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Is this Food or Litter? Explicit and Implicit Attitudes to Sub-Optimal Foods in Evoked Purchase and Consumption Contexts

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Abstract

One of the major global societal and environmental issues today is consumer food waste. While attitudes against food waste may be strong, internal intuitive mechanisms may lead consumers to prefer fresher and neater products to less appealing ones. The main objective of this thesis is threefold. First, to compare consumers' implicit and explicit attitudes towards optimal and suboptimal foods. Second, to investigate the complementarity of implicit and explicit methods when predicting consumer behavior from high-cognitive and low-cognitive measures. Finally, to find out if context has an effect on consumers' explicit perception of suboptimal foods. Suboptimal fruits and vegetables (bruised, misshaped) and packaged products (dented packaging, broken product) were used as a case.

A total of 459 consumers (33.7% males, 18–64 y.o.) from three countries (Canada, Norway and Sweden) conducted an online test in four parts: 1) socio-demographic and attitudinal questionnaire on food usage, food waste and environmental issues, 2) an Implicit Association Test (IAT) measuring approach-avoidance tendencies towards optimal and suboptimal foods, 3) explicit assessment of the same food images regarding safety, quality and expected liking, and 4) stated behavior measured either as willingness to buy or consume each item (Canada and Sweden), or as a choice task (Norway). For task 4, half the consumers answered in an evoked home-consumption context and half in a grocery store purchase context.

Implicit associations to suboptimal foods generally aligned with explicit assessments. The IAT revealed slight implicit approach tendencies towards optimal products. However, implicit attitudes did not contribute to models predicting consumer behavior. Two clusters of consumers were identified from the attitudinal questionnaire: quality seekers (54% of consumers) and budget eaters (46% of consumers). Both segments assessed optimal products with higher expected liking, safety and quality than their suboptimal counterparts, and more so for fruits and vegetables than for packaged products. Consumers are more willing to consume suboptimal foods at home, than to purchase the same in the store. These results bring light on consumer acceptance of suboptimal food products through internal and external cognitive processes.

Sammendrag

Et av de største globale samfunns- og miljørettede problemene i dag er matsvinn forårsaket av forbrukere. Selv om holdninger mot matsvinn er sterke kan det være interne intuitive mekanismer som leder forbrukere til å velge ferskere og penere produkter fremfor mindre attraktive produkter. Denne oppgaven har tre hovedmål. Det første er å sammenligne forbrukeres implisitte og eksplisitte holdninger til optimale og suboptimale matvarer. Det andre er å undersøke komplementariteten av implisitte og eksplisitte metoder for å forutse forbrukeratferd ved bruk av høye og lave kognitive målinger. Det tredje er å finne ut som kontekst har en effekt på forbrukeres oppfatning av suboptimale matvarer. Suboptimale frukt og grønnsaker (lettere skadet, misformet) og emballerte produkter (bulkete emballasje, produkter som har gått i stykker) ble brukt som prøver.

Totalt 459 forbrukere (33.7% menn, 18-64 år) fra tre land (Canada, Norge og Sverige) deltok i en nettbasert forbrukertest som bestod av fire deler: 1) sosio-demografiske målinger og spørreskjema basert på holdninger rettet mot bruk av mat, matsvinn og miljø, 2) en Implicit Association Test (IAT – test av implisitte assosiasjoner) for å måle forbrukernes implisitte tendenser til å 'nærme seg' eller 'unngå' optimale og suboptimal matvarer, 3) eksplisitte målinger av forbrukeraksept, mattrygghet og kvalitet av de samme optimale og suboptimale matvarene, og til slutt 4) angitt forbrukeratferd målt enten ved bruk av «willingness-to-buy/consume»-skalaer (Canada og Sverige), eller via en «choice task» (Norge). Under bedømmelsene i del 4 ble den ene halvparten av forbrukerne satt i en fremkalt kontekst av være i en butikk, mens den andre halvdelen i en fremkalt kontekst av å være hjemme.

Implisitte assosiasjoner til suboptimale matvarer var generelt i tråd med eksplisitte målinger. IAT-en viste svake implisitte tendenser til å 'nærme seg' de optimale matvarene. Implisitte målinger bidro derimot ikke til å forbedre våre statistiske modelleringer av forbrukeratferd. To segmenter av forbrukere ble observert via clusteranalyse basert på holdninger: «kvalitetssøkere» (54% av forbrukerne) og «budsjetthandlere» (46% av forbrukerne). Begge segmentene bedømte de optimale variantene som bedre likt, tryggere og av høyere kvalitet enn de suboptimale variantene, spesielt for frukt og grønnsaker sammenlignet med emballerte produkter. Forbrukerne var mer villig til å konsumere suboptimale matvarer hjemme enn de var å kjøpe de samme varene i en butikk. Disse resultatene gir et innblikk i forbrukeraksept av suboptimale matvarer gjennom interne og eksterne kognitive prosesser.

Preface

This Master's thesis is a part of a Master's degree program in Food science at the Norwegian University of Life Sciences, Faculty of Chemistry, Biotechnology and Food Science, Ås, Norway.

The study was conducted in collaboration with Nofima AS in Ås, Norway, at the department of Innovation, Consumer and Sensory Sciences. Other international research partners include Applied Consumer & Clinical Evaluations International (ACCE) in Canada and Research Institutes of Sweden AB (RISE). It is part of the project *Explicit and Implicit Attitudes to Sub-Optimal Foods in Purchase and Consumption Contexts* (conducted from 2019-2020) and was funded by the European Sensory Network. The project was on the societal issue of food waste by exploring issues involving consumers' food acceptance of sub-optimal foods and situations in which food decisions are made. There was also a focus on investigating how implicit measures might complement predictive behavioral models based on explicit approaches.

First off, I would like to thank my supervisors Valérie Lengard Almli (NMBU, Nofima) and Paula Varela-Tomasco (NMBU, Nofima) for their excellent guidance and support throughout this project. I honestly believe that I could not have been in better hands. Thanks to ESN and all the members of the food waste project, it has been a pleasure working with you.

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1. Introduction

One of the major global societal and environmental issues today is consumer food waste. According to the FAO (2019), food waste is defined as the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food services and consumers. The amount of produced food being wasted along this supply chain is estimated to be around 30 percent globally each year (FAO, 2011; Parfitt et al., 2010). In retail, food waste is usually a result of a product's limited shelf life, its suboptimal quality and/or appearance (e.g. the product's shape, size or damaged packaging etc.) and changes in product demand (Aschemann-Witzel et al., 2015; FAO, 2019; Göbel et al., 2015). Even with the focus on climate change and sustainability that has been increasing in recent years, resulting in a general attitude against food waste, consumers may still reject safe and tasty food based on its appearance (Rohm et al., 2017). Additionally, consumer waste is also a consequence of poor purchase planning and impulse control (FAO, 2011). The rejection of suboptimal food due to its flawed appearance by consumers causes food waste in all aspects of the value chain. To help prevent this, there is a need to gain insight into the complex processes that determine consumer choices regarding suboptimal foods.

In recent years, consumer studies have seen an increase in incorporating implicit methods for observing food choice and behavior (Kraus & Piqueras-Fiszman, 2018). The most popular method used, by far, is the implicit association test (IAT). With its origin in social psychology, the IAT was developed to measure implicit attitudes that are otherwise unobtainable through traditional explicit methodologies (Greenwald et al., 1998). While consumers might have a cognitive understanding that food waste is bad, and that their actions could help to prevent it, they still intuitively reject suboptimal food. This results in a conflict between intuitive and cognitive interests. Bolos et al. (2019) showed that while explicit measures using highly cognitive 7-point scales best predicted consumer waste behavior regarding optimal and suboptimal apples, implicit measures further contributed to the predictive ability of their consumer behavioral models.

Attitudes towards suboptimal food are also related to context, as shown by de Hooge et al. (2017). Consumers are on average four times more likely to choose suboptimal food when put into an evoked context of being at home compared to in a supermarket. The same study also revealed that consumer choice and behavior towards food waste was also related to demographics, characteristics based on the respondents' personality and values as well as individual-waste aspects. Unlike Bolos et al. (2019), a lower cognitively demanding choice-task was used.

The main objectives of this Master's thesis was:

- Compare consumers' implicit and explicit attitudes towards optimal and suboptimal foods.
- Investigate the complementarity of implicit and explicit methods when predicting stated consumer behavior from high-cognitive and low-cognitive measures.
- Find out if context has an effect on consumers' explicit perception of suboptimal foods.

The secondary objective of this Master's thesis was:

- Reveal cultural, attitudinal and sociodemographic effects in consumers' perception of suboptimal foods, both implicitly and explicitly.

To answer these objectives, 459 consumers were recruited in three countries (Canada, Sweden and Norway) to participate in an online test. First, the respondent answered a few questions regarding socio-demographics which were subsequently followed by an attitudinal questionnaire. After this, a total of 16 images of optimal and suboptimal foods belonging to two product categories, 'fruits and vegetables' and 'packaged products', were implicitly assessed using the IAT. Finally, an explicit assessment of the same images was done either using 9-point scales or through a choice-task while in an evoked context of either being at home or in a store.

The following hypotheses was identified:

- Explicit measures better predict stated behavior than implicit measures, however implicit measures positively contribute to the predictive ability consumer behavioural models (Bolos et al., 2019).
- Implicit measures gain in predictive power when predicting low-cognition behavioural measures such as a choice-task.
- Explicit perceptions of suboptimal foods differ based on context (de Hooge et al., 2017).
- Socio-demographic, cultural and attitudinal effects occur, possibly revealing segments of consumers.
- Consumers' perceptions of suboptimal foods differ based on the product category (fruits and vegetables vs. packaged products).

2. Theory

2.1 Implicit and explicit attitudes

Attitudes are referred to in psychology as people's behavior, feelings, values and beliefs towards objects, groups, events or symbols that are of social significance (Hogg & Vaughan, 2008). One of the major influences that govern people's behavior is the strength of the attitudes they hold. Dual-process theories, which have their origins in the field of social cognition, are based on the idea that there are two mental processes responsible for guiding social behavior (Gawronski & Creighton, 2013). On the one hand, there is impulsive, automatic or implicit behavior, sometimes referred to as system 1 thinking, while on the other there is the controlled, reflective or explicit behavior; or system 2 thinking (Kahneman, 2003; Kraus & Piqueras-Fiszman, 2018). It is suggested that these systems operate in parallel while interacting with each other either consciously or unconsciously (Kraus & Piqueras-Fiszman, 2018; Strack & Deutsch, 2014). Therefore, explicit measures such as self-reported questionnaires may not be sufficient to explain consumer behavior.

Because of their differences in nature and in level of consciousness, measuring these two types of attitudes requires different methodological approaches. Bolos et al. (2019) included an IAT as part of their study when measuring consumers' implicit attitudes towards optimal and suboptimal apples in order to predict purchasing behavior. Their results revealed that while explicit measurements better predicted when consumers would buy apples, the implicit measurements better predicted when consumers would reject apples (Bolos et al., 2019). In general, explicit measures better predicted stated behavior compared to implicit measures, however implicit measures positively contributed to the predictive ability of their consumer behavioural models.

2.2 Implicit Association Test

2.2.1 Measuring implicit attitudes with the Implicit Association Test

The Implicit Association Test (IAT) was developed by Greenwald et al. (1998) in the field of social psychology as a way of measuring the strength of implicit associations between pairs of concepts. In practice, the IAT is an indirect measurement procedure involving two binary computerized categorization tasks (Kraus & Piqueras-Fiszman, 2018). The strength of implicit associations is measured by observing the respondents' reaction times during the categorization tasks. These reaction times are used to calculate so-called "IAT effects" which can be interpreted as an index of implicit preferences and attitudes (Kraus & Piqueras-Fiszman, 2018). The IAT works by comparing two concepts (e.g., flowers and insects) against each other with regard to respondents' positive and negative implicit associations. Assumption

is made that one concept (e.g., flowers) is more congruent with positive implicit perception, while the other (e.g., insects) is congruent with negative implicit perception.

Since its inception, the IAT has been used in a great deal of research within different fields of psychology as well as applied sciences, and more recently, in consumer science (Bolos et al., 2019; Greenwald et al., 2009; Kraus & Piqueras-Fiszman, 2018). The IAT is known for its high internal consistency estimates and large effect sizes which are probably some of the reasons for its popularity.

The IAT is what is called a response interference task (Kraus & Piqueras-Fiszman, 2018). That is, any stimulus presented to the respondent during the categorization process can potentially evoke an implicit association and thereby interfere either positively or negatively to the reaction time, or accuracy, of the responses given during the main task. As a result of this, it has been suggested that the IAT reflects mental associations that are constructed there and then during the task and might only be temporarily accessible during the context of the experiment.

The structure of a standard IAT usually consists of seven tasks where the first and second tasks act as a way of familiarizing the respondent with the practical aspects of how the test works, and the stimuli and concepts that they will be presented with throughout the test (Greenwald et al., 1998). In the first task, one category (e.g. flowers) will be presented on one side of the screen, while its contrasting category (e.g. insects) will be located on the opposite side of the screen. Whenever an image is shown in the middle of the screen that relates to either of these categories, the objective is to put it into its correct category as quickly as possible. See figure 1 for an example on how this is presented. The same is then repeated in the second task, but with the other pair of contrasting concepts (e.g. positive and negative words). In the third and fourth task, the categories are combined with both visible on the screen at the same time (see Figure 2). It is during these double-sorting tasks that implicit associations between the concepts are measured. To the left you might have (images of flowers+positive words), while on the right (images of insects+negative words). These would be examples of congruent concept pairings, where the assumption is that images of flowers are more associated with positive words than with negative words. After this, the first two categories (i.e., flowers and insects) switches places on the screen and a new training session ensues. The reason for this is to consider individual differences in left-right reaction times, in particular left-handed or right-handedness. Finally, two additional double-sorting tasks follow, still with the new category placements. Half of the respondents in the test receive congruent concept

pairings in their first double-sorting tasks, while the other half starts with incongruent concept pairings.

Figure 1. *Example of a single-sorting training screen in an Implicit Association Test, categorizing an image of an insect into either the "Flowers" or the "Insects" category.*

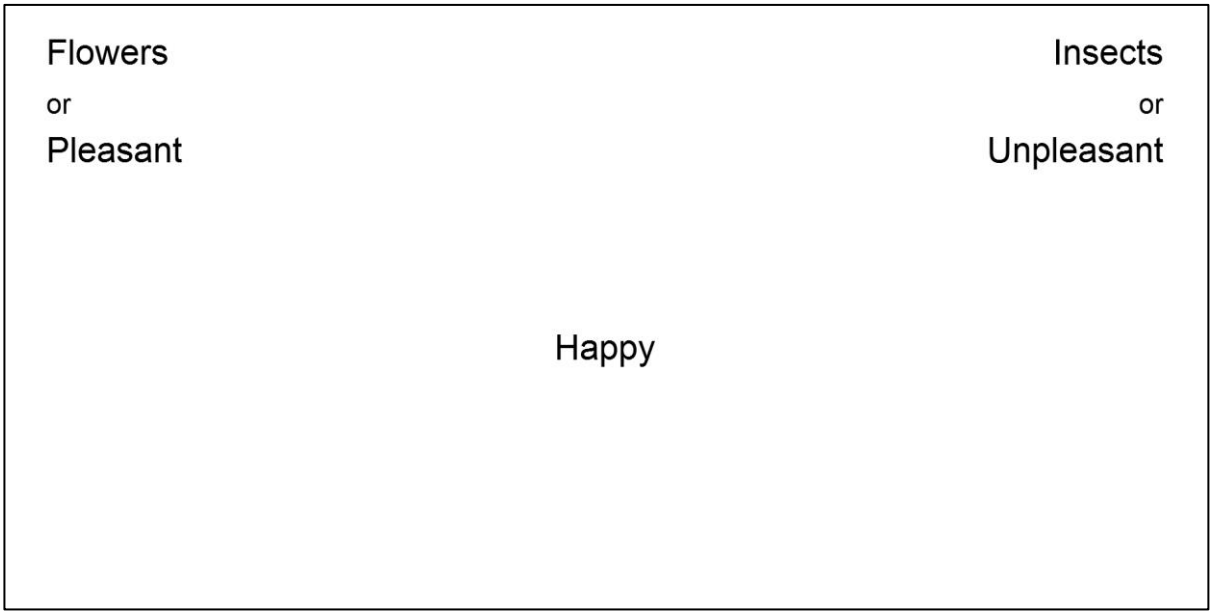


Figure 2. *Example of a double-sorting screen in an Implicit Association Test, categorizing the word "Happy" into either the combined categories "Flowers or Pleasant" or "Insects or Unpleasant".*

2.2.2 Alternatives to the standard Implicit Association Test

While the standard IAT is the most commonly used version of the test, other variants have started to appear in order to possibly address some of the problems associated with the IAT (Klauer & Teige-Mocigemba, 2010). One of these problems is the process of recoding that can potentially be done by the respondent, either consciously or subconsciously, during the process of doing an IAT. Recoding, in this case, would be the process of mentally merging the concepts presented during the congruent double-sorting tasks from four categories down to two in order to simplify the categorization task. In this case, during the congruent double-sorting tasks, instead of studying each category pairing closely before categorizing the presented stimulus, the respondent might lump both categories on one side of the screen into "the negative side" and the other as "the positive side" while ignoring the words. The resulting IAT effect could reflect this recoding process rather than true implicit associations to the stimuli. In order to prevent this, alternative variants of the IAT such as the Single Block IAT (SB-IAT) and Recoding Free IAT (IAT-RF) randomizes the placement of the categories per trial, instead of per block (Klauer & Teige-Mocigemba, 2010). In this way, the respondent has to relearn the category placements for each evaluation by being forced to read the names of the categories for each categorization.

2.2.3 Motivational Implicit Association Test

While the IAT can be used with evaluative attribute concepts (i.e. e-IAT), such as positive vs. negative, to measure the relative preference between target concepts (e.g. flowers vs. insects), it is also possible to measure other implicit associations, such as motivational tendencies (i.e. m-IAT) (Kraus & Piqueras-Fiszman, 2018). In this case, the attribute concepts could be 'I want vs. I don't want', or 'Approach vs. Avoid' instead of 'Positive vs. Negative'. One study conducted by Kraus and Piqueras-Fiszman (2016) revealed that using the e-IAT-RF as a way of measuring the relative "liking" aspect from attribute concepts 'Positive vs. Negative', did not result in any measurable difference between target concepts 'Sweets vs. Sandwich'. However, by using m-IAT-RF they were able to measure a difference in the relative "wanting" aspect between the same target concepts. A study by Ashby and Stritzke (2013) revealed that by incorporating m-IAT in a study conducted on participants with either high or low reward sensitivity they were able to capture consumers' implicit motivation towards high- and low-caloric foods. Finally, Kemps et al. (2013) incorporated m-IAT-RF in their experiments to measure implicit approach-avoidance associations with regards to food craving. Their first experiment revealed the existence of an approach bias for chocolate, and their second experiment demonstrated that this bias could be manipulated by training the consumers' to

associate chocolate pictures with either approach or avoid words prior to the main task. The consumers' that trained with chocolate pictures associated to approach words had increased chocolate-approach associations and also reported stronger cravings towards chocolate. This manipulation could potentially be useful for correcting some of the detrimental consequences of food craving, such as weight gain and overeating.

2.3 Explicit methods

2.3.1 Measuring explicit attitudes with scales

One of the most common attitude scales is the food-related lifestyle scale developed by Brunsø and Grunert (1995) and later adapted to food-waste issues by Aschemann-Witzel et al. (2018a). Data collection with attitude scales often rely on a Likert scale where the respondent is asked to what extent they agree or disagree with various statements related to certain attitudes (Hogg & Vaughan, 2008; Likert, 1932). The lowest rating on the scale reflects a strong disagreement, while the highest rating reflects a strong agreement to the statement being assessed. Likert scales are ordinal, meaning an increase in rating reflects an increase in degree of agreement (Lawless & Heymann, 2010). Aschemann-Witzel et al. (2018a) investigated the relationship between food waste and food-related lifestyle patterns by including an adapted version of the food-related lifestyle questionnaire (Brunsø, 1995). They concluded that while different consumer segments reported relatively high levels of food waste, their opinions differed regarding the importance of the food waste issue (Aschemann-Witzel et al., 2018a).

2.3.2 Evoked context

Food choice is a complex process dependent on a variety of variables, one of them being the specific context under which the choice is made (Köster, 2009). A useful tool for observing how a consumer behaves in a specific situation (when physically placing them in the corresponding situation is impossible) is by utilizing evoked contexts (Almli & Næs, 2018). By putting a consumer in an evoked context that is relevant to the experiment, the assessed sample is given more complete meaning and the resulting responses can be in turn be more accurate (Hersleth, 2018). When being put in an evoked context, the consumer is told to imagine being in a certain situation, for example "at home" or "in a store", during assessment of the sample. A study by de Hooge et al. (2017) utilized evoked contexts and showed that consumers were four times more likely to choose suboptimal foods while in an evoked context of being at home compared to an evoked context of being in a supermarket.

2.3.3 Choice task

In a choice-task, the respondent is presented with a selection of samples where the aim is to pick the one they prefer (Almli & Næs, 2018). When simply comparing products according to variations in one attribute at two levels (e.g., optimal vs. suboptimal), a simple paired-comparison choice task can be used. Usually, the task is forced, meaning the respondent is required to choose an option before they are able to continue (Hui & Culbertson, 2006). To allow the respondent to express rejection towards all the samples that they're presented with, an option for choosing "none" is commonly added. With today's technological advancements, computerized choice-tasks are fast and easy to setup and conduct with the advantage of only relying on pictures of the samples as product stimuli. By counting how many consumers prefer one sample over the other in a paired-comparison choice task, statistical significance of the difference between samples can be calculated.

Arguments have been made that choice-task, compared to other methods such as rating based studies, is more similar to real life buying situations. (Næs et al., 2011) Even if choosing products based on pictures on a computer screen might not correspond completely with browsing products in a store, recent developments in online based grocery shopping might make the choice task more similar to this way of shopping. The test is simpler than an alternative rating test and requires a lower mental cognition when conducted for the respondents as the consumer only has to choose one product from a selection of products instead of rating each individual product on a scale.

2.3.4 Purchase intent (willingness to buy)

Tasks based on rating scales are commonly used in order to measure consumer's level of stated purchase or consumption intention with regard to a product (Almli & Næs, 2018). These scales usually range from 1 to 5, 7 or 9 with 1 being equal to "Definitely would not buy/consume" and 9 being equal to "Definitely would buy/consume". During the rating task, several products are assessed in a monadic sequential order. This requires as many screens as there are products to evaluate, while half the number of screens are needed when conducting a simple paired-comparison test on one varying factor. Moreover, grading a sample on a 1-9 scale requires a higher cognitive effort as compared to only picking one option among two or three offered.

2.3.5 Acceptance testing

An alternative to choice-based procedures of measuring preference is acceptance testing (Lawless & Heymann, 2010). Instead of having to state a preference between two or more samples, the acceptance, in other words liking or disliking, of a sample can be measured using scales. As opposed to choice-based tests, this form of measurement allows for granular ratings of acceptance which can result in a more nuanced description of the sample. The most commonly used scale for this purpose is the ordinal 9-point hedonic scale which has its origin from as far back as the 1940s (Peryam, 1952). Usually, a 1 on the scale equals 'dislike extremely', a 5 equals 'neither like nor dislike' and a 9 equals 'like extremely' (Lawless & Heymann, 2010). If hypothetical samples are being assessed (e.g. in form of images instead of real samples), the use of expected liking ratings are appropriate (Cardello, 2005). In this way, the consumer can be asked to assess their likely affective response to the sample.

2.3.6 Familiarity

One of the most important drivers of preferences towards food is consumers' familiarity to the product (Næs et al., 2018). Familiarity towards food products and brands varies across individuals and different segments of consumers based on cultural aspects, traditions and habits (Pollard et al., 2002). Brand recognition, especially, is known to influence product attitudes and purchasing behavior among consumers (Næs et al., 2018). Borgogno et al. (2015) discovered that consumer segments with high familiarity towards the same food products lead to stronger associations of pleasure and symbolic value to the products they were familiar with. As with acceptance testing, the familiarity of a product can be measured using scales ranging from low to high familiarity.

2.4 Statistical methods

2.4.1 Analysis of variance (ANOVA)

Analysis of variance (ANOVA) is a common term used for a variety of statistical methods (Næs et al., 2011). These methods are among the most used, and most important, when analyzing consumer data. The main reason for using ANOVA methods is to determine whether the means of groups are significantly different from each other. One-way ANOVA estimates in what way the mean for an outcome variable depends on a single categorical value (Murray, 2017). Multi-Way ANOVA compares the means of three or more groups in the dataset that are split on two or more independent variables. The purpose of the ANOVA is to see if there is an interaction between the independent variables on the dependent variable (*Two-way ANOVA in SPSS Statistics*, n.d.).

ANOVA uses a decomposition of variances in order to calculate how much of the variability in the outcome variable is explained, or unexplained, by different assignments to the categorical variable (Murray, 2017). The explained variation is referred to as the Between Group Variation. This is the measure of variability in the outcome variable which is explained by one of the categorical variables. The unexplained variability, or the Within Groups Variation, is the measure of variability with each sub-category of the explanatory variables. When the explained variation is sufficiently large compared to the unexplained variation for a given categorical variable, there is sufficient statistical evidence to conclude that there is a significant difference.

2.4.2 Partial least squares regression (PLSR)

Partial Least Squares Regression (PLSR) is suited for explaining complex relationships between variables in a dataset (Næs et al., 2011). It is useful for datasets that contain a large amount of independent variables (X-variables) that can then be subsequently used to predict a set of dependent variables (Y-variables). PLSR's strength lies in its ability to analyze X- and Y-variables that are noisy, collinear and even incomplete (Wold et al., 2001). In order to evaluate the predictive quality of the model acquired through PLSR, it is common to apply cross-validation techniques (e.g. jackknife) (Abdi, 2010).

2.4.3 Agglomerative Hierarchical clustering

Clustering techniques are used to identify possible segments of consumers in a dataset (Næs et al., 2018). Agglomerative Hierarchical Clustering (HAC) is a so-called 'bottom-up' clustering algorithm, meaning each consumer is first considered as an individual cluster, then several consumers and eventually groups of consumers are merged according to similarity. This happens in a step-by-step process where each step results in a merging process. When two clusters are merged, be it one consumer with another, or one consumer with a group of consumers, a linkage method is used to calculate the distance between the two merging clusters. One such method is Ward linkage, where for each step in the process, all possible pairs are considered for merging and whichever pair that results in the smallest increase of the inner sum of squares is selected.

3. Materials & methods

3.1 Overview

An online consumer study was conducted in Canada, Norway and Sweden that consisted of four tasks which were done in sequence in one sitting. The structure of the questionnaire was as follows:

Task 1. Socio-demographics and Food (Waste)-related Lifestyle Questionnaire.
Task 2. Implicit assessment: rapid categorization of optimal and suboptimal food images and words using the IAT method.
Task 3. Explicit assessment: rating of optimal and suboptimal food items concerning familiarity, expected liking, safety and quality.
Task 4. Stated behavior. In Canada and Sweden: Willingness to buy/consume optimal and suboptimal food items while in an evoked context of either being 'in a store' (willingness to buy) or 'at home' (willingness to consume). In Norway: Choosing between optimal and suboptimal food items in a choice task while in an evoked context of being 'in a store' or 'at home'.

The survey was initially developed in English and then translated into Norwegian and Swedish by the researchers responsible in each respective country. All questions were presented in each country's native language. Every version of the test went through extensive pretesting to reveal any technical issues, spelling errors, etc. and to make sure the test was understandable. Each part of the test was programmed in Norway by the same person to ensure that the test was technically identical between all three countries, and to be able to offer swift technical support while the test was online.

