



## Beauty-is-good, ugly-is-risky: Food aesthetics bias and construal level

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### ABSTRACT

Consumers use aesthetics bias to judge the risk of their food intake, having an important impact on food waste of less appealing food (i.e., aesthetically imperfect foods). In six studies, this research adds to past work by revealing that when the aesthetics bias is applied to food targets, consumers make risk inferences for imperfect (vs. perfect) food products, thus reducing their purchase intention. In addition, the findings suggest that construal level moderates food aesthetics bias, reducing perceived risk and increasing purchase intention of aesthetically imperfect foods in abstract (vs. concrete) construal. This research uncovers the importance of abstract thinking in order to revoke the food aesthetics bias. The findings have critical implications for researchers, managers, and public policy makers on how to mitigate food aesthetics biases, which can contribute to reducing food waste.

### 1. Introduction

Approximately one-third of food produced is lost or wasted every year mainly due to food production systems and consumption patterns focused on aesthetics (Food and Agriculture Organization of the United Nations – FAO, 2020). At the same time, millions of people around the world suffer from hunger and malnutrition (FAO, 2019). An important contributor to food waste is consumers' preferences for highly aesthetic products (beauty-is-good bias). As the saying goes “the first taste is always with the eyes”, consumers are known to use aesthetic cues to make inferences about freshness, flavor, and food quality (Zellner, Loss, Zearfoss, & Remolina, 2014).

We explore consumers' food waste decisions by examining two lay theories: beauty-is-good and ugly-is-risky. The “beauty-is-good” bias (Griffin & Langlois, 2006) can be explained by survival instincts, where the search for the perfect aesthetic is conceptualized by the evolutionary literature (Griffin & Langlois, 2006; Griskevicius & Kenrick, 2013). Concerning food products, which have a direct relationship with people's health, the instinct to search for the perfect food appearance is dominant. We propose that consumers associate aesthetically imperfect foods with food hazards (i.e., the ugly-is-risky bias). The rigorous quality standards established by large-scale distributors involving the size, shape, and appearance of food products contribute to such risk

perceptions (Loebnitz & Grunert, 2018). Considering the high impact of aesthetics on consumers' food decisions, the desire for perfect appearance leads to food waste (Göbel, Langen, Blumenthal, Teitscheid, & Ritter, 2015; Petit et al., 2020). However, little is known how to mitigate the ugly is risky bias in order to induce sustainable consumption (White, Lin, Dahl, & Ritchie, 2016).

To bridge that gap, we rely on the construal level theory to investigate its effect on aesthetic biases and risk perceptions. The construal level theory (CLT) (Liberman & Trope, 1998) posits that consumers process objects according to concrete and abstract construals, thus influencing people's perceptions of visual attributes such as colors and shapes (e.g., Lee, Deng, Unnava, & Fujita, 2014). In this paper, we extend this line of research to investigate whether an abstract (vs. concrete) construal helps in diminishing the “beauty is good” and “ugly is risky” biases.

We conducted six studies to explore consumers' risk perceptions and purchase intention of imperfect food products. The first set of studies (pilot study and study 1) examined the basic effect of imperfect foods on consumers' risk perceptions and purchase intention. The pilot study used an eye-tracking technique to measure participants' perceived risk and study 1 tested theoretically relevant alternative mediators. Studies 2 and 3 examined the moderating role of construal level and the mediating role of risk perception. We used three different CLT manipulations

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(mindset priming, pictorial versus verbal representations, and product construal) to show the robustness of the effect. Study 4 (using real behavior) and Study 5 (field study) provide further evidence for the importance of CLT in reducing aesthetic biases.

This research makes at least three contributions to the literature and practice. We extend the literature by examining a novel intersection between three substantive areas — food aesthetics, risk perceptions, and construal level. First, it shows that aesthetics of imperfect foods lead to enhanced risk perceptions thus influencing consumers’ purchase intention.

Second, it demonstrates that construal level moderates the “beauty is good” and “ugly is risky” biases. Although extensive research has suggested a link between a concrete construal and greater risk perceptions

(e.g., Lerner, Streicher, Sachs, Raue, & Frey, 2016; Raue, Streicher, Lerner, & Frey, 2015), the results are mixed (e.g., Chandran & Menon, 2004; Yan & Sengupta, 2013; Park & Morton, 2015; Lerner, Streicher, Sachs, Raue, & Frey, 2015). Thus, our findings contribute to the literature by reconciling the literature on construal level and risk.

Specifically, our findings demonstrate that an abstract construal mitigates the biasing effect of food aesthetics, thus leading to reduced food waste of imperfect foods. Consumers primed with an abstract construal are not affected by the aesthetics bias, reporting similar levels of risk perceptions and purchase intentions across perfect and imperfect foods. Conversely, consumers with a concrete construal have higher perceptions of risk and lower purchase intention for imperfect food products.

**Table 1**  
Studies on aesthetics, risk and construal level.

Study	CLT Manipulation	Food Waste	Risk	Aesthetics	Dependent Variables	Findings
Jin and Chattopadhyay (2018)	Blurry backgrounds as Construal Level Abstract manipulation	No	Yes	Yes	Purchase Intentions	Exposure to blurry backgrounds activates a high-level construal which in turn promotes consumers’ risk-taking.
Kim, Lee, and Choi (2019)	Visual angle: Image Proximity	No	No	Yes	Brand Attitude	Close-up advertising images evoke low-level construals, with resulting higher evaluations of rational appeals. By contrast, long-shot images evoke high-level construals, with resulting higher evaluations of emotional appeals.
Vergura and Luceri (2018)	Psychological distance (Different Spacial Representations)	No	No	Yes	Emotional Response to the Ad	The results show that the foreground representation of the product on the packaging, triggered by a lower perceived spatial distance between the subject and the product, generates on average more positive emotional responses compared to the background representation.
(Lee et al., 2014)	Advertising, packaging color: black or white	No	No	Yes	Consumer information processing	Visualizations of distant (vs. near) future events are increasingly less colorful (i.e., more BW).
Schimmel and Förster (2008)	Psychological distance (proximal vs. distal)	No	No	Yes	Aesthetic Judgment	Consumers with Abstract construal were more likely to include unconventional artworks into the category of arts than participants that had thought about near events (concrete).
Lerner et al. (2015)	Mindset (abstract vs. concrete)	No	Yes	No	Risk Taking behavior	In the gain domain, abstract construals promote risk-taking because abstract construals increase payoff sensitivity. Concrete construals promote probability sensitivity. In the loss domain, abstract construals promote risk aversion and concrete riskiness.
Lerner et al. (2016)	Mindset (abstract vs. concrete)	No	Yes	No	Risk Taking Behavior (risk to die)	Online studies show that CL influenced risk estimates. Participants with a concrete mindset estimate risk to be higher than those with an abstract mindset, could not be confirmed with the risk manager sample set. However, the results showed that risk estimates given by the concrete group were significantly higher than those of the control group.
(Sagrignano et al., 2002)	Psychological distance (time: proximal vs. distal)	No	Yes	No	Preference measure (Risk gambles)	Temporal distance from future gambles increases the weight of information about payoffs and decreases the weight of information about the probability of winning those payoffs. Participants were willing to take more risks in distant-future gambles (abstract).
Raue et al. (2015)	Psychological distance (proximal vs. distal)	No	Yes	No	Risky choice behaviour; organizational decision making.	High construal level (abstract) leads to less risk avoidance in gain frames than a low construal level (concrete). In loss frames, construal level did not have an influence on risk seeking.
Park and Morton (2015)	Psychological Distance (Social Distance)	No	Yes	No	Behavioral Attitude	Promotion focus terms may be more effective in terms of responsible drink attitudes when the object of judgment is a distant entity (abstract). The salience of low-level construals (i.e., prevention focus) is not as affected by psychological distance.
Yan and Sengupta (2013)	Social Distance (Self × Other); Temporal distance: (Near vs. Far); Mindset (abstract vs. concrete)	No	Yes	No	Perceived risk likelihood	Consumers’ reliance on base-rate information for assessing health risk will be enhanced when the judgment is psychologically distant, abstract (vs. relatively close, concrete). Case-risk information (e.g., pathogenic behaviors), on the contrary, will exert a greater influence when the judgment is close (vs. distant).
(Chandran and Menon, 2004)	Psychological distance (Day vs. Year)	No	Yes	No	Risk Perceptions	When the outcome is framed negatively, the day frame (concrete) is more persuasive. When the outcome is framed positively (i.e: averting heart disease), the day frame (concrete) makes the health hazard less of a threat than the year frame (abstract).

