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Comfortably numb: Choose, eat, waste.

Four experimental essays on consumers' acceptance of sub-optimal food

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**SWEDISH UNIVERSITY
OF AGRICULTURAL
SCIENCES**

DOCTORAL THESIS

Uppsala 2021

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Abstract

A vast amount of food is being wasted across the globe and the entire supply chain. There are multiple reasons for this, but when it comes to our part as consumers, the amount of food wasted is mostly due to our unwillingness to accept food that deviates from the norm, which is called sub-optimal food.

This thesis is a compilation of four papers that study consumer attitudes and choices related to sub-optimal food. The data used in this thesis is primary data, collected through both online (Paper I, III and IV) and laboratory studies (Paper II) conducted in Sweden (Paper I and II) and the US (Paper III and IV). As a whole, the four papers depict a multi-dimensional approach to food choices, offer practical insights for reducing consumer food waste and provide detailed guidance on the use of approaches and methodologies applied. In Paper I, we apply a dual-process model to study consumer food choices. We measure attitudes towards sub-optimal food using implicit and explicit methods, and we investigate the predictive validity of these two measures. In Paper II, we apply a serial mediation model to study the relationship between the visual characteristics of apples and expected liking and to investigate the role of attitudes and emotions as mediators of this relationship. Finally, in Papers III and IV we study the role of information framing in increasing consumers' acceptance of sub-optimal food choices increased acceptability of sub-optimal food on consumer choices. We also study the implications of consumers' values (Paper III) and goal-setting for purchasing sub-optimal food (Paper IV). We use personal values and goals to identify sub-groups of consumers with similar preferences for sub-optimal within each group.

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Dedication

To my beloved parents *Dan Bolos* and *Georgeta Bolos.*

To the memory of my grandfather *Constantin Alexe.*

Contents

List of publications

This thesis is based on the work contained in the following papers, referred to by Roman numerals in the text:

I. Bolos*, L. A., Lagerkvist, C. J., Kulesz, M. M. (2019). Complementarity of implicit and explicit attitudes in predicting the purchase likelihood of visually sub-optimal or optimal apples. *Food Quality and Preference*, 75, 87–96.

II. Bolos* L. A., Lagerkvist, C. J., Normann A, Wendin K (2021). In the eye of the beholder: Expected and actual liking for apples with visual imperfections. *Food Quality and Preference* 87:104065

III. Bolos*, L.A., Lagerkvist, C. J., Nayga Jr., R. M. (2021). Information Framing, Personal Values and Consumer Preferences for Visually Sub-Optimal Foods: Evidence from the US (in review)

IV. Bolos*, L.A., Lagerkvist, C. J., Edenbrandt, A. K., Nayga Jr., R. M. (2021). The Role of Goals in Consumer Preferences for Visually Sub-Optimal Foods: Evidence from the US (manuscript)

Papers I-II are reproduced with the permission of the publishers.

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Abbreviations

APE	Associative and Propositional Processes in Evaluation
DCE	Discrete choice experiment
FAO	Food and Agricultural Organization
FSC	Food supply chain
IAT	Implicit association test
IRB	University of Arkansas Review Board
PANAS	Positive and negative affect schedule
RISE	Research Institute of Sweden
SCAR	European Commission's Standing Committee on Agricultural Research
SVS	Schwartz Value Survey
UN	United Nations
UN SDG	United Nations Sustainable Development Goals
US	United States
VEFA	Visually evoked food attitudes
WTP	Willingness to pay

1. Introduction

> *"It is not freedom from conditions, but it is freedom to take a stand toward the conditions."*
>
> Viktor Frankl

1.1 The state of food waste

In December 2020, the European Commission's Standing Committee on Agricultural Research (SCAR) published a special 5th SCAR Foresight Exercise Report highlighting how research can contribute towards faster social and economic progress, and help our societies recover from the COVID-19 pandemic (European Commission, 2020). The report depicts some of the issues the world is facing, such as the food and agriculture sector being responsible for 30 percent of the total greenhouse gas emissions, and the food waste issue, where around 30 % of all the food produced for human consumption ends up as waste (European Commission, 2020). The global food waste amounts of 1.3 billion tonnes (FAO, 2019). Food is being wasted across the entire supply chain, and the wastage varies depending on the region. However, the yearly amount of food wasted by rich countries is almost equivalent the entire food production in sub-Saharan Africa (European Parliament, 2017). None of these problems are new, yet the COVID-19 pandemic has stressed even further the importance of working

on solutions to food waste (European Commission, 2020). SCAR states that significant educational initiatives on the farm, post-farm, and consumer levels can help to stop wasteful food practices and contribute to a circular food and resource supply system (European Commission, 2020).

