



Milan BExpo 2015: A behavioural study on food choices and eating habits

Final report

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Executive summary

This behavioural study examined consumer choices in relation to food sustainability, and was carried out at the Milan Expo 2015 among EXPO visitors, by CentERdata, GFK, and Ecorys. This project examined two aspects related to consumer sustainability: consumer use of sustainability information and food waste.

Consumer use of sustainability information

Consumer use of sustainability information was studied by means of an experimental field study carried out in the COOP Supermarket of the Future. In this supermarket consumers could look up product information through interactive displays, on for instance price, nutritional values and several sustainability aspects of the product. The main aim was to investigate whether exposure to sustainability-related information in an innovative, interactive way translates into more sustainable product choices. In addition, we investigated if sustainable activation in one domain (non-food) spills over to another domain (food). In the study 300 consumers participated. One group of consumers received a sustainability pre-task after which they visited the Supermarket of the Future (group 1), one group of consumers visited the Supermarket of the Future without a pre-task (group 2), and a control group consisted of Milan Expo visitors who did neither visit the Supermarket of the Future nor received the sustainability pre-task (group 3). The study reveals the following key insights:

- The Supermarket of the Future seems a promising concept with several innovative features that have the potential to enhance sustainable consumer behaviour. The atypical setting makes generalizability of results difficult, though. For example, many supermarket visitors did not make any purchase and customers mainly bought drinks.
- That being said, when consumers are activated to process sustainability information before entering the supermarket, this seems to enhance their interest in the innovative shopping concept even if the activation is not food related. But strong evidence that the increased interest translates into more sustainable consumer choices in the Supermarket is lacking.
- Consumers consider price and nutritional values, rather than sustainability, the most important attributes to gather information on. Consumers pay equal attendance to the different indicators related to sustainable information (carbon foot print, sustainability logos, organic logos). Results may be driven by informational sequence as price and nutritional information were presented before the sustainability information at the informational screens. Information overload may also play a role.
- Store visitors have stronger intentions to pay attention to sustainability information in the future than non-visitors. Participants in the study are allowed to donate to good causes as a reward; interestingly, store visitors donate more to sustainable charities than non-store visitors do. As such, the store visit seems to act as a sustainability activator.

Food Waste: Date marks

The issue of food waste was investigated by means of two experimental lab studies carried out at the EXPO; 500 Milan EXPO visitors participated in the two studies. The main aim of the first lab study was to investigate consumers' decision to use or dispose non-perishable (long shelf-life) foods and how this was affected by date marking: the presence of a best before date, a production date or absence of any date on the food package. The perception of product quality, safety and likelihood of disposal were measured at various time points. This experimental approach provides unique insights into how consumers treat products with different date marks that deviate from current market practices, by manipulating the type of date mark while keeping the rest constant. The most important results are as follows:

- Understanding of the best before date (BBD) can be improved, only 47% of consumers participating in the experiments indicated the meaning of the best before date correctly whereas consumers are often not aware of this ignorance. This is in line with other studies (see for instance results from the United Kingdom - WRAP, 2014).
- Whether it is preferable, from a food waste prevention point of view, for a food product to be labelled with a BBD date or not, depends very much on how long consumers store products at home prior to using them. Before the BBD has been reached it seems better to have a BBD on products (less disposal; higher perceived product quality and safety perceptions) than no date or a production date. However, for the time points after the BBD is reached, consumers are less likely to throw out a food product if there is no date indicated on the label i.e. no reference point such as the BBD or production date. This pattern is even more pronounced for products with a long perceived shelf-life by consumers.
- Overall, consumers are more likely to dispose a product across all time points when a production date is provided compared to no date at all. Providing a production date is less effective (products with long shelf-life) or equally effective (products with short shelf-life) compared to no date mark.

Food Waste: imperfect foods

The main aim of the second experimental lab study was to investigate how to increase consumer acceptance of imperfect (strangely shaped) foods with effective communications. We investigated whether persuasive messages can be used as an alternative to diminish the need for price reductions on imperfect fruits and vegetables. More specifically we analysed the effectiveness of an authenticity message (stressing that the food is "naturally" imperfect) or an anti-food waste message, in combination with: no price reduction, a moderate price reduction (15%) and a sharp price reduction (30%) (2x3 design). The results are as follows:

- Price reductions lead to higher willingness to buy imperfect foods. If no price reduction was provided 74% of consumers would buy the perfect foods while only 26% prefer the imperfect ones. With a moderate price reduction 31% of people would buy the imperfect foods and with a sharp price reduction 39%.
- Providing persuasive messages increases the willingness to buy imperfect foods more strongly. If an anti-food waste message or authenticity message was provided, more respondents (41% and 42%) would buy imperfect foods, but at normal prices and thus preventing a drop in retailers' revenues.
- Price reductions in combination with persuasive message frames are most effective:
 - If an anti-food waste message was provided, more respondents would buy the imperfect foods with a moderate price reduction (51%) and a sharp price reduction (51%).
 - If an authenticity message was provided, more respondents would buy the imperfect foods with a moderate price reduction (40%), and a sharp price reduction (50%).
- Authenticity messages increase quality perceptions and decrease the necessity of price reductions of imperfect foods.

1 Introduction

For the Milan Expo 2015, an exploratory research project in the area of food on consumer choices and food sustainability has been carried out on behalf of the European Commission. The research consists of a field study in the Supermarket of the future and two lab studies (experiments) on food waste carried out among Expo visitors. This report provides background information on each of the studies, and presents the key results and conclusions and suggestion for future research for each of the studies. The current study could be considered as a contribution to the growing body of behavioural studies conducted for policy purposes. These behavioural studies shine light on behavioural aspects and reactions of consumers to policy interventions from a real life (either lab or field) perspective.