Third, we present implications for managerial practice and public policy in the area of food waste. Food waste has a multitude of societal and economic consequences, including global food access. Our findings shed light into this critical problem by introducing an abstract construal level as an approach to reduce the biasing effect of food aesthetics, and consequently, food waste.

## 2. Literature review and hypotheses

### 2.1. Literature review

We first conducted a systematic literature review using several online databases to identify empirical studies examining risk, aesthetics, and construal level (see Table 1). We found 12 empirical studies, 8 directly linking construal level with risk and 5 directly linking construal level with aesthetics. Regarding the construal level manipulation, 66.6% of the studies used psychological distance and only 25% applied a construal level mindset (e.g., how vs. why).

Previous studies have failed to examine the joint effects of food aesthetics bias and construal level in the context of food waste. In addition, to the best of the authors' knowledge, this is the first study to assess construal level and aesthetics in a field experiment. Our main goal is to use CLT to show the food aesthetics biases can be reduced to diminish food waste.

### 2.2. Food aesthetic biases and food waste

Consumers unconsciously search for cues that signal safety and quality of food products. Aesthetics is one of the primary attributes that consumers use as unconscious cues of quality (Bloch, 1995; Fitzsimons et al., 2002). The beauty-is-good bias (Griffin & Langlois, 2006) influences consumer inferences about attributes that are difficult to judge such as brand personality (Townsend & Sood, 2012) and credibility (Robins & Holmes, 2008).

In this paper, we examine how the beauty bias predisposes people to reject imperfect foods, thus leading to waste. Avoiding food with low aesthetics, which can represent cues of contamination and risk, allowed the first humans to maximize their chances of survival (White et al., 2016). However, this avoidance tendency is considered to be irrational because aesthetic imperfections do not pose any health threat (De Hooge et al., 2017). On the contrary, aesthetically perfect products often require the use of pesticides and chemical fertilizers, thus increasing the chance of chemical contamination (Lagerkvist, Berthelsen, Sundström, & Johansson, 2014).

Given the power of aesthetics on food consumption, companies have alternated their strategies in order to make their products more attractive. For instance, retail chains started to display their products in attractively designed packages (Wu, Samper, Morales, & Fitzsimons, 2017) and logos (Bettels & Wiedmann, 2019). However, imperfect vegetables and fruits do not reach grocery store shelves and end up being discarded (Parfitt, Barthel, & Macnaughton, 2010; Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011). Therefore, consumers are unfamiliar with such products, thus leading to automatic negative attitudes toward imperfect food products (Loebnitz & Grunert, 2015).

We suggest that the beauty-is-good bias (Griffin & Langlois, 2006; Dion, Berscheid, & Walster, 1972; Alfakhri, Harness, Nicholson, & Harness, 2018) also applies to the food domain. Such a bias implies that imperfect foods are risky. We propose that aesthetically imperfect foods evoke greater perceptions of risk, and consequently, lower purchase intention. Thus, we predict that:

**H1A:** *When exposed to imperfect (vs. perfect) food products, consumers will exhibit higher risk perceptions.*

**H1B:** *When exposed to imperfect (vs. perfect) food products, consumers will exhibit lower purchase intentions.*

### 2.3. The mediation of risk perception

Risk perception is a fundamental psychological concept that shapes people's attitudes, decisions, and even eliminates their motivation to purchase. Most psychological studies define risk as an individual's subjective expectation of loss (Mitchell, 1999). Thus, as consumers generally are unfamiliar with imperfect foods (Aschemann-Witzel, 2018), they tend to perceive them as risky (Byrd-Bredbenner et al., 2007; Redmond & Griffith, 2004).

Previous research shows that consumers associate damaged products, even superficial packaging damages, with safety risks, thus reducing their purchase likelihood (White et al., 2016; Sen & Block, 2009). As food is directly associated with health risks (Nardi, Teixeira, Ladeira, & de Oliveira Santini, 2020), we propose that risk perceptions will mediate the impact of food aesthetics on purchase intentions. Therefore, we hypothesize that:

**H2:** *Risk perceptions mediate the influence of aesthetics on purchase intentions. Consumers will have higher risk perceptions and, consequently, less purchase intention for imperfect (vs. perfect looking) food products.*

### 2.4. The moderating role of construal level

The construal level theory (CLT) assumes that the same event or object can be represented at multiple levels (Trope & Liberman, 2010). While the concrete level (low-level) focuses on means, the abstract level (high-level) focuses on goals (Trope & Liberman, 2003). That is, with abstract construals, the importance is on "why" an action is performed while the focus shifts to "how" action is performed with concrete construals. An abstract mindset leads the consumer to think about global goals and benefits (Agrawal & Wan, 2009; Gardner, Wansink, Kim, & Park, 2014).

CLT provides a theoretical framework for understanding how people consider objects and events (distant vs. proximal), space (here vs. there), individuals (you vs. me) as psychologically distant or proximal (Lee et al., 2014). The way consumers assess product aesthetics can be explained by construal level. For instance, an attention to details and forms also changes according to the construal level: while an object's form induces a high-level construal (abstract), the details of the product are construed at a low-level (concrete) (Lee et al., 2014).