Figures 1 and 2 depict the amount of food waste across the entire food supply chain (FSC), in Europe, North America and Oceania. For root and tubers, fruits and vegetables, fish and seafood there is a high amount of waste occurring at the production stage. However, most of the waste for all the food categories is generated by consumers (Gustavsson et al., 2011). The negative economic, societal and environmental impacts of food waste are highlighted in the United Nations Sustainable Development Goals (UN SDGs), specifically Goal 12 - Ensure Sustainable Consumption and Production Patterns (United Nations, 2015). Several targets comprise each of the SDGs and target 12.3 is the one that pertains to food waste: "*By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses*" (United Nations, 2015, p 22).
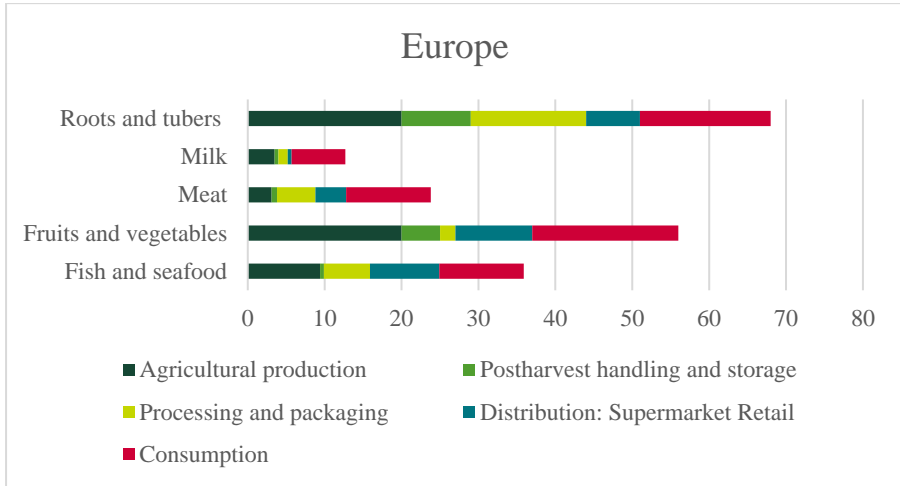
Figure 1. Food wasted in Europe across the entire supply chain in percentage.

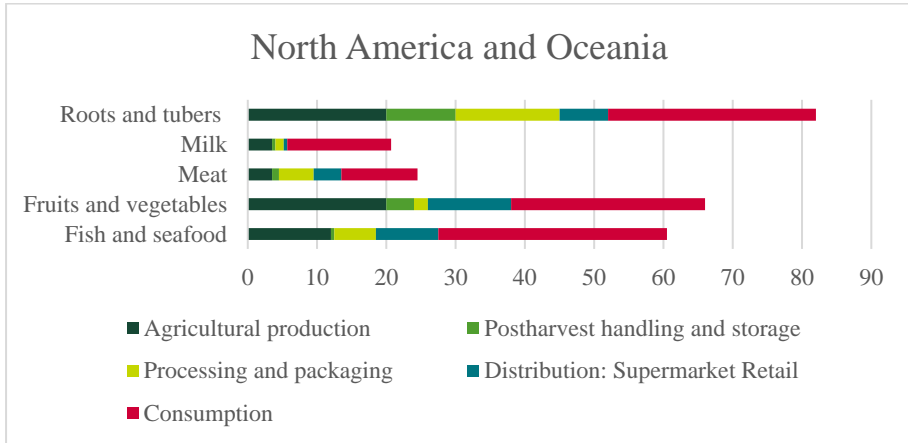Based on data from Gustavsson et al., p. 26, (2011), and reprinted from Bolos et al., (2019).

Figure 2. Food wasted in North America and Oceania across the entire supply chain in percentage.

Based on data from Gustavsson et al., p. 26, (2011), and reprinted from Bolos et al., (2019).

Part of the consumers' food waste may due to a) consumers being unwilling to accept at the point of purchase food that visually deviates from the norm due to cosmetic imperfections, such as being misshapen, off-color or slight damage, or b) consumers discarding food at home (Aschemann-Witzel et al., 2015; de Hooge et al., 2017). While some of the food waste is foreseeable and to a certain extent unavoidable, the current scale of the food waste is a clear indication of unsustainable use of resources (Kummu et al., 2012).

Many initiatives across the globe have been taken to sell sub-optimal food. Table 1 shows just a few examples of these initiatives (Imperfect Produce, 2019; Intermarché, 2019; Matsmart, 2019; Misfits Market, 2020; Pomranz, 2018; Wefood, 2021).

Table 1. Examples of initiatives to sell sub-optimal food and reduce food waste in the US and Europe

	Initiatives
United States	Imperfect Produce works to reduce food waste by taking food with cosmetic imperfections (which would otherwise be wasted) from farmers and delivering it to customers for about 30% less than grocery store prices (Imperfect Produce, 2019).
	In 2019, grocery chain Kroger announced the launch of Peculiar Picks, a brand of food with cosmetic imperfections (Pomranz, 2018).
	Misfits Market is a company selling visually sub-optimal fruits and vegetables supplied by farms across the US (Misfits Market, 2020).
Europe	Retailer Matsmart (Sweden) sell food that, for example, has been mislabeled, has a short or has already passed best-before date, or has other imperfections and could not have been sold in regular stores (Matsmart, 2019).
	Wefood (Denmark) it is the first supermarket in Denmark that sells food donated by regular supermarkets, where it can no longer be sold due to imperfections, damage, incorrect labels (Wefood, 2021)
	Inglorious Fruits and Vegetables is a marketing campaign conducted by the French Supermarket Intermarché. Foods with cosmetic imperfection are sold at 30% discount. (Intermarché, 2019).

Note. Updated and reprinted from (Bolos et al., 2019)

Working towards sustainable food consumption, means also working towards reducing consumer food waste. This requires a very good understanding of the underlying motives that drive consumers' food choices, namely, what drives consumers' acceptance or rejection of visually sub-optimal food. Tackling consumer food waste also requires the collaborative effort of retailers and authorities to support and enable sustainable choices.

1.2   A short journey down the history line of choices and food acceptance through visual evaluation

To assure our survival as a species, humans have learned and internalized how to make effective decisions, such as what to eat, when to sleep and when to reproduce (Lim et al., 2016). When it comes to eating and food choices, this evolutionary trajectory has led humans to have innate proclivities (e.g. for sweet and salty tastes) or to have visceral abilities to evaluate the quality of the food just by looking at it (Hiramatsu et al., 2008; Lim et al., 2016). In other words, avoiding the ingestion of food that can potentially harm us is anchored in hard-wired circuits in our brains. However, besides these innate, implicit choices, many of our current food choices are a result of our own experiences and our social and cultural environments (Belasco, 2008). Therefore, there is both an innate and a contextual side to our food choices.

