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Consumer acceptance of aesthetically imperfect vegetables – The role of information framing and personal values: Evidence from the United States

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ABSTRACT

Based on a survey of 3,504 consumers in the United States, this study investigates acceptance for food with varying types of aesthetic imperfections. A product-based discrete choice experiments (DCE) were utilized to provide preference estimates based on trade-offs between attributes of aesthetic imperfections and other relevant product attributes including price and type of production and origin. Respondents were randomly allocated to information treatments (control, gain-framed, loss-framed) tailored to nutritional and environmental impacts of food waste. Results showed that consumers accept aesthetic food imperfections related to color while not accepting those related to shape and physical aspects. The price discount was the second most important attribute for consumers' acceptance. Hence, marketing initiatives to promote 'ugly' food needs to be set with a rather substantial price discount in relation to physical imperfections but not so much in relation to shape or color imperfections. Furthermore, both gain-framed and loss-framed information increased acceptance and this effect was influenced by consumers' personal meta-value orientation. Individuals with an affinity for the meta-value orientations self-transcendence and openness to change were most accepting of aesthetically imperfect food, and individuals with an affinity for openness to change were particularly affected by gain-framed information. Tailoring the information to personal value-dimensions support the role of information to bridge the knowledge-deficit gap in terms of food waste reductions. We suggest to broaden this approach using a set of message contents to achieve increased message congruence through provision of information tailored by type of dominant personal meta-value.

1. Introduction

In the United States, an estimated 139 kg per capita of food is wasted each year. The largest share of this waste comes from the food service level (64 kg per capita) (UNEP, 2021), followed by food waste and loss from households (59 kg/capita) and from food retail (16 kg/capita). The amount of food waste in the US is the highest among countries with similar economic development (where highly reliable data are available), followed by Australia (124 kg/capita) and the United Kingdom (94 kg/capita). One of the goals within the United Nations' (United Nations, 2015) Sustainable Development Goal 12.3 is to reduce per capita food waste by half. Food producers, wholesale, retailers, and households contribute to food waste by discarding large amounts of perfectly edible food because it is considered suboptimal either through its physical appearance, by other product characteristics (tactility,

smell, etc.) or because of issues concerning the expiry date of the product (Hingston and Noseworthy, 2020; Mookerjee, Cornil and Hoegg, 2021). Wasting safe and edible but suboptimal produce contributes to resource and nutrient losses and has a negative environmental impact. Cereal, fruits, and vegetables represent the three food groups that contribute the most to waste and nutrient losses along the supply chain (Chen, Chaudhary and Mathys, 2020).

A recent and expanding literature has identified abnormal appearance and near expiration date as the dominant triggers to consumers' avoidance of suboptimal food (for recent reviews, see, e.g., Raak et al., 2017; Hartmann, Jahnke, and Hamm, 2021). In their analysis, Hartmann et al. (2021) identified quality concerns as well as price sensitivity as the two main barriers to acceptance of three categories of barriers triggered by food suboptimality: (i) unfavorable shopping and house-keeping contexts and habits, (ii) sociodemographics, and (iii) attitudes

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as well as knowledge/information seeking. Furthermore, an attitude-behavior gap has been identified suggesting that negative quality expectations trump environmental awareness as well as food waste awareness on intentions to buy damaged produce. In this respect, existing research suggests that the interrelation between awareness and behavior towards suboptimal food remain complex. The potential for information provision to raise food waste awareness at the retail level as a communication measure to influence preferences for suboptimal food remains an open question.

Existing research has also examined the effectiveness of various marketing measures necessary to overcome existing barriers related to the acceptance and commercialization of suboptimal food (for reviews, see [Hartmann, Jahnke, & Hamm, 2021](#); [Varese, Cesarani, & Wojnarowska, 2022](#)). Such measures include aspects related to the product and packaging, price formation and price discounts, place and availability, as well as promotion and communication. Initiatives like Imperfect Produce and Peculiar Picks – started by Kroger, one of the US's largest grocery chains – are examples of recent initiatives from the food retail side to commercialize suboptimal food. These are typically accompanied by information aimed at raising awareness, knowledge and attitudes of the food waste issue and reducing food waste by selling aesthetically sub-optimal food ([Imperfect Produce, 2019](#); [Pomranz, 2018](#)). This approach follows well-established marketing methods to influence environmental consciousness as well as pro-environmental behavior by communication of certain new or additional information to amplify consumer preferences. The review by [Hartmann et al. \(2021\)](#) suggests that such efforts should frame suboptimal food positively by providing anti-food waste marketing campaign messages to redirect product quality expectations and the provision of suboptimal food at retail. In addition, based on their review, [Varese, Cesarani, & Wojnarowska, 2022](#) suggested an approach that addresses intrinsic motivation and use of environmental messages to induce intentions to purchase suboptimal food. Moreover, research indicates that information to correct consumers' biased expectations of unaesthetic produce is more effective when combined with moderate, rather than substantial, price discounts, which recommends the integration of promotion and pricing measures ([Mookerjee, Cornil, & Hoegg, 2021](#)).

Persuasion is a key aspect in any message design to generate acceptance of consuming suboptimal food, and the effectiveness of such attempts will depend on the extent to which individuals will absorb and act on the information presented. Early research made it evident that more information does not necessarily lead to more enlightenment, but that the psychological characteristics of the recipients also need to be taken into account ([Hyman and Sheatsley, 1947](#)). From this, communication efforts that aim to generate attitudinal and behavioral modification developed based on audience segmentation and message targeting with practices directed to design messages based on identified group-level similarities (e.g., [Mendelsohn, 1973](#)). More recently, a practice of tailored communication by which information are customized based on characteristics to the individual recipient and related to the outcome of interest has been shown to be effective (see review by [Noar, Grant Harrington, and Shemanski Aldrich, 2009](#)). The mechanism to persuasion and behavioral change is then, in line with the Elaboration Likelihood Model ([Petty and Cacioppo, 1981](#)), that the individual engagement is spurred by personal involvement, after which the message is perceived to be personally relevant.

As noted by [Reisch et al. \(2021\)](#) and ([Castagna, Pinto, Mattila, & de Barcellos, 2021](#)), there has been little research on psychological methods to reduce food waste. In line with the criteria of information relevance, research into how information may contribute to pro-environmental food consumption behavior suggests that the efficacy of such information is driven by consonant personal values (e.g., [O'Connor, Sims, and White, 2017](#); [Steiner, Peschel and Grebitus, 2017](#)). Furthermore, as individuals hold several personal values concurrently, but to differing extents, [Kumpulainen et al. \(2018\)](#) showed that the system of value-orientation is an underlying factor to explain

the product experience and food choice, as multidimensional facets draw on several product attributes, such as origin, or on other characteristics. To our knowledge, the present study is then the first to explore: (1) if and to what extent information provision in relation to the environmental consequences from food waste framed either as benefits (gains) or as losses are associated with consumer acceptance (preferences) for aesthetically imperfect food, and (2) how this effect is influenced by consumers' personal value-orientation. We use a discrete choice experiment so that the preferences for aesthetic imperfections can be examined with account given to trade-offs to other potentially relevant product attributes such as price, origin, and production methods. We focus on physical aesthetic imperfections (color, shape and physical form), instead of other extrinsic imperfections (such as defect packages, or out-of-date expiry) since the former have been found to more negatively impact consumer evaluations ([White et al., 2016](#)).