Relying on CLT (Lermer et al., 2015; Liberman & Trope, 1998), we propose that abstract (vs. concrete) construals drive the impact of aesthetics judgments on risk. Research on the impact of construal levels on risk is mixed, with some research suggesting that concrete mindsets lead to higher risk sensitivity (Lermer et al., 2015; Raue et al., 2015) and others suggesting that abstract mindsets result in higher risk perceptions (e.g., Chandran & Menon, 2004; Yan & Sengupta, 2013; Park & Morton, 2015).

Since our focus is on long-term goals such as sustainability, we argue that an abstract mindset might be more effective in reducing risk perceptions of imperfect foods. Purchase decisions involving an abstract construal reflect desirability concerns, which embrace the value of the action's end-state (the "why" aspect of buying the product) (Eyal, Liberman, & Trope, 2009; Lermer et al., 2015). Specifically, we predict that an abstract mindset enables consumers to see beyond the aesthetics of imperfect foods, thus inducing thoughts on waste reduction and sustainability offered by such products. Conversely consumers with a concrete mindset tend to focus on potential losses, such as the healthy concerns of consuming imperfect foods.

In sum, we postulate that consumers with an abstract (vs. concrete) mindset will not fall prey to the beauty-is-good bias, thus exhibiting similar levels of same risk perceptions and purchase intention for food products high and low in aesthetic qualities. Considering that the details of imperfect food products might be construed at a low-level (concrete construal), an abstract construal might reduce the food aesthetics bias. Thus, consumers with a concrete mindset will exhibit higher risk

perception, and consequently, lower purchase intention for imperfect foods products. Formally, we hypothesize that:

**H3:** *Construal level will moderate the influence of aesthetics on risk perceptions. Consumers with a concrete mindset will have higher risk perceptions of imperfect (vs. perfect looking) food products. Such an effect will not be observed among consumers with an abstract mindset.*

**H4:** *Construal level will moderate the influence of aesthetics on purchase intentions. Consumers under concrete construal will have less purchase intentions of imperfect (vs. perfect looking) food products. For consumers under abstract construal, aesthetics will have no effect on purchase intentions.*

### 3. Overview of studies

We conducted six studies using different manipulations of food aesthetics and construal level. Considering the relevance of food aesthetics on food, we first conducted a pretest using food pictures with different aesthetic levels (imperfect vs. perfect food products). In the pilot study, we conducted an eye-tracking experiment to initially test our predictions that when aesthetics is low (i.e., imperfect food products) consumers increase their risk perceptions. We analyzed the time of fixation duration as a proxy for risk perceptions. Study 1 provided a conceptual replication of the aesthetic bias on risk perceptions and also tested the underlying process of risk perceptions on the impact of aesthetics on purchase intention. Study 2 used a construal level priming task in order to test hypotheses 3 and 4. We showed that consumers with a concrete mindset perceived imperfect food products as riskier than in an abstract mindset. In Study 3 we used pictorial and verbal representations to demonstrate the moderating role of construal level. Study 4 replicates our findings using real behavior. Finally, Study 5 is a field study offering important managerial implications to practitioners. For an overview of studies, please see Appendix C.

#### 3.1. Eye-tracking pilot study: Food aesthetics and risk perception

**Pretest.** Aesthetics was manipulated using product images. The focal product of was a carrot that was either normally or abnormally shaped. One hundred and sixteen participants (50.8% male,  $Mage = 24$ ), recruited from MTurk. Amazon's Mechanical Turk were randomly assigned to one of the five aesthetic conditions. The color and the background were controlled using Photoshop software. We selected two images with the highest ( $M = 8.04$ ,  $SD = 1.442$ ) and lowest ( $M = 2.81$ ,  $SD = 2.301$ ) mean evaluations to represent low versus high aesthetics, respectively.

**Study Design.** The Pilot study adopted a within-subject design with one-factor at two levels (food aesthetics: perfect vs. imperfect). The experiment took place in a Portuguese University using a high frequency (120 Hz) Tobii X3120 eye-tracker to collect raw eye movement data points every 8.3 ms. Participants were 41 students who came individually to a room where the experimenter invited them to sit in front of the eye tracker. The process of calibration was performed for each participant prior to the recording of five second exposures to the stimuli. All participants had normal or corrected-to-normal vision.

We chose fixation duration as a proxy for risk perceptions. Fixation encompasses slower movements that assist the eye to be aligned with the target. Risk perceptions motivate intensified information seeking (Witt & Moutinho, 1995), increasing visual attention. For instance, in their eye-tacking experiment Süssenbach et al. (2013) demonstrate the link between attention and risk perceptions. Thus, fixation duration is a measure of cognitive processing and visual attention (Wang, Yang, Liu, Cao, & Ma, 2014). A longer duration indicates a difficulty in assimilating information (Just & Carpenter, 1976; Wang et al., 2014), such as in the case of food risk perceptions.

**Results and Discussion.** Before our quantitative analysis, we conducted a heat map analysis to reveal qualitatively the effects of

aesthetics on consumers' fixation duration (Table 2). The heat map reflects the degree of visual attention and contributes to a more visceral understanding of fixation results. That is, these maps illustrate the total time that participants fixed their eyes in each image's element. The heat scale means that the darker colors represent a larger time spent looking at the image area, that is, when the color is red the attention is higher (Vila & Gomez, 2016). When exposed to the imperfect (vs. visually appealing) food product, participants had the highest number of eye fixations.

We expected imperfect foods to induce higher levels of visual attention and cognition than their visually appealing counterparts. To examine such effects, we used the eye movement measure of the fixation duration, which corresponds to the average time of fixation on a specific area. A one-way ANOVA was run to analyze the effects of aesthetics on fixation duration. A significant main effect of aesthetics on fixation duration emerged ( $F_{(1,35)} = 7.388$ ,  $p < .05$ ,  $\eta^2 = 0.174$ ). Calculating total fixation duration show that overall participants fixated longer on the imperfect (vs. perfect looking) condition. To explore this, we examined the effects within each aesthetics level below (see Table 3). Thus, the pilot study provided initial evidence of our risk perception hypothesis. The eye-tracking experiment supported our predictions that when consumers are exposed to imperfect foods their average of fixation duration is higher and fixations is a proxy for risk perceptions.

#### 3.2. Study 1: The impact of food aesthetics on risk perceptions and purchase intention

**Study Design.** The main purpose of study 1 was to analyze the underlying process of risk perceptions reducing purchase intention. We used abnormally and normally shaped carrots in order to manipulate aesthetics of imperfect (vs. perfect) food products. We selected two images to replicate the aesthetic standard that retailers generally use (Loebnitz & Grunert, 2015).