Many of our food choices today are made within a visual environment that was created to either attract or distract our attention (Orquin et al., 2020). Seeing food stimulates different psychological, emotional and cognitive responses that can affect our food choices (van der Laan et al., 2011), placing visual attention as a principal component in food selection (Linné et al., 2002). In supermarkets today, consumers are exposed to plentiful availability

and variability of food constantly competing for our attention. Visual attention can be described in terms of either top-down and bottom-up processing (Bialkova & van Trijp, 2010). The bottom-up attention is stimulus driven, and depends on the salience of the product; for example, a product might have certain characteristics that stand out and draw instant attention (Bialkova & van Trijp, 2010; Orquin & Mueller Loose, 2013). On the other hand, top-down attention is intentional and purposeful, and can be driven by consumers' goals or defined preferences (Bialkova & van Trijp, 2010; van Herpen & Trijp, 2011).

In economics, food choices have been largely studied through the lens of the multi-attribute utility model. This approach assumes that consumers are rational and that they get their utility (happiness) not from the food item itself, but from the different attributes of that particular product (Lancaster, 1966). Following Lancaster, (1966), if we take, for example, fruit as a product, it possesses nutritional, taste and visual characteristics (intrinsic characteristics), as well as having different prices, origins and/or production types (extrinsic characteristics). Hence, different fruits (within a given category) can vary from each other based on differences in their intrinsic and extrinsic characteristics. One of the assumptions of this perspective is that consumers take into account all the information provided in order to choose the item with the highest utility (McFadden, 1973). In practice, the reality is rather different, and consumers often do not have the capacity to take in all the information available or lack the cognitive abilities (Cameron & DeShazo, 2010). Nevertheless, Lancaster's utility model continues to occupy a very important role in understanding consumer choices. However, research moved away from the Lancaster utility model towards a more multidimensional approach (e.g. Marley & Swait, 2017; van Osselaer &

Janiszewski, 2012). We will discuss the most prevalent models later in the articles.

Agents' rationality has been widely discussed to study decision-making processes since Simon published the book *Administrative Behavior* (Simon, 1947). Following Simon: the set of options from which we choose from are limited first by the kind of environment in which we exist, and second by our cognitive abilities (Simon, 1955). We can take the example of a shopping situation in a grocery store, in which a consumer could face a number of constraints. For example, the supply of products in the store establishes a boundary on the set of choices that a consumer has. Other boundaries are related to the consumer's ability to process the information at hand.

The idea of two-process theory models was developed in the 1970s, with predominant contributions by Posner & Snyder (1975). They studied attention and conducted experiments to investigate automatic activation and conscious processing systems. Following this line, Shiffrin & Schneider (1977) introduced the concepts of automatic and controlled processes. There are a few other examples throughout the years of similar dual-process models, for example Stanovich and West (2000) talks about System 1 and System 2, or Epstien, who wrote about an experiential and rational system, and described the interaction between these two processes as "*conflicts between the heart and the head*" (Epstein, 1994, 709). The overall impression pertaining the literature on dual-process models is that it acknowledges the existence and interaction of the automatic and deliberate processes, but it does not explain how the actual interaction between the two takes place, nor does it explain how the the similarities or dissimilarities between implicit and explicit attitudes take place (Gawronski & Bodenhausen, 2006).

A model that makes specific assumptions about the two-way interaction between the automatic and deliberate processes is the associative-propositional evaluation (APE) model (Gawronski & Bodenhausen, 2006). Within the framework of the APE model, the automatic evaluations are inherent to the associative process, which is the foundation of implicit attitudes (Gawronski & Bodenhausen, 2006). This process works on pattern activation based on both (1) previously stored associations in memory, which are a result of previous experiences, and, (2) exposure to certain stimuli. What is very important about the automatic associations is that a person has no control over their activation, and the associations do not necessarily have to be validated by the person, or be in accordance to that person's values; automatic evaluations are *"independent of the assignment of true values"* (Gawronski & Bodenhausen, 2006, p. 693). Let us take for example a consumer in a grocery store planning to buy apples and the consumer sees visually sub-optimal apples. The first reaction might be an automatic negative one. However, this negative reaction does not necessarily has to be the only impression pertaining the visually sub-optimal product. This is where the second aspect of the APE model comes in.

The second process of the APE model is the propositional process, which works on evaluative judgements. Evaluative judgements are the foundation of explicit attitudes. These evaluative judgments require more reflection and are influenced by personal goals, values and facts (Strack & Deutsch, 2004). Going back to the example pertaining sub-optimal apples: Consumers' previously mentioned negative automatic reaction could change in two main ways: (1) further evaluation occurs and transforms the reaction into a negative proposition (e.g., I do not like these apples); or (2) the consumer might not endorse the negative automatic reaction and evaluate the

sub-optimal apples differently (e.g., the apples are perfectly fine for making jam). This interplay between the associative and propositional processes, together with how these possesses can be influenced to change implicit and explicit attitudes, offers a new and valuable insight in consumer choices (Deutsch et al., 2006; Gawronski, 2012; Gawronski & Bodenhausen, 2006).

Based on the sum of the aforementioned theories, this thesis is comprised of four papers that study consumer choices of sub-optimal food. In a simplified linear way, one can describe the choice process as follows: (1) the stimulus attracts attention; (2) attention initiates an evaluation process; (3) the evaluation process leads decision (e.g., to buy or not to buy). These four papers focus on the space between the exposure to the stimulus and the response/choice, and incorporate constructs like attitudes, emotions, values, and goals to better understand consumer's choices of visually sub-optimal food. For this purpose, we designed four studies.

