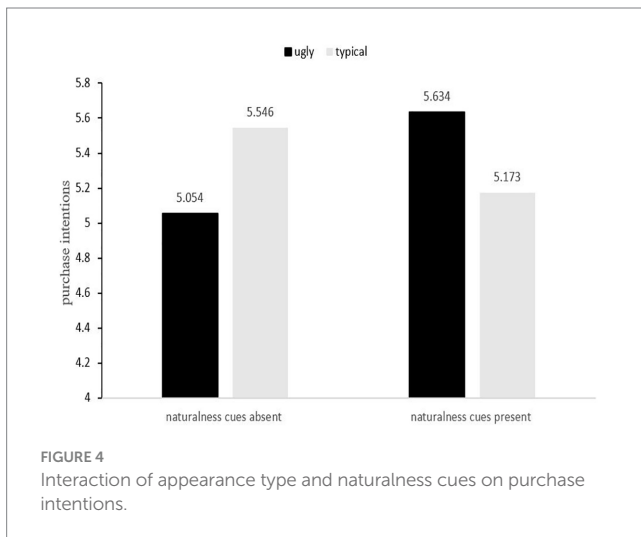
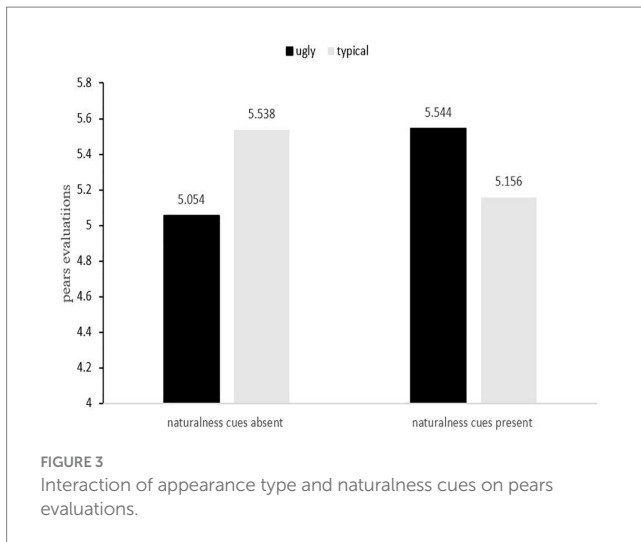
For naturalness cues, the one-way ANOVA results showed a significant difference in awareness of the presence of the naturalness cues. Participants exposed to the naturalness cues indicated greater awareness of the cues than participants who were not [$M_{\text{present}} = 6.380$, $SD = 1.127$; $M_{\text{absent}} = 3.270$, $SD = 1.510$; $F(1,346) = 470.479$, $p = 0.000$, partial $\eta^2 = 0.576$], suggesting naturalness cues manipulation was successful.

5.3.2 Pears evaluations

The two-way ANOVA results showed that the interaction effect between appearance and naturalness cues was significant [$F(1,344) = 17.200$, $p = 0.000$, partial $\eta^2 = 0.048$]. In the naturalness cues absent groups, simple effect analysis showed that participants in the ugly conditions reported lower pears evaluations than those in the typical conditions [$M_{\text{ugly}} = 5.054$, $SD = 1.326$; $M_{\text{typical}} = 5.538$, $SD = 0.837$; $F(1,344) = 10.707$, $p = 0.001$, partial $\eta^2 = 0.030$]. However, it is noteworthy that, in the naturalness cues present groups, participants in the ugly conditions reported higher pears evaluations than those in the typical conditions [$M_{\text{ugly}} = 5.544$, $SD = 0.626$; $M_{\text{typical}} = 5.156$, $SD = 1.010$; $F(1,344) = 6.737$, $p = 0.010$, partial $\eta^2 = 0.019$; Figure 3]. Consistent with the results of experiment 1, this result once again supports H1 (Supplementary Table 2).