The three studies address two different sub areas. The field study regards consumers' use of interactive sustainability information and its effect on consumer behaviour. The experimental shopping concept "Supermarket of the future" as built on the EXPO has been used for a field experimental study on this topic. Both lab studies address the issue of food waste. One experiment studies the topic of consumers' disposal of food, and investigates the influence of date marks on consumer use or disposal of food. The other experiment researches how imperfect fruits and vegetables could successfully be marketed, so that consumers are willing to purchase them.

Chapter 2 reports the background, key results and conclusions for the field study, Chapter 3 for the lab study on date marking, and Chapter 4 for the lab study on imperfect foods. The report is followed by several appendices which contain background information relevant for the studies, the experimental set-up and sample size, the questionnaires, a statistical and technical appendix providing more details on the analyses of the different studies, and the reference list.

2 Field study

2.1 Background

The COOP Supermarket of the Future is a large supermarket based at the Milan Expo, with many different product categories and Stock Keeping Units. A unique feature of this supermarket is that consumers can, by pointing at a product, request more background information about the product to be depicted on interactive screens (see pictures). For each product information is available on seven aspects: (1) price information, (2) the history of the product, (3) the origin of raw materials used, (4) nutritional values, (5) allergy information, (6) environmental information and the carbon footprint, (7) organic and sustainability logos. Sustainability information can thus be derived from the origin of raw materials, the carbon footprint and the organic and sustainability logos¹. **The aim of the field study is to investigate if and how the information displayed on the interactive screens is being used in consumer decision-making, and – more specifically – whether exposure to sustainability-related information in an innovative, interactive way translates into more sustainable food choices.**



Though sustainability is a difficult concept to consumers, in general they consider sustainability “a good thing” and have positive attitudes towards it (Grunert, 2011). But for sustainability information to impact consumer behaviour, the information (1) should be noticed and processed, (2) accurately interpreted and understood, and (3) considered sufficiently important (relative to other product features). In order to gain deeper insight into how exposure to sustainability information affects consumers’ choices, this study surveys visitors of the Supermarket of the Future, to observe to what extent they attended sustainability information in the supermarket, considered sustainability an important factor in their food choices, and whether this impacts their current and future sustainability choices. In order to draw valid conclusions, we compared responses of store visitors (group 2, see figure 2.1) with EXPO visitors who did not visit the supermarket of the future (control group, group 3).

Furthermore, it is often discussed that sustainable initiatives should not be considered on their own, as sustainable incentives in one domain are likely to spill-over to other domains (Thøgersen & Crompton, 2009). This could imply that enhancing sustainable consumption is a matter of many small steps adding up to a sustainable all-round consumer in the end. Previous results on spill-over effects are mixed, sometimes showing positive spill-overs, sometimes showing negative spill-overs (i.e. “licensing effects”, where an act of pro-environmental behaviour is used by consumers to justify not carrying out other pro-environmental activities (Mazar & Zhong, 2010), or no effects at all. In order to investigate if sustainable actions in a non-food domain spill over to the food domain, some of the store visitors were exposed to a sustainable pre-task *prior* to their visit to the Supermarket of the Future (group 3 in Figure 2.1). This sustainability pre-task

¹ It should be noted however that the sustainability concept is much broader than these specific information units.

consists of having to select the most sustainable product from product sets from different non-food product categories. In addition, consumers judged whether a possible action enhances sustainability. We investigate whether this group is more receptive to food sustainability information in the supermarket and make more sustainable choices accordingly as compared to the group that did not take the pre-task (group 3 versus group 2).

In sum we expect that:

- Consumers who visited the supermarket (group 1 and 2) (1) find sustainability information more important, (2) and are more likely to use this information in future food choices, (3) have higher intentions to make sustainable food choices in the future, and (4) donate more to charities related to food sustainability, compared to non-visitors (group 3);
- Store visitors with a sustainability pre-task (group 1) (1) pay more attention to sustainability information, (2) find this information more important, (3) are more likely to use this information in future food choices, (4) have higher intentions to make sustainable food choices, and (5) donate more to charities related to food sustainability, compared to store visitors who did not make the pre-task (group 2) (positive spill-over effect).

Figure 2.1 Overview of the study design

Group	Pre-visit contact	Visit	Post-visit contact
1	Sustainable behavior activation	Supermarket of the future	Questionnaire + Donation behaviour
2	X	Supermarket of the future	Questionnaire + Donation behaviour
3	X	X	Questionnaire + Donation behaviour

In total 303 Milan Expo visitors participated in the study (about 100 per group). The sustainability behaviour activation took place next to the entrance of the COOP Supermarket of the Future (group 1), whereas the post-visit questionnaire for supermarket visitors was conducted right at the exit of the supermarket (groups 1 and 2). Data collection for the non-visitors (group 3) took place at a different location at the Milan Expo, outside the Future Food District area. The sustainability activation task turned out to be sufficiently challenging for consumers, as only 6 (out of 100) consumers performed very well, whereas many (41) made only a few correct choices. Respondents across all experimental groups indicated that they were relatively pro-environmental in their purchases and choices during the past year (traveling, leisure, household products, and food products)² (all means > 5.12 on a 7-point scale). In addition, they consider themselves as having a very pro-environmental self-identity (M = 5.40 on a 7-point scale).