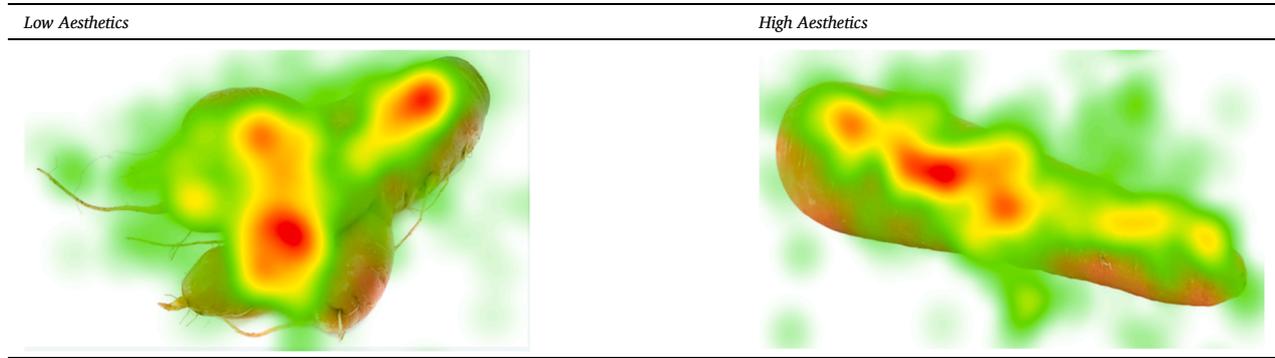
We employed a one factor (food aesthetics: perfect vs. imperfect) between subjects' design. One hundred and six (59.4% male,  $Mage = 38$ ) US-based individuals were recruited from MTurk. Participants were randomly assigned to one of the two aesthetics conditions.

The key dependent variables were purchase intention and risk perceptions. Participants evaluated their purchase intention ("very unlikely/very likely to buy this product," "very unwilling/very willing to buy this product," "very uninclined/very inclined to buy this product") rated on a nine-point scale (White, MacDonnell, & Dahl, 2011) (Cronbach's alpha = 0.971). Risk perceptions were assessed with three items: "Considering the carrot you just saw, how "risky" / "safe" / "harmful" would you consider it?", also rated on a nine-point scale (adapted from White et al., 2016) (Cronbach's alpha = 0.620). Regarding alternative mediators, participants also reported their contamination perceptions toward food products ( $\alpha = 0.97$ ) ("not at all safe/very safe," "unhealthy/healthy,") (White & Dahl, 2016). Further, aesthetics fluency was measured through the milliseconds that participants remained in each aesthetics condition (adapted from Reber, 2012). At the end of the study, participants completed demographic measures and were debriefed.

**Results.** A one-way ANOVA was performed to investigate the effect of food aesthetics on purchase intention. There was a statistically significant difference between the two conditions ( $F_{(1,104)} = 15,902$ ,  $p < .001$ ,  $\eta^2 = 0.133$ ). As predicted, purchase intention for the highly appealing carrot was significantly higher ( $M = 6.09$ ,  $SD = 2.48$ ) when compared with to its imperfect counterpart ( $M = 4.006$ ,  $SD = 2.90$ ), providing support for H1B. In terms of risk perceptions, there was a statistically significant difference between the two conditions ( $F_{(1,104)} = 8,253$ ,  $p = .005$ ,  $\eta^2 = 0.074$ ), supporting H1A. Risk perceptions for the highly appealing carrot were significantly lower ( $M = 3.09$ ,  $SD = 1.88$ ) when compared with the imperfect carrot ( $M = 4.22$ ,  $SD = 2.12$ ).

**Mediation of Risk Perceptions.** In order to determine if risk perceptions mediate the effect of food aesthetics on purchase intentions, we conducted a mediation analysis using PROCESS Model 4 (Hayes, 2013). The

**Table 2**  
The effects of low vs. high aesthetics on consumers' fixation duration.



**Table 3**  
Pilot study results on risk perception (fixation duration).

Dependent Variable	Low Aesthetics		High Aesthetics	
	M	SD	M	SD
Fixation duration	2.515	0.229	2.154	0.159

mean indirect effect was positive ( $a \times B = 0.58, SE = 0.25$ ), with a 95% confidence interval excluding zero (0.15 to 1.15), as well as the direct effect ( $c' = 1.49, p = .0036$ ), indicating significant partial mediation by risk perceptions, supporting H2 (see Fig. 1).

**Alternative Processes.** To rule out alternative mediating processes, we examined contamination perceptions (White & Dahl, 2016) and aesthetics fluency (i.e., the ease of aesthetics processing – Reber, 2012). Our results show that the relationship between food aesthetics and purchase intentions was not significantly mediated by contamination perceptions (95% CI:  $-0.051$  to  $0.3210$ ) nor by aesthetics fluency (95% CI:  $-0.0327$  to  $0.0897$ ). Both results rule out for alternative mediators, providing additional support for our prediction that risk perception is the mediating mechanism between food aesthetics and purchase intention. Appendix A shows mediation analysis details, including alternative underlying processes.

**Discussion.** The findings from Study 1 are congruent with H1A, H1B, and H2, providing initial evidence that aesthetics influences the extent to which risk perceptions impact consumers' purchase intention of food products. Our results show that consumers exposed to imperfect foods exhibited higher perceived risk and lower purchase intention. This finding suggests that the unconscious ugly-is-bad bias was at work. In the next set of studies, we will gauge the influence of construal level as a potential safeguard against the beauty-is-good bias.

3.3. Study 2: The moderation of construal level

Consumers with an abstract mindset are more likely to assess products considering attributes that go beyond their intrinsic characteristics (such as appearance), which we call a more holistic view. The opposite happens with a concrete construal, where attention is focused on intrinsic attributes. The primary goal of Study 2 was to investigate how construal levels influence consumers' risk perceptions of imperfect foods.

**Study design.** The study was a 2 (mindset: concrete vs. abstract)  $\times$  2 (food aesthetics: perfect vs. imperfect) between-subjects design. Two hundred and two (54% female, *Age* = 42) US-based consumers participated in this study.

Participants were first randomly assigned to a construal level manipulation adapted from Fujita, Trope, Liberman, and Levin-Sagi (2006). In abstract construal, the importance is on “why” an action is performed, and in concrete construal terms the focus is on “how” an action is performed. Thus, participants in the abstract condition were asked to explain why they should try to maintain and improve their mental health. Participants in the concrete condition were asked to explain how they might do so. We chose the mental health context because it is unrelated to the dependent variable (purchase intention for a food product). Having completed the construal level manipulation task, they were randomly assigned to one of the food conditions. We used the same food images and measures of risk perceptions as in study 1.