2. Designs of the four studies

For the first paper, we designed a study to capture consumers' attitudes towards sub-optimal apples and to investigate the validity of implicit and explicit measures to predict purchase likelihood (Figure 3). Hypothesis were based on the assumption that attitudes guide behavior, and that by exposure to stimuli, attitudes can be automatically or intentionally retrieved from the memory, or formed in the moment (Deutsch et al., 2006). Attitudes can be ambivalent, and one could hold opposite attitudes at the same time, which could lead to decision being harder to make (Songa & Russo, 2018). For example, sub-optimal food is not particularly attractive to consumers due to its visually imperfections; however, some consumers also find it unethical to discard food that is perfectly fine to be eaten (de Hooge et al., 2018; Loebnitz et al., 2015; Neff et al., 2015). With the help of a dual-process model, we investigated the relationship between implicit and explicit attitudes and their role in predicting purchase behavior.

For the implicit measure we used the implicit association test (IAT), which was programmed and conducted with the experimental software Inquisit Web (www.millisecond.com), based on the work of Greenwald et al., (2003). The IAT test was combined with the remaining part of the questionnaire (i.e. the explicit measure) with the help of the consulting company GfK Norm, which also assisted with the data collection. The final

sample resulted in 608 Swedish consumers who completed the study at time 1, from which 386 completed the study at time 2 (63 % retention).
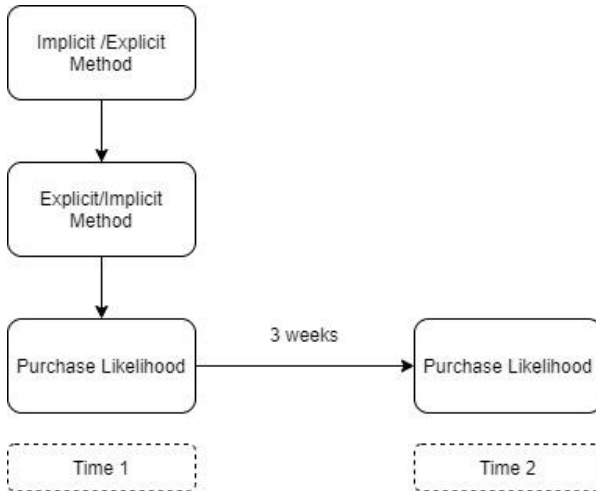

Figure 3. Study flow chart for paper I

The flow of the study was as follows: (1) complete the implicit association test (IAT); (2) grade pictures of apples on six bi-polar scales (the order of tasks (1) and (2) is balanced); (3) indicate whether or not one would by the different categories of apples if they were available in a store; and (4) repeat the purchase likelihood question 3 weeks later.

There are many initiatives to increase consumers' acceptability to visually sub-optimal food (e.g. Intermarché, 2019; Matsmart, 2019), however, for the most part there is still a reduced availability of fruits and vegetables with certain visual imperfections in stores. In this study, we focused on a wide range of visual sub-optimality, which for the most part are not available in stores. We investigated the attitudes and emotions these sub-optimal categories elicit and the role the attitudes and emotions in predicting expected liking of the apples (Spinelli et al., 2014; Thomson et al., 2010).

Following on from the first investigation, for the second paper we designed two related studies to investigate: (1) the relationship between the visual attributes of apples and expected liking, as well as the roles of attitudes and emotions in mediating this relationship; and (2) the difference between expected and actual liking (Figure 4). Eight groups of apples were studied, where each group varied by two levels (optimal and sub-optimal) in terms of color, shape and form. Pictures of each of the eight categories were sent to the company Äppelriket Österlen early during the preparation of the study to make sure that they could supply us with the right categories of apples. The experiment was conducted at Deptartment of Agrifood and Bioscience at the Research Institute of Sweden (RISE) in Gothenburg. The data was collected during the course of a week during February 2017, by the end of which we collected a total of 130 complete answers. The participants were recruited from the RISE consumer panel.
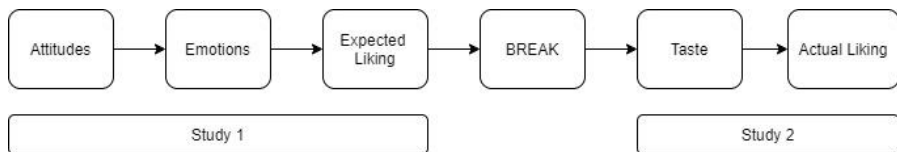

Figure 4. Study flow chart for paper II

The flow of the two studies is as follows. For the first study consumers: (1) graded pictures of apples on six bi-polar 11-point scales; (2) indicated the emotions (positive or negative) that were elicited by looking at the pictures of apples; and (3) indicated the expected liking for each particular group of apples. After a short break, the second study followed, where consumers: (1) tasted apples from each category of apples and indicate the actual liking.

As it has been described in section 1.2, there are two theories of attention processing: bottom-up (stimulus driven) and top-down (goal driven, based on predefined values and preferences) (Bialkova & van Trijp, 2010; Blake et al., 2020). According to previous studies, consumers may

focus their attention on certain products based on pre-defined goals, habits, or/and values (top-down), which has an impact on food choices (Graham & Abrahamse, 2017; van der Laan et al., 2016). Moreover, the use of information faming may help highlight the importance of certain goals, or emphasize certain values (Blake et al., 2020; van der Laan et al., 2016). Therefore, in the last two papers we focused on the roles of goals and personal values to study consumer preferences for visually sub-optimal food, and on the use of information framing to influence choices (Britwum & Yiannaka, 2019; Chang & Wu, 2015).