² These four items were added and averaged and formed a reliable construct ($\alpha = .90$).

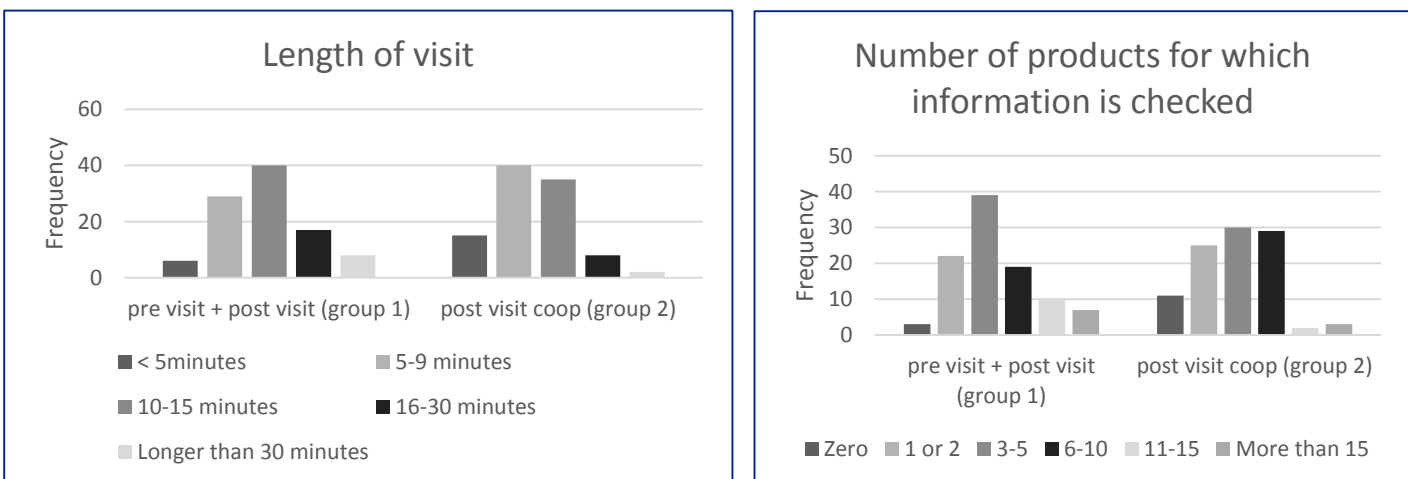
2.2 Key results

2.2.1 Consumers' visit and purchasing at the Supermarket of the Future

Most consumers stayed in the Supermarket for the future for less than 15 minutes, which is shorter than for a typical supermarket. Both the average length of visit and total number of products for which information are checked is higher for those consumers that took a sustainable pre-task (group 1) than for store-visitors who did not (group 2) (see figure 2.2 & 2.3). This suggests that the sustainability pre-task has activated consumers' interest in the store concept.

Most consumers did not make any purchase while visiting the supermarket (66%) and those who did mostly bought drinks only (46%). This again illustrates that the Supermarket of the Future is an atypical supermarket, as in normal supermarkets the conversion rate is close to 100% (almost all visitors that visit a store make a purchase). However, the conversion rate for visitors who were exposed to a sustainability pre-task (group 1) is higher (34%) than for store visitors who were not (23%, group 2). Furthermore, visitors with a sustainability pre-task bought 46 products in total and store visitors bought 25 products in total.

Figure 2.2 and Figure 2.3 Length of visit in the Supermarket of the Future and number of products for which information is checked in the Supermarket of the Future



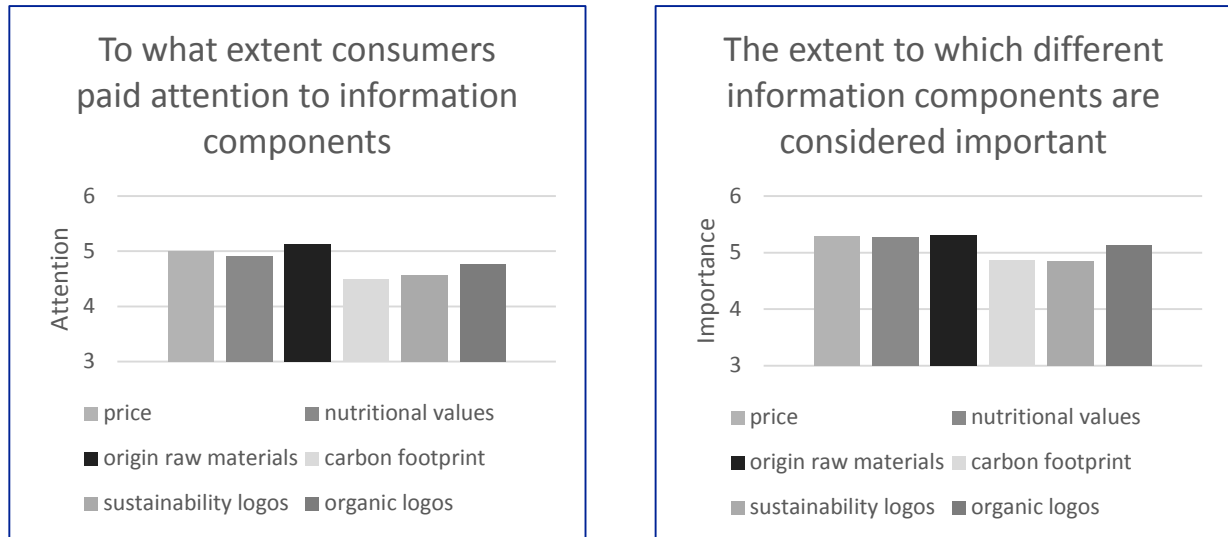
2.2.2 Consumers' attention and importance of product information and impact on future choices