2. Theoretical background and study hypotheses

2.1. Aesthetic bias and the role of information framing

Aesthetically imperfect food is associated with signals of inferiority to safety and quality, implying that such food is associated with not only greater perceptions of risk ([Loebnitz and Grunert, 2018](#)) but also to the perception of poorer taste or less nutritional value (e.g. [Bolos et al., 2019](#)) leading to the reluctance and avoidance of buying such products. In this respect, consumers have been found to be more accepting of aesthetic food imperfections related to color and shape than those related to physical form.

The provision of information has the potential to raise awareness and expectations of the issues to which it is related and in doing so help to bridge a knowledge-deficit gap ([Schultz, 2002](#); [Piqueras-Fiszman and Spence, 2015](#)). The assumption is that a further (or deeper) understanding of how and/or why the change is necessary would leverage the behavioral adaptation. There is then a role for retail initiatives to be accompanied by information framed to mitigate this bias.

The predispositions for an aesthetic bias (beauty-is-good; ugly-is-bad) might be irrational given that aesthetic imperfection leads not only to irrational concerns about health, but also to the perception of poorer taste or less nutritional value ([de Hooze et al., 2017](#)). [Entman \(1993\)](#) described message framing as "to select some aspects of a perceived reality and make them more salient in communication text, in such a way as to promote a particular problem definition, casual interpretation, moral evaluation, and/or treatment recommendation..." (p. 52). Following the original work on prospect theory by ([Kahneman and Tversky, 1979](#)), researchers have examined how the framing of information to either suppress or accentuate certain contents or dimensions in a way that either highlights the merits (a gain-frame) of adopting a particular behavior or the negative consequences (a loss-frame) of not engaging in a particular behavior. [Britwum and Yiannaka \(2019a; 2019b\)](#) found that loss-framed information had greater effect on consumers' willingness-to-pay than gain-framed information when relating to ways to mitigate a food safety risk. [Rosenblatt et al. \(2019\)](#) evaluated the influence of message framing on the perception of food product health warnings and presented similar results, indicating that negatively framed warnings were perceived as more efficacious than positively framed messages, although the positive message frames improved motivation to live a healthy lifestyle relative to the negative framing. However, from a theoretical perspective, and as demonstrated by [Forster, Higgins, and Idson \(1998\)](#), it is not obvious that information framing of consequences in terms of gains or losses can serve as a simple proxy for a prevention versus a promotion regulatory focus. Research has shown that people tend to perceive salient negative consequences as signaling the existence of a threat or problem triggering it to be prevented and that this signal is stronger than the trigger following from behavioral promotion (for example, [Baumeister et al., 2001](#)).

Several studies have examined the manner in which information is

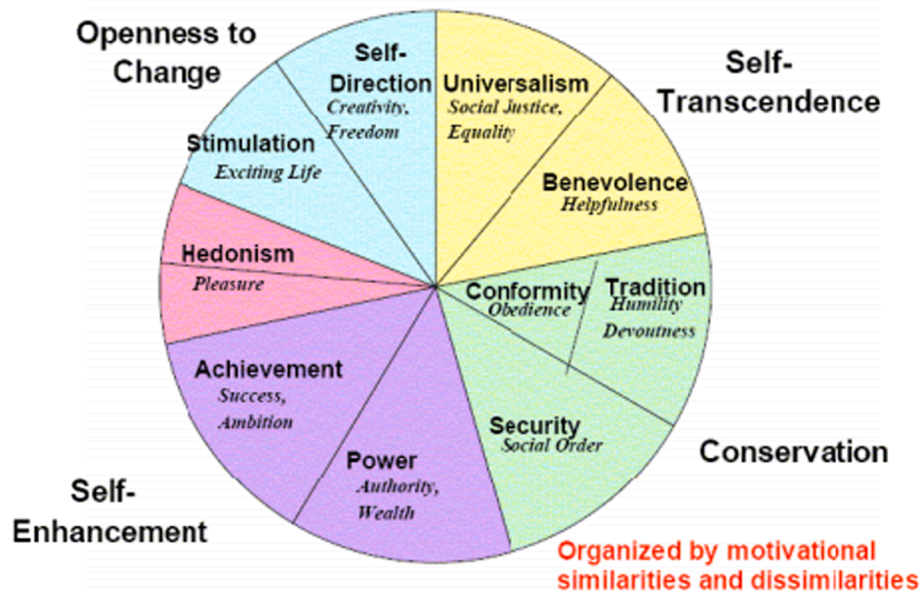


Fig. 1. Schwartz ten basic personal values and bi-polar meta-value dimensions. Source, Schwartz, 2006.

designed in terms of cognitive appeal to raise awareness of wasted food as an issue. Neff, Spiker and Truant (2015) found that for U.S. consumers such information need to avoid treating them as ignorant or as novices to the issue of food waste as well as that framing was effective when focusing on budgets. Qi and Roe (2017) found that the pursuit by individual customers to reduce food waste in restaurants can be offset if they become aware that there is a recycling policy in operation. Interestingly, Grewal et al. (2019) found that consumers purchasing intentions for unattractive versus attractive produce was higher when their self-esteem were boost in ways that increased a more positive self-perception.

Moreover, existing research focusing on the emotional appeal and response to message framing has found that gain framed information evoked more hope and loss framed evoked more fear, which then influenced advocacy behaviors (Nabi, Gustafson and Jensen, 2018). In relation to consumer awareness of food waste, Septianto, Kemper and Northey (2020) found that adding gratitude for having (food on your table) as a goal framing when paired with loss framed environmental implications (increased environmental damage) where more effective than when paired with gain framed implications (less damage). They report the opposite effect when pairing the gain or loss frame with gratitude for not having (you don't go hungry). Furthermore, the study by Shao et al. (2020), while in support of a congruency effect between gain/loss framed messages and temporal distance, found support for that by attributing human characteristics (anthropomorphism) to the ugly food product helped consumers to establish an emotional bond which increased purchase intentions. Other research have sought to align messages to either self-centered or others-centered motives (Aschemann-Witzel et al., 2019).

The literature is still inconclusive about the extent to which gain-framed and loss-framed messages can be effective in terms of affecting food consumer behavior. Moreover, the applicability of such message adaptations to improve the efficaciousness of information and the inclination to reduce food waste is not well-understood. It may be pertinent to frame information in terms of salient consequential environmental gains or losses from buying and consuming food with aesthetic imperfections to bridge a knowledge-deficit gap in favor of aesthetic perfect produce. Consumers can then be expected to be more in acceptance of marketing initiatives such as reduced prices and more willing to adapt their behavior to reduce food waste (Helmert et al., 2017; Aschemann-Witzel, 2018; Aschemann-Witzel et al., 2019). Therefore, in relation to the direct effect of gain/loss framed information

about environmental consequences from food with aesthetic imperfections, we expect that:

Hypothesis 1 (H1): Gain-framed information about environmental consequences and resource use from avoidable food waste at the retail level will mitigate the disutility (that is, negative preferences) for aesthetic imperfections relative to loss-framed messages.