The third and the fourth paper are based on an online experiment conducted in the US. The data were collected during the same online study. The studies were planned during an exchange semester at the Department of Agricultural Economics and Agribusiness at the University of Arkansas in Fayetteville, Arkansas, US in 2018. We applied for an ethical approval from the the University of Arkansas Review Board (IRB) that granted exemption from ethical approval. Furthermore, the study was programmed in the software Qualtrics (www.qualtrics.com), and the data was collected with the assistance of the marketing research company Qualtrics during 2019. We ran two focus groups, one with university students and the other one with consumers across the US to assure the quality of the study and of the data, before proceeding with collecting all the necessary data.

The third paper investigates stated preferences among US consumers for tomatoes with different types of sub-optimality. To study this we built a 2-treatment design to expose consumers to positive and negative information. The information is related to the consequences of food waste and actions consumers can take to make a change. We complement the study by capturing consumer values applying the short Schwartz value survey

(SVS) (see Figure 5). Taken altogether, and based on personal values, we identify latent groups of consumers sharing similar preferences.
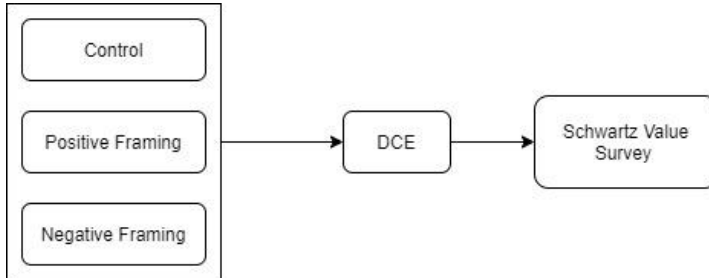

Figure 5. Experimental flow chart for paper III

The experiment starts by randomly assigning consumers to either control, positive or negative framing, followed of a discrete choice experiment (DCE). At the end of the study, consumers answer the short Schwartz value survey (SVS).

Similar to the third paper, in the fourth paper we also investigate stated preferences among US consumers for tomatoes with different types of sub-optimality. We run a similar design to the one in the third paper; however, this fourth study is comprised of three waves. In the fourth study we: (1) incorporate goal setting relating to purchasing food; (2) measure the trajectory of goal strength across time (see Figure 6); and (3) measure the effect of information framing on consumers' willingness to pay (WTP) for sub-optimal tomatoes.
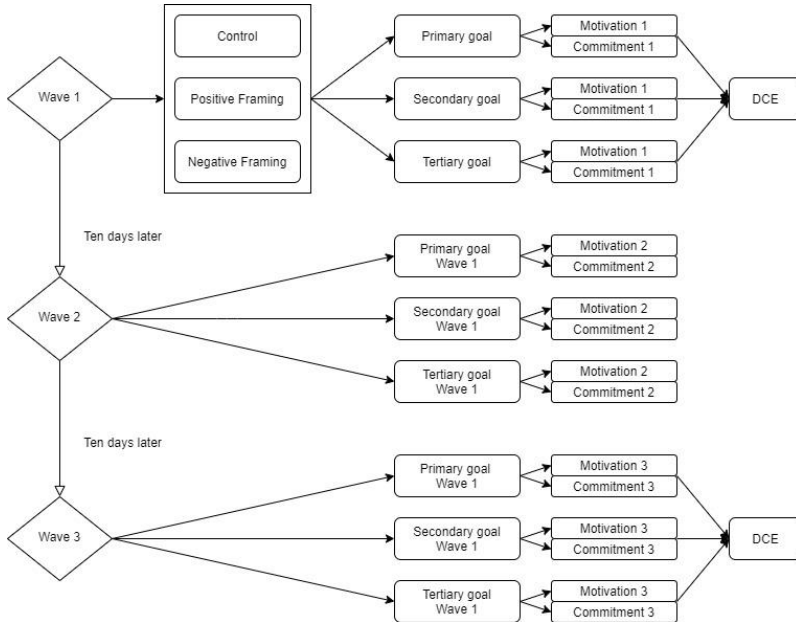
Figure 6. Experimental flow chart for paper IV

During wave 1, the experiment starts by randomly assigning consumers to either control, positive or negative framing, after which the consumer chooses the three most important goals related to purchasing food. For every goal, consumers indicate the motivation and commitment to fulfilling the goal. This step is followed by a DCE. During wave 2, the consumer indicates their current motivation and commitment to the goals they chose during the first wave. Finally, during wave 3, consumers, for the last time, indicate their current motivation and commitment to the same goals they choose during wave 1. Then the study ends with the same DCE as in wave 1.

3. Contribution

This compilation of essays makes a contribution to the understanding of consumers' choices of sub-optimal food, and the studies are both methodological and empirical in nature. Throughout this thesis, we expose participants to a set of food items comprising different levels of sub-optimality, and we ask them to rate and evaluate each of them: Why do they choose a given item? How do they make the choice? What influences this choice? Our contribution lies within this thin space occurring between the exposure/stimulus and the response/choice.

Paper I contributes to the literature in the field of dual-process models as it shows that both implicit and explicit models complement each other to predict purchase likelihood. It is indeed not new that implicit methods have predictive validity; however, our paper highlights the importance to this duality when choosing sub-optimal food. Our results confirm that even though consumers are biased towards beauty and attractiveness, they still have room to accept some sub-optimality.

Paper II studies the mechanism through which different combinations of visually optimal and sub-optimal apples influence expected liking, through intermediary variables such as emotions and attitudes. Results show that (1) between attitudes and emotions, attitudes are the stronger mediator, and (2) between the positive and the negative emotions, it is the negative

emotions that is the stronger mediator. The novelty of this study is in its detailed characterization of sub-optimality and in the estimation of the serial effects of the intermediary variables.