Participants were asked to what extent they paid attention to the different information components (price, nutritional values, and origin of raw materials, carbon footprint, sustainability logos, and organic logos) and whether they used the perceived information to base their current and future purchase decisions on. Store visitors paid more attention to the price, nutritional values and origin of raw materials than to the sustainability information components, see figure 2.4³. In the same vein, price, nutritional values and origin of raw materials are considered more important to consumers than sustainability (figure 2.5). Visitors with and without a sustainability pre-task neither differ regarding the amount of attention paid to sustainability information, nor differ regarding the importance of sustainability information in purchase decisions. As such, it seems that asking consumers to make sustainable food choices in non-food domains does not positively spill-over to the food domain. In addition, there are no differences between

³ This concerns all store visitors as there were no differences across groups.

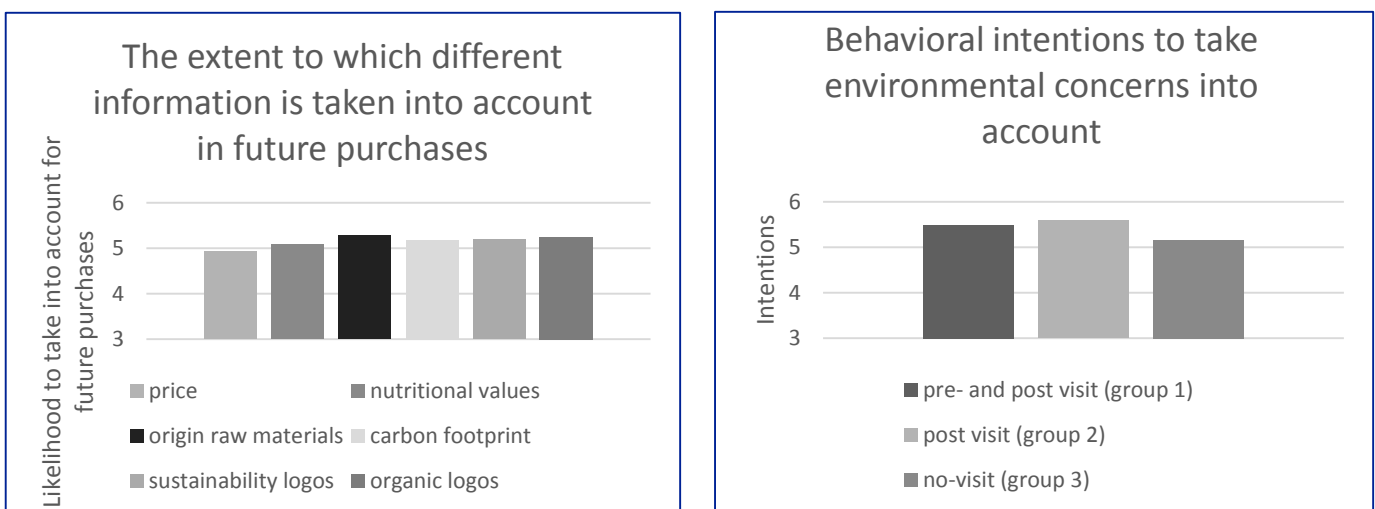
store visitors versus non-visitors, which indicates that the Supermarket of the Future itself did not induce heightened attention and importance attached to sustainability cues, also in relation to future food choices.

Figure 2.4 & Figure 2.5 The extent to which consumers paid attention to different information components and consider this important



Despite the fact that the supermarket did not enhance sustainability of consumers' current food choices, sustainability information may gain importance in their future decisions. That is, consumers intent to put relatively more weight to sustainability information compared to the other informational attributes (price, nutritional value, original raw materials) in the future, see figure 2.6. In addition, store visitors have stronger intentions to take environmental concerns into account in future shopping than non-visitors, see figure 2.7. It seems that the supermarket triggers consumers to think about environmental concerns which induces future spill-over effects in the food domain, more so than asking consumers to make sustainable choices in non-food domains.

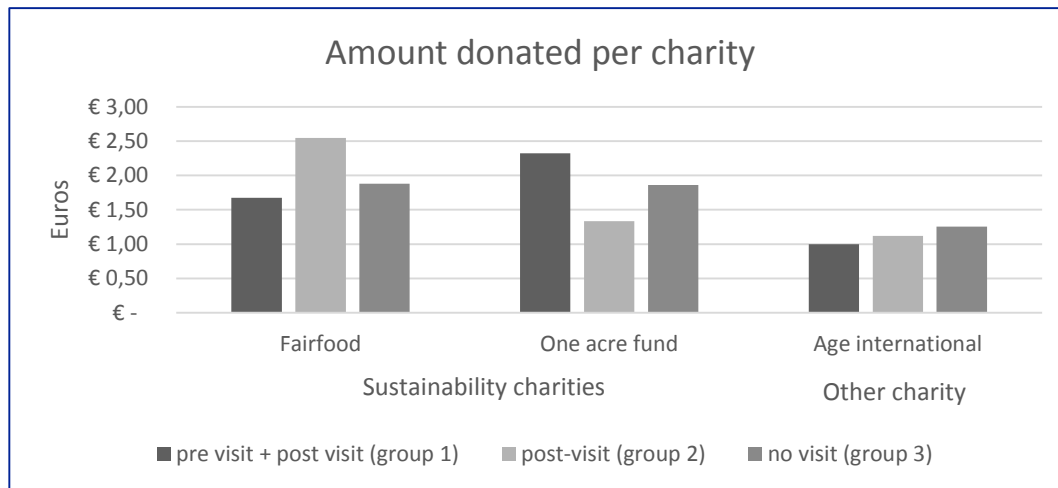
Figure 2.6 & Figure 2.7 The extent to which different information components are taken into account in future food purchases and behavioural intentions to take environmental concerns into account