2.2. Information framing and the role of personal values

Information provision may not necessarily have sufficient impact to lead to behavioral change because it may not be aligned with the underlying motivations of individuals for engaging in the behavior (Graham and Abrahamse, 2017). A fundamental prerequisite for the persuasive effect of message cues on behavioral adaptation is thus that the cues resonate with personal propositional reasoning to be either affirmed, or rejected (Gawronski and Bodenhausen, 2006). This is especially important in the case of food waste reduction, given that many consumers may not be aware of the negative impact of nutritional and environmental losses (Zhang et al., 2020).

Personal values are enduring universal ideals constructs that serves to direct how individuals weigh in and balance consequences when evaluating and considering the implications of their choices and decisions (Schwartz and Bilsky, 1987; Schwartz, 1992). According to Schwartz (1992), the 10 basic values, each denoted after its motivational basis, are (1) power, (2) achievement, (3) hedonism, (4) stimulation, (5) self-direction, (6) universalism, (7) benevolence, (8) tradition, (9) conformity, and (10) security. According to the study by Brunsø et al. (2004) the importance of product information to purchase intentions were related with values associated with self-transcendence as well as with conservation.

There is an extant literature to support that personal values can direct consumer attitudes and behavioral intentions (for example, Kamakura and Novak, 1992). There is also research indicating that these values direct environment-related behaviors (Thøgersen and Grunert-Beckmann, 1997) as well as that consumers with different value-orientations react to different product-related cues such as environmental footprint labels in diverse ways (Greibitus, Steiner, and Veeman, 2013; 2015; Katt and Meixner, 2020). An extensive literature exist on value-based food choices with this level of value disaggregation (for example, de Boer, Hoogland, and Boersema, 2007; de Boer and Schösler,

2016; Ditlevsen et al., 2020; Grebitus, Steiner, and Veeman, 2013, 2015; Steiner, Peschel, and Grebitus, 2017). In such work, Vermeir and Verbeke (2008), showed that consumers with power orientation were less appreciative of environmentally friendly products. Hedonism has been found to be associated with a preference for flavorful foods that are not necessarily healthy (de Boer, Hoogland, and Boersema, 2007; Thomson et al., 2017). De Boer et al. (2007) found that taste-orientated consumers were more focused on stimulation and thereby more interested in novel food concepts. The study by Zander and Hamm (2010) found that self-direction was connected to acceptance of new products, but also to increased acceptance of additional ethical attributes, such as organic products. Universalism has been found to be indicative of choosing products that are environmentally friendly (Thøgersen and Ölander, 2002), as well as with buying less meat (de Boer, Hoogland and Boersema, 2007), with more frequent consumption of vegetables (Farragher, Wang, and Worsley, 2016) as well as being more appreciative of local origin (Kumpulainen et al., 2018). Tradition has been shown to have a positive impact on whether a consumer chooses local origin, environmentally friendly or natural food products (Vermeir and Verbeke, 2008; Botonaki and Mattas, 2010). Aspects related to human health and safety such as the choice of organic products have been found to relate to security value motives (Schiffstein and Oude Ophuis, 1998).

According to Schwartz and Boehnke (2004), the 10 basic values are related to each other in a quasi-circular spatial structure, where values in close proximity on the circle are conceptually more compatible, while opposite values are far apart on the circle and in conflict (Fig. 1: Schwartz, 2006). Within the circular structure, there are two main orthogonal dimensions meaning that the Schwartz value taxonomy can be reduced to five meta-values: self-transcendence, openness to change, conservation, self-enhancement, and hedonism. The first main dimension includes the contrast between *openness to change* and *conservation*. *Openness to change* (stimulation and self-direction) represents independence and evident acceptance of change (Caracciolo et al., 2016; Schwartz, 2012). *Conservation* (security, conformity, and tradition), on the other hand, symbolizes order, self-restriction, and resistance to change (Schwartz, 2012). The second main dimension includes the contrast between *self-transcendence* and *self-enhancement*. *Self-transcendence* (altruism, benevolence and universalism) represents concern for the wellbeing of others. On the other hand, *self-enhancement* (achievement and power) embodies a more self-centered approach, where the pursuit of one's own interests and a wish to dominate and succeed over others tend to prevail (Schwartz, 2012). An orientation towards this dimensional end would be less likely to show concern for the environment (Caracciolo et al., 2016). Finally, *hedonism* shares elements of both *openness to change* and *self-enhancement*, representing the individual pursuit of pleasure and a focus on personal gratification.

The majority of existing research on value-based food choices has examined relations between specific values and particular behaviors, or examined such relationships based on the full range of values with the use of segmentation or hierarchical analytical approaches in terms of predictive ability, or order of importance (see for example Vermeir and Verbeke, 2008). However, as noted by Schwartz (1992), it should be appropriate to focus on the holistic value system because individuals holds the basic values concurrently, with different individual profiles, and not in isolation. Following this idea, Lindeman and Verkasalo (2005) developed an approach to compute a two-dimensional aggregated value measure based on the bi-polar relationships in Fig. 1. With the exception of the study by Kumpulainen et al. (2018), there is currently scant research examining how meta-values influence food choices based on the aggregated two-dimensional approach. Their findings showed that self-transcendence as well as conservation were related to product pleasantness and choice, but these relations were product specific. Self-transcendence was also positively related to preferences for local origin of food. The aggregated model by Lindeman and Verkasalo (2005) was also used in the study by Caracciolo et al (2016) to examine consumer preferences for process attributes of pig farming.

Their study suggest more support for more sustainable practices correspond to a strong orientation towards self-transcendence as well as to openness to change, while individuals with a stronger orientation to self-enhancement as well as to conservation lacked attention to sustainability practices.

Therefore, adapting information messages to recipients' motivational orientation may represent a way to improve the effectiveness of information campaigns to direct food choice or product preferences because more motivational congruent messages are processed more fluently and evaluated more positively (for example, Cesario, Grant and Higgins, 2004). There are research showing that individually focused messages appeal more to individuals with stronger self-enhancement values, while society-focused messages would appeal to those with higher self-transcendence values to reduce their meat consumption by information provision targeted at certain personal values (Graham and Abrahamse, 2017). Existing research has also examined the responsiveness to message cues showing support for message-congruence effects for framing persuasive information in relation to the Big Five personality dimensions (Hirsh, Kang and Bodenhausen, 2012). Relevant to this, Lunn et al.'s (2014) review found support for "a positive association between openness and consumption of fruits and vegetables" (p. 403). Furthermore, openness have displayed positive relationship to healthy eating in a large US sample (Goldberg and Strycker, 2002). Other research suggests that personal values but not concerns or attitudes/intensions in support of green consumption, are associated with behavioral change in favor of green consumption (Flagg and Bates, 2016). However, to the best of our knowledge, whether there is an information framing congruency effect in relation to personal meta-values is an open question. Addressing such integration at the level of personal meta-values would allow for a higher-dimensional assessment with relevance for exploring how to make persuasive information about the environmental consequences of food waste from buying/consuming unaesthetic food more tailored and effective.