3.2 Recruitment

A total of 459 consumers (34% male, 18-64 years old) were recruited in three countries (Canada, Norway and Sweden) to participate in an online study. The recruitment criteria's for participating in the test was age (18-64 years old) and amount of household shopping done (consumers who reported doing no household shopping were excluded). The respondents were recruited from databases of consumers maintained by each institute responsible for conducting the test in the respective countries. In Canada, respondents were selected from ACCE's consumer database. All recipients were given option to participate and those who did, and completed the entire test, were compensated in form of a monetary price by draw. In Sweden the recruitment was done via e-mail through RISE's consumer database as well as an ad placed on a website dedicated to recruiting people for scientific surveys

(StudentKaninen, n.d.). Participants who completed all parts of the test were compensated in the form of a gift card for 150 SEK (GoGift, n.d.). Finally, in Norway the consumers were recruited via e-mail (see Appendix A) through Nofima AS' consumer database which comprises a wide selection of different leisure time organizations (such as sports teams, student organizations, local choirs etc.) with members that are willing to participate in consumer tests conducted by Nofima. Participants who completed all parts of the test were compensated in the form of a monetary prize of 150 NOK going directly to their respective leisure time organizations.

Willing consumers that potentially fit the target group of the experiment received an e-mail invitation to participate including a link to start the online test, estimated at taking approximately 30 minutes to finish. The first part of the test, which concerned socio-demographic questions and an attitudinal questionnaire, automatically disqualified any consumer that were either outside the target age range (i.e. under 18 years of age, or 65 or over) or that reported doing none of their household's grocery shopping. In order to participate in the test the respondent had to consent to a form that were in compliance with the recent General Data Protection (GDPR) regulations within EU law (EU, 2016) (See Appendix B). See Appendix C for the permission from the Norwegian Centre for Research Data (NSD) to collect potentially sensitive data (name, age, etc.) as a part of the survey with the promise that the data would later be anonymized and could not be traced back to individuals (NSD, n.d.). The respondent was instructed that the study could only be completed on a computer with a keyboard attached (Windows or Mac), as the software used for implicit measurements would only work on these devices. They were told that the purpose of the study was to investigate the potential of reaction time methodologies in the investigation of food-related consumer habits. The respondent was also instructed that they could, at any time, choose to withdraw their consent without stating a reason. If they decided to withdraw, all their data would be removed. See Appendix D-G for the complete questionnaires used in task 1, task 2, task 4 for Canada and Sweden and task 4 for Norway respectively.

3.3 Image stimuli

The different food items, 16 in total (8 optimal variants and 8 suboptimal variants), assessed in tasks 2-4 were presented in the form of images and were identical between tasks. The images were generated following a design with variables consisting of two different product categories ('packaged products' and 'fruits and vegetables') and two quality standards (optimal and suboptimal product quality) with four food items representing each category (see Figure 3). Products that are commonly used in all three countries were chosen, and familiarity

was measured for each product as a part of the study to validate the selection. Both product categories represented safe foods in terms of their suboptimal variant (suboptimal in appearance, but not hazardous to consume), as well as representing different kinds of sub-optimality: the fruits and vegetables were directly bruised or had deformed, while the packaged products had external damage on the packaging itself. For the packaged products we used real brands. The reason was to make the samples more realistic in a real-life situation. Even though all the brands are not equally common in all three countries, each country has products on the market that are similar in terms of the contents, the shape and the structure of the packaging. Similar products to what was ended up being selected have been tested in other studies with similar objectives (Aschemann-Witzel et al., 2018b; Bolos et al., 2019; de Hooge et al., 2017) suggesting that they would also be appropriate for this study.

For the second task in the study, the implicit association test, it is recommended to have at least four samples, or stimuli, representing each category in order to achieve robust results (Nosek et al., 2005). It is also important that all stimuli are easily identified as belonging to any of the superordinate categories and not confounded with other categories in the same test. It was therefore taken into careful consideration that each food item was identical with regards to its optimal and suboptimal variant. It was also made sure that all images had a white background and that the food items themselves covered approximately the same amount of pixels shown on the screen.

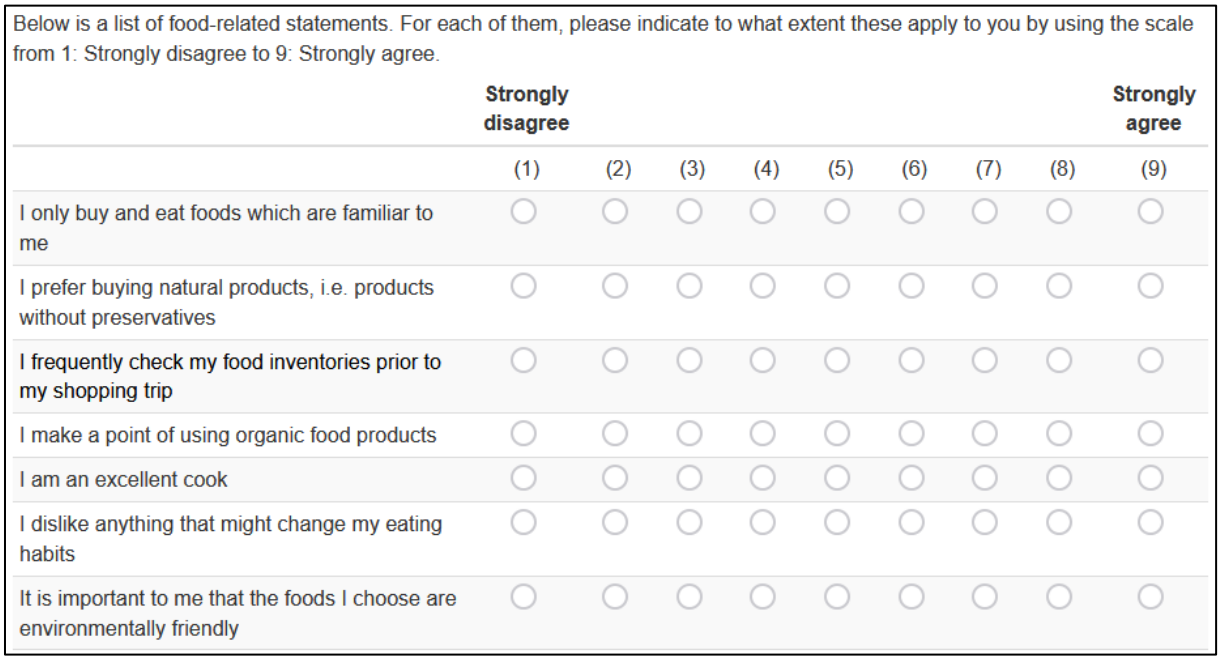
In the earlier stages of planning the study there were intentions of also including products with higher risk levels as well as an additional product category for products labeled with differing expiration dates. However, early pilot testing suggested that this would make the study too long and fatiguing for the consumer, both with regards to the explicit and the implicit tasks. In the implicit test, where the respondent must categorize samples as fast as possible, the expiration dates required a higher cognition of concentration to parse quickly enough than what felt appropriate to use in the IAT.

Product category: Fruits and vegetables			
			
Apple (optimal)	Carrots (optimal)	Strawberries (optimal)	Tomatoes (optimal)
			
Apple (suboptimal)	Carrots (suboptimal)	Strawberries (suboptimal)	Tomatoes (suboptimal)
Product category: Packaged products			
			
Biscuits (optimal)	Pasta (optimal)	Canned tomatoes (optimal)	Apple juice (optimal)
			
Biscuits (suboptimal)	Pasta (suboptimal)	Canned tomatoes (suboptimal)	Apple juice (suboptimal)

Figure 3. *Set of the 16 images used in the study: eight food items from two product categories, each declined in an optimal and a suboptimal variant.*

3.4 Task 1: Socio-demographics and attitude questionnaire

After agreeing to take part in the test, a brief description of the whole study was presented followed by socio-demographic questions about gender, age, employment status, highest level of completed education, area of living and income to see if these factors could have an effect on the results. Age and nationality, especially, have shown to have an influence on consumer choices and waste behaviors of suboptimal products (de Hooge et al., 2017). The respondent was also asked whether they lived alone or not, and with or without kids. Finally, a modified version of a Food (Waste)-related Lifestyle questionnaire (Aschemann-Witzel et al., 2018a) with 27 different statements was presented in a randomized order (see Appendix H for a full list of statements). Here, the respondent indicated to what extent each statement applied to them using a scale from 1 (Strongly disagree) to 9 (Strongly agree) (Figure 4). The modified Food (Waste)-related Lifestyle questionnaire was included in the experiment to potentially identify and reveal groups of consumers based on sociodemo- and psychographic factors (Aschemann-Witzel et al., 2015) that are especially relevant to the subject matter of this experiment, namely food waste, food involvement, environmental concern and price.



Below is a list of food-related statements. For each of them, please indicate to what extent these apply to you by using the scale from 1: Strongly disagree to 9: Strongly agree.

	Strongly disagree								**Strongly agree**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I only buy and eat foods which are familiar to me	○	○	○	○	○	○	○	○	○
I prefer buying natural products, i.e. products without preservatives	○	○	○	○	○	○	○	○	○
I frequently check my food inventories prior to my shopping trip	○	○	○	○	○	○	○	○	○
I make a point of using organic food products	○	○	○	○	○	○	○	○	○
I am an excellent cook	○	○	○	○	○	○	○	○	○
I dislike anything that might change my eating habits	○	○	○	○	○	○	○	○	○
It is important to me that the foods I choose are environmentally friendly	○	○	○	○	○	○	○	○	○

Figure 4. *Excerpt from the modified Food (Waste)-related Lifestyle questionnaire showing 7 out of the 27 statements.*

3.5 Task 2: Implicit Association Test (IAT)

Both in the email invitation to the test, and at the beginning of the study itself, the respondents were instructed to set aside 30 minutes to complete the test without any interruption. This was especially important for the implicit test in task 2 as any interruption during this part could result in invalid data. IAT was incorporated in the study to measure implicit approach-avoidance associations with regards to optimal and suboptimal food items. When asked a question explicitly, one might give a response in order to please the test designers, or to deliver an answer that one feels is the "correct" one with regards to ethical or cultural appropriation, even if it doesn't necessarily correlate with real-life behavior (Kraus & Piqueras-Fiszman, 2018; Lawless & Heymann, 2010). We are also less consciously aware of our implicit attitudes, or we might want to refrain from admitting them to others, or even ourselves, meaning the more commonly used explicit approaches would not be able to measure our implicit approach-avoid associations. While you might state explicitly that you would be just as willing to buy deformed carrots at the store, even when "normal", or optimal, looking carrots are readily available, it is possible that you have implicit avoidance attitudes towards deformed carrots, possibly without being actively aware of it, which could result in you actually choosing the carrot with a "normal" appearance instead when faced with the choice in a real-life situation. Considering this, the inclusion of the motivational IAT to the study could reveal congruity or discrepancies between the implicit and explicit attitudes towards optimal/suboptimal foods stated by the respondents (Payne et al., 2008). Additionally, Bolos et al. (2019) have shown that the combination of implicit measurements together with explicit measurements might improve the predictive ability of consumer preferences and choices.

Running the IAT task required download and installation of a plugin on the respondent's computer. The barrier of having to download and install the plugin could explain the relatively high drop-out rate of approximately 35% of all consumers between task 1 and task 2. However, having the test be online-based would still be more cost effective than an alternative experiment conducted under monitored laboratory conditions, even if that would most likely result in much lower drop-out rates. Additionally, in a laboratory condition, only respondents from restricted geographic areas can be reached. Respondents who failed to complete the IAT task were not able to progress further in the experiment.

In an IAT, the task is to quickly sort stimuli (in our case words and images) that appear in the middle of the computer screen into a category located either on the left or the right side of the same screen. The respondent is not asked whether they *think* the stimuli should be paired with a given category or not; they are first given instruction about what stimulus shall be

sorted into which category in the task, then asked to sort the stimuli according to this simple instruction, resulting in an answer that is either correct or incorrect. We used words as stimuli for representing approach and avoid tendencies (see Table 1). The words were carefully selected in terms of representing either 'approaching' something, or 'avoiding' it, while also having the possibility of being translated between countries while still retaining the same meaning. The mean time for completing the IAT task between all three countries was 8.73 minutes with a standard deviation of only 0.23 minutes which could indicate that the test was indeed perceived equally between countries.

Table 1. Overview of the word stimuli representing 'approach' and 'avoidance' used in the IAT in each country.

Canada	Norway	Sweden
Approach	**Nærme seg**	**Komma**
Take	Ta	Ta
Safe	Trygg	Säker
Accept	Godta	Acceptera
Keep	Beholde	Behålla
Avoid	**Unngå**	**Undvika**
Leave	Forlate	Lämna
Risky	Risikabelt	Riskabelt
Reject	Avvise	Rata
Throw	Kaste	Kasta

The stimuli representing optimal and suboptimal food items in the form of images are the food items presented in 3.3. In order to drive respondents away from conscious evaluative thinking about optimal and suboptimal food items, it was decided that instead of sorting the various images of foods into categories labeled 'Optimal' and 'Suboptimal', they would be marked with a colored line and the task would then be to link the color-coded image to the category named after the same color (see Figure 5). The idea was that while sorting the color-coded images you would still register the product's quality as either optimal or suboptimal. Orange and blue were chosen as they offer a good visual contrast (unlike red and orange or green and blue), do not symbolize "opposites" (such as green and red) and do not carry gender associations (such as blue and pink). Half of the respondents would have orange representing the optimal products and blue representing the suboptimal products, while the other half would have the opposite. This allowed to check whether coding with blue or orange for the optimal variant influenced the results, as well as to counterbalance the color effects at population level, if any occurred. The study was first conducted in Canada, and the preliminary results showed that the choice of colors did indeed influence the results. Respondents that had optimal products colored with an orange line also showed stronger implicit approach tendencies

towards optimal products than those who had optimal products colored with a blue line. As a response to this, it was decided that for Norway and Sweden the color coding would be replaced by framing the image of the food products with either a circle or a square (see Figure 6). Half the respondents had optimal products inside a circular frame and suboptimal products inside a quadratic frame, while the other half had the opposite. Fortunately, the results showed that while color coding influenced the IAT results, shape coding did not.

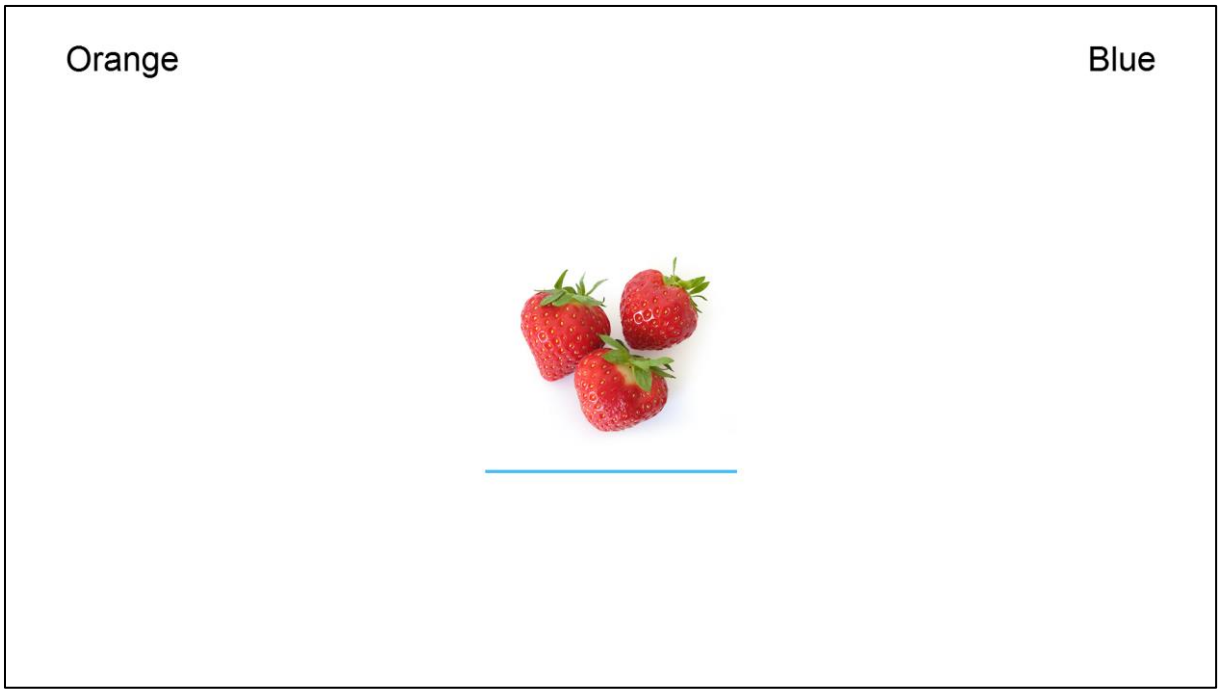


Figure 5. *Screenshot of categorizing a color-coded image of optimal strawberries in the IAT in Canada. As the image has a blue line, the respondent must hit the "I" key to sort the strawberries into the blue category.*

On the first screen of the IAT, the respondent was instructed that *"In this part you will sort pictures and words according to simple rules, as fast as you can. This part will take about 10 minutes to complete."* Furthermore, they were told that the stimuli which they would be categorizing throughout the various parts of the IAT would appear in the center of their screen, and an overview of all the stimulus items were presented in the form of a table on the second screen of the test (see Figure 7). The respondent was instructed that to pair stimuli with the left-side category (or combination of categories) they would have to press the 'E'-key on their keyboard, while pairing stimuli to the right-side category (or combination of categories) was achieved by pressing the 'I'-key. They were told to perform this categorization task as quickly as they could with as few errors as possible. Whenever an error occurred, they were instructed to press the correct key to progress (see Figure 8). The instructions on how to perform each part of the IAT were shown at the beginning of each block.

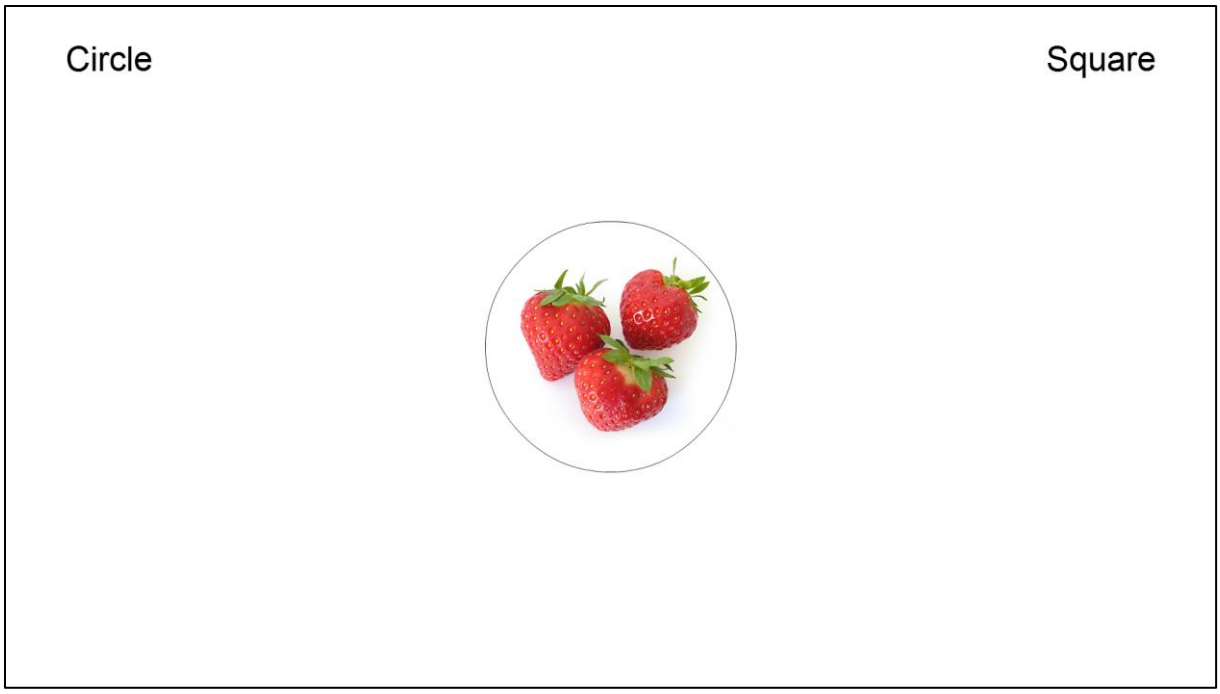


Figure 6. *Screenshot of categorizing a shape-coded image of optimal strawberries in the IAT in Sweden and Norway (translated to English for the purpose of the screenshot). As the image has a circular frame, the respondent must hit the "E" key to sort the strawberries into the circle category.*

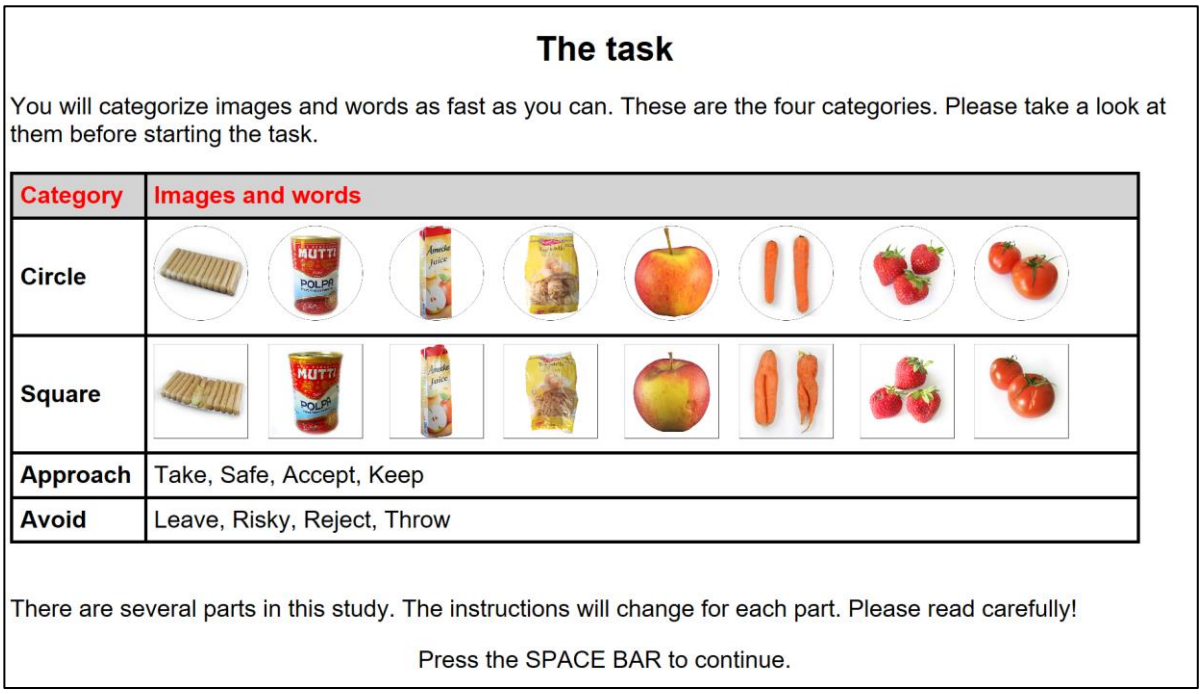


Figure 7. *Screenshot of the overview of stimuli presented to the consumer at the start of the IAT.*

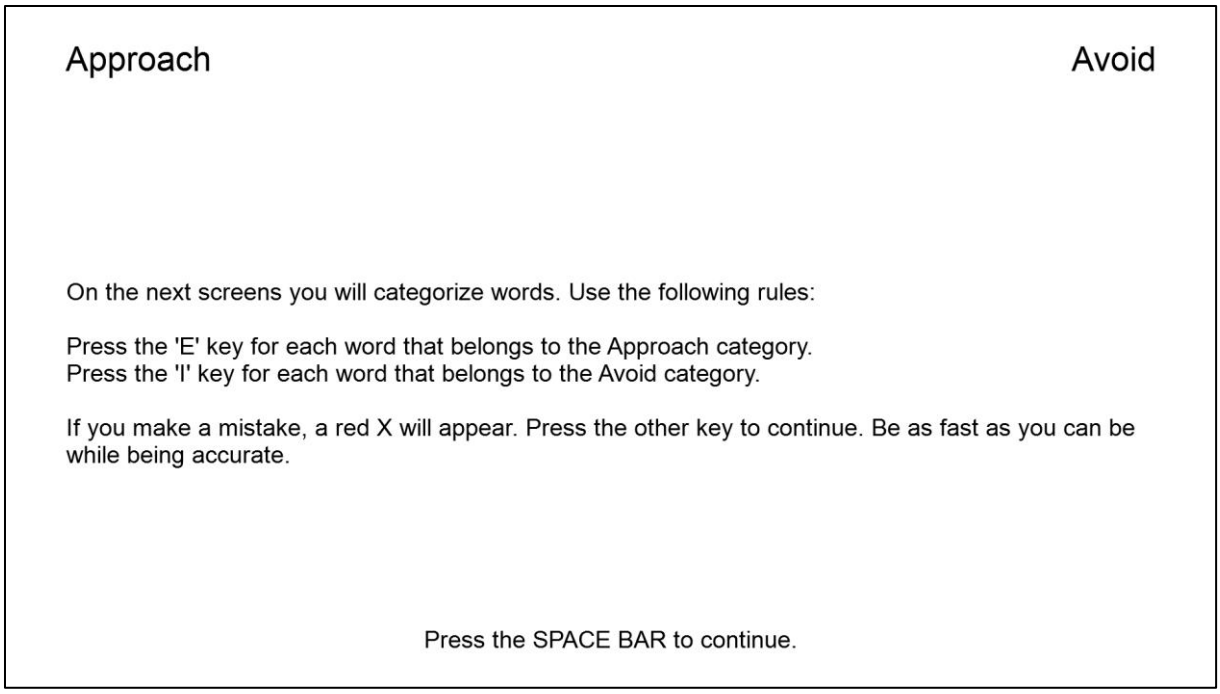


Figure 8. *Screenshot of the instructions given at the beginning of each block of the test.*

The IAT followed the traditional design as originally suggested by Greenwald et al. (1998) and further expanded upon and improved in Greenwald et al. (2003). The IAT consisted of seven blocks where in each block the respondent was told to correctly categorize a range of stimuli either into one of two categories (single sorting, blocks 1, 2 and 5), or into one of two groups of two categories (double sorting, blocks 3, 4, 6 and 7). The first two blocks of an IAT, the single sorting blocks, mainly acts as ways of familiarizing the respondent with how the categorization task should be executed, the type of stimuli that they will be presented with throughout the test and how it will appear on the screen, as well as where on the computer screen the various categories will be situated (either on the left side, or the right – see Figure 9) (Greenwald et al., 1998). The double sorting blocks (i.e. blocks 3, 4, 6 and 7) are the critical blocks where data was collected. Blocks 3 and 4 are identical in terms of where the categories are situated on the screen (see Figure 10), while blocks 6 and 7 have the category pairings switched to the opposite of blocks 3 and 4 (see Figure 11). This means that if you had the category pairings Circle+Approach and Square+Avoid in blocks 3 and 4, you would have the category pairings Square+Approach and Circle+Avoid in blocks 6 and 7. The order of the two double sorting tasks was counterbalanced, meaning half of the respondents started with blocks 3 and 4 after the first two single sorting tasks, while the other half had blocks 6 and 7. The double sorting blocks either have congruent category pairings (i.e. Optimal products + words relating to ‘Approach’ on one side of the screen and Suboptimal products + words relating to ‘Avoid’ on the other) or incongruent category pairings (Suboptimal products + words relating to ‘Approach’ on one side of the screen and Optimal products + words relating to ‘Avoid’ on

the other). The expectation is that the respondent will categorize the stimuli faster and with fewer errors when presented with congruent category pairings as opposed to incongruent category pairings (Greenwald et al., 1998). When true, a stronger association between the concepts paired in the congruent blocks (in this case, Optimal products and words relating to 'Approach') is measured. The single sorting tasks consisted of 24 trials, while the double and alternative double sorting tasks consisted of 48 trials. All the individual stimuli were presented in a randomized order without replacement for all consumers (Lavrakas, 2008). An overview of the experimental design of the IAT is presented in Table 2. It was decided to put the implicit test before the explicit assessment and stated behavior measurements to reduce any influence that the high-cognitive form of thinking required in the explicit tasks might have on the implicit measurements.