2.2.3 Supermarket of the Future and Charity donation behaviour

As a reward for their participation, consumers could donate to a charity of their choice with three options available: one charity related to sustainability in the food domain (Fairfood), one charity pursuing sustainability in general (One Acre), and one charity outside the sustainability domain (Age international). It turns out that supermarket visitors (group 1 and 2) donate more to sustainable charities than non-visitors (group 3). That is, non-visitors spread their donation more equally over all three charities, see figure 2.8.

Figure 2.8 Average amount of money donated per charity



2.3 Conclusions and suggestions for future research

- The Supermarket of the Future seems a promising concept with several innovative features that have the potential to enhance sustainable consumer choices. On the other hand, the atypical setting of the World EXPO makes it difficult to draw generalizable conclusions on effectiveness. First of all, most consumers make only short-lasting visits at the EXPO-supermarket, a high percentage of visitors do not make any purchase and those who do buy a limited number of items, mostly drinks. Purchases in the Supermarket of the Future do not represent typical purchases, mostly because the context differs and is leisure related. Second, the Supermarket of the Future is different from a typical supermarket on very many aspects, which makes it difficult to disentangle the effects of each of them. Moreover, the high technical complexity of the Supermarket of the Future requires much cognitive processing from consumers, which may make them fall back on simple heuristics. Under such circumstances many changes in technical complexity at once may in fact be less effective than only a few minor changes at a time;
- When consumers are activated to think of sustainability before store entrance (even if this is unrelated to food), this seems to enhance interest in the innovative shopping concept. However no strong evidence exists that this translates to consumer attention and choice to more sustainable alternatives (the spill-over effect from sustainable choices in a different domain to sustainable behaviour in the food domain). Below we elaborate on the finding that consumers were acting less pro-sustainable than may be expected or hoped for:
 - 1) Consumers pay more attention to price and nutritional values than to sustainability information. The sustainable information dimensions (such as carbon footprint and logos) do not differ from each other in attention paid and importance. These results may partly be caused by information sequence, as price, nutritional values and origin of raw materials were always presented first on the interactive screens. Consumers probably only

watch the first part of information displayed on the interactive screens when they look up product information. Moreover, previous research has also shown that in the food domain, choices seem to be more often influenced and prioritized by how healthy the products are than how important food choices are for the environment (Kriflik & Yeatman, 2005; Lang & Rayner, 2003). In addition, price always plays a key role, such that higher prices are often an obstacle for consumers to consume more sustainable foods (O'Donovan & McCarthy, 2002);

- 2) Pro-environmental self-identity seems to be biased as practically all consumers indicate that they are very pro-environmental. This seems to be the result of a strong social desirability response. We find a discrepancy in self-reported pro-environmental behaviour and actual sustainable choices made in the pre-visit questionnaire. Within the group of visitors with a sustainability pre-task, only a small group indeed accurately choose the sustainable options (6 out of 100). Taken together, our results show only weak evidence for a spill-over effect from other sustainability domains to the food domain. However, in the donation task we see that people who were asked to make sustainable choices in the non-food domain also donated more money to general sustainability charities, which provides evidence that the sustainability mindset was induced as desired.
- Though there is limited evidence that the supermarket visit itself strongly induces towards sustainable purchases at the Supermarket of the Future, we find evidence of positive spill-over effects. That is, visitors report stronger intentions to take environmental concerns into account in future food choices than non-visitors do (group 1 & 2 vs. group 3). This indicates that the Supermarket of the Future triggers consumers to think about environmental concerns, as such the supermarket could be considered as sustainability behaviour activation itself. This conclusion was underlined by the finding that consumers who visited the Supermarket of the Future on average donate more money to sustainable charities compared to consumers who did not visit the supermarket.

Despite the potential and opportunities that such an innovative supermarket brings to consumers, it also created in an atypical setting which at the same time was technologically challenging for consumers. For instance, consumers did not always understand that they needed to point at the product, so instead they placed the product in front of the interactive screen waiting for the information to come. Also, out of convenience, consumers looked at the products as they would normally do, instead of using the interactive screens. This also happened when consumers started comparing products.

Consumers have limited capacity to process all information available to them. If too much information is provided consumers rely on heuristics and simply do not process all available information (Malhotra, 1982). Consumers for instance focus on the first information presented. In future research it could be helpful to make a hierarchy in information that is available to consumers on information displays. For instance, it could be helpful to consumers if they could select the type of information where they are most interested in, so that they could directly compare this information across different products. This also makes it easier for consumers to remember the information. This is in line with research showing that the way consumers encounter information has a substantial impact on the way this information is evaluated and integrated (Ariely, 2000). Specifically, interactive communication that gives consumers control over the content, order, and duration of product-relevant information causes information to have higher value and to become increasingly usable over time (Ariely, 2000).