In relation to existing research, and even though foods with aesthetic imperfections do not represent a new product category, the meta-value orientation to *openness to change* might help consumers be more open-minded in terms of being responsive to information about foods with aesthetic imperfections. On the other hand, *openness to change* has also been associated with healthy eating, and given consumer misconceptions about the quality of foods with aesthetic imperfections, this could make consumers more skeptical towards foods with aesthetic imperfections (Loebnitz et al., 2015). Based on the existing research using the set of disaggregated personal values, we then test:

Hypothesis 2 (H2). *Self-transcendence* and *openness to change* will be associated with higher acceptance of foods with aesthetic imperfections, and *self-enhancement* and *conservation* will be associated with a reluctance to accept foods with aesthetic imperfections.

Finally, we posit that that personal meta-values mediate the effect of gain- and loss-framed information and product preferences. This then ask how the congruence effect between information provision and personal values differ depending on whether the information is gain- or loss-framed. Notably, gain-, or loss-framing of information focusing on the importance of the consequences of the behavioral response serve to make the "why necessary" part of the message content more salient. This can be expected to have impact on product expectations and evaluative tendencies depending on how the cues resonate, and are cognitively consistent, with the truths (propositions) held by the individual (Gawronski and Bodenhausen, 2006). To resolve inconsistencies between the information and the validity of the proposition, and striving for cognitive consistency, the individual can either change the propositional reasoning or find another proposition that would resolve the inconsistency. For example, if exposure to aesthetically imperfect food activates negative associations, people might adapt their behavioral response when accepting the gain- or loss framed information content about the benefits in terms of environmental consequences from doing

Table 1

Socio-demographic characteristics of the study sample and US population as a whole.

Variable	Category	Sample proportion	US population ^{1,2}
Gender	Female	50.6	50.7
	Male	49.4	49.2
Age (years)	Median	49	38
	20–29	14.4	20.0
	30–44	28.7	25.3
	45–59	25.5	26.8
	60+	31.3	26.4
Region	Midwest	22.0	20.9
	Northeast	19.0	17.2
	South	36.1	38.1
	West	21.9	23.8

Note: 1. Gender and age: <https://www.census.gov/data/tables/2018/demo/age-and-sex/2018-age-sex-composition.html> 2. Region: <https://www.census.gov/newsroom/press-kits/2018/pop-estimates-national-state.html> https://www.census.gov/popclock/data_tables.php?component=growth.

so. The personal value-orientation might serve to either affirm, or reject such adaptation. We then test:

Hypothesis 3 (H3). Consumers with an affinity for *self-transcendence* and *openness to change* will be more influenced by gain-framed information – that is, the “whys” – in relation to making environmental benefits of buying aesthetically imperfect food to reduce food waste more salient, which will lead to a higher acceptance of foods with aesthetic imperfections.

3. Materials and methods

The study was granted an exemption from requiring ethical approval by the University of Arkansas Review Board (IRB) on 28th of June 2018 (Protocol number 1806125693). For the purposes of this study, aesthetically imperfect food was defined as food that is safe to be eaten even though it is perceived as unwanted relative to otherwise similar food because it deviates visually from what is regarded as the optimum (for example, good quality, no damage) in terms of color, shape, and physical form (Bolos et al., 2019; Aschemann-Witzel et al., 2015). Fruits and vegetables were selected to study consumers' preferences for food with aesthetic imperfections because these products are often not packaged at the retail, or are packaged in a way that allows the product to be seen (Deng and Srinivasan, 2013) while offering few extrinsic quality cues. More specifically, fresh tomatoes were chosen as the product of interest because they are frequently purchased fresh produce in the US, with the average American consuming around 13.7 kg pounds of tomatoes in 2019 (Statista, 2019).

3.1. Sampling and participants

Data were collected through an online survey in February–April 2019 as well as in August–October 2019, based on a representative sample of 3,504 US consumers aged 20–75, recruited by Qualtrics. Respondents who did not eat tomatoes, were allergic to tomatoes, or were not at least partially responsible for purchasing groceries in their household were excluded from the study. Due to uneven population distribution across US regions (Northeast, Midwest, West, South), quotas were added for gender, age, and regional distribution following census percentages for both data collection periods. The characteristics of the final sample and the average for the US population are described in Table 1 (see Table S1 in the Supporting Material for a detailed description of all the socio-demographic characteristics of the sample).

3.2. Study design and information treatments

Respondents were randomly assigned to three information framing

treatments (control, gain-framed treatment, loss-framed treatment). The control group was presented with an image showing food shopping (see Fig. S1, Supplementary Material) as well as an information text (see below), to introduce the concept of unaesthetic (suboptimal) food as well as the environmental and resource-use consequences of food waste. The treatment texts were adopted to the finding by Kautish, Paul and Sharma (2019) that environmental consciousness and recycling intentions direct the disposition to act environmentally friendly. In the gain-framed treatment, participants received material as used in the control group, plus additional information on the magnitude of food waste and examples of resources that are being wasted when food is thrown away. Participants were told that by purchasing suboptimal foods they would help reduce food waste, which results in gains at the societal level. Similarly, the loss-framed treatment received the same information as the control group, plus the additional information as in the gain-framed treatment, but expressed that by *not* purchasing suboptimal foods, they would contribute to food waste, which results in losses at the societal level. The specific information provided are:

Control group.

During this study, please think about suboptimal food at the retail level as food with certain damage or that is less fresh, but without affecting its safety. It can also be food that is misshaped. Examples of this could be oddly shaped fruits and vegetables.

Now please imagine you are shopping for food in the grocery store. On display is both food that you can identify as suboptimal and food that is more and even perfectly optimal in appearance.

Gain-framed information

Across the world, 815 million people go hungry every day and almost half (45 percent) of all fruits and vegetables are wasted. Please keep in mind that food waste is a big challenge in the US as well, and according to United States Department of Agriculture, 31 percent of the available food at the retail and consumer levels ends up uneaten.

Valuable natural resources go into producing the food we throw away. For example, it takes 13 L of water to grow a tomato, in addition to all other resources necessary. While extreme weather conditions are increasing and climate change is real, food waste squanders resources, such as water, land, and energy and produces excess greenhouse emissions.

As a consumer, by PURCHASING suboptimal food at a price you are willing to pay, you are contributing to DECREASING food waste, which implies CONSERVATION of resources, such as water, land, energy, and FEWER greenhouse emissions.