**Results.** A 2 (food aesthetics)  $\times$  2 (construal level) ANOVA examined the effects of food aesthetics and construal level on risk perceptions. A significant interaction emerged ( $F_{(1, 202)} = 4.954, p = .027, \eta^2 = 0.024$ ). As predicted, only the concrete mindset had an impact on food aesthetics and risk ( $F_{(1,198)} = 17,129, p = .0001, \eta^2 = 0.008$ ). Participants in the concrete construal condition had higher risk perceptions of imperfect foods ( $M = 4.019, SD = 0.241$ ) than for their perfect looking

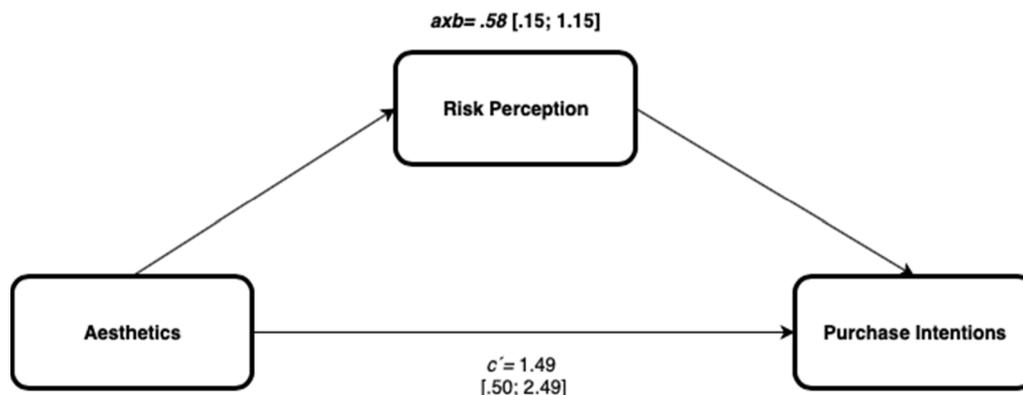


Fig. 1. Perceived Risk Mediation in Study 1.

counterparts ( $M = 2.609$ ,  $SD = 0.241$ ). As predicted, an abstract mindset didn't have an impact on perceived risk ( $p = ns$ ), such that risk perceptions were similar across the imperfect ( $M = 3.220$ ,  $SD = 0.262$ ) and perfect looking food ( $M = 2.901$ ,  $SD = 0.236$ ) (see Fig. 2). Thus, consumers primed to have an abstract mindset do not fall prey to the beauty is good bias.

**Discussion.** These findings provide support for our theorizing. Construal level moderates the influence of food aesthetics on risk perceptions. Specifically, when consumers have a concrete mindset, they have higher risk perceptions for imperfect foods. However, for consumers who have an abstract mindset, food aesthetics has minimal effect on perceived risk. That is, they consider vegetables with low and high aesthetic qualities similar in terms of health risk.

Study 2 has important theoretical and practical implications for food companies and policy makers. Our findings highlight a strategy to minimize consumers' risk perceptions of imperfect foods: activating abstract thinking. We urge companies to develop interventions that induce an abstract mindset, as consumers with a concrete mindset focus on intrinsic product attributes rather than higher-order goals such as minimizing food waste (Gardner et al., 2014). To enhance the generalizability of our findings in Study 3 we use another food product (lemon) and use pictorial and verbal representations to prime construal levels.

### 3.4. Study 3: Extending the construal level moderation with representations

The goal of Study 3 is to examine whether the moderation of construal level using pictorial concrete - versus verbal abstract - representations (Amit, Algom, & Trope, 2009) explains differences in consumers' perceptions of imperfect foods. Prior research indicates that words serve as powerful conveyors of meaning (abstract construal), while pictures consist of a more context-bound representation (concrete concrete) (Amit et al., 2009).

**Method.** Two hundred and twenty US-based consumers (57.7% female,  $Mage = 35.12$ ) participated in a 2 (food aesthetics: high vs. low)  $\times$  2 (construal level: pictorial vs. verbal representations) between-subjects study with purchase intention and risk perception as dependent variables. The study was introduced as a print advertisement evaluation task. Participants matched pictorial or verbal representations of an imperfect (vs. appealing) lemon for a lemonade advertisement. Next, participants rated their purchase intention and risk perceptions using the same scales in previous studies.

**Results for Purchase Intentions.** A 2  $\times$  2 ANOVA examined the effect of food aesthetics and construal level on purchase intention. The food aesthetics  $\times$  construal level interaction was significant ( $F_{(1,220)} = 5.681$ ,  $p = .018$ ,  $\eta^2 = 0.026$ ). Consumers who were exposed to the concrete mindset condition (i.e., images) showed differences in purchase intention across the two types of lemons ( $F_{(1,216)} = 14.536$ ,  $p = .0001$ ,  $\eta^2 = 0.063$ ). Specifically, those who had been exposed to concrete construal presented less purchase intentions for the imperfect foods ( $M = 4.836$ ,  $SD = 0.306$ ), when compared with their perfect looking counterparts ( $M = 6.485$ ,  $SD = 0.306$ ). Conversely, consumers in the abstract mindset condition (i.e., exposed to verbal representations) were equally likely to purchase the imperfect ( $M = 5.915$ ,  $SD = 0.311$ ) and normal looking lemon ( $M = 6.078$ ,  $SD = 0.323$ ) ( $F_{(1,216)} = 0.132$ ,  $p = .716$ ,  $\eta^2 = 0.001$ ).

**Risk Perceptions.** As predicted, a significant interaction of food aesthetics  $\times$  construal level emerged ( $F_{(1, 220)} = 7.608$ ,  $p = .006$ ,  $\eta^2 = 0.034$ ). A concrete mindset makes people perceive imperfect foods as riskier than conventional food ( $F_{(1, 216)} = 11.24$ ,  $p = .001$ ,  $\eta^2 = 0.049$ ), while in the abstract condition, participants' risk perceptions were not affected by food aesthetics ( $p = ns$ ). More specifically, participants exposed to the concrete construal had higher risk perceptions of imperfect foods ( $M = 3.953$ ,  $SD = 0.248$ ) than the perfect looking ones ( $M = 2.778$ ,  $SD = 0.248$ ). In the abstract construal, as predicted, both perceptions were similar for the imperfect ( $M = 3.200$ ,  $SD = 0.252$ ) and perfect foods ( $M = 3.418$ ,  $SD = 0.262$ ) (see Fig. 3). The results show no main effects of food aesthetics or construal level.

**Mediation of Risk Perception.** We analyzed food aesthetics  $\times$  construal level for their effects on purchase intentions through risk perception. Our framework proposes that under concrete construal, low food aesthetics increases risk perceptions and mediates the interaction with purchase intentions. To test the theoretical framework, we conducted a moderated-mediation analysis (Hayes, 2013, model 8,  $n = 5000$ ) and uncovered that the suggested moderated-mediation pathway had a positive, significant indirect effect ( $B = 0.776$ ,  $SE = 0.307$ ; 95% CI [0.20, 1.41]). Indeed, in the abstract condition, there was no significant indirect effect of food aesthetics on purchase intentions by way of risk perceptions ( $B = -0.1217$ ,  $SE = 0.211$ , 95% CI [-0.531 to 0.312]). However, supporting our predictions, when participants were exposed to pictorial representations, concrete condition, there was a significant indirect effect ( $B = 0.655$ ,  $SE = 0.223$ , 95% CI [0.264 to 1.129]) (see Fig. 4).