For future research it would be important to systematically change the information order that is presented on the interactive screens. When a number of information components is presented about a product, usually consumers pay most attention to the information

that they see first. In the Supermarket of the Future price, nutritional values, and origin of raw materials were presented first on the interactive screens. Price and nutritional values are also the components which concern consumers most in their daily shopping (Kriflik & Yeatman, 2005; Lang & Rayner, 2003). Therefore, in future research it would be good to present sustainability information first to consumers. In this way it can be investigated whether the amount of attention paid to sustainability information and the importance of this information in food choices and future food choices will differ, compared to when such information is presented much later to the consumer. Though in general it helps when an environment is created in which sustainability information is presented to consumers in an interactive way, because this triggers consumers to take sustainability more into account in future food choices as seen in the current study.

The results from this study suggest that consumers consider environmental aspects important in their choices and behaviour at an abstract level. At a more specific level consumers are however not sure what to do (e.g. when consumers are asked to make sustainable choices in the non-food domain). For future research, it is therefore important to investigate how consumers can be effectively educated to take concrete actions to behave more sustainably.

3 Lab experiment 1: Date marking

3.1 Background

Worldwide roughly one-third of food produced for human consumption is lost or wasted, which amounts to about 1.3 billion tons per year (Gustavsson, Cederberg, Sonesson, Otterdijk, & Meybeck, 2011). In Europe, about 34% of still edible food is wasted by consumers, which amounts to around 95 kg/year per capita (Gustavsson et al., 2011). In order to increase sustainability in the food chain, household food waste needs to be reduced (Soethoudt, Sluis, Waarts, & Tromp, 2012). Misinterpretation by consumers of the meaning of "use by" and "best before" dates is considered to contribute to food waste in households. A possible solution is to extend the current (limited) list of non-perishable foods (e.g., sugar, salt) that are exempted from the obligation to include a minimum durability (i.e. "best before") date in food labelling⁴. However, the possible impact of removing "best before" dates on consumer behaviour, and in particular, household food waste is unclear and needs to be investigated. That is, successful expansion of the list, with other non-perishable foods such as rice and pasta for example, depends not only on food safety criteria but also on consumers' perceptions of the quality and durability of products without best before dates. **The aim of this study is to investigate consumers' decisions to use or dispose non-perishable long shelf-life food products they have stored in their kitchen cabinets over time, and how such behaviour may be influenced by the presence of dates on food labelling (best before date, production date) versus absence of a best before date on the food package.**

The current situation is that food producers are required to provide information about the expected durability of a product (except those that are exempted from minimum durability labelling), either in the form of a "best before date" (BBD) as an optimal quality guarantee, or a "use-by date" (UBD) to be utilised for highly perishable goods in order to indicate the date until which a food product can be eaten safely (see for instance Yngfalk, 2012). Date marks provide important cues to assess quality when buying or eating food (Harcar & Karakaya, 2005; Marietta, Welshimer, & Anderson, 1999; Terpstra, Steenbekkers, De Maertelaere, & Nijhuis, 2005; Tsiros & Heilman, 2005). When a best before date is present a strong increase in the disposal probability can be expected after the BBD expires. This study investigates what happens if no BBD is present on imperishable products by means of an experiment. The outcome is beforehand unclear. On the one hand, in the extreme case, it could be considered that consumers would never throw away a product that has no BBD on it and keep it in their storage cabinet forever. However, an alternative consumer reaction could be that disposal occurs *earlier* in the absence of a BBD, because without a clear reference point to rely on, consumers are rather safe than sorry. Ironically, this turning point could well occur before the BBD, especially for products that are *misperceived* by consumers to have a much shorter shelf-life than they actually have. Therefore we explored whether the increase in disposal probability will occur earlier (even before the BBD) or later in the absence of date marks. In addition to investigating the effects of removing the BBD date completely, we also explored what happens if information about the production date is available. While products without a date mark provide no reference point to consumers whatsoever, the production date does provide information about the "oldness" of the product.

In the experiment consumers were asked to indicate for two products a) their willingness to use/keep versus throw away a product, (b) their perceived product quality, and (c) their perceived product safety, at four different time points. 500 consumers (mostly Italian) visiting the Milan EXPO participated in the study. Participants judged products

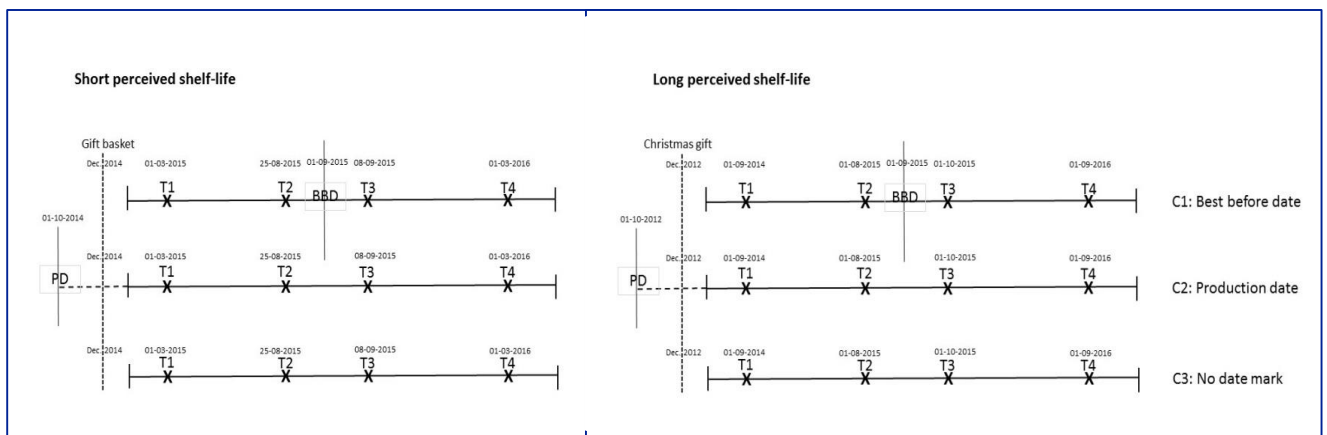
⁴ Annex X to Regulation (EU) No 1169/2011 on food information to consumers currently defines a list of foods for which the indication of a "best before" date on food labelling is not obligatory. Today these include foods such as vinegar, sugar, salt and chewing gum and could be extended to other foods for which removal of date marking would not pose a safety concern.