Papers III and IV lie on the demand side of sub-optimal food. We examine US consumers' choices between optimal tomatoes and different levels of sub-optimal ones, and we offer a clear insight into consumers' preferences for sub-optimal food and willingness to pay for it. This study is part of the ongoing scientific debate about the role of consumer behavior in reducing food waste, and more specifically, about the role of information provision in redirecting consumer behavior towards a more sustainable one. By using values and goals to identify classes of consumers, papers III and IV move away somewhat from the average consumer type of analysis and explore the analysis of inter-individual variability and subgroup of individuals.

4. Summary of the papers

4.1 Paper I: Complementarity of implicit and explicit attitudes in predicting the purchase likelihood of visually sub-optimal or optimal apples

The way we choose the food we want to eat is a result of both a long evolutionary process, during which we have developed the ability to identify nutritious food and exclude food that can potentially harm us, and an empirical training influenced by the cultural and societal environment we live in (Lieberman, 2006). Both play a role at the point of purchase, where consumers make decisions based on visual characteristics of food, such as colour, shape and form, combined with packaging and labelling (Lee et al., 2013; Simmonds & Spence, 2017).

There is no golden standard within the research community to explain consumer behavior. Instead, a variety of theoretical models and frameworks focus on explaining how consumers make food choices. One of them is the dual-process cognitive functioning perspective, which implies that an individual's evaluative response to an object is the result of the interaction between the associative and propositional processes (Gawronski & Bodenhausen, 2006). Based on a dual-process model, exposure to a stimulus draws attention, resulting in activating associations, which can lead to mutually interacting visually evoked implicit and explicit food attitudes

(VEFA) (Gawronski & Bodenhausen, 2006). Implicit attitudes, on the one hand, are the result of the the associative process, which happens automatically, and they can be captured by looking at the reactions on a millisecond-level; consumers' first reactiom captures what consumer cannot tell (Gawronski & Bodenhausen, 2006; Gawronski & Payne, 2011). Explicit attitudes, on the other hand, are the result of the propositional process, that implies a more conscious cognitive process, characterized by affirmation and validation of current beliefs (Gawronski & Bodenhausen, 2006).

The first objective of Paper I was to examine the implicit and explicit VEFA for apples with different levels of visual optimality and sub-optimality. Furthermore, the second objective of Paper I was to investigate the extent to which implicit and explicit VEFA can predict food purchase likelihood.

The data used in this study was collected through an online study, with the help of the market research company GfK Norm. The final sample comprised 608 Swedish consumers who completed three tasks. Task (1) involved an implicit association test (IAT), developed according to Greenwald et al., (2003). Task (2) was to answer a questionnaire developed by Richetin et al., (2007) and aiming to assess direct (explicit) attitudes. Task (3) helped to measure purchase likelihood. Three weeks after the main study, we included a robustness check of measuring the purchase decision again. This helped to assess the temporal stability of purchase likelihood.

We calculated scores for both implicit (Greenwald et al., 2003) and explicit attitudes (Richetin et al., 2007), which were included as explanatory variables in a multilevel mixed-effects ordinal logistic regression (meologit), in order to predict purchase likelihood. The predictive validity of implicit and explicit attitudes on purchase likelihood was investigated with the help of a structured set of predictive models. The analysis started with a simpler

model, a standard ordered logistic regression, where the purchase likelihood was predicted by its overall mean. This was followed by a set of multi-level mixed-effects models, where the first included a random by-subject error term, followed by more complex models, by adding each of the explanatory variables one by one (apple type, explicit attitude, implicit attitude and the interaction between the implicit and explicit attitudes). This allowed us to identify the model that can best predict purchase likelihood. Finally, the temporal stability of purchase likelihood was tested to confirm the validity of the measurement.

The results confirm the expectation that consumers have a clear preference for optimal apples over sub-optimal apples, which was further confirmed by the purchase likelihood. The results also confirm findings from previous studies that a) explicit attitudes are good predictors of controlled food choices (Czyzewska & Graham, 2008) and b) that implicit attitudes provide incremental validity to food choices (Songa & Russo, 2018). We also calculated the marginal effects of implicit and explicit attitudes on purchase likelihood, based on which we were able to conclude that the explicit attitude had a larger effect on purchase likelihood than the implicit attitude. What these results indicate is that explicit attitudes play a more important role in predicting purchase likelihood. Therefore, initiatives to increase the acceptability of sub-optimal food should be focused more on influencing explicit attitudes rather than implicit ones.

4.2 Paper II: In the eye of the beholder: Expected and actual liking for apples with visual imperfections

Visual attributes of food, such as colour, shape and physical form are very important indicators of the quality of food and influences consumer decisions on whether or not to purchase and eat a product (Normann et al., 2019;

Wendin et al., 2019). Besides conveying information about the state of the food, the visual attributes of food also evoke attitudes and emotions, which affects consumers' expectations and experience of that particular food item (Thomson & Crocker, 2013; Zellner et al., 2014). Anchored in previous studies on attitudes and emotions, this paper investigates the impact of different visual attributes of apples on expected and actual liking. This was done with the help of two inter-related studies conducted in Gothenburg, during 2017, with a sample of 130 Swedish consumers. Eight categories of apples (presented as pictures) were considered in terms of three visual attributes: colour, shape and damage. Each of the attribute had two levels optimal (0), and sub-optimal (1).