To understand the influence of additional constructs suggested in the aesthetics literature, we conducted a moderated-mediation analysis

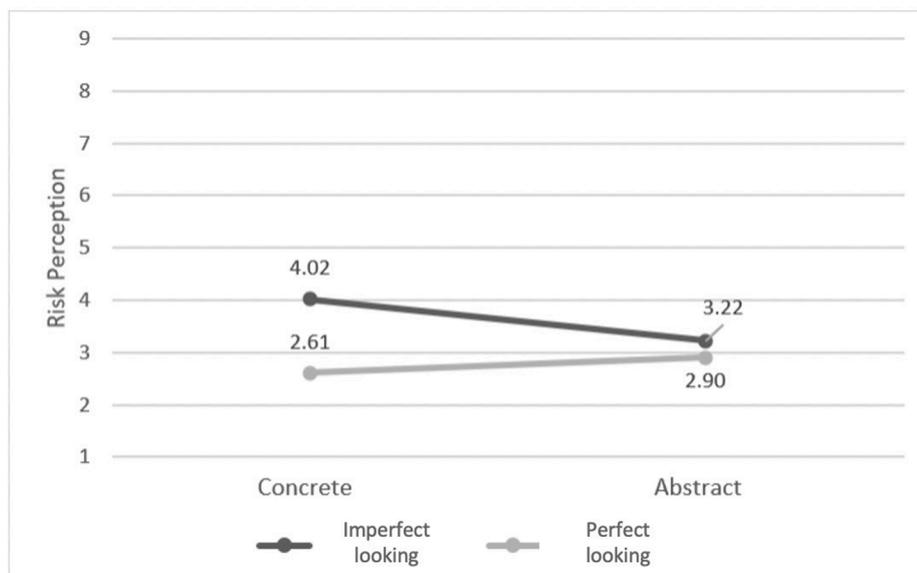


Fig. 2. Construal Level Moderation in Study 2.

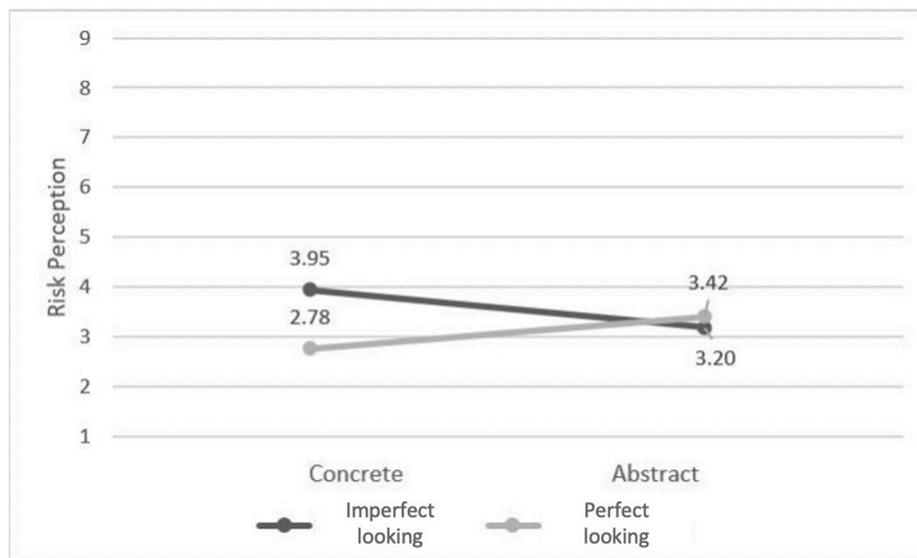


Fig. 3. Construal Level (Pictorial and Verbal Representations) Moderation in Study 3.

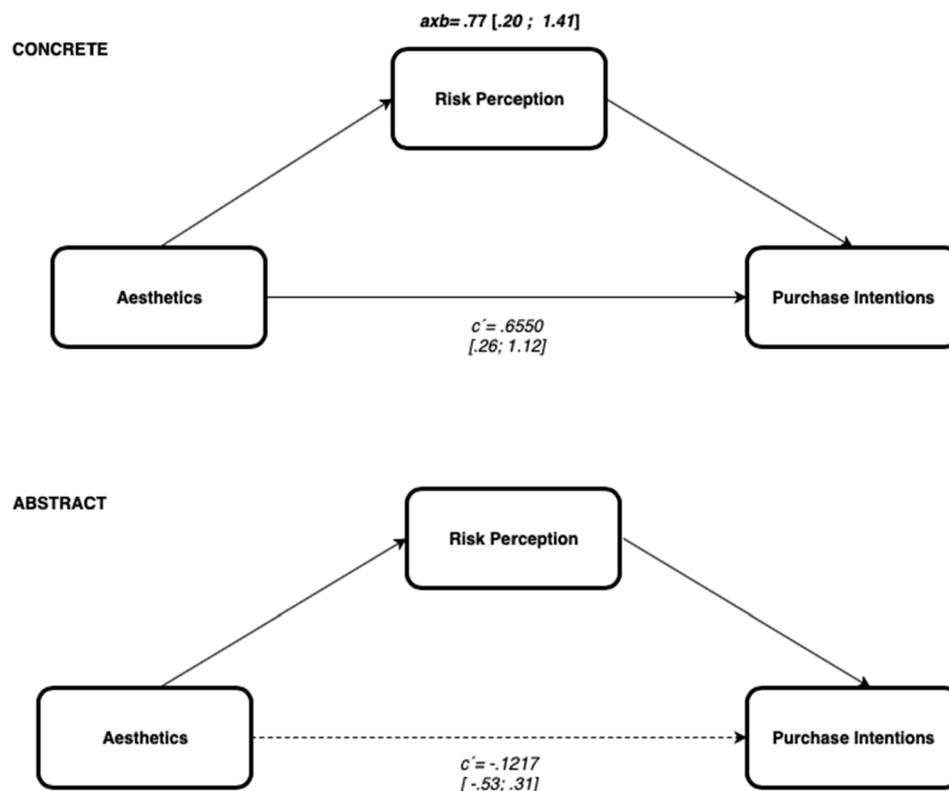


Fig. 4. Construal Level Moderated-mediation in Study 3.

(Hayes, 2013, model 8,  $n = 5000$ ) with construal level and food aesthetics, along with the alternative mediators on purchase intentions. Results showed no significant mediation effects for food aesthetics fluency and contamination perceptions (all  $p$ s were nonsignificant). Appendix B shows mediation analysis details, including alternative underlying processes.

**Discussion.** The results of Study 3 support H3 and H4. Moreover, we replicate the moderating effect of construal level on risk perceptions and show that the effect is mediated by risk perceptions. Thus, individuals with a concrete mindset are influenced by food aesthetics biases, showing more negative perceptions when exposed to imperfect foods.