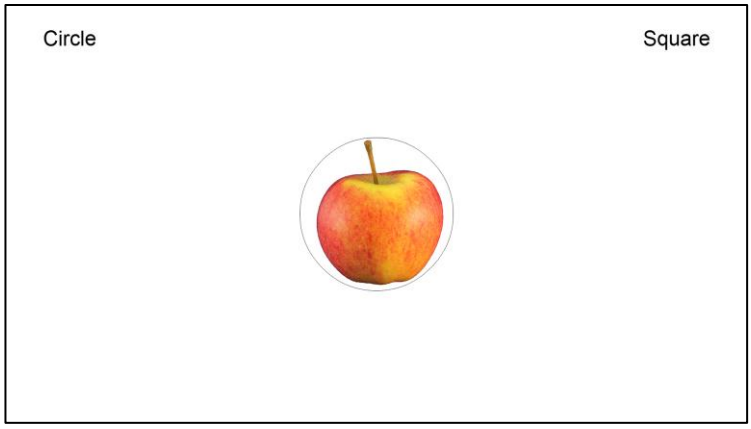


Figure 9. *Screenshot of an example of the IAT's single sorting task. As the image is framed in a circle, the respondents must hit the "E" key to sort the apple into the circle category.*

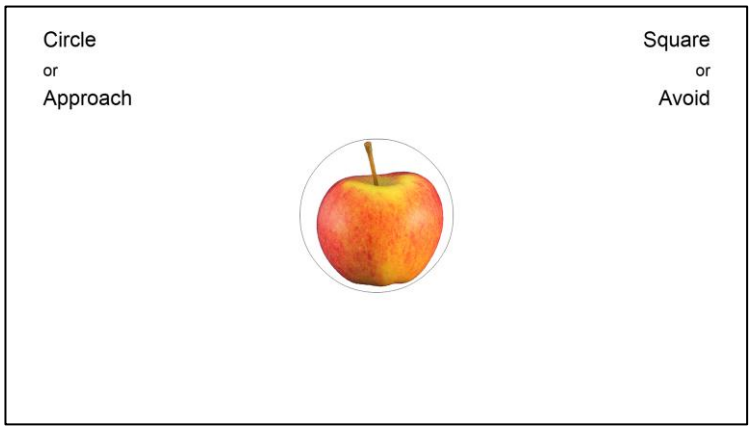


Figure 10. *Screenshot an example of the IAT's double sorting task. As the image is framed in a circle it belongs to the categories "Circle or Approach" and the respondents must hit the "E" key to sort the apple into the "Circle or Approach" category.*

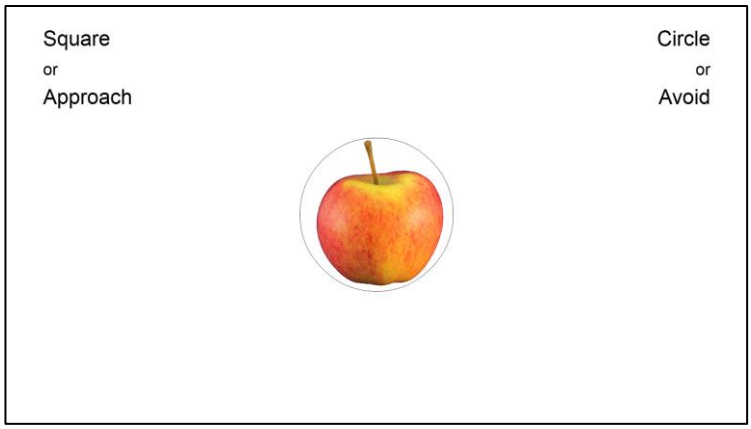


Figure 11. *Screenshot of an example of the IAT's alternative double sorting task. As the image is framed in a circle it belongs to the categories "Circle or Avoid" and the respondents must hit the "I" key to sort the apple into the "Circle or Avoid" category.*

Table 2. Experimental design of the Implicit Association Test featuring seven blocks of trials per respondent.

Block	Left key assignment	Right key assignment	# trials
1. Single sorting (Images)	Optimal product	Suboptimal product	24
2. Single sorting (Words)	Approach (Positive)	Avoid (Negative)	24
3. Double sorting (Words+Images)	Optimal product + Approach	Suboptimal product + Avoid	48
4. Double sorting (Words+Images)	Optimal product + Approach	Suboptimal product + Avoid	48
5. Single sorting (Images)	Suboptimal Product	Optimal product	24
6. Alternative double sorting (Words+Images)	Suboptimal product + Approach	Optimal product + Avoid	48
7. Alternative double sorting (Words+Images)	Suboptimal product + Approach	Optimal product + Avoid	48

3.6 Task 3: Explicit assessment

Explicit assessments were collected in the study to measure the expected liking, safety and quality of the products to see if consumers perceived the optimal and suboptimal products differently. In the explicit assessment task, the respondents were presented with a screen showing an image of one of the 16 food items and were asked to rate the product based on the following criteria:

1. Product familiarity (optimal products only)
2. Expected liking
3. Product safety
4. Product quality

All 16 samples were presented sequentially in a randomized balanced order.

3.6.1 Product familiarity

For all optimal samples respondents were asked *"How **familiar** are you with this product?"* Product familiarity was rated on a 9-point scale (see Figure 12) ranging from 1 = "Not at all familiar" to 9 = "Extremely familiar" (Lawless & Heymann, 2010).

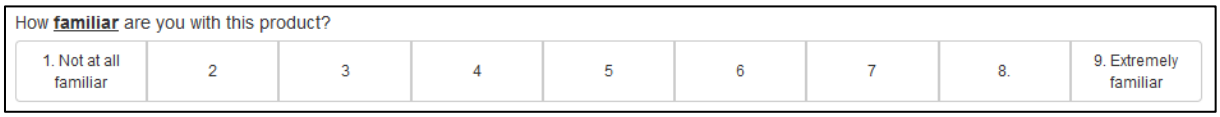


Figure 12. *Screenshot of 9-point scale for rating product familiarity.*

The main reason for including this question was to validate the choice of samples for the study. Familiarity was only asked for the optimal variants of the products as it was the product type itself that was of interest, not whether the respondent was familiar with damaged or deformed versions of it.

3.6.2 Expected liking

For all samples, the question *"How well do you think you would **like or dislike** this product?"* was asked for measuring the samples' expected liking. The expected liking of each sample was rated on the commonly used 9-point hedonic scale (see Figure 13) ranging from 1 = "Dislike extremely" to 9 = "Like extremely" (Lawless & Heymann, 2010; Peryam & Pilgrim, 1957).

Figure 13. *Screenshot of 9-point hedonic scale for rating expected liking.*

This question was included as the expected liking of a product affect consumer's choice in food products (Lawless & Heymann, 2010). If expected liking for a product is low, the chances of it being rejected are high. It is also interesting to compare the difference in expected liking between optimal and suboptimal variants of the same product, which would indicate if the suboptimal variants were indeed perceived to be suboptimal with regards to sensory characteristics, and by how much.

4.6.3 Product safety

Product safety was measured for all samples by asking *"How **safe** (to consume) does this product look?"* This was rated on 9-point scale (see Figure 14) ranging from 1 = "Not at all safe" to 9 = "Extremely safe".

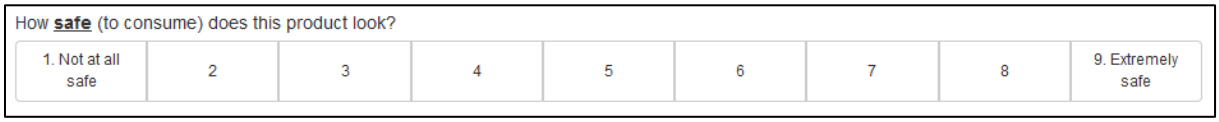


Figure 14. *Screenshot of 9-point scale for rating product safety.*

This question was included to measure the variance in the product's perceived safety between optimal and suboptimal variants. If a sample would have too low of a safety rating, it would indicate that the product seemed to be in fact hazardous to consume. This would make the sample not a realistic choice for purchasing or consumption for more than just aesthetic reasons.

3.6.4 Product quality

Finally, the question *"How would you rate the **quality** of this product?"* was asked for each sample and was rated on a 9-point scale (see Figure 15) ranging from 1 = "Very low quality" to 9 = "Very high quality".

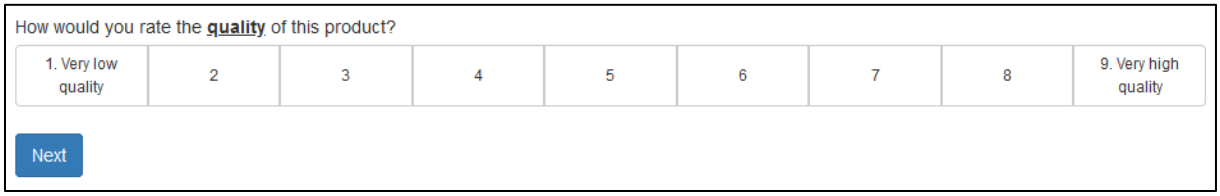


Figure 15. *Screenshot of 9-point scale for rating product quality.*

The intrinsic quality of the suboptimal products used in this study would not differ much from the optimal variants in terms of their sensory characteristics and nutritional content in real-life. However, by having slight alterations in their appearance, the perceived quality, as well as safety, of the suboptimal products was expected to be lower than its optimal counterpart.

Tasks 3 and 4 were programmed to be a part of the same project-file, meaning there were no additional technical hurdles of moving between survey platforms. Perhaps because of this, approximately 92% of all consumers who completed the IAT in task 2 also completed tasks 3 and 4.

3.7 Task 4: Stated behavior

In Canada and Sweden, the stated behavior of choosing optimal or suboptimal foods were assessed using high-cognition 1-9 Likert scales (Lawless & Heymann, 2010; Likert,

1932), while in Norway this was measured using a low-cognition choice-task (Lawless & Heymann, 2010). For Canada and Sweden tasks 3 and 4 were done sequentially per food item, while in Norway task 3 was completed for all food items before moving on to task 4. In task 4 the consumer was randomly assigned into an evoked context of either 'being in a store' or 'being at home' while conducting the task. The extent to which context influences food related behavioral choices has been shown to have a significant effect in similar studies (de Hooge et al., 2017). de Hooge et al. (2017) reported that consumers were four times more likely to choose a range of suboptimal foods in an evoked context of being 'at home' as opposed to an evoked context of being 'in a supermarket'.

3.7.1 Stated behavior using scales (Canada and Sweden)

Respondents with the evoked context of being in a supermarket were presented with a screen containing the text *"Now we would like you to imagine purchasing this product."* This was then followed by *"Imagine yourself at the grocery store about to buy <product>. If this item was available at a fair price, how likely would you be to buy it?"* Underneath the instructional text was an image of the sample being rated and a 9-point Likert scale ranging from 1 = "Definitely would not buy" to 9 = "Definitely would buy" (see Figure 16). Similarly, for the respondents in the evoked context of being at home, the first instructions stated, "*Now we would like you to imagine having this product at home."* followed by *"Imagine yourself at home about to use/eat/drink <product>. If you had this product, how likely would you be to consume/use it?"* An image of the sample being assessed was shown, with a 9-point Likert scale ranging from 1 = "Definitely would not consume" to 9 = "Definitely would consume" underneath (see Figure 17). The respondents rated all 16 samples in this way. The order in which the samples were presented followed the order in task 3 as this rating was done directly after the explicit assessments for each sample.

Measuring a respondent's willingness to buy or consume a product could give an insight into real-life behavior of consumer choice towards optimal and suboptimal products when at home versus in a store. Whereas you would likely have optimal alternatives to products when shopping in a store, suboptimal products located at home have already been purchased, which could result in higher ratings of willingness to consume suboptimal products in a 'home' context, especially considering consumer's dislike for not using products to their full potential (Bolton & Alba, 2012).

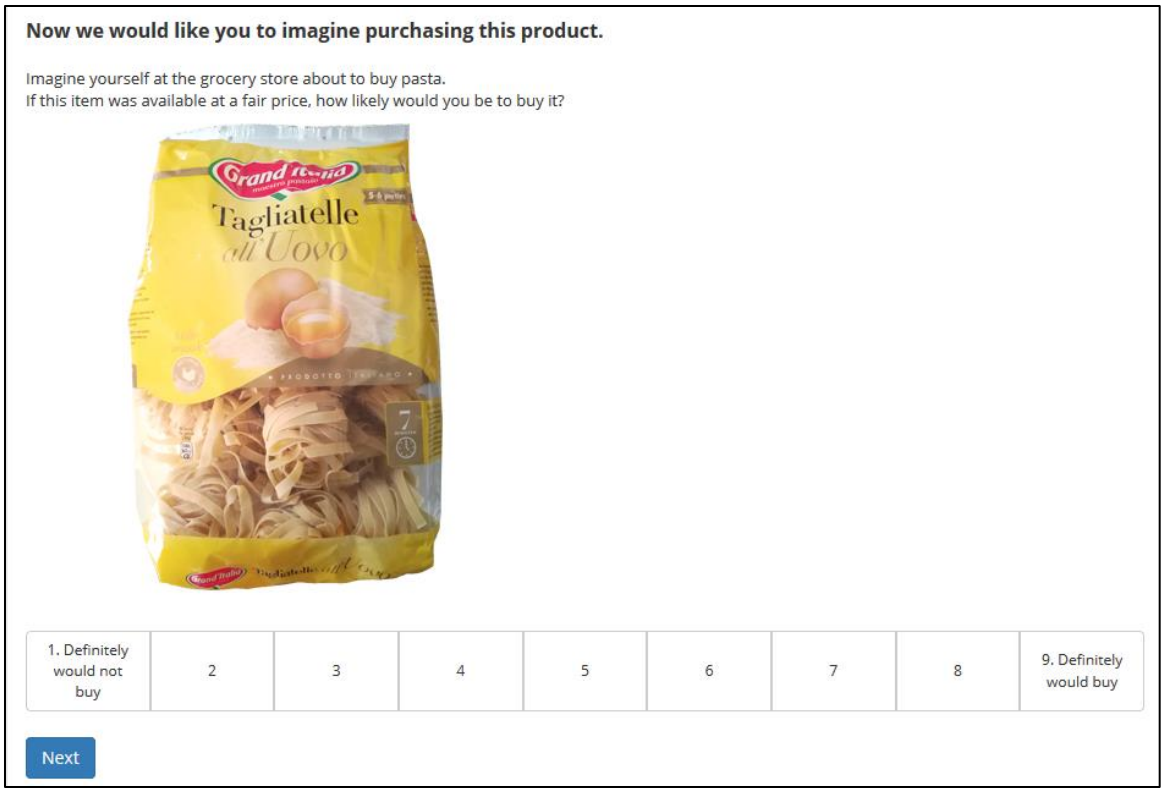


Figure 16. *Screenshot of rating willingness to buy an optimal pasta for respondents in the 'store' context.*

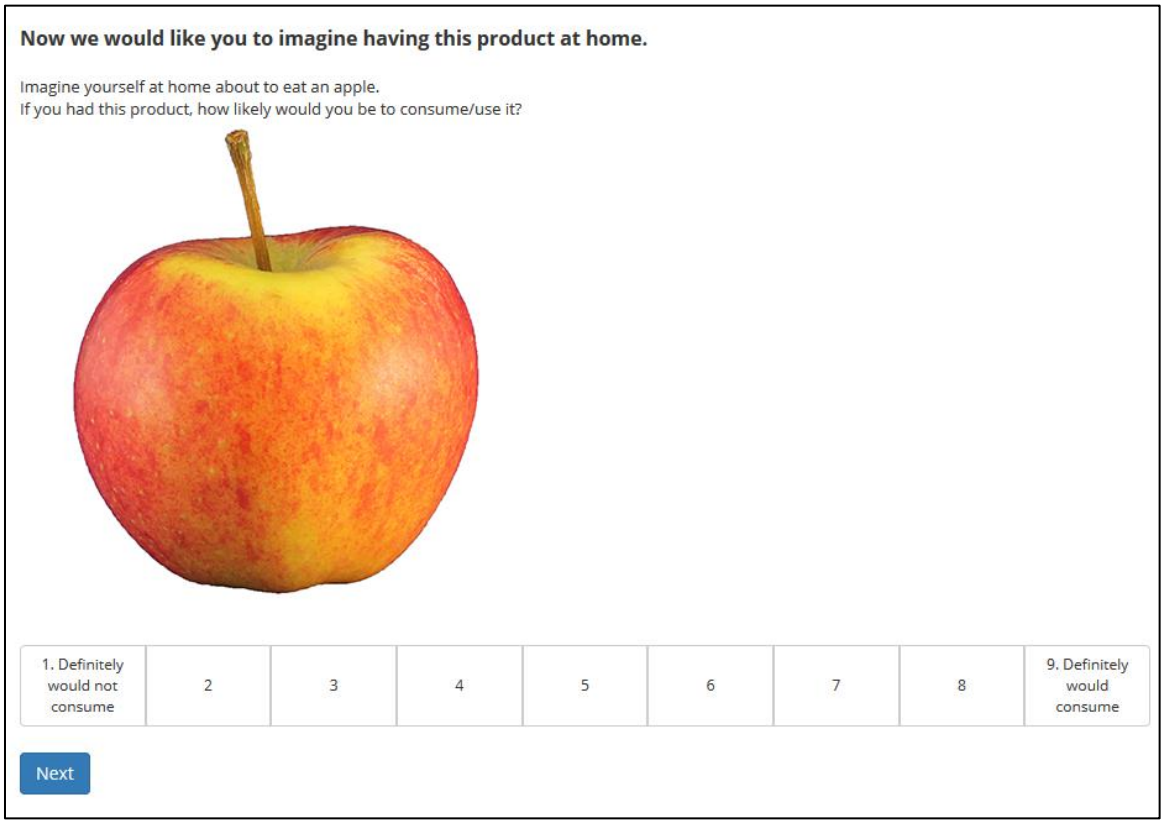


Figure 17. *Screenshot of rating willingness to consume an optimal apple for respondents in the 'home' context.*

3.7.2 Stated behavior using choice-task (Norway)

After assessing all 16 samples using the explicit scales in task 3, Norwegian consumers moved on to a choice-task. Consumers in the evoked context of being in a store were shown a screen with the instructions *"Imagine yourself being at the grocery store about to buy this product."* This was followed by *"Imagine being at the grocery store about to buy <product>. If these two products were for sale for an acceptable price, which product would you most likely choose?"* Underneath this were three options: either picking the optimal variant of the product, the suboptimal variant of the product or 'Neither' (see Figure 18). Similarly, for consumers in the evoked context of being at home, the instructions were *"Imagine yourself having this product at home."* followed by *"Imagine being at home about to use/eat/drink <product>. If you had the choice between these two products, which would you most likely choose?"* (see Figure 19) Both in the 'store' and in the 'home' context, the order of the first two options (optimal and suboptimal product variant) were randomized and the third option ('Neither') was fixed to always be to the right. The choice-task was done for all four of the fruits and vegetables items and all four of the packaged product items resulting in a total of eight screens. The order of the screens followed a balanced design.

Figure 18. *Screenshot of choice-task for biscuits in a 'store' context. Translated from Norwegian.*

When clicking on any of the three boxes in the choice-task, the test automatically progressed to the next screen without the need of having to click on a dedicated 'Next'-button. This, along with the reduced number of screens and the absence of evaluative scales, resulted in a faster test as opposed to the scales used in Canada and Sweden.

Figure 19. *Screenshot of choice-task for apple juice in a 'home' context. Translated from Norwegian.*

3.8 Data analysis

Tasks 1, 3 and 4 were programmed in EyeQuestion® 4.11.48 (Logic8, The Netherlands), while task 2 was programmed in Inquisit 5.0.14.0 (Millisecond Software, LLC, USA). These are both online platforms and data was collected directly through the software. All tasks were linked together using custom URL forwarding passing on each respondent's unique ID number between platforms. Only data from respondents who completed all four tasks were included in the analysis (n=459).

3.8.1 Task 1 – Socio-demographics and attitude questionnaire

Originally, in the questionnaire regarding socio-demographics within task 1, there were seven possible age groups ('17 or under', 18-24, 25-34, 35-44, 45-54, 55-64 and '65 or older' years old), nine educational levels and seven levels of income to choose from. For simplicity and stronger statistical models, these were reduced to two levels: 18-44 and 45-64 years old, High and Low education and High and Low income respectively. It was made sure that the merging of levels did not result in groups that were severely unbalanced.

Segmentation based on the attitude questionnaire was done with Agglomerative Hierarchical Clustering using Ward's method in XLSTAT 2019.4.1.62958 (Addinsoft, USA). Further characterizations of the segments were analyzed in The Unscrambler X 10.4.1 (Camo Software AS, Oslo) based on Partial Least Squares Regression models. Before running the analysis, four statements which were related to the environment and food waste (h, r, s, t) were excluded. To reduce the noise and increase discrimination, four statements were eliminated

from the attitudes results, as consumers gave very diverse answers to them. The remaining 23 variables were standardized prior to running the analysis to remove use-of-scale effects by the respondents. Standard Euclidean distance was used as the dissimilarity measure. From this, two main segments were obtained from the resulting Dendrogram with a cophenetic correlation coefficient of 0.303.

Further analysis in 4.2 focuses on characterizing the segments in terms of the attitudes, socio-demographics, their implicit associations and explicit evaluations. This was achieved using PLSR-regression with segment as the Y-variable and all socio-demographics (including Food (Waste)-related Lifestyle questionnaire, labeled 'D12. a-zz')), familiarity, expected liking, safety and quality as X-variables. Familiarity, expected liking, safety and quality varies between 'fruits and vegetables', 'packaged products' and all products. First, all X-variables were included, then gradually the relevant variables were selected based upon Jack-knife uncertainty tests (95%). A cross-validation with 20 random segments was performed. A 2-factor model was retained as per calibration and validation results recommendations.

3.8.2 Task 2 – Implicit Association Test (IAT)

IAT-data was processed in accordance with the suggestion made by its creators Greenwald et al. (2003). The data was cleaned removing any observations with response times above 10.000 ms. In addition, any respondent that had above 10% of their response times under 300 ms were removed. Any respondent with missing data was removed. The strength of the associations in the IAT was measured by calculating D-scores (mean response times from the critical blocks divided by its standard deviation). Data cleaning and D-score calculations were done in R 3.4.3 (R Core Team, Austria) using the IAT-package (Dan Martin, 2016). Further ANOVA-analysis on the D-scores incorporating socio-demographic, attitude and design factors were done in Minitab 19.2 (Minitab LLC, USA) using General Linear models.

3.8.3 Task 3 – Explicit assessment

ANOVA was used to test differences in familiarity, expected liking, safety and quality for the optimal and suboptimal products using EyeOpenR® 4.11.48 (Logic8, The Netherlands) ($p<0.05$). Product was included as fixed effect, consumer as random effect and familiarity, expected liking, safety and quality as dependent variables.

3.8.4 Task 4 – Stated behavior

Predictive models for stated behavior based on socio-demographic, IAT and explicit measures were conducted in The Unscrambler X 10.4.1 (Camo Software AS, Oslo) based on Partial Least Squares Regression models. In terms of data preparation, explicit product evaluations on expected liking, safety and quality, as well as willingness to buy/consume, were recoded as 'score suboptimal' - 'score optimal'. Results from the choice-task were recoded as +1 for choice of suboptimal product, -1 for choice of optimal product and 0 for choosing 'Neither'. All product specific results (i.e. on strawberries, tomatoes, biscuits etc.) were averaged across the 'fruits and vegetables', 'packaged products' and all products for each consumer.

PLS-regression was used to find out which variables are positively or negatively related to willingness to buy/consume or the choice of optimal and suboptimal products in a choice-task. This was achieved by using the results from willingness to buy/consume (in Canada and Sweden), or results from the choice-task (in Norway) as the Y-variable and all socio-demographics (including Food (Waste)-related Lifestyle questionnaire, labeled 'D12. a-zz')), familiarity, expected liking, safety and quality, D-score and context as X-variables. Familiarity, expected liking, safety, quality and D-score varies between 'fruits and vegetables', 'packaged products' and all products. First, all X-variables were included, then gradually the relevant variables were selected based upon Jack-knife uncertainty tests (95%). However, D-score was always kept in the model to verify if implicit associations were useful for predicting stated behavior. A cross-validation with 20 random segments was performed. 1-factor or 2-factor model were retained as per calibration and validation results recommendations. Only the final models will be presented in the results section.

4. Results

4.1 Socio-demographics and attitude characteristics

In total, 513 consumers completed all four tasks in the consumer test. After removing missing, invalid and incomplete answers (mostly as a result of analyzing the implicit measures), 459 respondents were included in the data analysis. Table 3 presents socio-demographic characteristics and shopping responsibility of the respondents. Ideally, we aimed for balanced groups of consumers. However, as an effect of convenience sampling, in all countries gender, education and age are unbalanced towards more females (especially in Sweden), youngers consumers (especially in Sweden), and higher education (especially in Canada). Consequently, any country-oriented result should be interpreted with these deviations in mind.

Table 3. Socio-demographic characteristics of the respondents per country and for the pooled sample.

	Canada (n=197)	Norway (n=138)	Sweden (n=124)	All (n=459)
Gender (%)				
Female	58.3	67.1	77.2	66.1
Male	41.7	32.9	22.0	33.7
Not specified	0.0	0.0	0.8	0.2
Age in years (%)				
18 – 44 y.	61.8	57.1	70.9	62.9
45 – 64 y.	38.2	42.9	29.1	37.1
Household (adults) (%)				
One	23.1	22.9	30.7	25.1
Two	31.2	47.9	53.5	42.3
Three or more	45.7	29.3	15.7	32.6
Household (kids < 18 y.) (%)	31.7	59.3	41.7	42.7
Education (%)				
Low[1]	8.5	15.0	48.8	21.5
High[2]	91.5	83.6	49.6	77.7
Other/not specified	0.0	1.4	1.6	0.9
Occupation (%)				
Full-time employment	57.3	66.4	55.1	59.4
Part-time employment	12.1	7.1	17.3	12.0
Homemaker	5.5	0.7	0.0	2.6
Student	18.1	24.3	14.2	18.9
Retired	1.5	0.0	2.4	1.3
Unemployed	5.5	1.4	11.0	5.8
Economic situation (%)				
Difficult	17.6	8.6	23.6	16.5
Moderate	75.9	82.9	68.5	75.9
Well-off	3.5	8.6	7.1	6.0
Not specified	3.0	0.0	0.8	1.5
Place of residence (%)				
Large city or municipality near large cities	81.9	33.6	66.1	63.1
Medium-sized town or municipality near medium-sized towns	14.1	20.0	14.2	15.9
Smaller town. smaller urban area or rural municipality	3.0	46.4	18.9	20.4
Not specified	1.0	0.0	0.8	0.6
Household shopping (%)				
All of it	41.2	29.3	35.4	36.1
Almost all of it	27.6	28.6	37.0	30.5
About half of it	21.6	32.1	18.9	24.0
Less than half of it	9.5	10.0	8.7	9.4
Evoked context (%)				
Store	51.3	47.1	54.1	50.7
Home	48.7	52.9	45.9	49.3

[1] *Low education refers to anything below college or university level.*

[2] *High education refers to partially completed college/university and beyond.*

Table 4. Attitude questionnaire means (M) and standard deviations (SD).