5.3.3 Purchase intention

The two-way ANOVA results showed that the interaction effect between appearance and naturalness cues was significant [$F(1,344) = 18.337$, $p = 0.000$, partial $\eta^2 = 0.051$]. In the naturalness



cues absent groups, simple effect analysis showed that participants in the ugly conditions reported lower purchase intentions than those in the typical conditions [$M_{\text{ugly}} = 5.054$, $SD = 0.838$; $M_{\text{typical}} = 5.546$, $SD = 1.295$; $F(1,344) = 9.843$, $p = 0.002$, partial $\eta^2 = 0.028$]. However, in the naturalness cues present groups, it is worth noting that, simple effect analysis revealed participants in the ugly conditions reported higher purchase intentions than those in the typical conditions [$M_{\text{ugly}} = 5.634$, $SD = 0.930$; $M_{\text{typical}} = 5.173$, $SD = 1.036$; $F(1,344) = 8.523$, $p = 0.004$, partial $\eta^2 = 0.024$; Figure 4]. Once again, this result showed that when ugly produce and naturalness cues are combined, consumers instead have higher choice preferences (produce evaluations and purchase intentions) for ugly produce compared to naturalness cues are absent.

5.3.4 Subtyping effect

The two-way ANOVA results indicated that the interaction effect between appearance and naturalness cues was significant [$F(1, 344) = 8.236$, $p = 0.004$, partial $\eta^2 = 0.023$]. In the naturalness cues absent groups, simple effect analysis revealed that there were no significant differences in subtyping effect between participants in the ugly conditions and those in the typical conditions [$M_{\text{ugly}} = 4.460$,

$SD = 1.531$; $M_{\text{typical}} = 4.500$, $SD = 1.493$; $F(1,344) = 0.035$, $p = 0.853$, partial $\eta^2 = 0.00$]. Consistent with our expectations, In the naturalness cues present groups, simple effect analysis indicated that participants in the ugly conditions produced significantly higher subtyping effect than those in the typical conditions [$M_{\text{ugly}} = 4.620$, $SD = 1.374$; $M_{\text{typical}} = 3.780$, $SD = 1.313$; $F(1,344) = 14.887$, $p = 0.000$, partial $\eta^2 = 0.041$; Figure 5]. These results support H2.

5.3.5 Moderated mediation analysis

To further examine the psychological mechanism underlying the above-reported effect of appearance type of produce and natural cues on consumer preferences (produce evaluations and purchase intentions), we performed a moderated mediation analysis following (Hayes, 2013) model 8 with the subtyping effect as the mediator, appearance type as the independent variable, naturalness cues as the moderator, and product evaluations as the dependent variable. A 10,000 resample bootstrap analysis revealed that the 95% confidence interval did not contain zero, indicating a significant moderated mediation effect ($\beta = -0.088$, $SE = 0.046$, 95% $CI = [-0.191, -0.014]$). Similarly, replacing the dependent variable with purchase intention and repeating the above analysis process, again reveals a significant moderated mediating index ($\beta = -0.092$, $SE = 0.052$, 95% $CI = [-0.209, -0.009]$). These findings further supported H3 and provided novel insights regarding the psychological mechanism underlying the joint effect of the appearance of produce and naturalness cues.