The aim of the first study was to measure the effect of different levels of visual sub-optimality on expected liking and whether or not this relationship is mediated by attitudes and emotions (Hayes & Little, 2018a, 2018b). For the measurement of emotions, we used the short (ten-item) positive and negative affect schedule (PANAS) (Thompson, 2007). For the measurement of attitudes, we applied a bipolar seven-point scale (*bad-good, unpleasant-pleasant, negative-positive, unenjoyable-enjoyable, unhealthy-healthy* and *unattractive-attractive)* developed by Richetin et al. (2007). Finally, expected liking was measured with the help of a seven-point scale question, ranging from (1) *I would absolutely not like this apple* to (7) *I would like this apple very much*.

In terms of the visual attributes, as expected, the apple category optimal in terms of color, shape and physical form, was rated highest on expected liking, while the category of apples sub-optimal at all three levels was rated lowest. Moreover, results show both emotions (positive and negative) and attitudes being significant both independent and as serial mediators between the apple category and expected liking. However, the

explicit attitude was a stronger mediator than positive or negative emotions, and between the positive and negative emotions, the negative one turned out as a stronger mediator.

In the second study we investigated whether there are any differences between expected and actual liking. This study was a taste deception study. Each participant received a tray with eight cups, each containing peeled pieces of apples, paired with the pictures from the first study. Participants thought they were eating apples similar to the ones presented in the pictures, while the apples were actually randomly selected. Results indicate a significant difference between expected and actual liking. Finally, pertaining actual liking, results indicate that participants liked the apples sub-optimal in color and shape more, even though the apples they tasted were similar.

Our results show that attitudes and emotions are significant mediators between the visual characteristics of apples and expected liking. Moreover, exposure to pictures depicting sub-optimality in terms of shape and color, while eating, resulted in a higher liking than when being exposed to pictures depicting physical damage. These are relevant results to take into consideration when trying to sell sub-optimal food. Retailer should focus on selling sub-optimal food in terms of shape and color, while finding other solution for slightly damaged fruits and vegetables, such as use for cooking.

4.3 Paper III: Information Framing, Personal Values and Consumer Preferences for Visually Sub-Optimal Foods: Evidence from the US

Research has shown that providing information can be effective to increase awareness of relevant issues, such as the consequences of meat consumption on the environment or practices to reduce food waste (e.g. Lefebvre et al.,

2017; Nolan, 2010). These previous works draw on the idea that the more a consumer is informed about an issue, the higher is the likelihood that the consumer will do something to change the situation, given that there are clear indications on how to go about it (Schultz, 2002). Anchored in previous research on information framing, we conducted an online discrete choice experiment (DCE) on a sample of 3504 randomly chosen consumers in the US. The participants were surveyed about their tomatoes preferences and exposed to two treatments, and a control. The aim of the study was to investigate the persuasive impact of gain-framed and loss-framed information on consumers' purchase decision, as well as the role of personal values in guiding consumer behavior.

The first treatment group was exposed to information about the issue of food waste. Additionally, participants were informed that by purchasing sub-optimal foods they would contribute to reducing food waste, which implies gains at the societal level. The second treatment group was also exposed to the same information about food waste and the consequences of food being thrown away. However, participants in this group were informed that by *not* purchasing suboptimal foods, they would contribute to increasing food waste, which implies losses at the societal level.

The attributes and their levels included in the DCE were: 1) picture with four attribute levels (optimal and sub-optimal in colour, shape and physical form); 2) origin (local, imported, domestic); 3) production (organic and conventional); and 4) price ($0.80, $1.80, $2.80, $3.80). Total 36 choice sets divided into three blocks amounted to 12 choice sets per participant. After completing the DCE, participants were asked to complete the SVS (Schwartz, 2012).

The analysis was comprised of a mixed logit model for the pooled sample (control, treatment 1 and treatment 2), with interaction effects between the picture attributes and the information treatments. Afterwards, we run a latent class model to identify latent groups of consumers based on consumers' proclivity for certain values. In addition, to investigate the model's ability to make in-sample predictions, we run a mixed logit model within each class and for each of the three treatments groups, and calculated the WTP,

Results indicated that both gain- and loss-framed messages had a positive effect on consumers' preferences for different levels of food sub-optimality. Based on the latent class analysis we identified three groups of consumers. The data indicates that consumers with a higher proclivity for *self-enhancement* and *conservation* and lower proclivity for *self-transcendence* and *openness to change* tend to have lower acceptance for sub-optimal foods. Moreover, price-sensitive consumers tend to have a higher acceptance of sub-optimal food and are more likely to be influenced by both gain- and loss-framed information.

4.4 Paper IV: The Role of Goals in Consumer Preferences for Visually Sub-Optimal Foods: Evidence from the US

Food choices, like most of our choices, are goal-oriented (Ferguson & Bargh, 2004; Kruglanski et al., 2002). Consumers' pre-defined goals influence consumers' food choices (van der Laan et al., 2016). There are three main categories of goals: gain, hedonic and normative (Lindenberg & Steg, 2007). Moreover, the motivation and commitment to pursue a goal (goal strength) are not fixed across times and situations; goals can change in relevance,

become more or less prioritized, be replaced by other goals depending on the situation or information provided (Ferguson & Bargh, 2004).

This paper studies the effect of goal setting when purchasing sub-optimal food and the impact of goal strength on preferences for sub-optimal food. We designed an online study to investigate the effect of positive and negative information framing on goal-setting and the development of goal strength over time. Furthermore, we studied preference heterogeneity between subgroups of respondents using the goal-strengths as class membership parameters. We also investigated the impact of information treatments on consumers' WTP for sub-optimal food.

The collected data consist of 1705 complete answers of randomly selected US consumers, where 598 belonged to the group that was exposed to positive information framing, 532 belonged to the group exposed to negative information framing and 574 belonged to the control group.