Statement	Canada	Norway	Sweden	All
a) How frequently do you make a list of the food you want to buy prior to your shopping trip	6.7 (2.3)	6.3 (2.4)	6.1 (2.4)	6.4 (2.4)
b) How frequently would you say you buy too much food (more than you need or can eat) when you go shopping	4.6 (2.2)	4.3 (2.1)	4.2 (2.4)	4.4 (2.2)
c) I frequently check my food inventories prior to my shopping trip	6.6 (2.0)	6.5 (1.8)	6.4 (2.0)	6.5 (2.0)
d) I only buy and eat foods which are familiar to me	5.2 (2.0)	4.3 (1.9)	4.5 (2.0)	4.7 (2.0)
e) I dislike anything that might change my eating habits	3.9 (2.1)	2.7 (1.5)	3.1 (1.9)	3.3 (1.9)
f) I am an excellent cook	5.6 (2.1)	6.0 (1.8)	5.9 (2.1)	5.8 (2.0)
g) I enjoy being able to create meals from scratch	6.4 (2.1)	5.9 (2.1)	6.6 (2.2)	6.3 (2.2)
h) It is important to me that the foods I choose are environmentally friendly	5.3 (2.0)	4.7 (2.0)	5.4 (2.2)	5.1 (2.1)
i) I often think about food safety when choosing foods to buy	5.9 (2.1)	5.0 (2.0)	5.0 (2.1)	5.4 (2.1)
j) I control what I eat to make sure it is healthy	6.3 (1.9)	5.9 (1.8)	5.5 (2.0)	6.0 (1.9)
k) I prefer buying natural products. i.e. products without preservatives	6.0 (2.1)	4.8 (2.1)	5.3 (2.3)	5.5 (2.2)
l) I make a point of using organic food products	4.2 (2.1)	3.1 (2.2)	4.9 (2.3)	4.1 (2.3)
m) Getting a low price is more important to me than getting top quality	4.6 (2.1)	4.2 (2.1)	4.6 (2.2)	4.5 (2.1)
n) I find taste in food products important	7.8 (1.4)	7.2 (1.4)	7.4 (1.7)	7.5 (1.5)
o) When cooking. I first and foremost consider taste	7.1 (1.7)	6.1 (1.7)	6.5 (1.8)	6.7 (1.8)
p) We use a lot of ready-to-eat foods in our household	4.1 (2.1)	4.2 (2.1)	3.4 (2.0)	3.9 (2.1)
q) Frozen foods account for a large part of the food products I/we use in my household	4.2 (2.0)	4.0 (1.9)	4.2 (1.9)	4.1 (1.9)
r) I hate it when I need to throw food in the trash	7.9 (1.5)	7.0 (2.0)	7.3 (2.0)	7.5 (1.8)
s) As long as there are still hungry people in this world. food should not be thrown away	7.3 (2.0)	7.3 (1.7)	6.4 (2.3)	7.1 (2.1)
t) I always eat what is on my plate	7.0 (1.8)	7.0 (1.9)	7.3 (1.9)	7.1 (1.9)
u) I always plan what we are going to eat a couple of days in advance	4.8 (2.3)	4.7 (2.3)	4.5 (2.4)	4.7 (2.3)
v) What we are going to have for supper is very often a last-minute decision	4.8 (2.1)	4.6 (2.2)	4.6 (2.0)	4.7 (2.1)
w) I appreciate that packaging keeps products hygienic and safe	7.2 (1.7)	6.1 (1.9)	5.5 (2.0)	6.4 (2.0)
x) I compare product appearance to decide which fruit and vegetable to buy	7.2 (1.7)	6.8 (1.9)	6.2 (2.1)	6.8 (1.9)
y) I compare date labels to select food with the longest shelf life	6.9 (2.0)	6.1 (2.4)	5.8 (2.2)	6.4 (2.2)
z) I frequently buy food close to the best-before date. if it is offered at a lower price	4.3 (2.4)	6.1 (2.5)	6.2 (2.3)	5.4 (2.6)
zz) I frequently look for store specials or purchase food that is on discount	6.7 (2.1)	6.1 (2.3)	6.9 (2.1)	6.6 (2.2)

The modified Food (Waste)-related Lifestyle questionnaire measured the consumers agreement with various statements regarding food waste, food involvement, environmental concern and price. Table 4 shows a full list of all 27 statements (rated using 9-point scales) including the mean scores and standard deviations. Based on ANOVA, there were no significant difference ($p<0.05$) between countries for any of the statements. This data is used further in 4.2 for revealing segments of consumers in the data.

4.2 Consumer segments

Two segments of consumers were obtained by running agglomerative hierarchical clustering on the results from the Food (Waste)-related Lifestyle questionnaire included in task 1. Further analysis focuses on characterizing the segments in terms of the attitudes, socio-demographics, their implicit associations and explicit evaluations. Figure 20 shows the weighted regression coefficients describing the two consumer segments. Positive regression coefficients describe segment 1, the 'quality seekers' (n=250), while negative regression coefficients describe segment 2, the 'budget eaters' (n=209).

Consumers belonging to the 'quality seekers' segment mostly consists of females from Canada aged 55-64 years old. They share the household's shopping responsibility and have higher education and income than segment 2. They score higher in agreement on the following attitudes:

g. *"I enjoy being able to create meals from scratch"*,
h. *"It is important to me that the foods I choose are environmentally friendly"*,
i. *"I often think about food safety when choosing foods to buy"*,
j. *"I control what I eat to make sure it is healthy"*,
k. *"I prefer to buy natural products, i.e. products without preservative"*,
l. *"I make a point of using organic food products"* and
y. *"I compare date labels to select food with the longest shelf life"*.

In general, this segment is composed of consumers who are concerned about food, health and food safety, and primarily seek quality when selecting food, hence the name 'quality seekers'.

Consumers belonging to the 'budget eaters' segment mostly consists of males from Norway with lower education. They score higher in agreement on the following attitudes:

e. *"I dislike anything that might change my eating habits"*,
m. *"Getting a low price is more important to me than getting top quality"*,
p. *"We use a lot of ready-to-eat foods in our household"*,
q. *"Frozen foods account for a large part of the food products I/we use in my household"*,

r. *“I hate it when I need to throw food in the trash”*,
z. *“I frequently buy food close to the best-before date, if it is offered at a lower price”* and
zz. *“I frequently look for store specials or purchase food that is on discount”*.

In general, this segment is composed of consumers who frequently use convenient food such as frozen foods and ready-to-eat meals, they dislike not eating up their plate and throwing out food, and lower prices are more important to them than top quality, hence the name ‘budget eaters’.

4.3 Explicit assessments

4.3.1 Familiarity

To start with, we checked if our preselection of products were familiar to the respondents. Familiarity was measured for all optimal variants. Generally, a higher familiarity was observed for fruits and vegetables (mean: 8.6 on a scale from 1-9) than for packaged products (mean: 5.9) (see Figure 21). ANOVA for familiarity showed a significant difference between the ‘fruits and vegetables’ and the ‘packaged products’ ($p<0.05$). All fruits and vegetables are perceived as equally familiar to the consumers with a mean familiarity of 8.6. Regarding the packaged products, the canned tomatoes are significantly more familiar to the consumers than the rest. The biscuits and the pasta are perceived as equally familiar, while the apple juice is considered the least familiar of all the products. The large standard deviations for the packaged products is likely due to the fact that even though we may safely assume that all consumers may be familiar with e.g. pasta, some may not be familiar to the specific brand we presented. All products rated on average higher than the middle point, validating the selection of products as familiar products of the two product categories ‘fruits and vegetables’ and ‘packaged products’. Consequently, a merging of the individual products into four groups of products was done: optimal and suboptimal fruits and vegetables, and optimal and suboptimal packaged products. This was achieved by calculating mean scores from the four individual products that make up each product group. A two-tailed t-test shows a significant difference in familiarity (Figure 22) between the group of fruits and vegetables products and the group of packaged products ($p<0.05$).

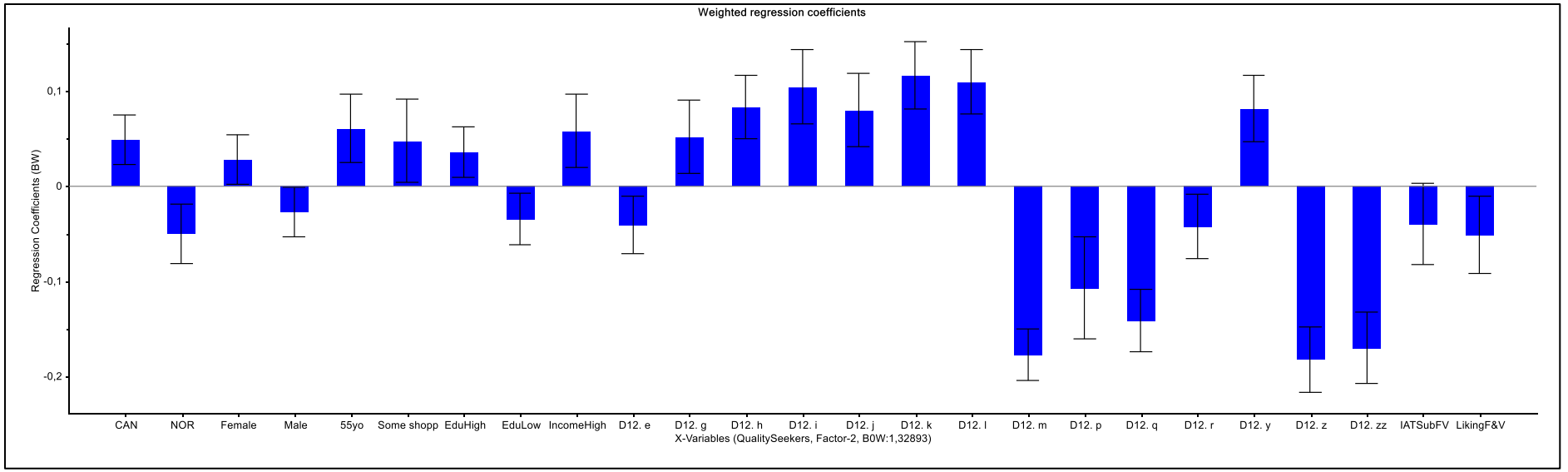


Figure 20. *Weighted regression coefficients from PLSR-model describing the two consumer segments. Positive coefficients indicate characteristics typical of segment 1, 'quality seekers', while negative coefficients are significantly related to segment 2, 'budget eaters' ($p<0.05$).*

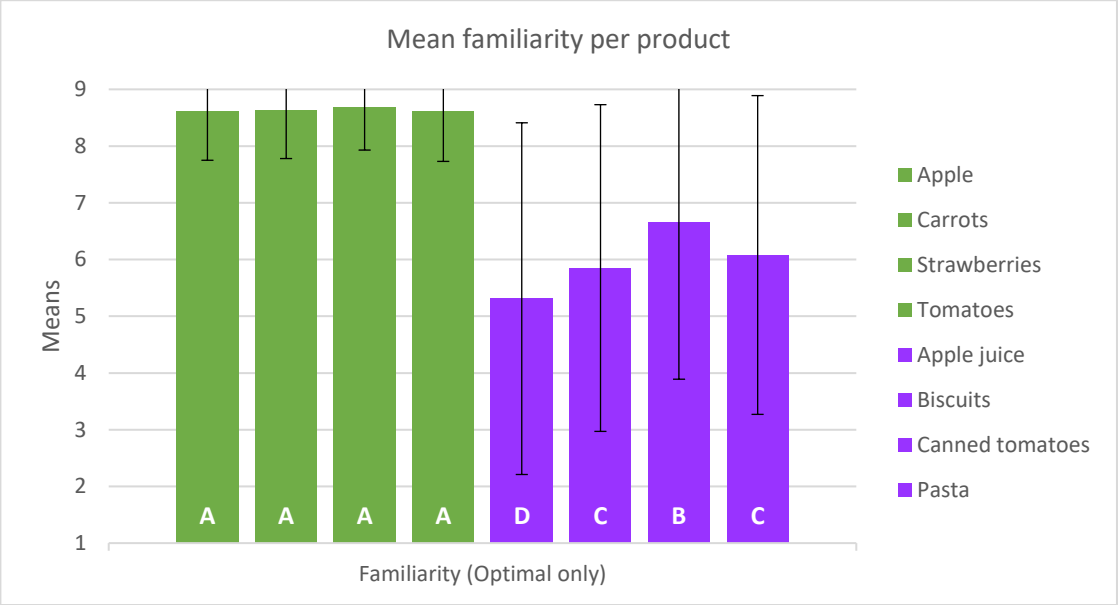


Figure 21. *Mean familiarity measured for all optimal products (green: fruits and vegetables, purple: packaged products) with error bars representing standard deviations. Means that do not share a letter are significantly different from each other (p<0.05).*

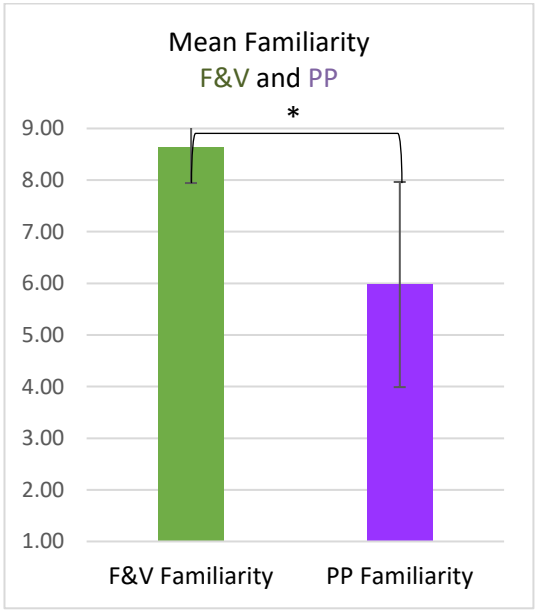


Figure 22. *Mean familiarity for fruits and vegetables (F&V) and packaged products (PP) with error bars representing standard deviations. The star indicates a significant difference between groups (p<0.05).*

4.3.2 Expected liking, safety and quality

Expected liking, safety and quality was measured for fruits and vegetables (Figure 23) and packaged products (Figure 24). All optimal products were significantly better liked, were

perceived as safer and were perceived as being of higher quality than their suboptimal counterparts based on ANOVA-results ($p<0.05$). This indicates that the respondents perceived a difference between the optimal and suboptimal variants of the same products. The optimal fruits and vegetables were significantly better liked than optimal packaged products. Generally, the difference in expected liking, safety and quality were larger between the optimal and suboptimal fruits and vegetables compared to the optimal and suboptimal packaged products.

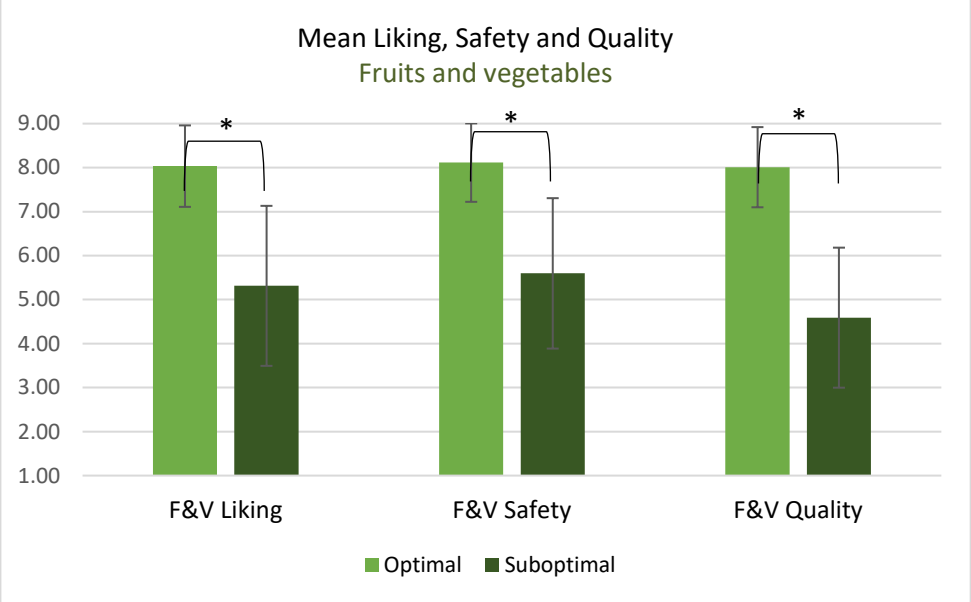


Figure 23. *Mean expected liking, safety and quality measured for optimal and suboptimal fruits and vegetables with error bars representing standard deviations. The star indicates a significant difference between groups (p<0.05).*

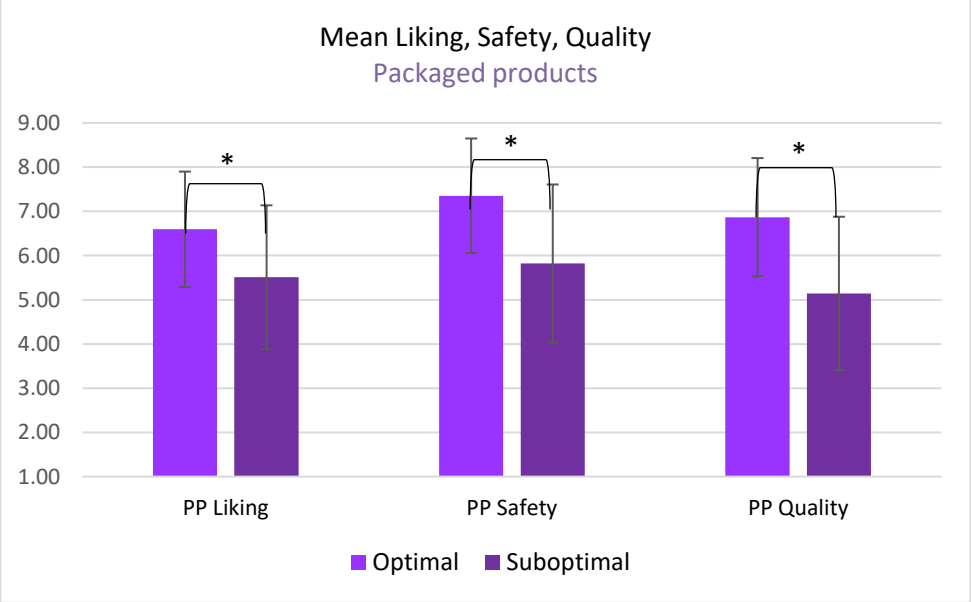


Figure 24. *Mean expected liking, safety and quality measured for optimal and suboptimal packaged products with error bars representing standard deviations. The star indicates a significant difference between groups (p<0.05).*

4.4 Implicit approach-avoid tendencies to optimal and suboptimal food items

Figure 25 gives an overview of the mean reaction times (in milliseconds) for all consumers measured for each stimulus item in the IAT. On the whole, the word stimuli have higher measured reaction times than the images, except for the words *Accept* and *Reject*. This indicates that images are in general cognitively faster to process than words. Generally, shorter reaction times are measured for the optimal products compared to their suboptimal counterpart (true for all products, except *Strawberries* and *Biscuits*), possibly linked to a higher familiarity and recognition of optimal products allowing faster image processing. Additionally, fruits and vegetables generally measure lower response times compared to packaged products, indicating that fresh produce images are cognitively processed more rapidly than food packaging images.

The calculated D-scores for various groups of consumers are presented in Table 5. Calculations were done for all stimuli (16 images of optimal and suboptimal products and 8 words), and on 'fruits and vegetables' and 'packaged products' separately, resulting in three D-scores for each calculation. The mean D-score for all consumers and all stimuli is a positive value which suggests a slight approach tendency for optimal products over suboptimal products ($M_{D\text{-}score}$=0.18, $SD_{D\text{-}score}$=0.47) (Greenwald et al., 1998; Greenwald et al., 2003). In this case, a positive D-score measures stronger associations between *Optimal – Approach* and *Suboptimal – Avoid* than between *Optimal – Avoid* and *Suboptimal – Approach*. The mean D-scores measured between different countries, age groups or genders were not significantly different. Neither were the mean D-scores measured between the 'fruits and vegetables' and 'packaged products' categories - although the D-scores show a trend of stronger approach tendencies for optimal fruits and vegetables than for optimal packages products, indicating that suboptimal packaged products tend to be better accepted than suboptimal fruits and vegetables. Ultimately, all D-scores are very small and with very large SD compared to the mean. This indicates that consumers on average didn't express any salient implicit approach/avoidance tendencies for optimal foods as compared to suboptimal foods.

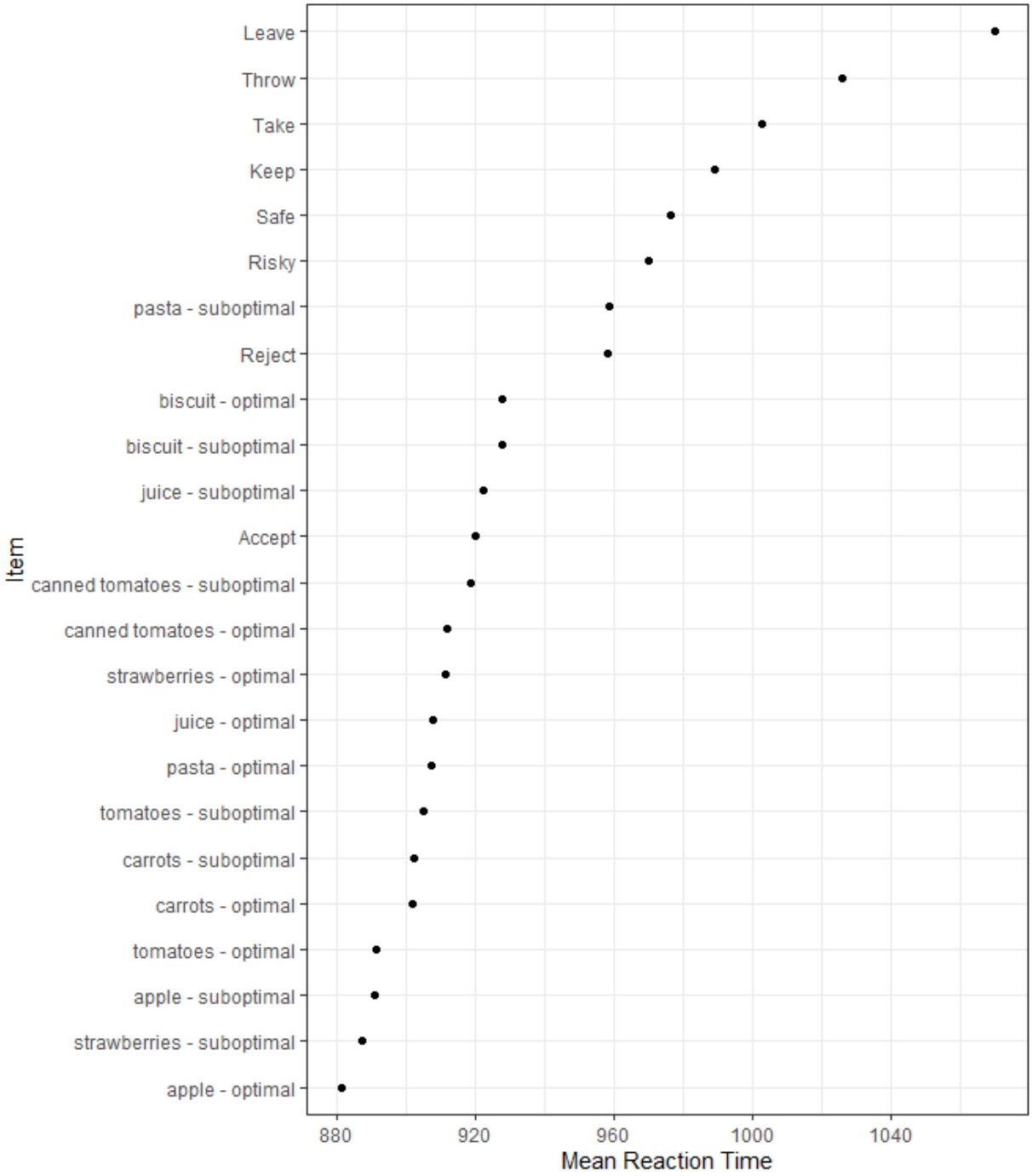


Figure 25. *Mean reaction time (in milliseconds) for each stimulus item in the Implicit Association Test. A shorter reaction time indicates a faster cognitive processing of the stimulus.*

Table 5. Mean (M(SD)) D-scores for **all** products, fruits and vegetables (**F&V**) and packaged products (**PP**) for different consumer groups. A higher D-score indicates a stronger approach tendency (and lower avoidance tendency) towards the stimuli.

Consumer group	n	D-score **all** items M(SD)	D-score F&V M(SD)	D-score PP M(SD)
All consumers	459	0.18 (0.47)	0.20 (0.47)	0.18 (0.47)
Canada	197	0.17 (0.48)	0.19 (0.49)	0.17 (0.48)
Norway	138	0.17 (0.49)	0.18 (0.48)	0.17 (0.50)
Sweden	124	0.21 (0.42)	0.22 (0.43)	0.22 (0.43)
Male	156	0.19 (0.48)	0.19 (0.49)	0.19 (0.48)
Female	303	0.18 (0.46)	0.20 (0.46)	0.18 (0.47)
18-44 y.o.	287	0.19 (0.45)	0.20 (0.46)	0.19 (0.46)
45-64 y.o.	172	0.18 (0.49)	0.19 (0.49)	0.17 (0.49)
Orange Optimal	98	0.24 (0.44)	0.26 (0.44)	0.24 (0.45)
Blue Optimal	99	0.09 (0.51)	0.12 (0.52)	0.11 (0.50)
Circle Optimal	134	0.22 (0.44)	0.23 (0.44)	0.22 (0.46)
Square Optimal	128	0.16 (0.47)	0.17 (0.47)	0.16 (0.47)

As mentioned in 3.5, the consumers sorted the optimal and suboptimal products based on orange and blue color coding in Canada, or circular and quadratic picture frames in Norway and Sweden. This means that the D-score measured is the strength of association between *Orange/Blue/Circle/Square* and *Approach* (see 'Orange/Blue/Circle/Square Optimal' in Table 5). The difference in D-score between those who had optimal products with Orange color coding and those who had Blue color coding was significant ($p=0.035$), while the difference between those who had Circle as optimal products and those who had Square was not significant ($p=0.297$). This means that whenever images of optimal products were marked with orange color coding, the strength of association between the optimal products and the positive words were stronger than when marked with blue color coding, while no coding effect occurred for circular and quadratic frames. Further, we note that all variants of optimal targets resulted in positive D-scores, also in Canada. This indicates that the strength of associations measured was not purely connected to the coding system, but also to the optimal product displayed on screen. In the following we report results for the optimal and suboptimal products disregarding of the color shape coding of the image stimuli.

4.5 Relating implicit approach-avoidance tendencies to socio-demographic, attitudinal and design factors

In order to investigate which socio-demographic, attitudinal and design factors are related to implicit approach-avoidance tendencies to suboptimal products, ANOVA-models

were fitted including all products (4.5.1), just the fruits and vegetables (4.5.2) and the packaged products (4.5.3) with a general linear model including D-score versus fixed factors related to socio-demographics, attitudes and design. For these calculations, the measured familiarity-scores were compressed into two levels: low (1) and high (2) familiarity based on a median split.

4.5.1 Relating implicit approach-avoidance tendencies to socio-demographic, attitudinal and design factors for all products

The model on all products show that the amount of household shopping has a significant effect on the resulting D-score for all products (*p<0.05*), as well as the interactions between country and familiarity (*p<0.01*), gender and familiarity (*p<0.01*), area of living and familiarity (*p<0.1*) and the optimal target (*p<0.1*). The resulting p-values are presented in Table 6. The model R^2 was low at 9.60%.

Table 6. ANOVA of D-scores on all products confounded.

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Country	2	0,1535	0,07673	0,37	0,692
Gender	1	0,0304	0,03045	0,15	0,702
Age	1	0,0625	0,06249	0,30	0,584
Shopping	2	1,4142	0,70708	3,40	**0,034**
Education	1	0,0000	0,00000	0,00	0,999
LivingArea	2	0,3338	0,16690	0,80	0,449
Segments_2	1	0,0013	0,00126	0,01	0,938
FamiliarityAll	1	0,0703	0,07030	0,34	0,561
Country*Shopping	4	1,4906	0,37264	1,79	0,129
Country*FamiliarityAll	2	2,7935	1,39674	6,72	**0,001**
OptTarget(Country)	3	1,5390	0,51299	2,47	**0,062**
Gender*Education	1	0,4276	0,42757	2,06	0,152
Gender*FamiliarityAll	1	1,4409	1,44086	6,93	**0,009**
Education*FamiliarityAll	1	0,3113	0,31133	1,50	0,222
LivingArea*FamiliarityAll	2	1,2096	0,60481	2,91	**0,056**
Error	431	89,6005	0,20789		
Lack-of-Fit	295	63,2734	0,21449	1,11	0,249
Pure Error	136	26,3272	0,19358		
Total	456	99,1130			

Figures 26 and 27 display the main effects and interaction plots from the ANOVA model for all products confounded. Significant effects with p-values below 0.1 are marked with a red border. By looking at the shopping-effect in Figure 26, the consumers who are responsible for most, or all, of their household's shopping have significantly lower D-scores indicating a lower

implicit avoidance tendency towards suboptimal products. By looking at the interaction effects in Figure 27, it is revealed that Swedes with high familiarity are implicitly more positive to suboptimal than those with low familiarity. Males with high product familiarity are implicitly more positive towards suboptimal products, while for the females it's the opposite. Consumers living in more rural areas with high familiarity are more positive towards suboptimal products.