Loss-framed information

Across the world, 815 million people go hungry every day and almost half (45 percent) of all fruits and vegetables are wasted. Please keep in mind that food waste is a big challenge in the US as well, and according to United States Department of Agriculture, 31 percent of the available food at the retail and consumer level ends up uneaten.

Valuable natural resources go into producing the food we throw away. For example, it takes 13 L of water to grow a tomato, in addition to all other resources necessary. While extreme weather conditions are increasing and climate change is real, food waste squanders resources, such as water, land, and energy and produces excess greenhouse emissions.

As a consumer, by REFUSING TO PURCHASE suboptimal food at a price you are willing to pay, you are contributing to INCREASING food waste, which implies SQUANDERING of resources, such as water, land, energy, and INCREASED greenhouse emissions.

3.3. Product-based discrete choice experiment

A product-based discrete choice experiments (DCE) were utilized to provide preference estimates based on trade-offs between attributes of aesthetic imperfections and other relevant attributes product attributes. In the US, from 2010 to 2018, the demand for organic food increased from a market share of 3.4 percent to 5.7 percent from the total food sales across the country (Statista, 2020). Organic products are generally more expensive, and also valued differently by consumers (Ditlevsen

Table 2
Product attributes and levels for the discrete choice experiment on tomatoes.

Attribute	Description	Levels
Picture	Visual appearance	Suboptimal color (Sub-color) Suboptimal shape (Sub-shape) Damaged (Sub-physical) <i>Optimal (Reference)</i>
Origin	Origin of production	Local (within 50 miles) Imported <i>Domestic (Reference)</i> Organic <i>Conventional (Reference)</i>
Production	Method of production	
Price	Tomato price per pound	\$0.80 \$1.80 \$2.80 \$3.80

et al., 2020). Consumers' expectations of how organic produce should look may differ from the the expectations for conventional produce where pesticides and chemical fertilizers can be used to enhance the aesthetics. Similarly, preferences for local food rather than for domestic or imported food are rooted in core beliefs related to the concept of locavorism (Reich, Beck, and Price, 2018). For example, locally produced food has been associated with better taste and quality, lower environmental impact, and support for local communities (e.g., Feldmann and Hamm, 2015).

Attributes and levels used in the DCE as shown in Table 2 were selected based on a literature review and from a pilot study conducted with 50 students from the University of Arkansas. Product visual appearances included three main categories: (1) color, (2) shape and (3) physical form (Johansson et al., 1999; Salvador, Sanz and Fiszman, 2007; Loebnitz et al., 2015). The price vector was relatively large corresponding to constraints in the DCE design to preclude that visual optimality and organic tomatoes were include at the lowest price level.

Estimates from a multinomial logit (MNL) model from a second pilot with participants recruited across the US by Qualtrics (n = 100) were used as Bayesian priors to generate an efficient final design, aiming to minimize the Db error (Scarpa et al., 2007) using the software NGENE (Ngene Team, 2018). The final design consisted of 36 choice sets divided into three blocks to reduce the number of choices per respondent (see Supplementary Material, Table S2 for the resulting choice sets). Figs. S2–S5 (Supplementary Material) show the visualization of aesthetic aspects. Fig. S6 (Supplementary Material) illustrates the presentation of a choice task, including two product alternatives. A cheap talk script (see Fig. S7, Supplementary Material) was used to reduce potential hypothetical bias (Carlsson et al., 2005).

3.4. Personal values

By the short Schwartz value survey (SVS), respondents were prompted to evaluate the importance of the 10 values with an attached description of each value on a seven-point scale (-1 = *strongly opposed to my principles*, 5 = *of supreme importance*) (Schwartz, 2012). The short SVS has been shown to have high reliability (Lindeman and Verkasalo, 2005). For each respondent, the importance of the two meta-value dimensions (*conservation vs openness to change*, and *self-transcendence vs self-enhancement*) were computed following Lindeman and Verkasalo's approach (2005).¹ These dimensions were included as covariates in the

¹ The two meta-values were computed from the following equations that apply to seven-point scales: **Conservation** = 0.92 + 0.15*power + 0.03*achievement - 0.17*hedonism - 0.25*stimulation - 0.31*self-direction - 0.26*universalism + 0.04*benevolence + 0.30*tradition + 0.30*conformity + 0.20*security. **Self-Transcendence** = -0.56 - 0.30*power - 0.33*achievement - 0.16*hedonism - 0.14*stimulation + 0.04*self-direction + 0.22*universalism + 0.24*benevolence + 0.12*tradition + 0.03*conformity + 0.03*security.

analysis of the DCE data. The 25th, 50th, and 75th percentiles of *conservation vs openness to change* were 0.49, 1.05, and 1.65, respectively. For *self-transcendence vs self-enhancement*, the 25th, 50th, and 75th percentiles were -1.21, -0.61, and 0.13, respectively.

3.5. Other measures

The ecologically focused worldview (that is, a beliefs system vis-à-vis nature and humans' role in the nature/environment) was measured by adapting Dunlap et al.'s (2000) New Environmental Paradigm (NEP) scale. We removed Item 5 (*Humans are seriously abusing the environment*) in the original scale as it is reported (Dunlap et al., 2000: 432) to overlap with the sub-dimension for nature's balance (that is, Items 3, 8, and 15). Using the NEP, the remaining 14 questions were scored on a Likert-Scale (1 = strongly disagree; 5 = strongly agree), where higher scores are indicative of a stronger ecologically friendly worldview. Cronbach's alpha was 0.838, which is comparable with the original scale (0.83), as well as with the study by Steiner et al. (2017) (0.82).

3.6. Data analysis

According to the Random Utility Theory (McFadden, 1974), the utility that a decision maker n obtains from choosing alternative $i = 1, \dots, J$ in choice situation $t = 1, \dots, T$ is $U_{nit} = \beta'_n x_{nit} + \varepsilon_{nit}$, where x_{nit} is a vector of observed attributes, β'_n is a vector of utility coefficients and ε_{nit} is an unobserved random error component of the utility assumed to be iid extreme value type 1 distributed with variance $\pi^2/6\lambda^2$, where λ is a scale parameter. The choice probability is then:

$$P_{nit} = \frac{\exp(\lambda(\beta'_n x_{nit}))}{\sum_{j=1}^J \exp(\lambda(\beta'_n x_{jit}))} \quad (1)$$

where λ is a scale parameter that is normalized to unity. Furthermore, because the estimated preference parameters are confounded with the scale parameter, the scale was allowed to vary between the control group and the two treatment groups:

$$\lambda = \exp(\gamma_1 \text{gain} + \gamma_2 \text{loss}) \quad (2)$$

where γ are parameters to be estimated. To account for the repeated observations per respondent and accommodating for preference heterogeneity between individuals, while relaxing the IIA assumption in the MNL model, we estimated mixed logit (ML) models (Train, 1998). The density of β'_n is $f(\beta'_n|\theta)$, with θ being parameters of the distribution (Hole, 2007).