The data were collected in three waves. In the first wave, after being exposed to one of the three information treatments, consumers were asked to choose their three most important goals related to purchasing sub-optimal food. The list of goals included *value for money, quality, safety, comfort and convenience, ethics, and reduce environmental impact* (Barbopoulos & Johansson, 2017). Once participants chose the three most important goals, they were asked to indicate their motivation and commitment related to each of the chosen goals. This step was followed by a DCE, during which participants had to make a set of choices between tomatoes that varied in terms of the attribute levels. The attributes were: visual stimuli (optimal, sub-optimal shape, sub-optimal colour, and sub-optimal physical form), origin (domestic, local and imported), production (conventional and organic), and price ($0.8, $1.8, $2.8, $3.8). The second wave of the study took place ten days after the completion of the first wave, during which consumers were

asked to re-evaluate their motivation and commitment to the previously chosen goals. Finally, the third wave took place ten days after the second wave and consumers were asked for the last time to re-evaluate their motivation and commitment to the chosen goals. The study ended by repeating the DCE.

We analyzed the development of the goal strength, comprised of commitment and motivation, by applying a multilevel mixed-effects model for each type of goals. Results suggested no impact of the goal strength based on the information treatments. Moreover, the goal strength decreased over time regardless of the goal type and information treatments.

Furthermore, by applying a LC model we were able to identify several consumer profiles with similar preferences across the information treatments. There are *gain-focused* consumers *that* are price-sensitive, do not mind sub-optimal tomatoes in terms of colour and shape and do not prefer organic tomatoes. We also identified *environmentally-focused* consumers, which value organic products and have few objections towards physically sub-optimal tomatoes. Finally, we identified *comfort-focused consumers* strongly reject sub-optimal tomatoes.

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Popular science summary

It is widely known that around one third of the food produced for human consumption is being wasted along the entire supply chain and consumers are responsible for a significant part of it. Consumers contribute to food waste mainly by not accepting at the point of purchase food with cosmetic imperfections (e.g. shape, color, slight damage), or/and by discarding food with cosmetic imperfections at home. What are the barriers to purchasing food with cosmetics imperfections? What are the facilitators to purchasing food with cosmetic imperfections? This compilation of four papers focuses on understanding why consumers choose a certain food item, how consumers make the choice and what influences the choices that consumers make.

In Paper I and II we measure concepts like attitudes and emotions which can be elicited by seeing food, and then investigate the role of the attitudes and emotions in predicting expected liking and purchasing likelihood. In the first paper we measure consumers' attitudes towards visually optimal apples and apples that deviate from the norm, and investigate the role of the measured attitudes in predicting purchasing behavior. Attitudes can be both implicit (automatic) and explicit (deliberate). Our result confirm that consumers have an overall preferences for visually optimal apples, however the results also indicate that there are consumers who might be interested in purchasing visually sub-optimal food. In the second paper, our results indicate that attitudes and emotions are significant mediators between the visual characteristics of apples and expected liking. In Paper III and IV, we investigate the role of information provision to influence consumers' choices of visual sub-optimal food, and the roles of personal values and goals to identify different profiles of consumers. By identifying different groups of consumers with similar preferences for sub-

optimal food can contribute toward designing better-personalized interventions in order to encourage consumption of sub-optimal food.

Acknowledgements

Six years have passed, six years filled with beautiful memories, with learning and growth, while slugging through the discomfort, questioning and doubt. None of this is new to anyone who has ever embarked on the PhD-journey. As much as this journey is a personal one, it is also a shared journey. Therefore, in the following lines, I would like to express my gratitude to everyone who has helped my along the way, both professionally and personally. None of this would have been possible without your help and support!

I would like to start by thanking my supervisor **Carl-Johan Lagerkvist**, who played a pivotal role in this journey. Thank you Carl-Johan for offering me the opportunity to take this path. Thank you for your support, supervision, and for your high-quality guidance on this educational and research path. I would like to continue by thanking my co-supervisor and dear friend **Mikaela Kulesz**. Thank you for your support and kindness. Thank you for encouraging me to find meaning in my work, not to give up, and for being a constant presence and support along the way. I would also like to share my gratitude to my co-supervisor **Anna Kristina Edenbrandt**. I am very thankful for your contribution and support. Thank you to **Helena Hanson,** for your time as my co-supervisor and study director of PhD studies.

Thank you **Rodolfo Nyaga** for inviting me to the University of Arkansas, and for offering me opportunity to work with you. Thank you to **Grant** and **Wei** for the help with the experiment. Thank you to **Rudy, Jean, Di, Diana, Bruce, Stephane, Li** and **Daniel** for making me feel welcomed in Fayetteville.

Susan to for reading and reviewing my draft on such short notice, and thank you for the beautiful conversations. Thank you as well to my dear friend **Uliana** for reading and reviewing my draft, and for the support. Thank you to **Patrick.**

Thank you to my dear sister **Iuliana Carlsson** and to brother-in-law **John Carlsson** for your support during difficult moments, and for many happy moments. Thank you to my wonderful niece **Victoria** and my wonderful nephew **Gabriel.** You always make me smile. Tusa' Deea loves you! I am sorry for not joining for Christmas this year. Thank you to my mother **Georgeta Bolos**, and father **Dan Bolos**. Your love and support means everything to me.

Andreea Bolos
January 2021, Uppsala

Acta Universitatis Agriculturae Sueciae

Doctoral Thesis No. 2021:9

This thesis focusses on consumers' preferences of food with cosmetic imperfection. Paper I applies implicit and explicit methods in predicting the purchase likelihood; Paper II investigates the role of attitudes and emotions as mediators between visual attributes and expected liking; Paper III and IV examine the roles of values and goals in revealing inter-variability in consumers' preferences for sub-optimal food.

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