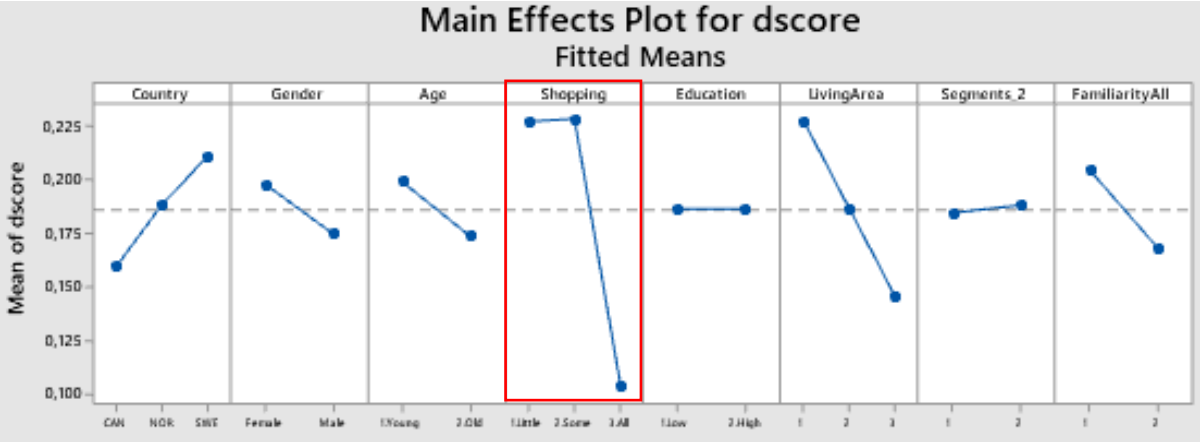


Figure 26. Main effects from the ANOVA model for all products confounded.

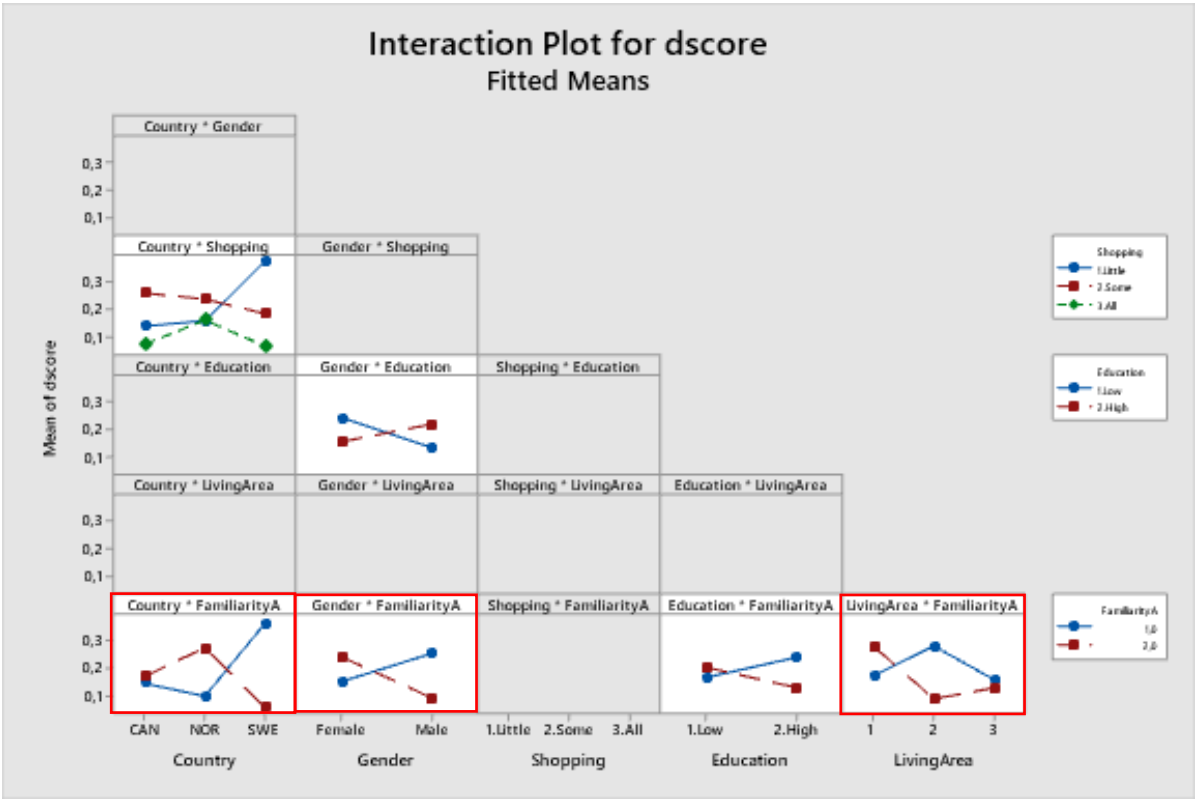


Figure 27. Interaction plots from the ANOVA model for all products confounded.

4.5.2 Relating implicit approach-avoidance tendencies to socio-demographic, attitudinal and design factors for fruits and vegetables

The model on fruits and vegetables show that the amount of household shopping has a significant effect on the resulting D-score for fruits and vegetables (*p<0.1*), as well as the interaction between country and gender (*p<0.1*). The resulting p-values are presented in Table 7. The model R^2 was low at 7.26%.

Table 7. ANOVA of D-scores on fruits and vegetables.

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Country	2	0,240	0,120197	0,56	0,572
Gender	1	0,003	0,003093	0,01	0,905
Age	1	0,017	0,016976	0,08	0,779
Shopping	2	1,055	0,527577	2,45	**0,087**
Education	1	0,012	0,011654	0,05	0,816
LivingArea	2	0,207	0,103749	0,48	0,618
Segments_2	1	0,148	0,148227	0,69	0,407
FamiliarityF&V	1	0,061	0,060662	0,28	0,596
Country*Gender	2	1,245	0,622578	2,90	**0,056**
Country*Shopping	4	1,645	0,411209	1,91	0,107
OptTarget(Country)	3	1,288	0,429479	2,00	0,114
Gender*FamiliarityF&V	1	0,057	0,056741	0,26	0,608
LivingArea*FamiliarityF&V	2	0,706	0,352891	1,64	0,195
Segments_2*FamiliarityF&V	1	0,189	0,188840	0,88	0,349
Error	432	92,887	0,215017		
Lack-of-Fit	289	61,428	0,212554	0,97	0,600
Pure Error	143	31,459	0,219996		
Total	456	100,159			

Main effects and interaction effects from the ANOVA-model are presented in figures 28 and 29 respectively. Significant effects with p-values below 0.1 are marked with a red border. By looking at the shopping-effect in Figure 28, the consumers who are responsible for most, or all, of their household's shopping have significantly lower D-scores indicating a lower implicit avoidance tendency towards suboptimal fruits and vegetables. The interaction between country and gender shown in Figure 29 reveals that Norwegian females are more positive towards suboptimal fruits and vegetables than Norwegian males.

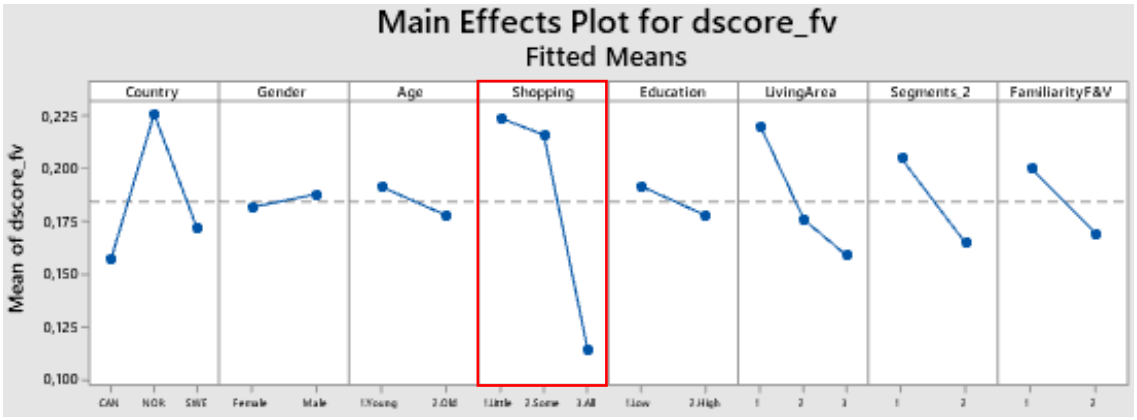


Figure 28. Main effects from the ANOVA model for fruits and vegetables.

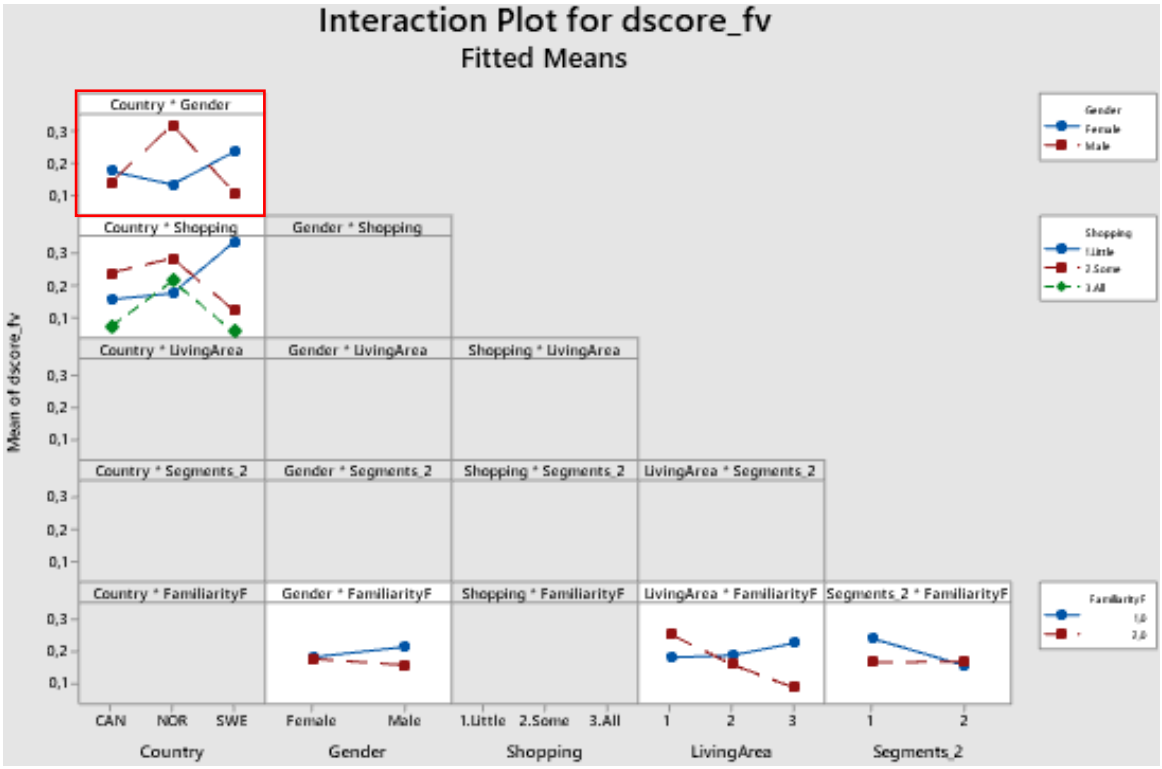


Figure 29. Interaction plots from the ANOVA model for fruits and vegetables.

4.5.3 Relating implicit approach-avoidance tendencies to socio-demographic, attitudinal and design factors for packaged products

The model on packaged products show that the amount of household shopping has a significant effect on the resulting D-score for packaged products ($p<0.1$), as well as the interaction between country and familiarity ($p<0.01$), optimal target within country ($p<0.1$) and gender and familiarity ($p<0.05$). The resulting p-values are presented in Table 8. The model R^2 was low at 6.66%.

Table 8. ANOVA of D-scores on packaged products.

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Country	2	0,075	0,03736	0,17	0,841
Gender	1	0,014	0,01437	0,07	0,796
Age	1	0,099	0,09925	0,46	0,497
Shopping	2	0,999	0,49934	2,32	**0,099**
Education	1	0,009	0,00882	0,04	0,840
LivingArea	2	0,406	0,20287	0,94	0,390
Segments_2	1	0,049	0,04925	0,23	0,633
FamiliarityPP	1	0,100	0,09993	0,46	0,496
Country*FamiliarityPP	2	2,275	1,13737	5,29	**0,005**
OptTarget(Country)	3	1,406	0,46856	2,18	**0,090**
Gender*Education	1	0,185	0,18479	0,86	0,355
Gender*FamiliarityPP	1	1,307	1,30750	6,08	**0,014**
Education*FamiliarityPP	1	0,414	0,41358	1,92	0,166
Error	437	94,024	0,21516		
Lack-of-Fit	306	67,903	0,22191	1,11	0,242
Pure Error	131	26,121	0,19940		
Total	456	100,731			

Main effects and interaction effects from the ANOVA-model are presented in figure 30 and 31 respectively. Significant effects with p-values below 0.1 are marked with a red border. By looking at the shopping-effect in Figure 30, the consumers who are responsible for most, or all, of their household's shopping have significantly lower D-scores indicating a lower implicit avoidance tendency towards suboptimal fruits and vegetables. The interaction between country and gender shown in Figure 31 reveals that Swedes with high familiarity of packaged products are more positive towards suboptimal packaged products than those with low familiarity. Norwegians show the opposite trend.

4.5.4 Relating implicit approach-avoidance tendencies to socio-demographic, attitudinal and design factors results overview

Significant variables that are important in all the models are country, gender and the amount of household shopping done. When modelling all products together, the important variables are familiarity of all products, optimal target and area of living. Important for packaged products specifically are optimal target and familiarity of the packaged products.

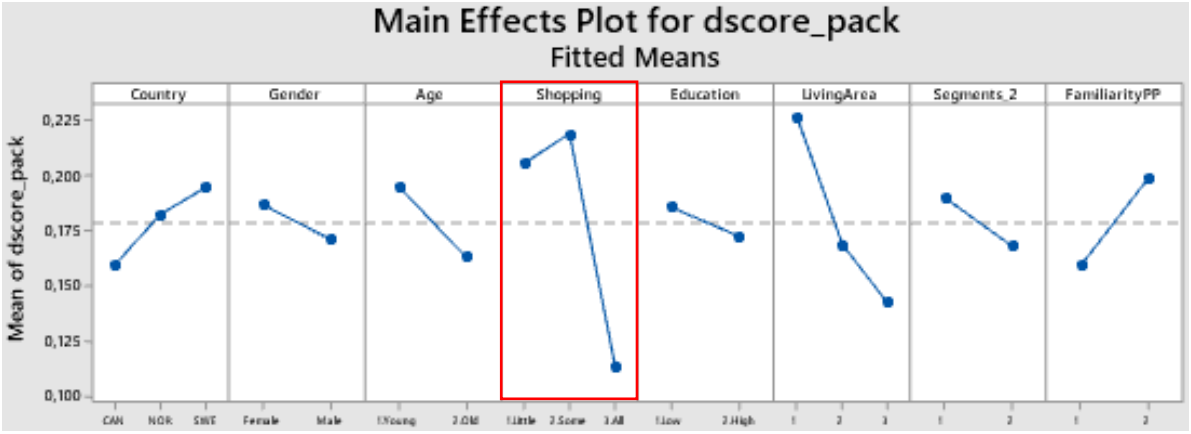


Figure 30. *Main effects from the ANOVA model for packaged products.*

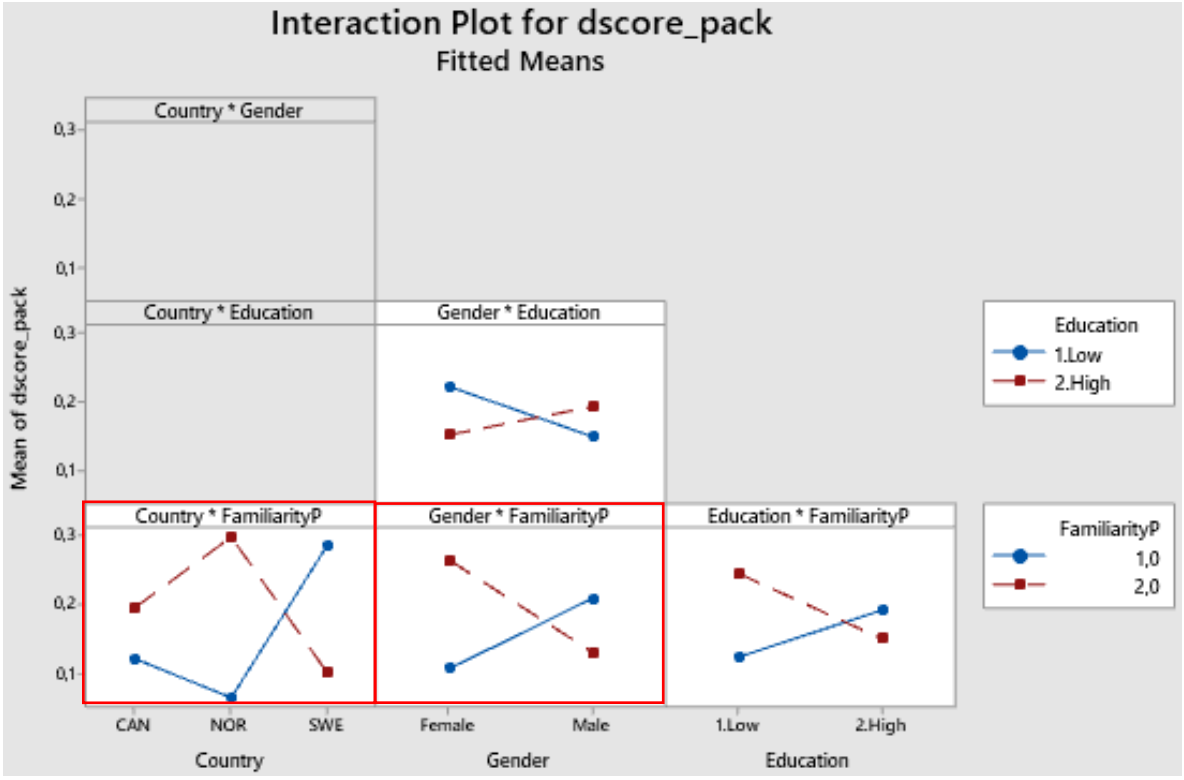


Figure 31. *Interaction plots from the ANOVA model for packaged products.*

4.6 Willingness to buy/consume

4.6.1 Willingness to buy/consume – Home vs. Store context

Approximately half of the consumers in Canada and Sweden were put into either an evoked context of being at the store or at home and rated their willingness to buy/consume all products from the 'fruits and vegetables' and 'packaged products' categories on 9-point scales (see Figure 32). All optimal products were rated with significantly higher willingness to buy/consume than their suboptimal counterpart based on ANOVA-results ($p<0.05$). Both the

optimal and the suboptimal variants of each product category (i.e. 'fruits and vegetables' and 'packaged products') were rated with significantly higher willingness to buy/consume in the home context compared to the store context. Optimal fruits and vegetables were rated significantly higher than packaged products in both contexts. The willingness-to-buy-scores follow similar trends as the measured expected liking, safety and quality in task 3 which indicates that these are factors that have an effect when consumers are choosing which product to purchase at the store or consume at home.

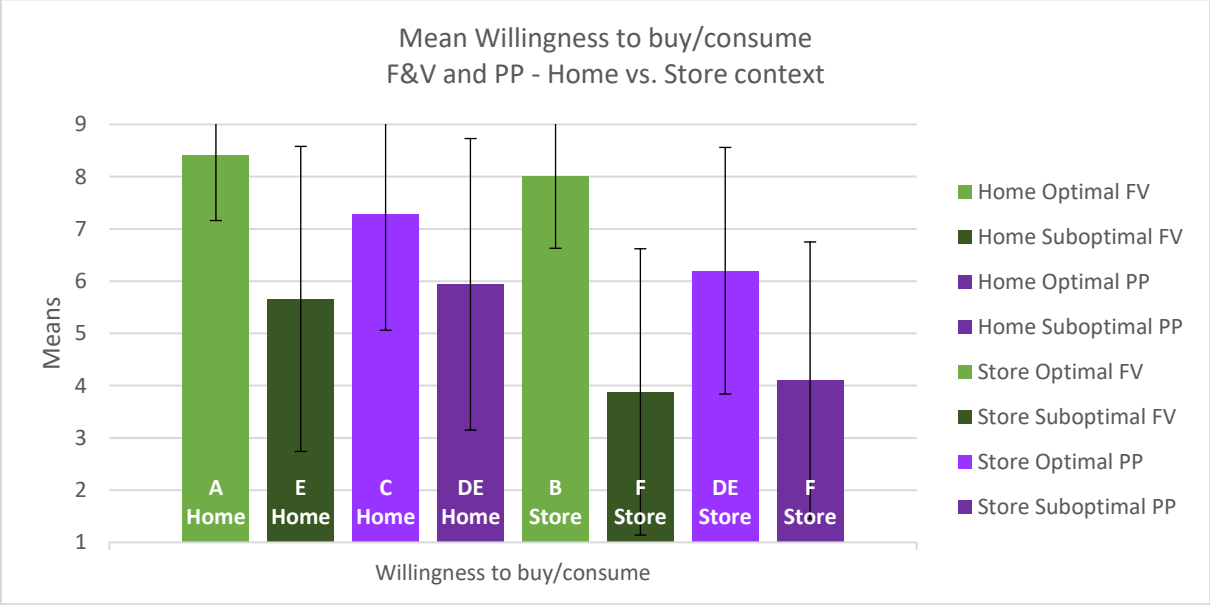


Figure 32. *Mean willingness to buy/consume in home and store context measured for both product categories with error bars representing standard deviations. Means that do not share a letter are significantly different from each other.*

4.6.2 Modelling stated behavior based on willingness to buy/consume for all products

The refined PLS regression model for stated behavior based on willingness to buy/consume for all products retained the following X-variables: country, statements c, h, o, s, t, u, w, y and z, D-score for all products, context, expected liking, safety and quality. D-score is not significant, meaning the implicit approach-avoid tendencies are not related to stated willingness to buy/consume all products. In this 2-factor model, 81% Y-variance is explained. Figure 33 shows the weighted regression coefficients explaining which variables are significantly positively or negatively related to stated willingness to buy/consume for all suboptimal products.

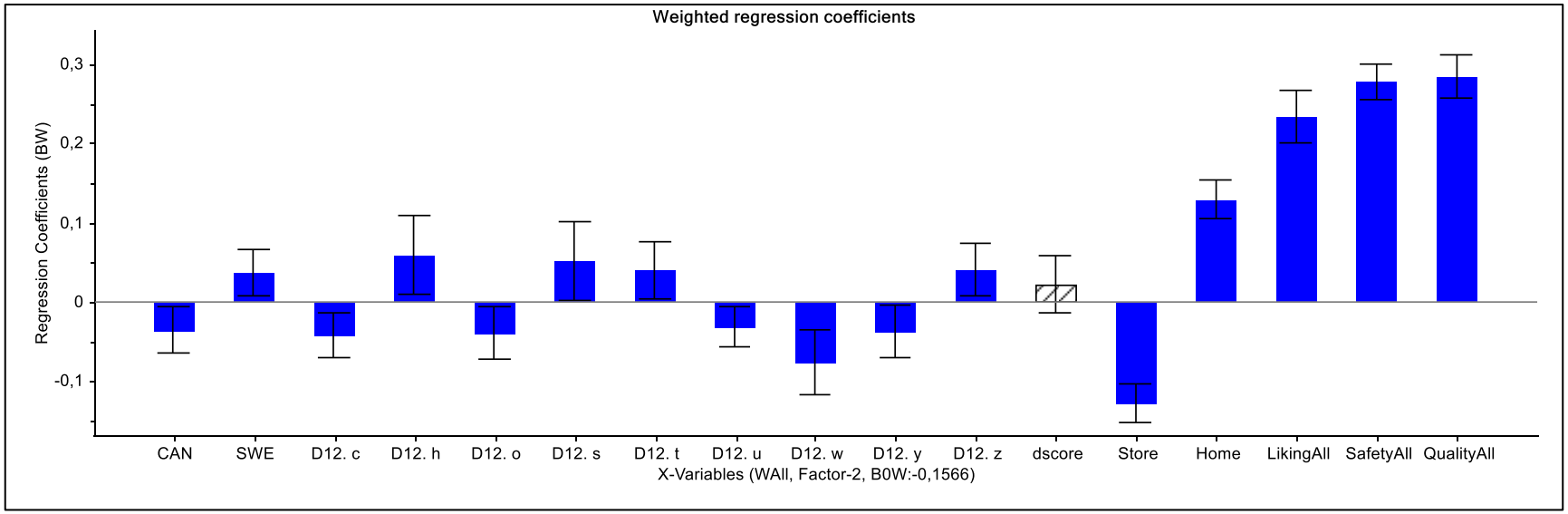


Figure 33. *Weighted regression coefficients from PLSR-model describing willingness to buy/consume, all products confounded. Variables with positive coefficients are significantly positively related to stated willingness to buy/consume suboptimal products, while variables with negative coefficients are significantly negatively related to stated willingness to buy/consume suboptimal products ($p<0.05$).*

Variables that are significantly positively related to stated willingness to buy/consume all suboptimal products are consumers from Sweden, are in the evoked context of being at home, have higher expected liking, safety and quality rating of suboptimal products and that score higher in agreement on the following attitudes:

h. *"It is important to me that the foods I choose are environmentally friendly"*,

s. *"As long as there are still hungry people in this world, food should not be thrown away"*,

t. *"I always eat what is on my plate"* and

z. *"I frequently buy food close to the best-before date, if it is offered at a lower price"*.

Variables that are significantly negatively related to stated willingness to buy/consume all suboptimal products are consumers from Canada, are in the evoked context of being in a store and that score higher in agreement on the following attitudes:

c. *"I frequently check my food inventories prior to my shopping trip"*,

o. *"When cooking, I first and foremost consider taste"*,

u. *"I always plan what we are going to eat a couple of days in advance"*,

w. *"I appreciate that packaging keeps products hygienic and safe"* and

y. *"I compare date labels to select food with the longest shelf life"*.

4.6.3 Modelling stated behavior based on willingness to buy/consume for fruits and vegetables

The refined PLS regression model for stated behavior based on willingness to buy/consume fruits and vegetables retained the following X-variables: country, shopping, familiarity of fruits and vegetables, statements b, h, s, t, u, w, x, y and z, D-score for fruits and vegetables, context, expected liking, safety and quality. D-score is not significant, meaning the implicit approach-avoid tendencies are not related to stated willingness to buy/consume fruits and vegetables. In this 2-factor model, 79% Y-variance is explained, and a plot showing the weighted regression coefficients explaining which variables are significantly positively or negatively related to stated willingness to buy/consume suboptimal fruits and vegetables is presented in Figure 34.