With the aim of identifying the percentage of individuals who ignored all attributes (that is, those with all systematic utility = 0), we adopted the approach by Malone and Lusk (2018) by estimating a restricted latent class logit model from the choice data with two classes. One class is specified with continuous random parameters for the attributes and with interactions as described above, while the other class is specified with parameters restricted to zero. This approach is then concerned with the nature of the utility function as such in addressing whether or not respondents are indeed making trade-offs between all attributes available in a choice setting. Such a lack of trade-offs may be indicative of non-compensatory preferences, or by plain neglect or lack of relevance of the choice situation. Class membership covariates were included to test whether gender, age, and low frequency of purchasing tomatoes explain random response behavior.

The model included interaction effects between the suboptimal preference parameters and treatments to investigate the effects of information framing on consumer preferences for suboptimal tomatoes. Interactions between the meta-values and the suboptimal preference parameters were included to test the second hypothesis, while three-way interactions between treatments and meta-values with the suboptimal preference parameters were included to test the third hypothesis.

Models choice were estimated using the Apollo package in R (Hess and Palma, 2019). All attribute parameters were specified with normal distributions, while the price parameter was set as non-random.² In the estimation of the final model, we used 1000 Sobol draws. We applied a start-value search algorithm to minimize the risk of reaching local optima (Hess and Palma, 2019).

4. Results

4.1. Aesthetic bias, personal values and the role of gain- and loss-framed information

In line with previous literature, the main effects in Table 3, Panel A when not considering data from those individuals that were identified as unengaged, shows that, on average, respondents prefer aesthetically optimal tomatoes to tomatoes with visible physical damage. Physically unaesthetic tomatoes provide a relatively large disutility, while unaesthetic tomatoes with respect to shape are, on average, also less preferred than aesthetically optimal tomatoes. The results also suggest that unaesthetic tomatoes with respect to color are less preferable than optimal tomatoes, but this effect is not statistically significant. Furthermore, there is large individual preference variation regarding the aesthetic attributes. This is revealed by the size of the standard deviation parameters relative to the mean parameters. Regarding the other attributes, we see that, on average, respondents prefer domestic tomatoes to local and imported ones. Furthermore, while the preference parameter for organic is negative (-0.24) on average, the standard deviation parameter is relatively large (0.89). This implies that 39 % of the individuals are estimated to hold a positive preference for organic. Finally, as reasonable, the price coefficient is negative, suggesting that an increase in price will decrease the utility of a particular type of tomato.

Our first research question concerns whether the acceptance of unaesthetic tomatoes is affected by gain- and loss-framed information. The results in Table 3, Panel B; shows that the preference for all three aspects of aesthetic imperfects (color, shape, and physical appearance) are positive in the gain framing treatment relative to the control group. Notably, the negative framing also contributed to more positive preferences for unaesthetic shape as well as physical aspects, but not for color. However, the treatment effects are not statistically significantly different between the gain framing and the loss framing.³ Moreover, the scale parameters are insignificant (see Note to Table 3), suggesting that there are no differences in error variance between the treatment groups and the control group. This means that the respondents in the treatment groups are no more or less consistent (certain) in their choice responses.

The second research question focused on the extent to which the personal value-orientation influence preferences for sub-optimal products. The interaction effects shown in Panel C (Table 3) support H2. Respondents with affinities for *conservation vs openness to change* show a lower acceptance of physically suboptimal tomatoes. Furthermore, respondents with affinities for *self-transcendence* have a higher acceptance of suboptimal tomatoes than consumers with affinities to *self-enhancement*, at the opposite end of this meta-value dimension. This holds for all three types of sub-optimality.

Finally, in the results in Panel D (Table 3), shows how preferences for the three aspects of aesthetic imperfects are influenced by the combined effect from provision of information framed in ways of environmental gains or losses and the personal meta-value orientations of individuals. When interpreting these estimates, it is important to note that these three-way interaction effects should be compared against the treatment effects in Panel B. The results in Panel D provide partial

² We estimated models where the price parameter took a negative lognormal distribution, but this caused difficulties with convergence and provided unstable results.

³ *t*-statistics (Delta method): Color=1.350, Shape=1.061, Physical=-0.294.

Table 3
Mixed logit estimates.

	Mean [95 % CI]	<i>t</i> -value	Std. dev	<i>t</i> -value
Panel A. Preference Parameters				
Price	-1.48 [-1.6, -1.6]	23.62		
Aesthetically imperfect (reference: optimal):				
Color	-0.23 [-0.5, 0.04]	1.64	1.18	11.96
Shape	-0.64 [-1.0, -0.3]	3.72	2.28	20.61
Physical	-3.64 [-4.2, -3.1]	12.70	4.03	21.18
Organic (reference: conventional)	-0.24 [-0.3, -0.2]	5.72	0.89	10.93
Place of origin (reference: domestic):				
Local	-0.46 [-0.5, -0.4]	10.50	0.23	1.72
Imported	-0.31 [-0.4, -0.2]	6.11	1.06	12.77
Panel B. Treatment interaction effects (reference: control):				
<u>Gain framing:</u>				
Color	0.58	2.65		
Shape	0.86	3.40		
Physical	0.80	2.35		
<u>Loss framing:</u>				
Color	0.24	1.15		
Shape	0.55	2.22		
Physical	0.91	2.71		
Panel C. Personal meta-values interaction effects				
<u>Conservation vs Openness-to-change:</u>				
Color	0.03	0.43		
Shape	-0.04	0.47		
Physical	-0.45	3.21		
<u>Self-transcendence vs Self-enhancement:</u>				
Color	0.63	6.19		
Shape	0.92	7.60		
Physical	1.38	7.53		
Panel D. 3-way interactions:				
Aesthetic imperfections × Treatment × Personal meta-values				
<u>Gain framing × Conservation ×</u>				
Color	-0.26	2.22		
Shape	-0.30	2.17		
Physical	-0.04	0.22		
<u>Gain framing × Self-transcendence ×</u>				
Color	0.20	1.37		
Shape	0.27	1.55		
Physical	0.17	0.67		
<u>Loss framing × Conservation ×</u>				
Color	-0.09	0.79		
Shape	-0.24	1.74		
Physical	-0.14	0.68		
<u>Loss framing × Self-transcendence ×</u>				
Color	-0.35	2.34		
Shape	-0.02	0.10		
Physical	-0.15	0.57		
Panel E. Random choice class				
Class membership = 18.7 %				
Constant	-0.71	4.09		

(continued on next page)

Table 3 (continued)

	Mean [95 % CI]	t- value	Std. dev	t- value
Age	-0.02	4.88		
Female	0.01	0.08		
Rarely purchase tomato	-0.13	0.59		

Notes: Scale in gain framing $M = -0.01$ ($|t\text{-value}|=0.10$), Scale in loss framing $M = -0.04$ ($|t\text{-value}|=0.79$). Bold estimates indicates 5 % significance level. Number of respondents = 3,504. LL = -20,739.

support for H3. While there was a positive effect from the gain-framed information on average (as shown in Panel B), this effect is counterweighed for aesthetic imperfections related to color and shape, but not in relation to physical aspects, for individuals with affinity for *conservation vs openness to change*. For example, the average effect from the gain-framed message on the preferences for unaesthetically shaped tomatoes was 0.86, but this positive effect was lower (-0.30) for individuals with an affinity for *conservation*. Hence, the total effect from gain-framed information on individuals at the 75th percentile of the *conservation vs openness to change* value-orientation is, on average, positive ($0.86 - 0.30 \times 1.65 = 0.37$). By contrast, this result also implies that individuals with low affinity for *conservation*, and thereby with an affinity for *openness to change*, were even more affected by the gain-framed information. Furthermore, the results suggest that there were no effects on the preferences for the three aspects of aesthetic imperfections among individuals with an affinity for *self-transcendence* instead of *self-enhancement* when receiving the gain-framed information. Notably, the combined effect of loss-framed information, when paired with an affinity for *self-transcendence* on preference for unaesthetic color, was negative.