Conversely, individuals with an abstract mindset seem more immune to food aesthetics biases.

3.5. Study 4: Laboratory study – Testing for real behavior (Lemonade)

**Method.** The goal of Study 4 is to examine whether the effects of construal level extend to real behaviors. Study 4 replicates the use of pictorial versus verbal representations of imperfect foods on a one-factor two levels (construal level: abstract vs. concrete representations) between-subjects laboratory study.

Sixty-nine graduate students from a major European University (49%

female,  $Mage = 22.12$ ) participated in the study. Participants were informed that the study was assessing consumers' opinions about a new lemonade beverage made with "ugly lemons" (imperfect foods). Following the CLT manipulation, they received a code to claim a glass of lemonade. Participants who wanted to drink the lemonade moved to another room where a lab assistant gave them a 200 ml cup of lemonade.

**Results.** Fifteen participants who mentioned that they do not drink lemonade were excluded from the final sample. We created a binary variable for lemonade consumption indicating participants willingness to drink the lemonade. A logistic regression revealed that there was a positive effect of construal level on lemonade consumption ( $\beta = 1.576$ ,  $Wald \chi(1) = 4.043$ ,  $p < .05$ ). Participants exposed to the abstract advertisement ( $M = 0.83$ ,  $SD = 0.064$ ) had a higher consumption rate of lemonade made with imperfect lemons than those in the concrete condition ( $M = 0.62$ ,  $SD = 0.083$ ).

**Discussion.** Study 4 replicated our basic findings with a more powerful outcome variable. Activating an abstract mindset increased participants' preference for drinking lemonade made from imperfect lemons. The findings have important practical implications on how to foster the consumption of imperfect foods using construal level framing.

### 3.6. Study 5: Field study – Overcoming food aesthetics bias with organic foods

**Method.** The goal of Study 5 was to examine the effects of construal level when manipulating a food product as either processed (abstract) or unprocessed (concrete) food. We argue that while processed products are psychologically distant from their natural form, unprocessed food products (e.g., raw vegetables) are associated with proximity. For instance, a raw carrot can be considered a concrete representation of a vegetable, while a carrot juice or a carrot cake are abstract representations of this vegetable ("you cannot concretely see the carrot, but you know it's there").

The study was conducted at a large retailer in Europe. A trained researcher collected the data by observing consumers during their organic food purchase decisions (whether they looked or not to the organic label). Participants were 261 consumers who were making their food purchases in the organic sector. The dependent variable was the number of purchases.

**Results.** Results from a 2 (construal level)  $\times$  2 (label verification) ANOVA examined the effects on purchases. A significant interaction of construal level  $\times$  label verification emerged ( $F(1, 224) = 12.906$ ,  $p < .001$ ,  $\eta p^2 = 0.047$ ). The results indicate that when imperfect foods are in their natural form (concrete representation), consumers are more likely to purchase them once they verify the organic label ( $M_{label} = 6.44$ ;  $SD = 7.480$ ) compared to when no verification took place ( $M_{nolabel} = 2.53$ ;  $SD = 2.328$ ). However, for processed food (abstract representation), the verification of the organic label had no effect on purchases ( $M_{label} = 2.50$ ;  $SD = 2.878$   $M_{nolabel} = 2.33$ ;  $SD = 3.129$ ;  $p = ns$ ).

**Discussion.** The findings of this study add to our previous studies in terms of external validity. First, we used a form of construal level manipulation that is embodied in the products (proximity - raw versus distance - processed). Second, we demonstrate the importance of label verification – as cues for quality and security of imperfect foods – on consumers' real purchase decisions of imperfect foods. Organic food products come in their natural form (concrete representations), that is, most of them have a different color, shape and size than their nonorganic counterpart. We show that when the product is in its natural, concrete form, organic labels work as quality and safety cues to revert the aesthetics bias.

These findings suggest that managers can overcome the imperfect food bias by offering consumers explicit information about product safety using organic labels. Moreover, selling imperfect fruits and vegetables in a processed way does not require any organic labels.

## 4. General discussion and conclusions

The present research sheds light on the role of food aesthetics in influencing consumers' risk perceptions and food waste through the lens of the construal level theory. Across six experiments, we examined how to use construal level to diminish risk perceptions of imperfect foods that otherwise would be end up as food waste.

### 4.1. Theoretical implications

The current study contributes to three fields of inquiry: first, it extends the domain of aesthetics-bias in multiple ways; second, it contributes to the intersection between construal level and risk; perceptions and third, it offers important theoretical contributions to the literature on food waste and sustainable consumption.

Extensive research on aesthetics has examined psychological processes that explain the choice of highly aesthetic products (Townsend & Sood, 2012) and evolutionary instincts (Dutton, 2009; Griskevicius & Kenrick, 2013). However, scant research has focused on ways to overcome the aesthetic bias in order to induce sustainable consumption (White et al., 2016). We extend previous research findings on aesthetics bias by investigating how food aesthetics and construal level jointly influence consumers' risk perceptions and purchase intention. Previous studies on CLT have examined its effects on risk perceptions via psychological distance or temporal distance (Sagrignano et al., 2002; Raue et al., 2015; Chandran & Menon, 2004; Park & Morton, 2015). Only a handful of studies have relied on an abstract vs. concrete mindset to understand consumers' risk perceptions (for rare exceptions see Lerner et al. (2015, 2016), and Yan and Sengupta (2013)). Our findings add a distinct psychological nuance to the aesthetics literature. We demonstrate that individuals with a concrete mindset have higher risk perceptions and lower likelihood of buying imperfect (vs. aesthetically appealing) foods due to the beauty is good and ugly is risky biases. Conversely, consumers with an abstract mindset do not seem to fall prey for such biases. To the best of our knowledge, our findings are the first to demonstrate the association between construal level, risk, and aesthetics. Specifically, this research shows that the impact of food aesthetics on risk perceptions is malleable as it is influenced by consumers' activated mindset. An abstract mindset can mitigate the food aesthetics bias, contributing to the acceptance of imperfect foods, thus reducing food waste (De Hooge et al., 2017).

Finally, there is scant research on psychological methods to diminish food waste (Grewal, Hmurovic, Lamberton, & Reczek, 2019). We contribute to the work of Reczek, Trudel, and White (2018) on sustainable actions by providing evidence that an abstract mindset helps to reduce perceived risk of imperfect foods. We suggest that this effect occurs as a lack of knowledge forces people to use a more abstract construal to represent distant objects. Thus, our work has potential implications for corporate social responsibility initiatives (Arnocky, Milfont, & Nicol, 2014; Reczek et al., 2018) by providing a mechanism that can help the reduction of food waste.