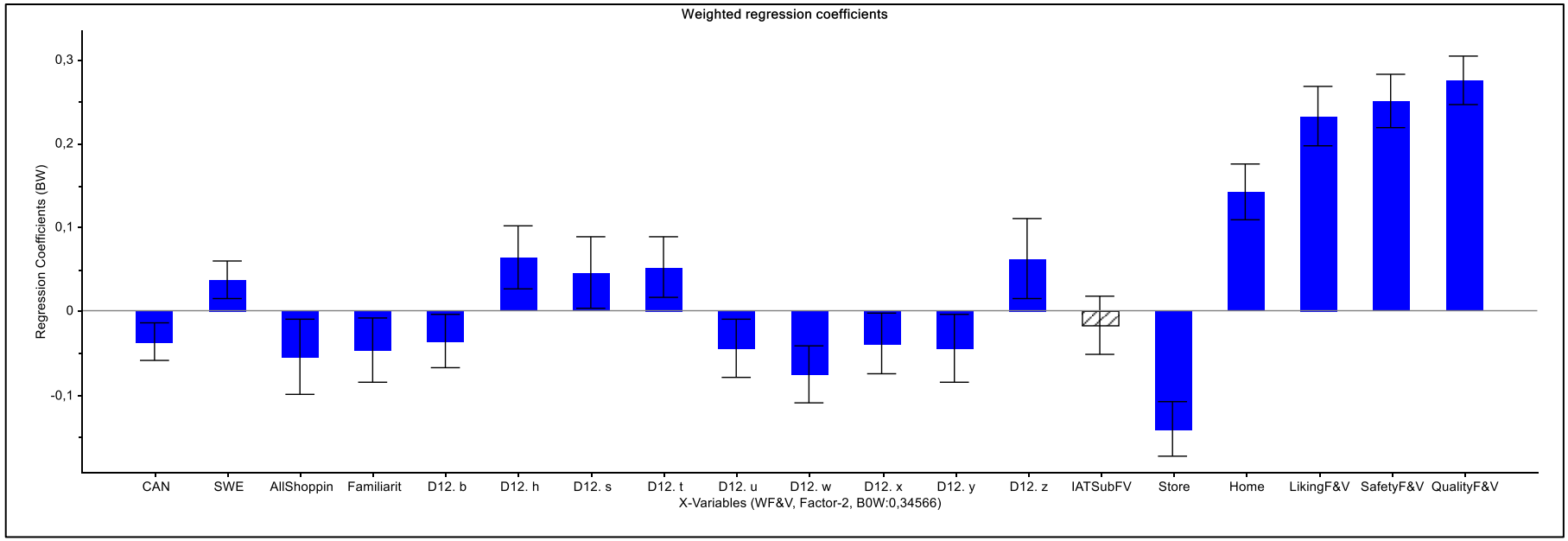


Figure 34. *Weighted regression coefficients from PLSR-model describing willingness to buy/consume fruits and vegetables. Variables with positive coefficients are significantly positively related to stated willingness to buy/consume suboptimal fruits and vegetables, while variables with negative coefficients are significantly negatively related to stated willingness to buy/consume suboptimal fruits and vegetables (p<0.05).*

Variables that are significantly positively related to stated willingness to buy/consume suboptimal fruits and vegetables are consumers from Sweden, are in the evoked context of being at home, have higher expected liking, safety and quality rating of suboptimal fruits and vegetables and that score higher in agreement on the following attitudes:

h. *"It is important to me that the foods I choose are environmentally friendly"*,

s. *"As long as there are still hungry people in this world, food should not be thrown away"*,

t. *"I always eat what is on my plate"* and

z. *"I frequently buy food close to the best-before date, if it is offered at a lower price"*.

Variables that are significantly negatively related to stated willingness to buy/consume suboptimal fruits and vegetables are consumers from Canada, are in the evoked context of being in a store, are responsible for all of their household shopping, have higher familiarity of the fruits and vegetables and that score higher in agreement on the following attitudes:

b. *"I frequently check my food inventories prior to my shopping trip"*,

u. *"I always plan what we are going to eat a couple of days in advance"*,

w. *"I appreciate that packaging keeps products hygienic and safe"*,

x. *"I compare product appearance to decide which fruit and vegetable to buy"* and

y. *"I compare date labels to select food with the longest shelf life"*.

4.6.4 Modelling stated behavior based on willingness to buy/consume for packaged products

The refined PLS regression model for stated behavior based on willingness to buy/consume packaged products retained the following X-variables: age, living area, familiarity of packaged products, statements o and w, D-score for packaged products, context, expected liking, safety and quality. D-score is not significant, meaning the implicit approach-avoid tendencies are not related to stated willingness to buy/consume packaged products. In this 1-factor model, 71% Y-variance is explained, and a plot showing the weighted regression coefficients explaining which variables are significantly positively or negatively related to stated willingness to buy/consume suboptimal packaged is presented in Figure 35.

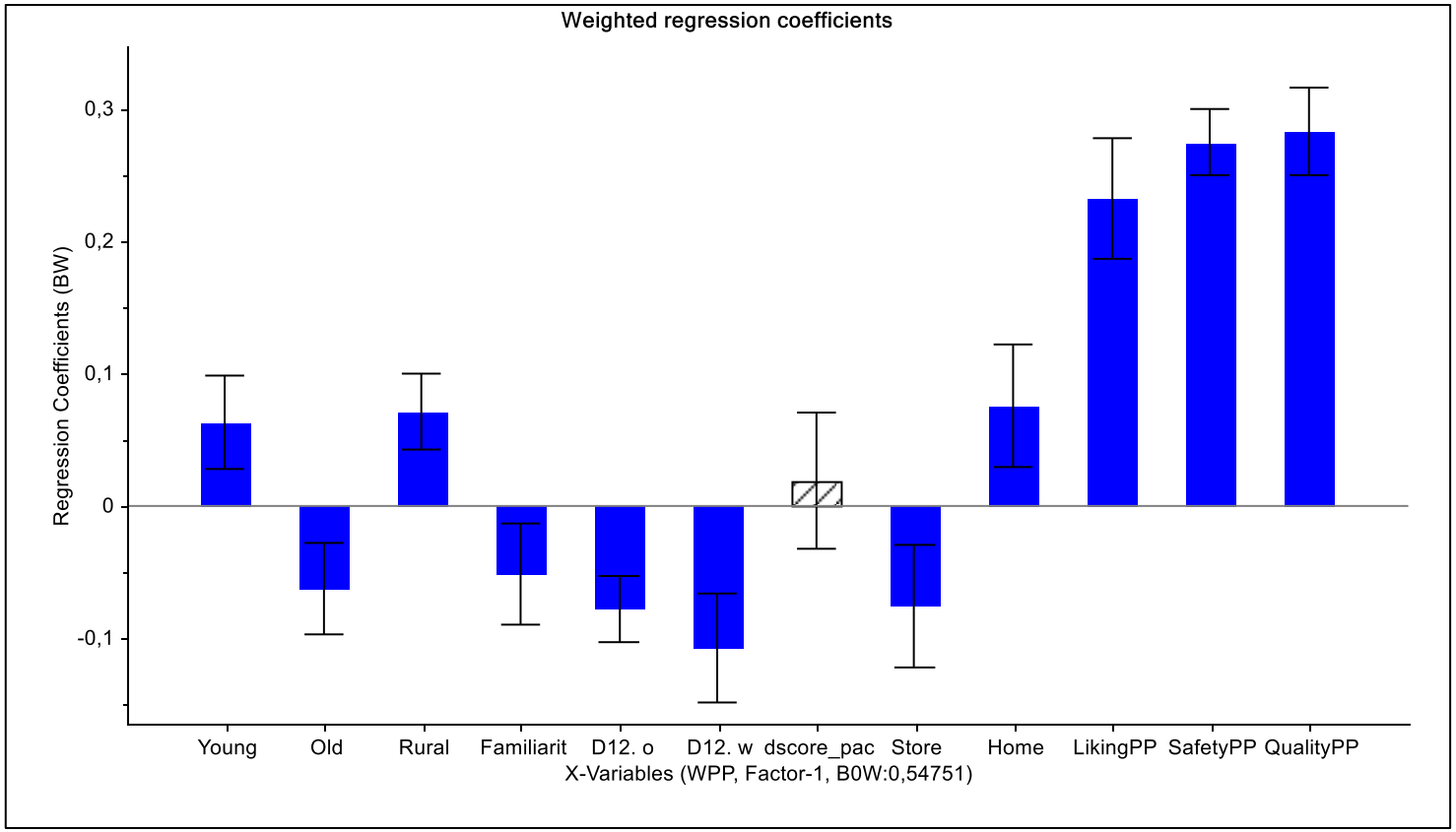


Figure 35. *Weighted regression coefficients from PLSR-model describing willingness to buy/consume packaged products. Variables with positive coefficients are significantly positively related to stated willingness to buy/consume suboptimal packaged products, while variables with negative coefficients are significantly negatively related to stated willingness to buy/consume suboptimal packaged products ($p<0.05$).*

Variables that are significantly positively related to stated willingness to buy/consume suboptimal packaged products are consumers in the young age group, that live in rural areas, are in the evoked context of being at home, have higher expected liking, safety and quality rating of suboptimal packaged products. Variables that are significantly negatively related to stated willingness to buy/consume suboptimal packaged products are consumers in the older age group, are in the evoked context of being in a store, have higher familiarity of the packaged products and that score higher in agreement on the following attitudes:

o. *"When cooking, I first and foremost consider taste"* and

w. *"I appreciate that packaging keeps products hygienic and safe"*.

4.6.5 Willingness to buy/consume results overview

Based on the above models, we can see that consumers are more willing to consume suboptimal products at home than to purchase them in a store and that their willingness to buy/consume increases with higher expected liking, safety and quality evaluations of suboptimal products. Positive significant variables for fruits and vegetables are consumers from Sweden and higher agreement with attitudes related to the importance of environmentally friendly food and the importance of eating up your plate and not to throw food. For packaged products, consumers that are in the younger age group and that live in rural areas.

Variables that are significantly negative for suboptimal food in all models are being in an evoked context of being in a store and higher agreement with attitude w. Negative significant variables for fruits and vegetables are consumers that are from Canada, that are responsible for all of their households shopping, have high familiarity of the suboptimal fruits and vegetables and that have higher agreement with attitudes relating to the importance of food inventory planning. They agree with the statement that says that they buy more food than they can eat. They also compare products in the store in order to decide which fruits and vegetables to buy, preferably those with the longest shelf life. For packaged products, consumers that are in the older age group, that have high familiarity of the suboptimal packaged products and that have higher agreement with attitude o. "*When cooking, I first and foremost consider taste".*

4.7 Choice task

4.7.1 Choice task – Home vs. Store context

Approximately half of the Norwegian consumers were put into either an evoked context of being at the store or at home while conducting a choice task on the optimal and suboptimal products. By and large, consumers mostly chose optimal products both in the store context

and home context. By looking at the percentages of consumers who chose suboptimal products it is easier to see the difference between the consumers in the different evoked contexts. Table 9 gives an overview over the percentages of consumer who chose the suboptimal variant over the optimal, or the 'Neither' choice, for the two product categories. For both categories, consumers are more willing to choose the suboptimal variant in the home context. In the home context, the consumers more often selected suboptimal variants in the packaged products group (9.1% more) compared to the fruits and vegetables (1% more). In general, 5% of consumers chose suboptimal over optimal products in the home context compared to the store context.

Table 9. Percentage of consumers who chose suboptimal products in the choice-task.

Product category	**Store**	**Home**
Fruits and vegetables	10%	11%
Packaged products	7.3%	16.4%
Total mean	**9%**	**14%**

4.7.2 Modelling stated behavior based on choice task for all products

The refined PLS regression model for stated behavior based on the choice task for all products retained the following X-variables: gender, segment, statements d, e, h, l and p, D-score for all products, safety and quality. D-score is not significant, meaning the implicit approach-avoid tendencies are not related to stated choice of all products. In this 1-factor model, 14% Y-variance is explained, and a plot showing the weighted regression coefficients explaining which variables are significantly positively or negatively related to stated choice for all suboptimal products is presented in Figure 36.

Variables that are significantly positively related to stated choice of suboptimal products are consumers that are female, that belong to segment 1 ('quality seekers'), have higher rated safety and quality rating of suboptimal packaged products and that score higher in agreement on the following attitudes:

h. *"It is important to me that the foods I choose are environmentally friendly"* and

l. *"I make a point of using organic food products"*. Variables that are significantly negatively related to choice of suboptimal products are consumers that are male, that belong to segment 2 ('budget eaters') and that score higher in agreement on the following attitudes:

d. *"I only buy and eat foods which are familiar to me"*,

e. *"I dislike anything that might change my eating habits"* and

p. *"We use a lot of ready-to-eat foods in our household"*.

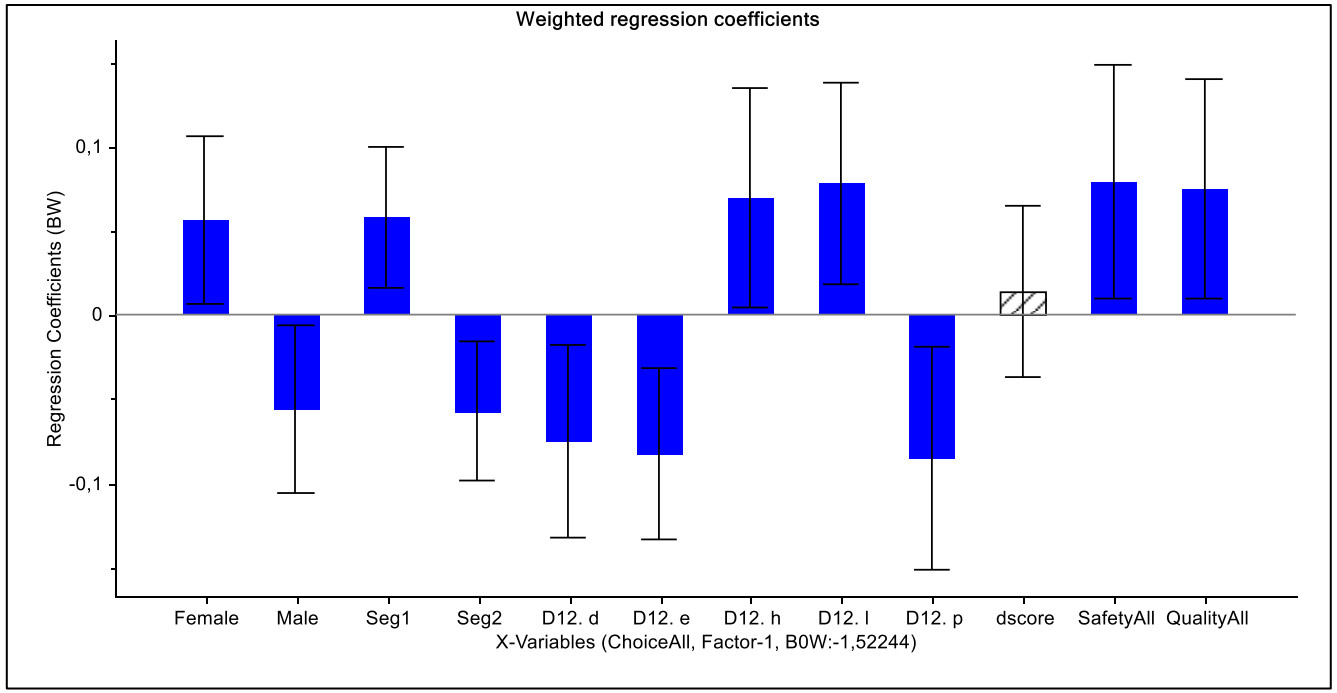


Figure 36. *Weighted regression coefficients from PLSR-model describing choice-task for all products. Variables with positive coefficients are significantly positively related to stated choice of suboptimal products, while variables with negative coefficients are significantly negatively related to stated choice of suboptimal products ($p<0.05$).*

4.7.3 Modelling stated behavior based on choice task for fruits and vegetables

The refined PLS regression model for Stated behavior based on the choice-task for the fruits and vegetables retained the following X-variables: age group, statements h, r, s and z, D-score for fruits and vegetables, expected liking, safety and quality. D-score is not significant, meaning the implicit approach-avoid tendencies are not related to stated choice of fruits and vegetables. In this 1-factor model, 18% Y-variance is explained, and a plot showing the weighted regression coefficients explaining which variables are significantly positively or negatively related to stated choice for suboptimal fruits and vegetables is presented in Figure 37.

Variables that are significantly positively related to stated choice of suboptimal fruits and vegetables are consumers that are between 18 and 24 years old, have higher expected liking, safety and quality rating of suboptimal packaged products and that score higher in agreement on the following attitudes:
h. *"It is important to me that the foods I choose are environmentally friendly"*,
r. *"I hate it when I need to throw food in the trash"*,
s. *"As long as there are still hungry people in this world, food should not be thrown away"* and
z. *"I frequently buy food close to the best-before date, if it is offered at a lower price"*. There are no variables that are significantly negatively related to choice of suboptimal fruits and vegetables.

4.7.4 Modelling stated behavior based on choice task for packaged products

The refined PLS regression model for Stated behavior based on the choice-task for the packaged products retained the following X-variables: segments, statements d, e, l, m, p, u and v, D-score for packaged products and evoked context. D-score is not significant, meaning the implicit approach-avoid tendencies are not related to stated choice of packaged products. In this 1-factor model, 16% Y-variance is explained, and a plot showing the weighted regression coefficients explaining which variables are significantly positively or negatively related to stated choice for suboptimal packaged products is presented in Figure 38.

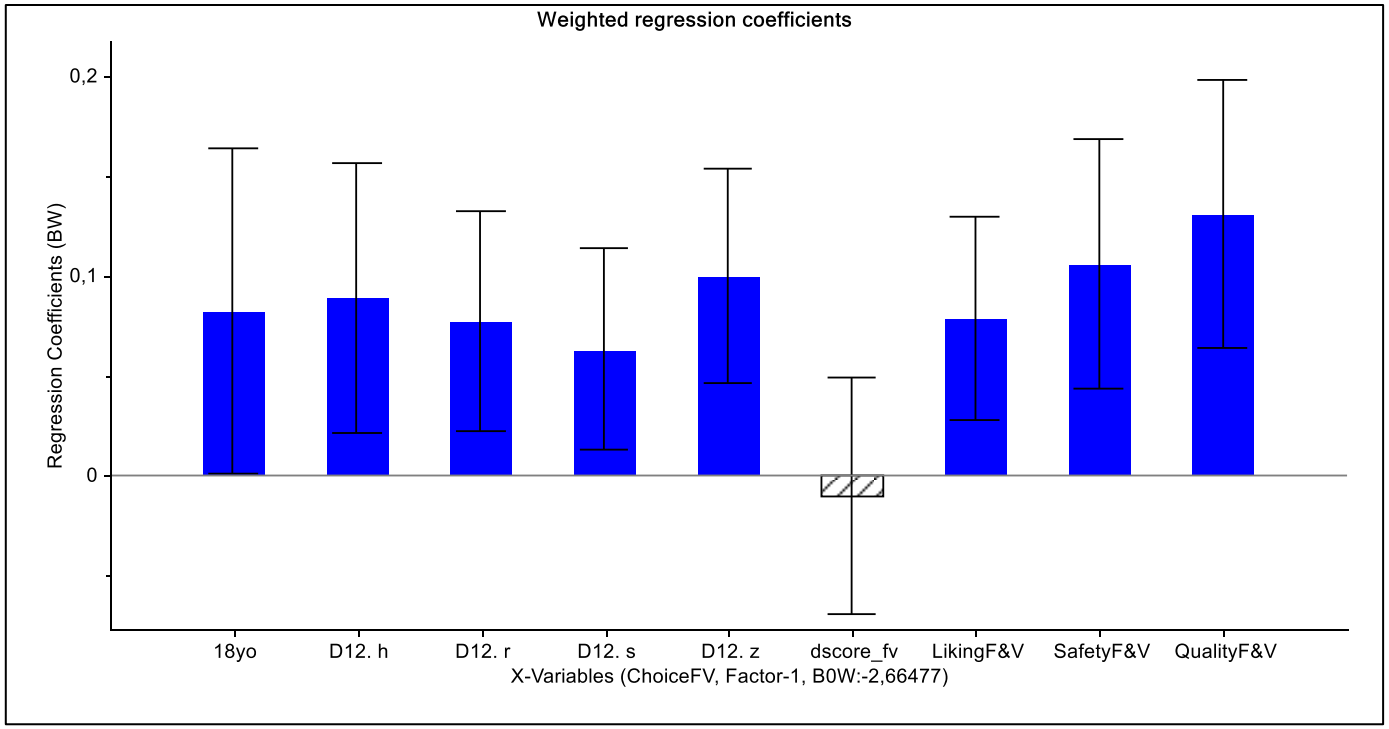


Figure 37. *Weighted regression coefficients from PLSR-model describing choice-task for fruits and vegetables. Variables with positive coefficients are significantly positively related to stated choice of suboptimal fruits and vegetables, while variables with negative coefficients are significantly negatively related to stated choice of suboptimal fruits and vegetables ($p<0.05$).*

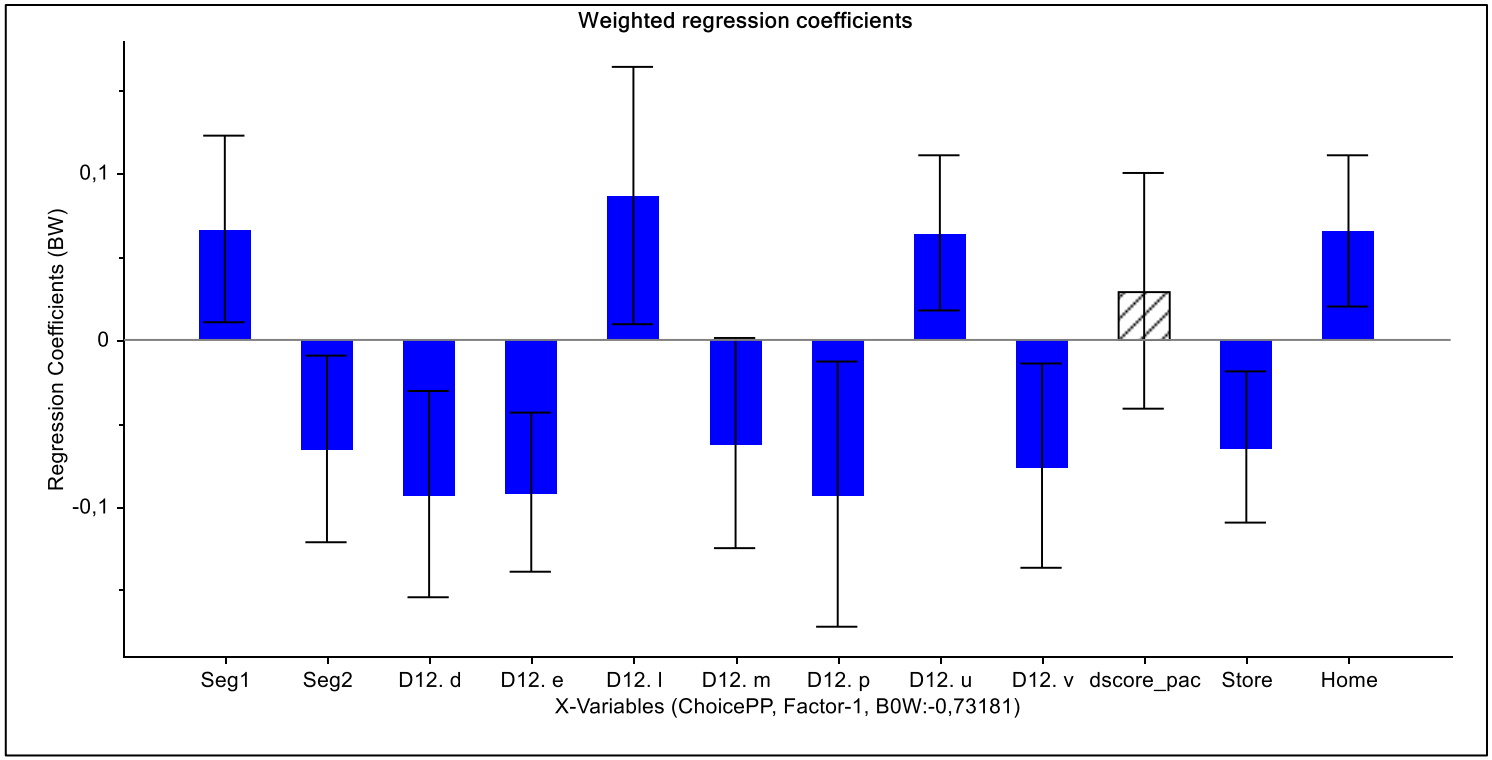


Figure 38. *Weighted regression coefficients from PLSR-model describing choice-task for packaged products. Variables with positive coefficients are significantly positively related to stated choice of suboptimal packaged products, while variables with negative coefficients are significantly negatively related to stated choice of suboptimal packaged products ($p<0.05$).*

Variables that are significantly positively related to stated choice of suboptimal fruits and vegetables are consumers that belong to segment 1 (‘quality seekers’), are in the evoked context of being at home and that score higher in agreement on the following attitudes:

l. *“I make a point of using organic food products”* and

u. *“I always plan what we are going to eat a couple of days in advance”*.

Variables that are significantly negatively related to choice of suboptimal packaged products are consumers that belong to segment 2 (‘budget eaters’), are in the evoked context of being in a store and that score higher in agreement on the following attitudes:

d. *“I only buy and eat foods which are familiar to me”*,

e. *“I dislike anything that might change my eating habits”*,

m. *“Getting a low price is more important to me than getting top quality”*,

p. *“We use a lot of ready-to-eat foods in our household”* and

v. *“What we are going to have for supper is very often a last-minute decision”*.

4.7.5 Choice-task, results overview

Based on the above models, we can see that the consumers who are more willing to choose suboptimal products are consumers that are female, that belong to segment 1 (‘quality seekers’), that have higher safety and quality evaluations of the suboptimal products and that have higher agreement with attitudes related to environmentally friendly food and food safety. Positive significant variables for fruits and vegetables are consumers that are between 18 and 24 years old, that have higher expected liking, safety and quality evaluations of the suboptimal fruits and vegetables and that have higher agreement with attitudes related to environmentally friendly food. They dislike throwing food as well as frequently buying food close to the best-before date if it is offered at a discount. For packaged products, consumers that belong to segment 1 (‘quality seekers’), that are in the evoked context of being at home and that have higher agreement related to organic food. They also plan what they are going to eat a couple of days in advance.

Variables that are significantly negative for suboptimal food in all models are consumers that are male, that belong to segment 2 (‘budget eaters’) and that have higher agreement with attitudes related to food habits. They are not positive to foods that are not familiar or that might change their eating habits. They often use ready-to-eat meals. Negative significant variables for packaged products are consumers that are belong to segment 2 (‘budget eaters’), that are in the evoked context of being in a store and that have higher agreement with the attitudes also relating to food habits. They agree that low price is more

important than top quality. They often use ready-to-eat meals and often plan what to have for supper at the last minute.

4.8 Results summary

Implicit associations to suboptimal foods generally aligned with explicit assessments. Stated behavior was successfully related to socio-demographic factors and explicit assessments, but not to implicit measures: incorporation of D-score values did not improve any of the predictive models. The low-cognitive explicit choice-task was not more related to implicit associations than the high-cognitive explicit task based on scales. Evoked context effects of either being at home or in a store are important with regard to explicit responses to suboptimal foods of both product categories. 'Quality seekers' (higher education, higher income, make meals from scratch, choose long shelf life, natural and organic) explicitly reject suboptimal foods more than 'budget eaters' (lower education, eat frozen and ready-made foods, concerned with price, eat up their plate, hate to throw food).

5. Discussion

The main objective of this thesis is threefold. First, to compare consumers' implicit and explicit attitudes towards optimal and suboptimal foods. Second, to investigate the complementarity of implicit and explicit methods when predicting consumer behavior from either high-cognitive and low-cognitive stated measures. Finally, to find out if context has an effect on consumers' explicit perception of suboptimal foods. In addition to this, a secondary objective was to reveal cultural, attitudinal and sociodemographic effects in consumers' perception of suboptimal foods, both implicitly and explicitly.