with either a best before date (BBD), no date, or a production date. In addition some consumers evaluated non-perishable products with a perceived short shelf-life beyond the best before date (*pasta sauce and orange juice*) and some with a perceived long shelf-life beyond the best before date (*coffee and pasta*).

The four time points (T) were made symmetric around the BBD (with half year before and after the BBD for the short shelf-life condition, and one year before and after the BBD for the long shelf-life condition, see Figure 3.1)⁵:

- T1: A substantial amount of time before the BBD;
- T2: Just before the BBD;
- T3: Just after the BBD;
- T4: A substantial amount of time after the BBD.

Figure 3.1 Time points for which consumers judged the product



3.2 Key results

First, general product liking was measured to check whether disposal rates were strongly affected by disliking of the products used⁶. In general, however, product liking is high (all means > 4.47, 7-point scale). Second, consumers self-report a high understanding of the best before date ($M = 5.86$, 7-point scale). However, only 47% of participants indicated correctly what the meaning is of the BBD when asked to select the correct answer out of 3 options. Thus, understanding about the BBD can be improved. Also, in general consumers think they can decide for themselves about expiration of a product ($M = 4.30$, 7-point scale), but they also believe that a BBD helps to make decisions about the product quality, safety and disposal of a product. Not having a BBD on a product is perceived as risky, mainly for products with a short perceived shelf-life. The results of the behavioural experiment shine further light on this point.

⁵ Time points for short perceived shelf-life and long perceived shelf-life were chosen in such a way that consumers would believe this and that these are in line with current dates used in the market. For instance, pasta that one buys now has expiration dates of 2018. A Christmas gift in 2012 is therefore a realistic reference point. The actual BBDs for sauce and UHT orange juice are March 2016 and May 2016 respectively. Currently the actual BBDs for coffee and pasta are November 2016 and June 2018 respectively.

⁶ For instance, if respondents dislike the specific product this might be the underlying reason why they choose to dispose the product.

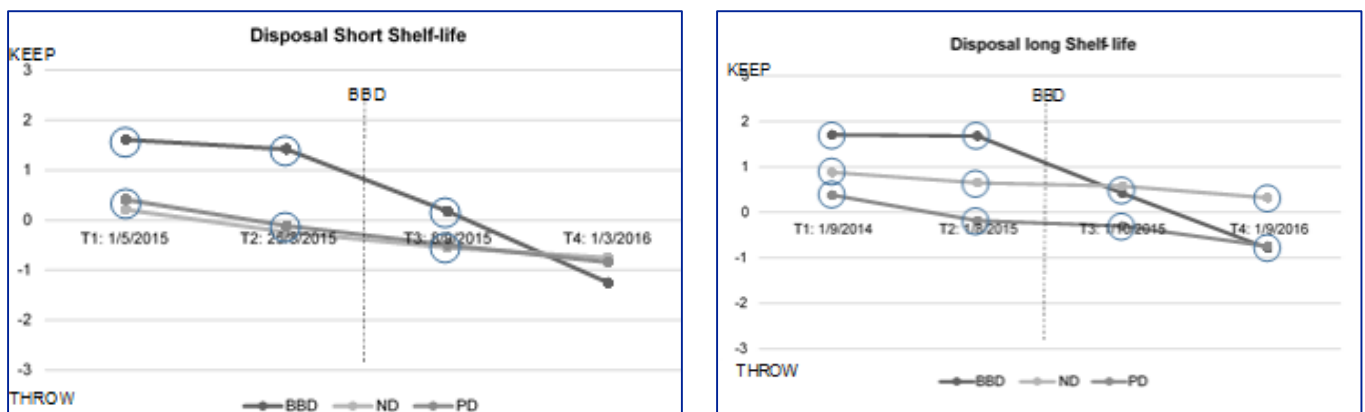
3.2.1 Disposal probability

Figure 3.2 shows that over time consumers are more likely to dispose a product, as indicated by the decreasing lines. In addition, disposal is dependent on the presence of a date and the type of date mark (BBD, PD), the exact patterns differ somewhat between short-life products (figure left-hand side) and long-life products (figure right-hand side).