### 4.2. Managerial and social implications

The current research offers important practical implications for sustainable consumption and food waste. Our findings offer suggestions for the food retail industry and public policy makers to increase sustainable consumption and a way to curtail aesthetics food bias with a high-level, abstract, construal. Those implications are particularly relevant to decrease the gap between how much is produced and consumed (FAO, 2013).

Our findings are of great importance especially for developed countries, where food waste mainly occurs in the household sphere (Hodges & Bennett, 2011). Reducing food waste brings benefits not only for consumers but for the society and the environment as a whole. That is, private stakeholders would increase their profits, consumers would

increase food security and nutrition, while the waste of natural resources and greenhouse gas emissions would diminish (FAO, 2019).

Companies or public policymakers could take our findings into account to develop effective communication strategies priming an abstract mindset. Our findings indicate that not all consumers are wary of imperfect foods. Individuals with an abstract mindset seem to be more open to purchasing such foods. For instance, *Fruta Feia* is a European NGO that created an alternative market for imperfect fruits and vegetables by selling food boxes of local producers. In addition, the Denmark’s supermarkets *WeFood* commercialize ugly fruits and vegetables for a low cost, reducing the economic and social losses generated by waste. In order to acquire more subscriptions, such organizations could focus on advertisements focusing on the “why” (abstract construal) buy imperfect foods. Also, priming an abstract construal thought verbal representations, food retailers could increase the acceptability of imperfect foods and help fighting food waste.

Another example related to our research is the French government’s campaign “*Les fruits et légumes moches*” (*Ugly fruits and vegetables*). In the beginning, consumers were reluctant to buy such produce, but after trying soups and other processed foods made with imperfect foods, consumers started to believe in the quality of such products (Food for Soul, 2020). Our findings indicate that selling imperfect foods in a processed state does not need to be backed with organic labels while such quality cues are needed for unprocessed ugly produce.

Food waste has a multitude of societal consequences, as a matter of food justice. Recent research demonstrates concerns about food deserts, areas without immediate access to fresh, healthy, and affordable food (Howlett et al., 2016). Thus, food retailers are encouraged to open stores in such locations as a matter of social responsibility. Recent efforts to cope with food waste have included new business models. For example, some retailers have opened new stores specifically for imperfect foods (e.g., suboptimal products – Kulikovskaja & Aschemann-Witzel et al., 2017). Thus, we strongly believe that our findings could assist the

introduction of new business models, such as the Danish supermarket *WeFood*, to provide food for undeveloped countries and food desert areas.

#### 4.3. Limitations and future research

This research has some limitations that offer avenues for future research. In this research, we relied mainly on online and laboratory experiments. An additional field study could examine various interventions campaigns to situationally-activate an abstract mindset. Future research could also replicate the use of pictorial or verbal representations on advertisements for organic food producers on local farmers’ markets.

Another limitation of this study is that we used only two types of food products. Thus, the effectiveness of abstract construal in reducing the beauty-is-good and ugly-is-risky biases should be tested with other types of food products. Future work may also wish to look at different advertising messages and manipulations in order to identify those that trigger the abstract thinking and lower risk perceptions of imperfect foods. Using neuromarketing tools such as EEG and eye-tracking technology would enable us to gain a deeper understanding of the food aesthetics bias.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### Appendix A. Mediation analysis Study 2

Mediator	Effect	BootSE	BootLLCI	BootULCI
Perceived Risk	0.3348	0.1850	0.0502	0.7649
Contamination Perception	0.1589	0.1395	−0.0489	0.4867
Blame	0.0281	0.0670	−0.0999	0.1828

### Appendix B. Moderated-Mediation analysis Study 4

Perceived Risk CLT	Effect	BootSE	BootLLCI	BootULCI
Abstract	−0.1217	0.2108	−0.5314	0.3121
Concrete	0.6550	0.2235	0.2647	1.1297
Index of moderated mediation	0.7767	0.3079	0.2010	1.4136

Contamination Perceptions CLT	Effect	BootSE	BootLLCI	BootULCI
Abstract	0.0119	0.0551	−0.0967	0.1318
Concrete	0.0911	0.0831	−0.0406	0.2828
Index of moderated mediation	0.0792	0.0946	−0.0517	0.3210

Aesthetics Fluency CLT	Effect	BootSE	BootLLCI	BootULCI
Abstract	−0.0137	0.0181	−0.0508	0.0251
Concrete	0.0051	0.0247	−0.0421	0.0638
Index of moderated mediation	0.0188	0.0305	−0.0327	0.0897

## Appendix C. Summary of the studies

Study	Sample Size	Participants	Aesthetics	Construal Level	Dependent Variables	Results
<b>Pilot Study:</b> Eye-Tracking	$n = 41$	University students	Two pre-tested imperfect (vs. perfect) carrot pictures. Color and background were controlled for.	–	Fixation Duration	When consumers are exposed to low aesthetic products, their average of fixation duration is higher which reflects a proxy for higher risk perceptions.
<b>Study 1:</b> The impact of food aesthetics on risk perceptions and purchase intentions	$n = 106$	Amazon Mturk	Adapted from the Pilot Test.	–	Purchase Intentions and Risk Perceptions	Consumers exposed to low food aesthetics presented higher perceptions of risk and low purchase intention. Risk perception mediates the effect.
<b>Study 2:</b> The Moderation of Construal Level	$n = 202$	Amazon Mturk	Adapted from the Pilot Test.	Abstract (Why) vs. Concrete (How) Mindsets on mental health	Risk Perceptions	<b>Abstract mindset:</b> similar risk perception for low and high aesthetics. <b>Concrete mindset:</b> higher risk perceptions for low aesthetics.
<b>Study 3:</b> The moderation of Construal Level as pictorial versus verbal representations	$n = 220$	Amazon Mturk	Low versus high food aesthetics (imperfect vs. perfect) for a lemonade advertisement	Abstract (Verbal) vs. Concrete (Pictorial) Representations	Purchase Intentions and Risk Perceptions	<b>Abstract:</b> similar risk perceptions for low and high aesthetics. <b>Concrete:</b> higher risk perceptions for low aesthetics.
<b>Study 4:</b> Ugly Lemons Lemonade	$n = 69$	University Students	Low versus high food aesthetics (imperfect vs. perfect) for a lemonade advertisement	Abstract (Verbal) vs. Concrete (Pictorial) Representations	Lemonade consumption	<b>Abstract:</b> higher consumption of the lemonade <b>Concrete:</b> lower consumption of the lemonade
<b>Study 5:</b> Organic ugly food's Field Experiment	$n = 261$	Field Study with Consumers of organic food on a supermarket chain	We focus on imperfect (vs. perfect) organic products since they usually have less aesthetics attributes due to natural growth (Yue et al., 2009)	Abstract (Processed food) vs. Concrete (Raw food) Products	Number of Purchases and Organic label verification	<b>Abstract:</b> Reading the organic label is not necessary for the purchase. <b>Concrete:</b> Consumers buy more when looking for organic labels.

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