In this chapter, the most important results related to the main objectives will be compared and discussed. First, the focus will be on fruits and vegetables versus packaged products. Then, on implicit versus explicit assessments of the optimal and suboptimal foods followed by socio-demographic, attitudinal and cultural differences. Finally, the focus will be the methodological approach and lastly, limitations and further research.

5.1 Fruits and vegetables versus packaged products

Familiarity was measured for all product stimuli using the optimal image variants. The fruits and vegetables were all rated as significantly more familiar to the consumers than the packaged products. While all the individual types of fruits and vegetables were rated as equally familiar, which makes sense as these are all common products in all three countries, the

familiarity ratings for the packaged products varied with large standard deviations for all four variants. This is likely due to the fact that while we can safely assume that the consumers were familiar with apple juice, biscuits, canned tomatoes and pasta, they might not have been familiar with the specific brands used in this study. To potentially prevent this, the question could be rephrased from *"How familiar are you with this product?"* to *"How familiar are you with products of this kind?"*. However, this phrasing would not fit well when assessing fruits and vegetables. The choice was made to keep the wording simple and identical for both product categories. Ultimately, all products rated on average higher than the middle point, validating the selection of products as familiar products of the two product categories 'fruits and vegetables' and 'packaged products'.

Expected liking for the optimal fruits and vegetables was significantly higher than for the optimal packaged products. However, there was no significant difference between expected liking for the suboptimal fruits and vegetables and the suboptimal packaged products. While the direct damaging of the products shown in the images of the fruits and vegetables might negatively affect the sensory characteristics of the products more than the damage to the packaging as shown on the packaged products, the results do not reflect this. The expected liking follows a similar trend to the familiarity ratings in that the fruits and vegetables are rated as having higher expected liking and are more familiar to the consumers compared to the packaged products. This is in agreement with the mere-exposure effect theory developed by Zajonc (1968) which suggests that people develop preferences for things based on their familiarity with them. Safety ratings showed similar results to expected liking in that the perceived safety of the optimal fruits and vegetables were rated higher than the optimal packaged products. For the suboptimal products, the perceived safety was rated equal across product categories. This indicates that the direct damage to the fruits and vegetables was not perceived as any less safe than the damaged packaging on the packaged products, regardless if this might be true or not in terms of potentially harmful microbial activity that can occur. Finally, the rated quality of the products followed a similar trend to both expected liking and safety. Optimal fruits and vegetables were rated as being of higher perceived quality than the optimal packaged products, while the quality ratings of the suboptimal variants in both product categories were equal. The similar ratings of expected liking, safety and quality indicate that they are correlated.

5.2 Implicit versus explicit measurements

In general, the results from the approach-avoidance motivational IAT showed a slight approach tendency towards optimal products. This is in line with the results from the explicit measures, although the explicit results, as well as predicted stated behavior, show far stronger preferences towards the optimal products in general. A similar trend was reported by Bolos et al. (2019) when they compared implicit to explicit attitudes towards apples of different qualities and freshness levels. In our study, the mean D-score across all consumers was 0.18 with a high standard deviation of 0.47 compared to the mean. This indicates that the consumers, on average, did not express any noteworthy approach or avoidance tendencies towards optimal foods as compared to suboptimal. This could be due to the fact that the distinction between optimal and suboptimal foods does not generate motivational differences large enough to be measured using implicit approaches.

By incorporating the D-scores with socio-demographic, attitudinal and design factors in ANOVA-models, it was revealed that some variables were significantly affecting the implicit approach-avoidance tendencies towards the suboptimal products. Three models were fitted for all 16 products together, for fruits and vegetables only and for packaged products only. Important variables in all three models were country, gender and the contribution to household shopping. Consumers responsible for all of their household's grocery shopping, or who lived in rural areas, showed stronger approach tendencies towards suboptimal products. In Norway, females had stronger approach tendencies towards suboptimal fruits and vegetables than males. With regards to the packaged products, Swedes with high familiarity of packaged products were more positive towards the suboptimal variants, while in Norway it was the opposite. It should be noted, however, that all ANOVA-models were quite weak, with R^2 ranging from 6.66% to 9.60%. This is, again, likely due to the low measured D-scores and the high standard deviations. In order to identify potential effects in the ANOVA-models based on the implicit measures, we are discussing any variable with p-value below 0.1, instead of 0.05 as is more commonly used. Whether consumers belonged to the quality seekers or budget eaters segment did not have a significant effect on implicit approach-avoidance tendencies, while in the explicit measures quality seekers explicitly rejected suboptimal foods more than the budget eaters.

When designing this study, we hypothesized that explicit measures would better predict stated behavior than implicit measures, but that implicit measures would positively contribute to improving the predictive ability of consumer behavioral models, as found by Bolos et al. (2019). In their study, explicit measures better predicted consumer waste behavior in general

compared to implicit measures, but the implicit measures positively contributed to the predictive ability of their consumer behavioral models. We also saw in our results that explicit measures better predicted stated behavior compared to implicit measures, as the models in these cases were stronger and showed more significant effects. However, the inclusion of D-score based on the implicit measures when predicting stated behavior did not improve any of our models. Hence, when we hypothesized that implicit measures would gain in predictive power when predicting low-cognition behavioral measures through choice task compared to willingness to buy/consume scales, this did not turn out to be true either as the D-score was not significant either way. This is likely due to the generally weak approach-avoidance tendencies that were measured by the IAT.

In general, nearly all consumers preferred the optimal to the suboptimal variant for all the products, both for the Norwegian consumers who did a choice task and the Swedish and Canadian consumers who's willingness to buy or consume was measured using scales. Overall, the willingness to buy/consume measures resulted in stronger predictive models compared to the measurements gained by the choice task. This is likely due to the fact that in the choice task, consumers were always met with the option of choosing between an optimal and a suboptimal variant of the same product, making the choice quite obvious and one-sided in almost all cases. This does not allow for the same level of granularity as 9-point scales, skewing the results more heavily towards the optimal variant.

Based on previous research, it was expected that most consumers would prefer the optimal over the suboptimal product variants. In the study conducted by Bolos et al. (2019), the difference between the two purchase likelihood scores, i.e. optimal and suboptimal, was significant with the optimal variants scoring the highest. de Hooge et al. (2017) saw in their results that out of the six product choices in their choice task, only one or two of the suboptimal products were selected on average. At approximately 25%, this is much higher than the 11.5% that chose suboptimal variants in our study. This could be due to the images used for representing the optimal and suboptimal products, although in the case of apples, biscuits and apple juice, we used the same images as they did for our study (with permission). Aschemann-Witzel et al. (2018b) also reported a preference in the consumers for the optimal products.

In our study there was, however, there were certain groups of consumers who were more accepting of the suboptimal products. An especially important variable for accepting suboptimal products was the evoked context the consumers were put in when measuring stated behavior. While in an evoked context of being at home, suboptimal products were significantly less often rejected compared to the evoked context of being in a store. This was

true for fruits and vegetables (both for consumers using scales and consumers doing a choice task) and the packaged products (for consumers using scales). This context effect confirms another one of our hypotheses and is in line with previous research on optimal and suboptimal food (de Hooge et al., 2017), who reported that consumers were four times more likely to choose suboptimal foods in an evoked context of being at home compared to in a store in an online choice task. When met with the choice between an optimal and a suboptimal variant of a product in a store there might not be an incentive for picking the suboptimal variant, unless it is offered at a discount. While most people understand that the suboptimal variant eventually will end up as food waste if no one ends up purchasing it, the act of actually throwing the product out is not directly in the hands of the consumer, but rather the store. However, when met with the choice between an optimal and suboptimal product at home, the product has already been purchased. Consequently, by not choosing the suboptimal variant at home, the consumer will eventually have to throw it out themselves, possibly bringing on a certain set of guilt of having wasted either the food, the money spent by purchasing it, or both. In the study conducted by Qi and Roe (2016), guilt of throwing away food was the statement that most respondents (77.2%) expressed the higher degree of agreement with.

5.3 Socio-demographic, attitudinal and cultural differences

One of the hypotheses in this study was that socio-demographic, cultural and attitudinal effects would occur, possibly revealing segments of consumers. This was confirmed, as through clustering methods, two consumer segments were generated from the consumers' responses to the various statements included in the modified Food (Waste)-related Lifestyle attitudinal questionnaire. The first segment is what we called the 'quality seekers'. Consumers in this segment are concerned with products being natural, organic and of high quality with a long shelf life. It is also important for them to make meals from scratch and have good control over what they eat to make sure it's healthy. This segment consisted mostly of females, in the highest age group, with high education and income, and/or shared shopping responsibilities. These consumers were also more often from Canada. The other segment, the 'budget eaters', are more concerned with convenience and low prices. Consumers in this segment reported that they commonly consume frozen and ready-made foods. They hate throwing away food, and it is important to them that they eat everything on their plate. The budget eaters' attitudes towards avoiding wasting food are potentially beneficial for reducing food waste. In terms of lowering prices, de Hooge et al. (2017) revealed in an online choice experiment that by offering suboptimal foods at a discount, more consumers were willing to choose them over their optimal counterpart. Consumers in the budget eaters segment had higher expected liking towards suboptimal fruits and vegetables compared to the quality seekers, indicating that discounted

fruits and vegetables might have a potential segment of customers in the budget eaters. The quality seekers explicitly rejected suboptimal products more than the budget eaters. Qi and Roe (2016) saw similar results in that consumers from higher income households more strongly agreed with statements that linked 'throwing away uneaten food' to 'perceived private benefits'.

5.4 Methodological approach

Another reason for the low D-score and high standard deviation measured in the IAT could be that the color and shape coding that represented the optimal and suboptimal product categories during the IAT actually resulted in indirect measurements of approach and avoid tendencies. This categorization of optimal and suboptimal products based on colors or shapes might have distracted the consumers from perceiving the state of the product shown in the image making the difference between the optimal and suboptimal variants lower. A potential solution to this could be to refer to the categories directly as 'Optimal' and 'Suboptimal' instead of using the aforementioned color and shape coding of the images. In their study on apples, Bolos et al. (2019) conducted an evaluative IAT to measure positive-negative tendencies to categories "optimal" and "suboptimal". These authors were able to successfully implement the IAT in their study to measure strong positive and negative implicit associations towards optimal and suboptimal apples with a resulting D-score of 0.93 and a standard deviation of 0.47. This could indicate that using 'Optimal' and 'Suboptimal' as categories in the IAT is more appropriate, or that evaluative tendencies are stronger than motivational tendencies when it comes to optimal and suboptimal food. Their study was also more streamlined by only considering one type of product (i.e. apples) as opposed to the wide range of fruits and vegetables and packed products that were used in this study.

An alternative to using the motivational IAT for measuring approach-avoidance tendencies that could have been used is the Approach-Avoidance Task (AAT) (Chen & Bargh, 1999; Solarz, 1960). In summary, this method incorporates a lever, or in the last few decades, a computer joystick, in order for the consumer to either avoid stimuli (by pushing the joystick away from them) or approach it (by pulling the joystick towards them). Similar to the IAT, this task also measures reaction times, in this case how fast the consumer pushes or pulls the joystick when responding to a positively or negatively valenced stimulus. Seeing as this method requires peripherals such as a joystick, compared to a standard computer keyboard as is required for the IAT, implementing the AAT in an online test would have restricted the eligibility criteria for participation dramatically. Coincidentally, in the process of writing this thesis, Zech et al. (2020) published an article presenting a new mobile version of the AAT that

runs on smartphones. In their study, 56 respondents' approach-avoidance tendencies towards happy and angry faces were measured both using the mobile AAT and the established version of the AAT using joysticks. While they were not able to measure a correlation between the mobile AAT and the zooming joystick AAT, the mobile AAT did successfully measure their hypothesized interaction effect between happy and angry faces indicating that this version of the AAT could be useful in settings where a joystick is not available (i.e. an online test). Future research may incorporate the mobile AAT as a part of an online consumer test in order to investigate approach-avoidance tendencies towards suboptimal foods.

5.5 Limitations and further research

In total, 459 consumers were included in data analysis. Ideally, we aimed for balanced groups of consumers with regards to gender, age and education. However, as an effect of convenience sampling, in all countries gender, education and age were unbalanced towards more females (especially in Sweden), younger consumers (especially in Sweden) and higher education (especially in Canada). Considering the practicalities of conducting this online study, and the large amount of consumers that dropped out during the test, mostly due to the obligatory installation of the IAT software (out of 683 consumers who started the IAT, only 535 completed), it was difficult to monitor this balance in the socio-demographics of the consumers while the test was live. The calculation of D-scores from the implicit measurements, which had to be done after the online experiment was completed, also further disqualified 10.5% of the consumers from our datasets due to unrealistically fast or unrealistically slow responses. All in all, this means it was impossible to know exactly the situation of the socio-demographics we would end up with in our consumer selection. Due to time and funding it was not possible to re-open the test in order to get additional consumers of the gender, age and education that would have been needed for a more balanced dataset. Both Bolos et al. (2019) and de Hooge et al. (2017) both reported stronger effects with regards to IAT and choice task, respectively, than what was found in our study. One of the reasons for this could be due to their larger number of consumers. However, with regards to the IAT specifically, studies frequently feature a much lower amount of respondents (Greenwald et al., 2009), than what was featured in our study, while still measuring strong effects, indicating that our weak D-score might be more related to the experimental design than to our consumer selection.

The low D-score measured in this study could be due to the fact that implicit motivational tendencies might be dependent on context. By incorporating evoked contexts in our explicit measurements of stated behavior, we saw that the acceptance towards suboptimal products were significantly higher when the consumers were put into an evoked context of

being at home as compared to in a store. However, incorporating evoked contexts into an IAT might prove difficult as the main focus for the consumer is on the categorization task itself, with opportunities for reminding the consumer of which context they are in being few and far between during the test. Future research may explore alternative implicit testing methodologies and investigate the potential effect of context on implicit responses to suboptimal foods.

As this study was conducted in the form of an online test, there was no option for the consumers to ask questions to the experimenters during the test. While consumers may be familiar with questions in the form of traditional questionnaires and through scales, the IAT is a foreign concept to most people. There is a possibility that the low measured D-score is a result of consumers not fully understanding the test. However, when calculating D-scores by following Greenwald et al. (2003) suggestions, all consumers who either answered too fast or too slow, or had an error rate over 10% were disqualified from the test which should help in solving this problem.

6. Conclusion

The main objective of this thesis was to investigate the use and potential complementarity of implicit and explicit methodology in order to measure consumers' attitudes towards optimal and suboptimal foods

In order to answer these objectives, 459 consumers were recruited in three countries (Canada, Sweden and Norway) to participate in an online test. First, the respondent answered a few questions regarding socio-demographics followed by a food and food-waste related attitudinal questionnaire. After this, a total of 16 images of optimal and suboptimal foods belonging to two product categories, 'fruits and vegetables' and 'packaged products', were implicitly assessed using the Implicit Association Test. Then the same food images were evaluated explicitly in terms of expected liking, safety and quality using 9-points scales. Finally, an explicit stated behavior assessment of the same images was done either using 9-point scales (willingness to buy or consume) or through a choice task. For this last task, consumers were placed in an evoked context of either being at home or in a store.

Our results showed that implicit associations to suboptimal foods generally aligned with explicit assessments. Stated behavior was best predicted from explicit measures compared to implicit measures. Incorporation of implicit measures did not improve any of the predictive models. The low-cognitive explicit choice-task was not more related to implicit associations than the high-cognitive 9-point scale task. Corroborating previous research, our results show that evoked context effects of either being at home or in a store were important with regard to responses to suboptimal foods of both product categories. 'Quality seekers' (higher education, higher income, make meals from scratch, choose long shelf life, concerned with natural and organic products, 54.5% of the respondents) explicitly rejected suboptimal foods more than 'budget eaters' (lower education, eat frozen and ready-made foods, concerned with price, eat up their plate, hate to throw food, 45.5% of the respondents).

These results bring light on consumer acceptance of suboptimal food products through internal and external cognitive processes. Future research may explore alternative implicit testing methodologies and investigate the potential effect of context on implicit responses to suboptimal foods.

7. Literature list

Abdi, H. (2010). Partial least squares regression and projection on latent structure regression (PLS Regression). *WIREs Computational Statistics*, 2 (1): 97-106. doi: 10.1002/wics.51.

Almli, V. L. & Næs, T. (2018). Measuring Implicit Associations in Food-Related Consumer Research. In Ares, G. & Varela, P. (eds) *Methods in Consumer Research, Volume 1: New Approaches to Classic Methods*, pp. 485-529: Woodhead Publishing.

Aschemann-Witzel, J., de Hooge, I., Amani, P., Bech-Larsen, T. & Oostindjer, M. (2015). Consumer-Related Food Waste: Causes and Potential for Action. *Sustainability*, 7 (6): 6457-6477. doi: 10.3390/su7066457.

Aschemann-Witzel, J., de Hooge, I. E., Almli, V. L. & Oostindjer, M. (2018a). Fine-Tuning the Fight Against Food Waste. *Journal of Macromarketing*, 38 (2): 168-184. doi: 10.1177/0276146718763251.

Aschemann-Witzel, J., Giménez, A. & Ares, G. (2018b). Consumer in-store choice of suboptimal food to avoid food waste: The role of food category, communication and perception of quality dimensions. *Food Quality and Preference*, 68: 29-39. doi: https://doi.org/10.1016/j.foodqual.2018.01.020.

Ashby, C. R. & Stritzke, W. G. (2013). Is sensitivity to reward associated with the malleability of implicit inclinations toward high-fat food? *Emotion*, 13 (4): 711-23. doi: 10.1037/a0031611.

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. doi: 10.1016/j.foodqual.2019.02.011.

Bolton, L. E. & Alba, J. W. (2012). When less is more: Consumer aversion to unused utility. *Journal of Consumer Psychology*, 22 (3): 369-383. doi: https://doi.org/10.1016/j.jcps.2011.09.002.

Borgogno, M., Favotto, S., Corazzin, M., Cardello, A. & Piasentier, E. (2015). The role of product familiarity and consumer involvement on liking and perceptions of fresh meat. *Food Quality and Preference*, 44. doi: 10.1016/j.foodqual.2015.04.010.

Brunsø, K. & Grunert, K. G. (1995). Development and Testing of a Cross-Culturally Valid Instrument: Food-Related Life Style. *Advances in Consumer Research*, 22: 475-480.

Brunsø, K. G., K. G. (1995). Development and Testing of a Cross-Culturally Valid Instrument: Food-Related Life Style. *Advances in Consumer Research*, 22: 475-480.

Cardello, A. V. S., H. G. (2005). Sensory Science: Measuring Consumer Acceptance. In Hui, Y. H. S., F. (ed.) *Handbook of Food Science, Technology, and Engineering - 4 Volume Set* pp. 56-2-56-16: CRC Press.

Chen, M. & Bargh, J. A. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin*, 25 (2): 215-224. doi: 10.1177/0146167299025002007.

de Hooge, I. E., Oostindjer, M., Aschemann-Witzel, J., Normann, A., Loose, S. M. & Almli, V. L. (2017). This apple is too ugly for me! *Food Quality and Preference*, 56: 80-92. doi: 10.1016/j.foodqual.2016.09.012.

EU. (2016). *Regulation (EU) 2016/679 (General Data Protection Regulation)*. Official Journal of the European Union. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679 (accessed: 04.03.20).

FAO. (2011). *Global food losses and food waste - Extent, causes and prevention*. Available at: http://www.fao.org/3/a-i2697e.pdf (accessed: 01.03.20).

FAO. (2019). *The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction.* The State of the World. Available at: http://www.fao.org/3/ca6030en/ca6030en.pdf (accessed: 01.03.20).

Gawronski, B. & Creighton, L. A. (2013). Dual process theories. In Oxford library of psychology., *The Oxford handbook of social cognition.*, pp. 282-312. New York, NY, US: Oxford University Press.

Göbel, C., Langen, N., Blumenthal, A., Teitscheid, P. & Ritter, G. (2015). Cutting Food Waste through Cooperation along the Food Supply Chain. *Sustainability*, 7 (2): 1429-1445. doi: 10.3390/su7021429.

GoGift. (n.d.). *SuperPresentKortet*. Available at: https://www.gogift.com/sv-SE/product/100277/SuperPresentkortet (accessed: 14.04.2020).

Greenwald, A. G., McGhee, D. E. & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74 (6): 1464-1480. doi: 10.1037/0022-3514.74.6.1464.

Greenwald, A. G., Nosek, B. A. & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *J Pers Soc Psychol*, 85 (2): 197-216. doi: 10.1037/0022-3514.85.2.197.

Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L. & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology*, 97 (1): 17-41. doi: 10.1037/a0015575.

Hersleth, M. (2018). Evoked Contexts. In Ares, G. V., P. (ed.) *Methods in Consumer Research, Volume 1: New Approaches to Classic Methods*, pp. 55-68: Woodhead Publishing.

Hogg, M. A. & Vaughan, G. M. (2008). *Social Psychology*: Prentice Hall.

Hui, Y. H. & Culbertson, J. D. (2006). *Handbook of Food Science, Technology, and Engineering*: Taylor & Francis.

Kahneman, D. (2003). Maps of Bounded Rationality: Psychology for Behavioral Economics. *The American Economic Review*, 93 (5): 1449-1475.

Kemps, E., Tiggemann, M., Martin, R. & Elliott, M. (2013). Implicit Approach-Avoidance Associations for Craved Food Cues. *Journal of experimental psychology. Applied*, 19. doi: 10.1037/a0031626.

Klauer, K. C. S., J. W. & Teige-Mocigemba, S. (2010). A Practical Guide to Implicit Association Tests and Related Tasks. In Gawronski, B. & Payne, B. (eds) *Handbook of Implicit Social Cognition: Measurement, Theory, and Applications*, pp. 117-139: Guilford Press.

Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference*, 20 (2): 70-82. doi: https://doi.org/10.1016/j.foodqual.2007.11.002.

Kraus, A. A. & Piqueras-Fiszman, B. (2016). Sandwich or sweets? An assessment of two novel implicit association tasks to capture dynamic motivational tendencies and stable evaluations towards foods. *Food Quality and Preference*, 49: 11-19. doi: 10.1016/j.foodqual.2015.11.005.

Kraus, A. A. & Piqueras-Fiszman, B. (2018). Measuring Implicit Associations in Food-Related Consumer Research. In Ares, G. & Varela, P. (eds) *Methods in Consumer Research, Volume 2: Alternative Approaches and Special Applications*, pp. 203-230: Woodhead Publishing.

Lavrakas, P. J. (2008). Encyclopedia of Survey Research Methods. doi: 10.4135/9781412963947.

Lawless, H. T. & Heymann, H. (2010). *Sensory Evaluation of Food: Principles and Practices*: Springer New York.

Likert, R. (1932). *A technique for the measurement of attitudes*. New York: The Science Press.

Murray, J. M. (2017). *Multi-Way Analysis of Variance (ANOVA)*. Available at: https://murraylax.org/rtutorials/multiway-anova.html (accessed: 31.05.2020).

Næs, T., Brockhoff, P. B. & Tomic, O. (2011). *Statistics for Sensory and Consumer Science*: Wiley.

Næs, T., Varela, P. & Berget, I. (2018). *Individual Differences in Sensory and Consumer Science: Experimentation, Analysis and Interpretation*: Elsevier Science.

Nosek, B. A., Greenwald, A. G. & Banaji, M. R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Pers Soc Psychol Bull*, 31 (2): 166-80. doi: 10.1177/0146167204271418.

NSD. (n.d.). *Meldeskjema for behandling av personopplysninger*. Available at: https://nsd.no/personvernombud/meld_prosjekt/meldeskjema (accessed: 15.04.2020).

Parfitt, J., Barthel, M. & Macnaughton, S. (2010). Food waste within food supply chains: quantification and potential for change to 2050. *Philosophical transactions of the royal society B: biological sciences*, 365 (1554): 3065-3081.

Payne, B., Burkley, M. & Stokes, M. (2008). Why Do Implicit and Explicit Attitude Tests Diverge? The Role of Structural Fit. *Journal of personality and social psychology*, 94: 16-31. doi: 10.1037/0022-3514.94.1.16.

Peryam, D. R. & Pilgrim, F. J. (1957). Hedonic scale method of measuring food preferences. *Food Technology*, 11, Suppl.: 9-14.

Peryam, D. R. G., N. F. (1952). Advanced taste-test method. *Food Engineering*, 24 (194): 58-61.

Pollard, J., Kirk, S. F. & Cade, J. E. (2002). Factors affecting food choice in relation to fruit and vegetable intake: a review. *Nutr Res Rev*, 15 (2): 373-87. doi: 10.1079/nrr200244.

Qi, D. & Roe, B. E. (2016). Household Food Waste: Multivariate Regression and Principal Components Analyses of Awareness and Attitudes among U.S. Consumers. *PloS one*, 11 (7): e0159250-e0159250. doi: 10.1371/journal.pone.0159250.

Rohm, H., Oostindjer, M., Aschemann-Witzel, J., Symmank, C., V, L. A., de Hooge, I. E., Normann, A. & Karantininis, K. (2017). Consumers in a Sustainable Food Supply Chain (COSUS): Understanding Consumer Behavior to Encourage Food Waste Reduction. *Foods*, 6 (12). doi: 10.3390/foods6120104.

Solarz, A. K. (1960). Latency of instrumental responses as a function of compatibility with the meaning of eliciting verbal signs. *Journal of Experimental Psychology*, 59 (4): 239-245. doi: 10.1037/h0047274.

Strack, F. & Deutsch, R. (2014). The reflective—Impulsive model. In *Dual-process theories of the social mind.*, pp. 92-104. New York, NY, US: The Guilford Press.

StudentKaninen. (n.d.). *Studentkaninen.se*. Available at: https://www.studentkaninen.se/ (accessed: 15.03.2020).

Two-way ANOVA in SPSS Statistics. (n.d.). Available at: https://statistics.laerd.com/spss-tutorials/two-way-anova-using-spss-statistics.php (accessed: 31.05.2020).

Wold, S., Sjöström, M. & Eriksson, L. (2001). PLS-regression: a basic tool of chemometrics. *Chemometrics and Intelligent Laboratory Systems*, 58 (2): 109-130. doi: https://doi.org/10.1016/S0169-7439(01)00155-1.

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9 (2, Pt.2): 1-27. doi: 10.1037/h0025848.

Zech, H. G., Rotteveel, M., van Dijk, W. W. & van Dillen, L. F. (2020). A mobile approach-avoidance task. *Behavior Research Methods*. doi: 10.3758/s13428-020-01379-3.

Appendix A. Recruitment e-mail sent to consumers in Nofima's consumer database

[Videresend til alle medlemmer i din forening]

Hei,

Nofima inviterer til en nettbasert forbrukertest om matvaner. Testen tar i underkant av **30 min.** og gjennomføres i ditt hjem.

Testen inneholder en utradisjonell del som utfolder seg som et reaksjonstidspill. Den er en viktig del av datainnsamlingen og vil kreve din fulle oppmerksomhet i ca. 10 min. Vær oppmerksom på at denne testen kun kan gjennomføres på **datamaskin med tastatur** (Windows eller Mac). Det er ikke mulig å gjøre denne testen på mobiltelefon, nettbrett eller lignende enheter.

Link til testen: https://smak.nofima.no/eq/r1/3gukc
Om du fullfører hele testen vil din deltakelse gi **150 kr** til din forening.

Takk for din oppmerksomhet ☺

Vennlig hilsen
<image001.png>

Osloveien 1, N-1430 Ås
www.nofima.no

Appendix B. GDPR acceptance form

Information about the purpose of the project and what your participation will involve:

Project title

"Reaction time methodologies in the investigation of food-related consumer habits"

Purpose of the project
The purpose of this project is to investigate the potential of reaction time methodologies in the investigation of food-related consumer habits. Through this survey, data collected through a reaction-time approach will be compared to data collected through a traditional questionnaire. The data analysis will aim to reveal eventual added benefits of a reaction time approach as compared to a traditional questionnaire. The results will be used to further develop methodologies in consumer research. Additionally, the results will be used to better understand consumer perception of selected food stimuli. Our findings may be communicated in scientific and popular-scientific theses, journals and conferences, as well as on the respective partners' websites and social media. All communication on the project will concern fully anonymized data.