4.2. Robustness

We find that 18.7 percent of the respondents are identified as making random choices in the choice tasks (Panel E, Table 3), which suggests that these respondents were not making trade-offs between the attributes. The share of respondents within the random choice class is similar to the findings in other studies that have implemented the approach of Malone and Lusk (2018), such as Lagerkvist et al. (2020). The class membership covariates in Panel E suggest that older individuals are less likely to be in the random choice class; there was no difference between genders or by purchase frequency.

For a further robustness check, we explored how the value orientations relate to general environmental consciousness. The analysis, available in Appendix 1, shows that environmental consciousness is associated with lower personal values for *conservation* and with stronger values for *self-transcendence*. The relatively strong effects of the NEP scale on the two meta-values suggest that environmental orientation and value-orientation are related, which supports the use of the value orientation scale in our analysis, and it also corroborates the findings of Flagg and Bates (2016) and of Kautish et al. (2019).

5. Discussion and conclusions

The present research sheds light on the role of aesthetic imperfections of fresh produce in influencing consumers' preferences and food choice decisions. The study was designed as a discrete choice experiment, meaning that the preferences for the aspects of aesthetic bias were not analyzed in isolation, but rather in relation to, and with trade-offs to, other relevant product attributes. In this way, our results are based on a well-tested behavioral theory with a link to product alternatives available in the market (the reference levels), even though some of the aspects of aesthetic imperfections might not be available/exist in a retail setting (partly because of official or private quality standards or by being sorted out to waste before being presented to consumers).

The estimated product preferences showed that consumers accept aesthetic food imperfections related to color while not accepting those related to shape and physical aspects. Marketing initiatives to promote 'ugly' food need to address that beliefs about physical aspects looms larger than just about the shape or color. This corroborate findings by Jaeger et al. (2018) that even minor defects lowered consumers quality perceptions for apples, as well as findings on the relation between abnormally shaped vegetables and elevated perception of risks (Loebnitz and Grunert, 2018), and also in relation to a negative sensory evaluation of more ripened bananas (Symmank, Zahn, and Rohm, 2018) or apples (Bolos et al., 2019). Furthermore, there was evidence for, on average, negative preference for local tomatoes, which was surprising and we speculate whether, for U.S. states where the conditions for growing tomatoes are not optimal, local tomatoes are considered less tasty than those from the tomato-exporting states such as Florida and California. There was also evidence to suggest that only 39 % of the individuals hold a positive preference for organic production. Interestingly, and related to the results from Mookerjee et al. (2021) to the balance of a price discount when labelling "ugly" produce, our results suggest that the price discount is the second most important attribute for consumers' acceptance. Hence, a rather substantial price discount would be required in relation to physical imperfections but not so much in relation to shape or color imperfections.

The first main contribution of the present study concerns the effect of gain-framed and loss-framed information regarding environmental consequences of food waste. Message framing would help to bridge a knowledge-deficit gap by making the environmental consequences of purchasing aesthetically imperfect produce more salient to consumers. Importantly for promotional issues and for behavioral change, our results suggest that information concerning environmental consequences of food waste can contribute to more positive preferences for the three aspects of aesthetic imperfections. Notably, our results suggest that it is the salience of the information as such that matters, rather than whether the message is framed to focus on gains or losses. This is in line with the 'one-size fits all' approach, which is clearly supported in existing research on climate change communication (Moser and Dilling, 2011; Graham and Abrahamse, 2017), as well as in relation to promotion of suboptimal food (Symmank et al., 2018). However, from an efficaciousness perspective, it would still be recommendable to use gain-framed information in relation to aesthetic imperfect produce because this treatment resulted in positive effects on preferences for all three aspects of aesthetic imperfections, while the negative framing only were found to increase the acceptance related to shape and physical aspects. Notably, these findings help establish that the effects of message framing may be context-specific. In the area of front-of-package nutrition labeling, extant research suggests that a loss-frame is more efficient than a gain-frame (for example, de Alcantara et al., 2020).

The second main contribution relate to the idea that bridging the knowledge-deficit gap by information provision may not be sufficient because the effect on behavioral change is not obvious. One further measure for reducing food waste would then be to tailor the messages to the individual motivational basis with the idea this to evoke awareness and behavioral adaptation. The contribution of the present research is to address if there may exist an information framing congruency effect in relation to personal meta-values. Furthermore, the analytical approach is based on the two contrasting meta-dimensions within the Schwartz personal value taxonomy. Examining the congruency effect from the perspective of higher-order value-dimensions also contribute to examine the stability and the generalization of this effect, if it exists. We find that individuals with a value-orientation more towards *conservation* were more invariant to color and shape imperfections but were more negative to physical damages in comparison to individuals who are more oriented to *openness to change*. Moreover, a value-orientation towards *self-transcendence* (as opposed to *self-enhancement*) was associated with a larger acceptance of all three aspects of aesthetic imperfections. The results related to *openness to change vs conservation* are in accordance with the

study by Zander and Hamm (2010), who emphasized that consumers with a stronger tendency for self-direction have a higher acceptance of new products and additional ethical attributes.

Lastly, the third main contribution of the present study goes to the combined effect of the gain- and loss-framed information and the personal value-orientation to the acceptance of the three aspects of aesthetically imperfect food considered in this study. This is relevant in the interest to examine whether there are reasons to further tailor initiatives by the value-orientation of consumers to leverage the effect of information provision on consumer acceptance of food with aesthetic imperfections. Doing so could be for at least two reasons. First, because just adapting the information is likely more manageable and cost-effective than also seeking ways to tailor the information provision to the specific value-orientations by certain types of consumer. While it is not impossible to affect or change personal values, there is evidence that personal values are fairly stable over time (Thøgersen and Ölander, 2002).

In relation to the combined three-way effect of aesthetic imperfections, information framing and personal value-orientation, it is noted that the estimated effects are negative (except for the value-orientation towards self-transcendence), although being mostly statistically insignificant. There is, however, support for that that gain-framed information will serve to further lower acceptance of color and shape imperfections for individuals with a higher affinity for conservation values, while loss framing will serve to further deter acceptance of color imperfections among individuals with a higher affinity for self-transcendence. Hence, this imply that approaches to tailor messages could focus further on aspects like social justice and environmental protection to improve the message congruency to individuals driven by the concern of others or altruism. Moreover, and importantly, these results implies that there remains a large group of consumers, with other value orientations, who are less likely to be motivationally affected by initiatives to inform consumers about the environmental benefits from such consumption.