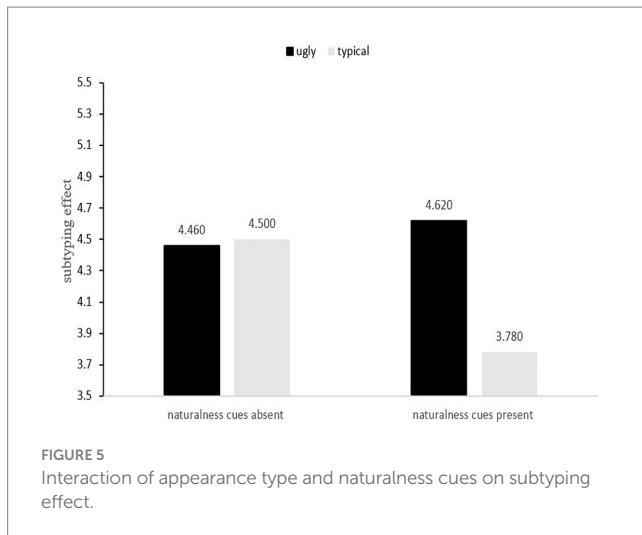
5.4 Discussion

The results of experiment 2 confirmed all our hypotheses using a different product category from experiment 1. Consistent with our hypotheses 1 and 2, the results indicated that when naturalness cues and ugly appearance are combined, this not only bolsters consumers' evaluation of ugly pears but even makes consumers generate higher evaluations than typical pears. This process occurs because the combination of the ugly appearance of pears and naturalness cues—the enabler corresponding to the ugly appearance that we have elaborated on in the previous section—facilitates consumers to subtype the ugly pears as a subcategory of the pear category and thus resolving the schema incongruity triggered by ugly appearance. This is, consistent with our hypothesis 3, the subtyping effect arises in consumers' category inferences for ugly pears. Further, consistent with schema congruity theory (Meyers-Levy and Tybout, 1989), this process not only elevates consumers' evaluation of ugly pears but even reverses consumers' preferences for typical pears, instead favoring ugly produce, so that the inherent negative feature of the ugly appearance of produce become a “positive” advantages. Experiment 2 increases the external validity of our studies and the generalizability of our findings.

6 General discussion

6.1 Theoretical implications

The theoretical implications of this research are as follows: Firstly, we tap into a condition that reverses consumer preferences for typical



produce, showing that consumers are more likely to favor ugly produce when naturalness cues are present as opposed to when they are absent. We bridge the gap of previous studies focusing only on the negative effects of ugly appearance. We illustrated that combined with the ugly appearance of the produce and naturalness cues, consumers will instead prefer ugly produce. In this case, the ugly appearance instead plays a “positive” advantage. Secondly, we demonstrate that naturalness cues are an enabler corresponding to the appearance of ugly produce, and their combination facilitates consumers to resolve the schema incongruity triggered by the ugly appearance of produce through subtyping resolution. These findings extend our understanding of the role of naturalness cues communication in the marketing of ugly produce. Finally, we examined the mediating mechanisms that bolster consumer preferences for ugly produce. The findings suggest that the subtyping effect mediates the interaction between the appearance of produce and naturalness cues on the produce evaluations, this elucidates and validates a novel consumer psychological cognitive mechanism that explains why consumers prefer ugly produce instead.

6.2 Practical implications

The findings of our research can have clear implications for retailers who wish to sell ugly produce without offering steep discounts, as we propose an easily implemented, low-cost intervention that may be more sustainable over the long term than discounting. First, ugly produce, combined with naturalness cues, could boost consumers’ preferences and help to create value for the farmers or retailers selling it. Second, the findings of the study could help to reduce food waste, which is a significant social dimension issue due to raising serious concerns about food security and economic and environmental pressures (Talwar et al., 2022). The avoidable food waste of produce due to their ugly appearance is currently very serious, which is not conducive to long-term sustainable social development. Our findings have theoretical implications and offer cost-effective management strategies for addressing the waste problem associated with ugly produce. By understanding and promoting consumer acceptance of esthetically imperfect produce, the research

contributes to sustainable consumption practices and offers a potential solution to reducing food waste. Overall, our findings provide coping strategies to promote consumer preferences (product evaluations and purchase intentions) for ugly produce, which in turn will help the stakeholder sector to reduce food waste due to the rejection of ugly produce and achieve more sustainable development of society in the long term.

6.3 Limitations and future research

We elaborated on how to boost consumers’ preference for ugly produces and provide coping measures to alleviate the major social problem of food waste caused by ugly produce. However, we also have limitations. First, we only focus on the categories of fresh produce. Future research can be extended to non-fresh food categories to further provide management measures for solving the problem of food waste at the social level, such as processed foods. Second, we only used a sample of participants from China. However, different countries have different cultural backgrounds and consumers have different consumer psychologies. So, future research could test whether our findings hold in the United States or other countries.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the (patients/participants OR patients/participants legal guardian/next of kin) was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

MX: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Visualization, Writing – original draft, Writing – review & editing. YJ: Investigation, Methodology, Resources, Supervision, Writing – review & editing. BC: Investigation, Methodology, Writing – review & editing.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This work was supported by the National Natural Science Foundation of China (grant number 71902066).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2023.1313814/full#supplementary-material>

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