Who is responsible for the research project?
This project is a collaboration between members of the European Sensory Network (ESN), an international non-profit organization https://www.esn-network.com/
Nofima AS (Norway), ACCE (Canada) and RISE (Sweden) are responsible for planning, conducting, analysing and reporting the study.
Nofima AS acts as project manager for the study.

Why are you being asked to participate?
The survey is targeted to adults in the Canadian, Norwegian and Swedish populations. Selection criteria and quotas apply in terms of age and household shopping responsibilities; all participants agreeing to participate and fulfilling the recruitment questionnaire's criteria may complete the study.

What does participation involve for you?
If you chose to take part in the project, this will involve that you fill in an online survey. This will take approx. 30 minutes of your time. The survey includes standard socio-demographic questions, food-related questions, and a reaction time categorization task on words and images. Your answers will be recorded electronically.

Participation is voluntary
It is voluntary to participate in this survey. You can, at any time, choose to withdraw your consent without stating a reason. If you decide to withdraw, all your personal data will be removed. Shall you decide to withdraw, please contact the principal investigator in charge of the study (contact information below).

Your personal privacy – how we will store and use your personal data
We will only use your personal data for the purpose specified in this information letter. All data are processed anonymously, confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act).
All personal data will be treated confidentially. The full data will be stored on a secure Nofima server until 01.03.2020. After this date, only anonymised data will be stored. Researchers and data analysts involved in the project at Nofima (Norway), ACCE (Canada), RISE (Sweden) and in

the ESN will have access to the anonymised data through a sharing platform.

What will happen to your personal data at the end of the research project?
All personal data will be stored on a secure Nofima server until 01.03.2020. After this date, only anonymised data will be stored. The project is scheduled to end by 31.12.2020.

Your rights
So long as you can be identified in the collected data, you have the right to:
- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

What gives us the right to process your personal data?
We will process your personal data based on your consent. The Norwegian Centre for Research Data AS (NSD) has assessed that the processing of personal data in this project is in accordance with data protection legislation.

Where can I find out more?
If you have questions about the project, or want to exercise your rights, contact:
- Principal investigator Dr. Valérie L. Almli, Nofima AS, valerie.almli@nofima.no, Phone: +47 64970305 (Project Manager)
- Our Data Protection Officer: Anna Maria Bencze Rørå, Nofima AS, mia.rora@nofima.no, Phone: +47 41443014
- NSD – The Norwegian Centre for Research Data AS, by email: personverntjenester@nsd.no, Phone: +47 55582117

Appendix C. Permission from NSD

NSD NORSK SENTER FOR FORSKNINGSDATA

NSD sin vurdering

Prosjekttittel

Reaction time methodologies in the investigation of food-related consumer habits

Referansenummer

103981

Registrert

28.11.2019 av Mads Erling Pedersen - mads.erling.pedersen@nofima.no

Behandlingsansvarlig institusjon

Nofima AS

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Valérie Lengard Almli, valerie.lengard.almli@nofima.no, tlf: 64970305

Felles behandlingsansvarlige institusjoner

Type prosjekt

Studentprosjekt, masterstudium

Kontaktinformasjon, student

Mads Erling Pedersen, mads.erling.pedersen@nmbu.no, tlf: 40550996

Prosjektperiode

01.06.2019 - 31.12.2019

Status

20.12.2019 - Vurdert

Vurdering (1)

20.12.2019 – Vurdert

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i

meldeskjemaet den 20.12.2019 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD.

Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:
https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG

VARIGHET

Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 31.12.2019.

LOVLIG GRUNNLAG

Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER

NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen

- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål

- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet

- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER

Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art.12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER

NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art.5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

RISE Research Institutes of Sweden, ACCE International, Center of Food And Fermentation Technologies, og Sensory Dimensions Ltd. er felles behandlingsansvarlige institusjoner. NSD legger til grunn at behandlingen oppfyller kravene til felles behandlingsansvar, jf. Personvernforordningen art. 26.

NSD legger til grunn at behandlingen oppfyller kravene til behandling av personopplysninger utenfor EU (personvernforordningen kapittel 5).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET

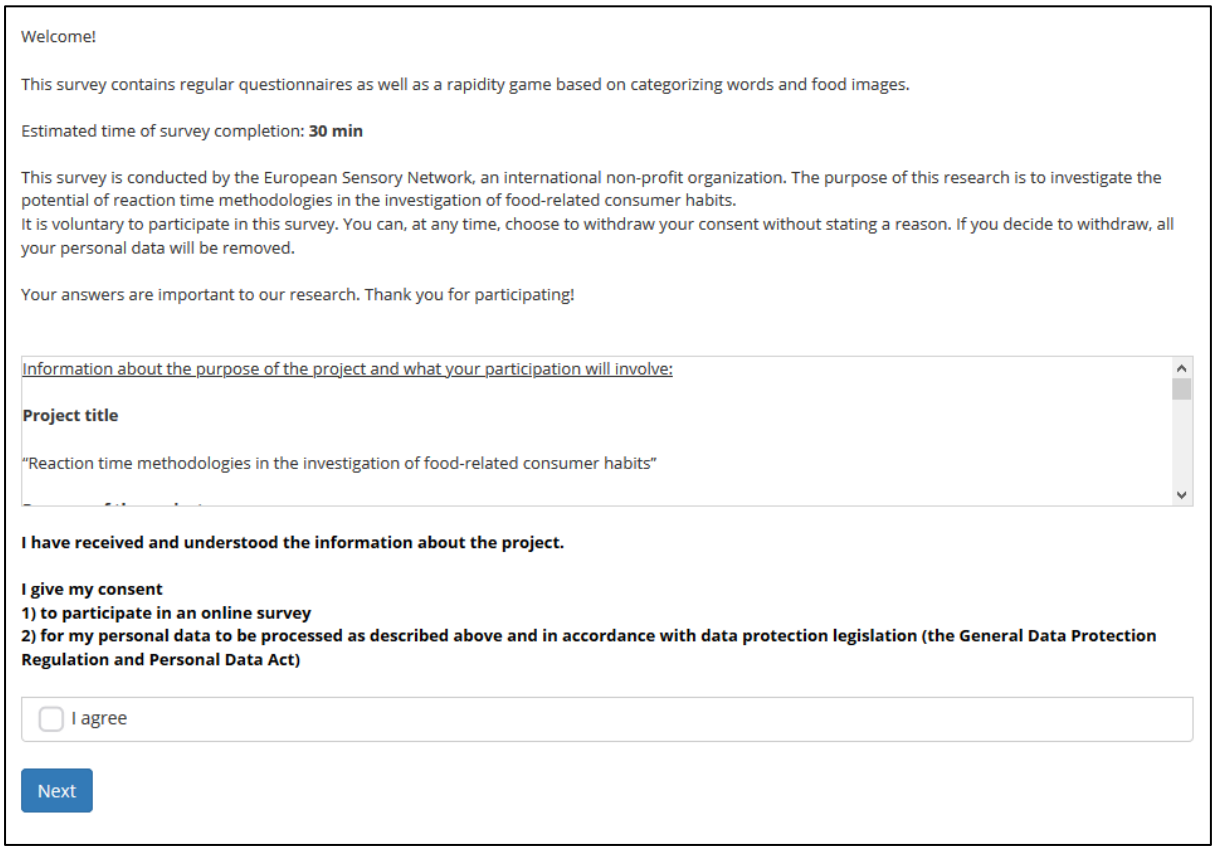
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Håkon J. Tranvåg

Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Appendix D. Task 1. Socio-demographic and attitude questionnaire



Welcome!

This survey contains regular questionnaires as well as a rapidity game based on categorizing words and food images.

Estimated time of survey completion: **30 min**

This survey is conducted by the European Sensory Network, an international non-profit organization. The purpose of this research is to investigate the potential of reaction time methodologies in the investigation of food-related consumer habits.
It is voluntary to participate in this survey. You can, at any time, choose to withdraw your consent without stating a reason. If you decide to withdraw, all your personal data will be removed.

Your answers are important to our research. Thank you for participating!

Information about the purpose of the project and what your participation will involve:

Project title

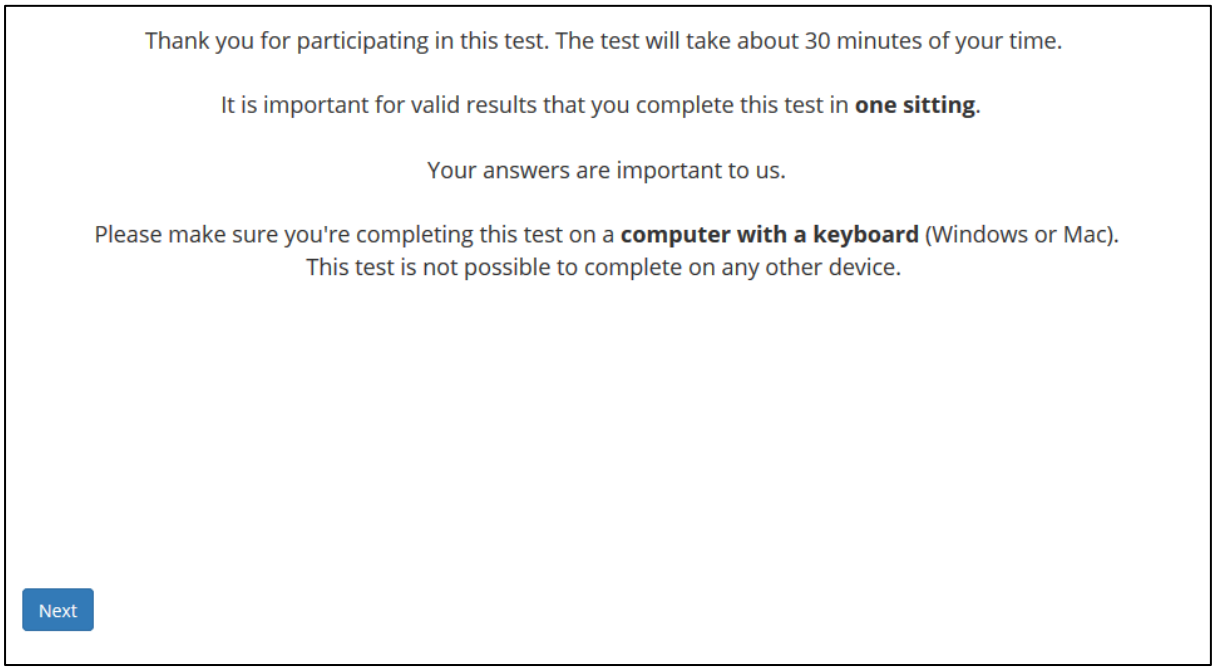
"Reaction time methodologies in the investigation of food-related consumer habits"

I have received and understood the information about the project.

I give my consent
1) to participate in an online survey
2) for my personal data to be processed as described above and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act)

☐ I agree

Next



Thank you for participating in this test. The test will take about 30 minutes of your time.

It is important for valid results that you complete this test in **one sitting**.

Your answers are important to us.

Please make sure you're completing this test on a **computer with a keyboard** (Windows or Mac).
This test is not possible to complete on any other device.

Next

Before you start the actual test, you will complete a few questions about yourself.

Then, you will be presented with the first part of the survey, which will require your uninterrupted attention. You will be asked to categorize food images and words as fast as possible.

In the second part, you will be asked about your opinion about the food products you have categorized.

Please follow the instructions closely

Next

Sex:

- ◯ Male
- ◯ Female

Which of the following age groups do you fit into?

- ◯ 17 or under
- ◯ 18 - 24 years of age
- ◯ 25 - 34 years of age
- ◯ 35 - 44 years of age
- ◯ 45 - 54 years of age
- ◯ 55 - 64 years of age
- ◯ 65 or over

How much of your household's grocery shopping do you do?

- ◯ All of it
- ◯ Almost all of it
- ◯ About half of it
- ◯ Less than half of it
- ◯ None

Next

Which of the following best describes your employment-status?

- ◯ Work full-time
- ◯ Work part-time
- ◯ Homemaker
- ◯ Student
- ◯ Retired
- ◯ Unemployed

Including yourself, how many adults (18 years of age or over) are there in your household?

- ◯ One
- ◯ Two
- ◯ Three or more

Do you have kids under 18 years of age in your household?

- ◯ Yes
- ◯ No

Next

What is the highest level of education you have completed?

- ◯ Some elementary school
- ◯ Completed elementary school
- ◯ Some high school
- ◯ Completed high school
- ◯ Some college or university
- ◯ Completed college/university undergraduate
- ◯ Some graduate degree
- ◯ Completed graduate degree
- ◯ Postgraduate
- ◯ Other (please specify)
- ◯ Prefer not to say

How would you describe your economic situation on a 7-point scale, where 1 means difficult and 7 means well-off?

- ◯ **1.** Difficult
- ◯ **2.**
- ◯ **3.**
- ◯ **4.** Moderate
- ◯ **5.**
- ◯ **6.**
- ◯ **7.** Well-off
- ◯ Prefer not to say

In what area does your family live?

- ○ Large city or municipality near large cities
- ○ Medium-sized town or municipality near medium-sized towns
- ○ Smaller town, smaller urban area or rural municipality
- ○ Prefer not to say

Next

Below is a list of food-related statements. For each of them, please indicate to what extent these apply to you by using the scale from 1: Strongly disagree to 9: Strongly agree.

	Strongly disagree								Strongly agree
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I often think about food safety when choosing foods to buy	○	○	○	○	○	○	○	○	○
I only buy and eat foods which are familiar to me	○	○	○	○	○	○	○	○	○
I make a point of using organic food products	○	○	○	○	○	○	○	○	○
I find taste in food products important	○	○	○	○	○	○	○	○	○
Getting a low price is more important to me than getting top quality	○	○	○	○	○	○	○	○	○
I enjoy being able to create meals from scratch	○	○	○	○	○	○	○	○	○
I frequently make a list of the food I want to buy prior to my shopping trip	○	○	○	○	○	○	○	○	○
I control what I eat to make sure it is healthy	○	○	○	○	○	○	○	○	○
I frequently buy too much food (more than I need or can eat) when I go shopping	○	○	○	○	○	○	○	○	○
I frequently check my food inventories prior to my shopping trip	○	○	○	○	○	○	○	○	○
I am an excellent cook	○	○	○	○	○	○	○	○	○
It is important to me that the foods I choose are environmentally friendly	○	○	○	○	○	○	○	○	○
I prefer buying natural products, i.e. products without preservatives	○	○	○	○	○	○	○	○	○
I dislike anything that might change my eating habits	○	○	○	○	○	○	○	○	○
When cooking, I first and foremost consider taste	○	○	○	○	○	○	○	○	○

Next

Below is a list of food-related statements. For each of them, please indicate to what extent these apply to you by using the scale from 1: Strongly disagree to 9: Strongly agree.

	Strongly disagree								Strongly agree
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I compare date labels to select food with the longest shelf life	○	○	○	○	○	○	○	○	○
As long as there are still hungry people in this world, food should not be thrown away	○	○	○	○	○	○	○	○	○
I compare product appearance to decide which fruit and vegetable to buy	○	○	○	○	○	○	○	○	○
What we are going to have for supper is very often a last-minute decision	○	○	○	○	○	○	○	○	○
I always plan what we are going to eat a couple of days in advance	○	○	○	○	○	○	○	○	○
I appreciate that packaging keeps products hygienic and safe	○	○	○	○	○	○	○	○	○
Frozen foods account for a large part of the food products I/we use in my household	○	○	○	○	○	○	○	○	○
I frequently look for store specials or purchase food that is on discount	○	○	○	○	○	○	○	○	○
We use a lot of ready-to-eat foods in our household	○	○	○	○	○	○	○	○	○
I always eat what is on my plate	○	○	○	○	○	○	○	○	○
I frequently buy food close to the best-before date, if it is offered at a lower price	○	○	○	○	○	○	○	○	○
I hate it when I need to throw food in the trash	○	○	○	○	○	○	○	○	○

Next

You will now need to install a small plugin for your computer. This is required to run the categorization task. The installation is quick and easy, just follow the on-screen instructions.

Next

Appendix E. Task 3. Explicit assessments

Thank you for completing the first part of the test.

You will now evaluate food products according to several criteria.

Next

For optimal products:

How **familiar** are you with this product?

1. Not at all familiar	2	3	4	5	6	7	8.	9. Extremely familiar

How well do you think you would **like or dislike** this product?

1. Dislike extremely	2. Dislike very much	3. Dislike moderately	4. Dislike slightly	5. Neither like nor dislike	6. Like slightly	7. Like moderately	8. Like very much	9. Like extremely

How **safe** (to consume) does this product look?

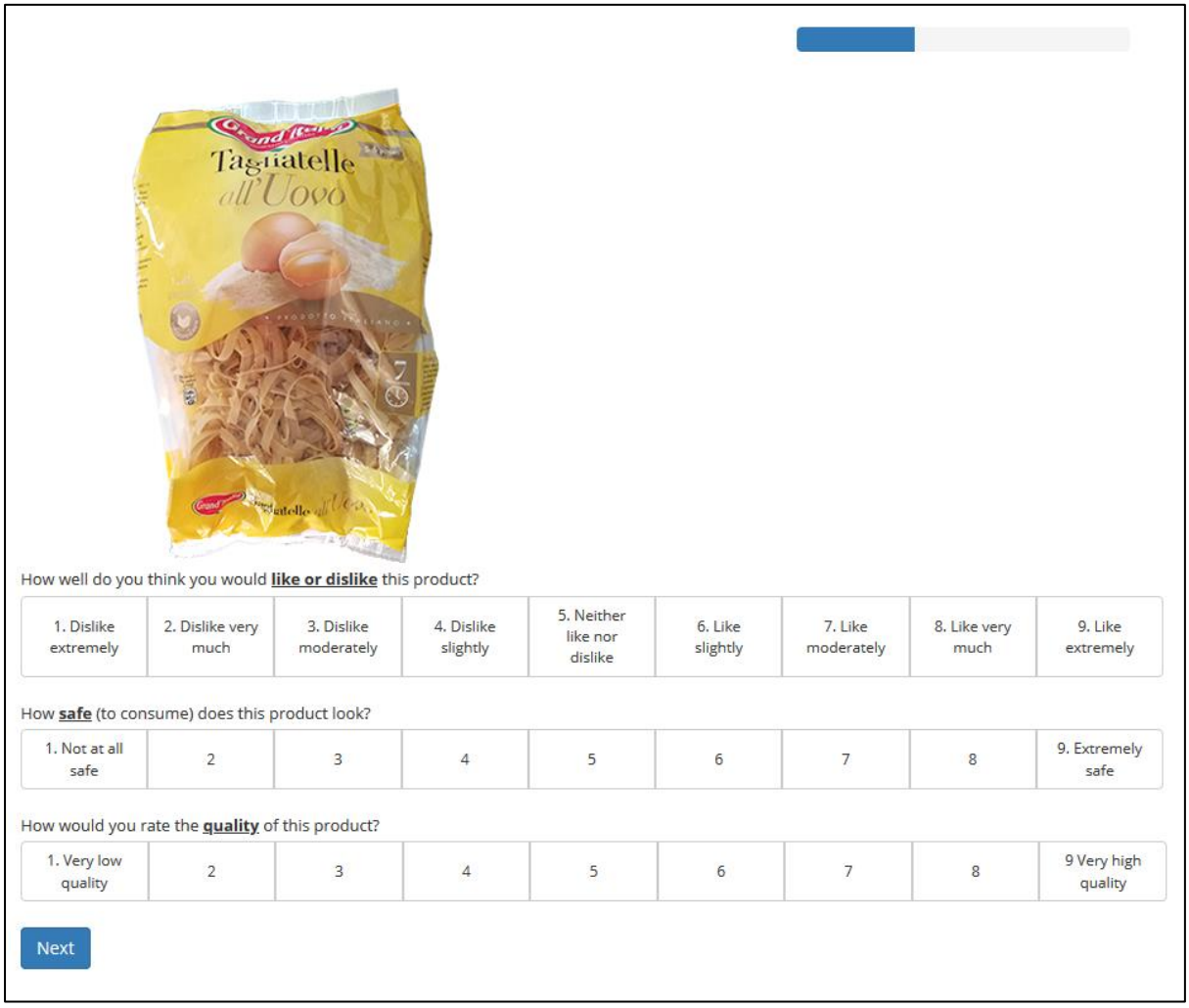
1. Not at all safe	2	3	4	5	6	7	8	9. Extremely safe

How would you rate the **quality** of this product?

1. Very low quality	2	3	4	5	6	7	8	9. Very high quality

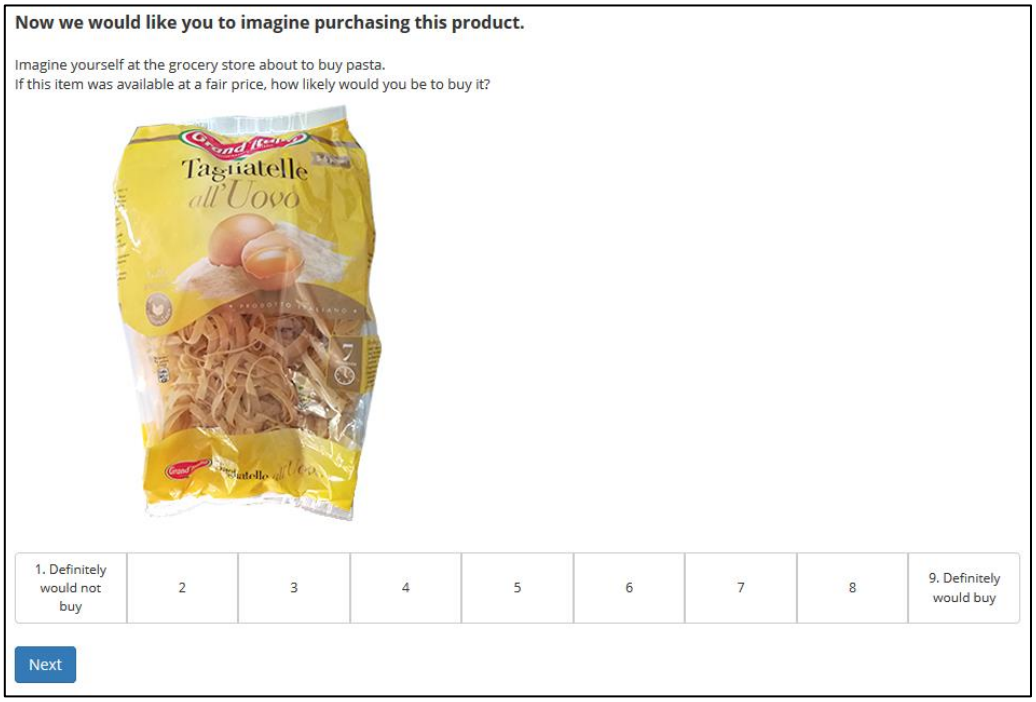
Next

For suboptimal products:

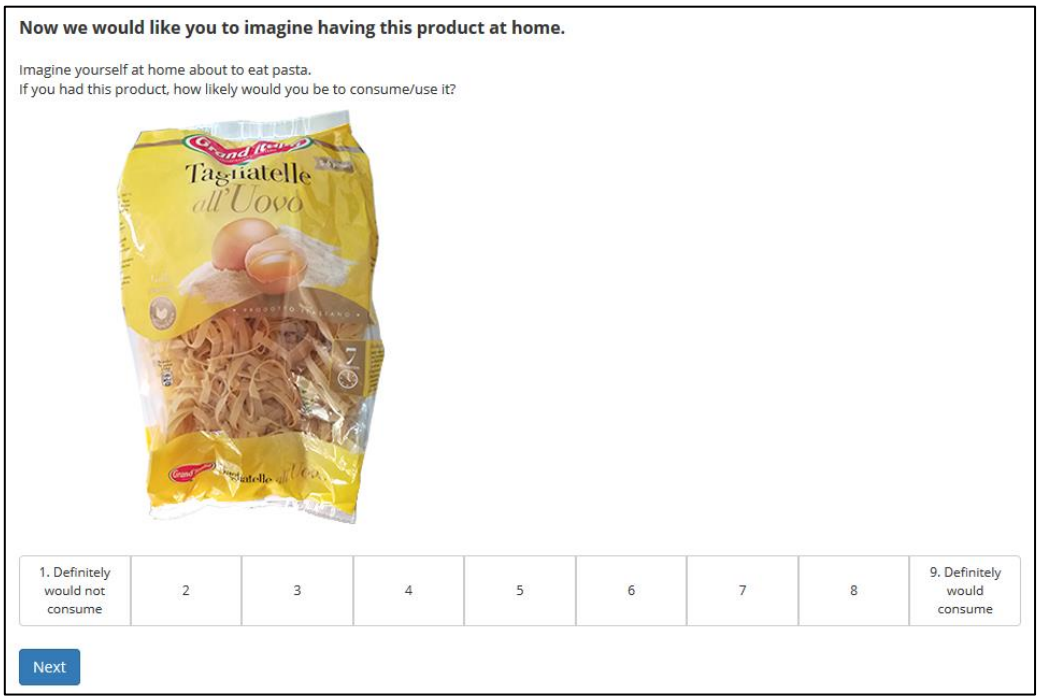


Appendix F. Task 4. Stated behavior in Canada and Sweden

Evoked context “in a store”:



Evoked context “at home”:



How **fun** did you think the **categorization** task was?

1. Extremely boring	2	3	4	5	6	7	8	9. Extremely fun

How **difficult** did you think the **categorization** task was?

1. Extremely easy	2	3	4	5	6	7	8	9. Extremely difficult

How **fun** did you think the **evaluation of food product images** was?

1. Extremely boring	2	3	4	5	6	7	8	9. Extremely fun

How **difficult** did you think the **evaluation of food product images** was?

1. Extremely easy	2	3	4	5	6	7	8	9. Extremely difficult

Next

In order to send you a check in the mail, we ask you to enter your full name and full address:

Full name:

Address:

Submit

Appendix G. Task 4. Stated behavior in Norway

Evoked context “in a store”:

Evoked context “at home”:

How **fun** did you think the **categorization** task was?

1. Extremely boring	2	3	4	5	6	7	8	9. Extremely fun

How **difficult** did you think the **categorization** task was?

1. Extremely easy	2	3	4	5	6	7	8	9. Extremely difficult

How **fun** did you think the **evaluation of food product images** was?

1. Extremely boring	2	3	4	5	6	7	8	9. Extremely fun

How **difficult** did you think the **evaluation of food product images** was?

1. Extremely easy	2	3	4	5	6	7	8	9. Extremely difficult

Next

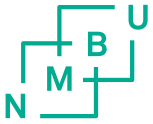
Organization:

Specify which organization you belong to:

Send inn

Appendix H. List of 27 statements from the Food (Waste)-Related Lifestyle questionnaire

Statement
a) How frequently do you make a list of the food you want to buy prior to your shopping trip
b) How frequently would you say you buy too much food (more than you need or can eat) when you go shopping
c) I frequently check my food inventories prior to my shopping trip
d) I only buy and eat foods which are familiar to me
e) I dislike anything that might change my eating habits
f) I am an excellent cook
g) I enjoy being able to create meals from scratch
h) It is important to me that the foods I choose are environmentally friendly
i) I often think about food safety when choosing foods to buy
j) I control what I eat to make sure it is healthy
k) I prefer buying natural products. i.e. products without preservatives
l) I make a point of using organic food products
m) Getting a low price is more important to me than getting top quality
n) I find taste in food products important
o) When cooking. I first and foremost consider taste
p) We use a lot of ready-to-eat foods in our household
q) Frozen foods account for a large part of the food products I/we use in my household
r) I hate it when I need to throw food in the trash
s) As long as there are still hungry people in this world. food should not be thrown away
t) I always eat what is on my plate
u) I always plan what we are going to eat a couple of days in advance
v) What we are going to have for supper is very often a last-minute decision
w) I appreciate that packaging keeps products hygienic and safe
x) I compare product appearance to decide which fruit and vegetable to buy
y) I compare date labels to select food with the longest shelf life
z) I frequently buy food close to the best-before date. if it is offered at a lower price
zz) I frequently look for store specials or purchase food that is on discount



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