Taken together, the results of this study suggest that initiatives to promote aesthetically imperfect produce by tailoring information to individuals' motivations to reduce food waste may consider to broaden the approach. Thus, a set of message contents, are likely needed to achieve increased message congruence with the aim to provide information tailored by type of dominant personal meta-value. In this way, messages aiming to motivate consumers' more prone to be open to change could be developed to allude to their willingness to accept new ideas and to try new experiences. Messages aiming to be relevant for those more characterized by self-enhancement could stress budget consequences and also stress the opportunity to show the power of taking action to reduce food waste to themselves. Individuals with a value-orientation towards conservation, could be triggered by messages highlighting that aesthetically imperfect food is like how fresh produce once appeared – to stress that the current retail presentation is quite 'unnatural'. The ultimate potential of such value-oriented messages remains an area for future research. Furthermore, other value-related initiatives to foster acceptance of aesthetically imperfect could be considered. Influencing individuals characterized with values towards *conservation* could potentially be achieved by appealing to social norms, especially in relation to injunctive norms, whereby the approval of aesthetic imperfect produce by significant peers could be in focus to facilitate acceptance. If such presentations give the impression that aesthetic imperfect foods are commonly bought by peers, that may represent relevant informational cues by such consumers (Carlsson et al., 2010; Yuan et al., 2019; Edenbrandt et al., 2020; Reisch et al., 2021). These attempts could also stress the importance of a community approach (social context). More long-term initiatives would then be relevant to allow peer-influence and social learning to be effective because norms evolve over time., and social norms, which are associated with such value dimensions as achievement, power, security, and tradition that underlie these two value-orientations. Other initiatives

could be developed to facilitate an acceptance of aesthetically imperfect food by individuals oriented towards self-enhancement. For example, setting reward schemes with recognition of the individuals' own contribution in terms of food waste reductions, or money saved, but not in terms of consequences to the environment, or to others, can be one way to appeal to their power status. In addition, in store designs could promote the selection of imperfect produce to install a sense of this is 'what's best for me'. A caveat to this would be the well-documented perceived health risks associated with aesthetically imperfect food, which can add to deter initiatives appealing to self-esteem or to monetary savings. Notably, the findings from the literature on front-of-package nutrition labelling would then suggest that a loss-frame could alleviate concerns related to risks.

In conclusion, this study has demonstrated that information messages regarding the environmental consequences of wasting aesthetically imperfect products hold promise in terms of increasing consumers' willingness-to-pay for such product features. The role of message framing was not pronounced, but tailoring the information to personal value-dimensions support the role of information to bridge the knowledge-deficit gap in terms of food waste reductions. The results of this study also suggest that, to be more effective, the information provision to reduce food waste may benefit from being tailored also to personal values not directly related to environmental consequences. There is also a role for other complementary measures to be aligned with the personal-value orientation of consumers and we propose that the study of such combined measures are interesting venues for influencing individuals to accept to buy aesthetically imperfect produce.

This study has certain limitations that could be the basis for some avenues for future research. First, taking actions to reduce food waste by supporting people who would accept to buy aesthetic imperfect food is not just about environmental aspects; it also relates to aspects such as access to nutritious and affordable food. It is then noteworthy that the results by Cao and Miao (2021) suggest that the effect of visual imperfections on product quality perceptions might not be as potent as suggested in the earlier literature but that instead consumer rejection of suboptimal food might be more because of abstract temporal awareness (considering the product to be close to or past a reasonable level of quality with loss aversion influencing the rejection) as well as by tactile impressions. Future research could address whether the acceptance of food imperfections differs in terms of the internal or external goal that this type of behavioral adaptation relates to. Second, we only examined one product type in the experiment. Future studies could broaden the product categories included and investigate potential differences of information provision to the acceptance of aesthetic imperfections by product type. This type of research could then further explore the findings by Kumpulainen et al. (2018) that the influence of personal meta-values on food choice depends on product type. Thirdly, our study used abstract information (on the "why") rather than concrete (the "how") information. Together, these two types of information represent a reasonable further step because consumers may ultimately need both to be aware of the severity of the issue of food waste from rejected food, but also to increase their behavioral efficacy, which could be needed to maintain a behavioral adaptation. In developing such communication, it would also be of relevance to consider the results from the recent study by Yuan et al. (2019) on the importance of using positively words and categories to emphasize the normality and safety of misshapen fruits and vegetables, as well as to their idea to use photos depicting, and narratives describing, real consumers' positive experiences with "ugly" fruits and vegetables. Another area for future research to keep in mind is that of data quality. While collecting data using online surveys is widely applied, the quality of responses is a concern that deserves attention. We applied a random-choice latent class approach to control for unengaged respondents and our results suggest that it is important to consider this aspect in future work based on self-reported measures. There is also a potential issue related to the images used to illustrate the three aspects of aesthetic imperfections. We acknowledge that the picture of the

Table A1

Estimates from multiple OLS regressions of age, gender and environmental consciousness on personal meta-values ($n = 3,504$).

	Conservation	Self-Transcendence
Mean (std.dev)	1.00 (1.13)	-0.51 (0.99)
Age	0.01***	0.02***
Female	0.14***	0.23***
Ecologically focused worldview	-0.45***	0.43***
Constant	2.18***	-3.14***
R ²	0.13	0.20

Note: Ecologically focused worldview is measured by the NEP scale (Dunlap et al., 2000). Item #5 in the original scale was omitted in the analysis.

tomato with the suboptimal physical form could be understood as a tomato that also has an internal defect. This would contradict the definition of aesthetic imperfect food adopted for this study and thereby challenge the validity of our results. On the other hand, the images that we used were pre-tested in the pilot studies without being questioned for interpretability.

CRedit authorship contribution statement

C.J. Lagerkvist: Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition. **A.K. Edenbrandt:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. **L.A. Bolos:** Conceptualization, Methodology, Data curation, Investigation, Formal analysis, Writing – original draft, Writing – review & editing. **R. M. Nayga:** Conceptualization, Supervision, Funding acquisition.

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.

Data availability

Data will be made available on request.

Appendix A

Ordinal regression analyses were used to examine the extent to which age, gender and ecologically focused worldview explain the main meta-value dimensions (*conservation/openness to change* and *self-transcendence/self-enhancement*).

The results in Table A1 show that the influence of age is relatively modest although older individuals, on average, have stronger value-orientations towards *conservation vs openness to change* as well as towards *self-transcendence vs self-enhancement*. The influence of gender is relatively strong and suggests that females have stronger values for both *conservation* and *self-transcendence*. The signs for the constants corroborate the results by Kumpulainen et al. (2018).

Appendix B. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodqual.2022.104737>.

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