When comparing disposal behaviour in case of a best before date with a situation without a date, patterns are relatively similar between non-perishable products with a short and a long shelf-life. Before the BBD has been reached (T1 and T2), a BBD on products is more effective in preventing food waste than no date mark or a production date. That is, in case of a BBD on products the likelihood of disposal is lower than in case of no date. However, after the BBD has been reached (T3 and T4), no date mark on products is more effective in reducing the likelihood to dispose than providing a BBD or PD (right half-part of figures).⁷ Right after expiry of the BBD there is strong increase in likelihood to dispose (or better: strong decrease in likelihood to keep) for products with a BBD, whereas the pattern for products without a date is more stable. As such, in case products are in consumers' cupboards long after the BBD, there is less disposal for products without a date compared to the BBD (see T4: 1/3/2016 or 1/9/2016). Overall, it is difficult to tell whether no date is preferred over best before date, because this strongly depends on how long consumers typically keep long shelf-life, non-perishable products in their cupboard before consuming them.

For the alternative option of date marking with a production date, we observe that for products with a short shelf-life consumers respond in the same way as when no date is provided. For products with a long shelf-life however, a production date leads to higher disposal rates at the first moment in time as compared to no date. In sum, putting a production date is the least preferred option as compared to no date and a best before date.

Figure 3.2 Disposal for short (left) and long shelf-life products



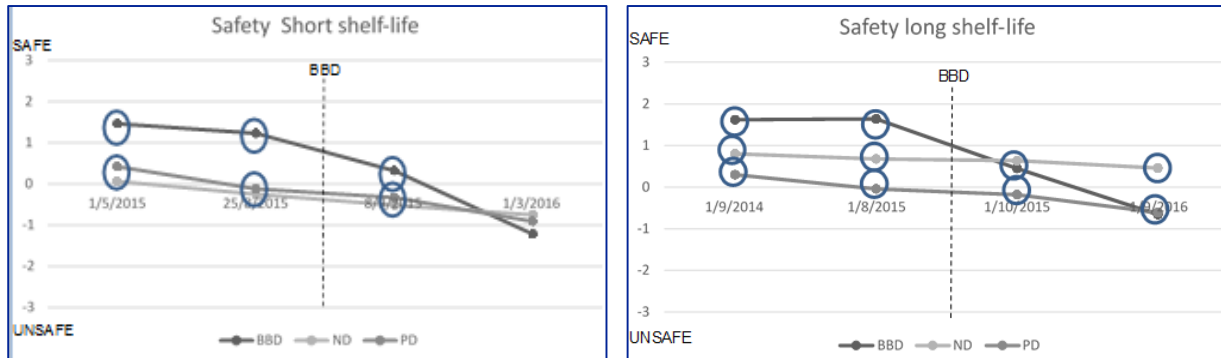
Note. Higher values indicate keeping a product. Circles indicate that the date marks at that time point are significantly different from each other.

⁷ It should be noted that, in case a production date or no date was provided to respondents, respondents were not aware that at T3 & T4 the BBD of the product was reached. For the production date condition, the production date could be used as a reference point to infer whether one wants to keep or dispose the product when time passes (instead of the BBD). If no date was provided one could use the date that the product was received as a gift as a reference point (instead of the BBD).

3.2.2 Perceived product safety

Apart from reporting of planned disposal behaviour, in the experiment consumers were also asked to indicate their perceived safety of the products (see figure 3.3). Over time consumers perceive the product as less safe, as indicated by the decreasing lines. In addition, perceived product safety is dependent on the type of date mark (BBD, ND, PD).

Figure 3.3 Perceived safety for short (left) and long shelf-life products



Note. Circles indicate that the date marks at that time point are significantly different from each other.

Before the BBD is reached, products with a BBD are considered more safe than similar products with no date mark or a production date (left part in the graph):

- Presence of BBDs on products leads to higher safety perceptions of consuming a product compared to products without a date mark or products with a production date.

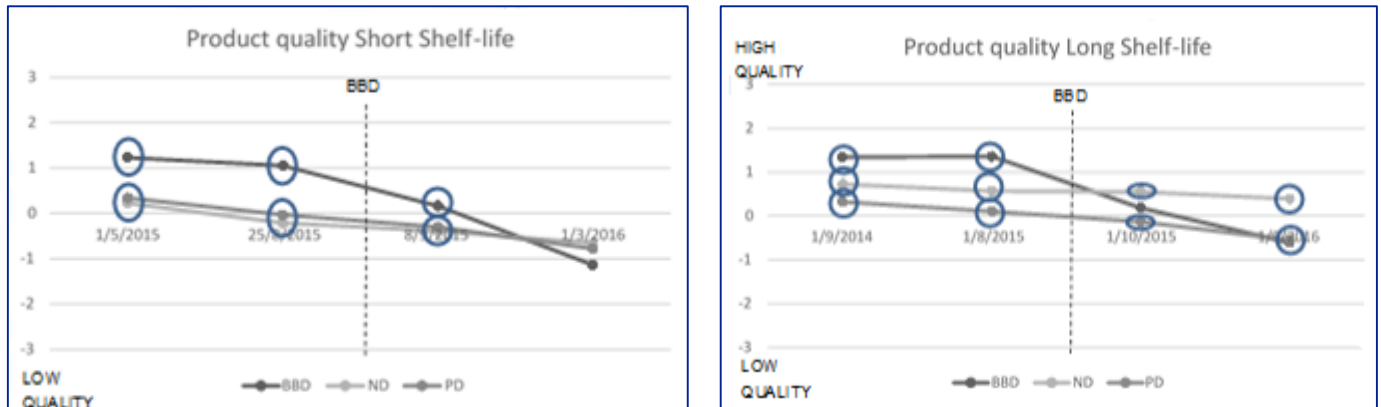
After the BBD has been reached, no date mark is preferred over providing a BBD or PD (left part in the graph):

- Right after the BBD is reached there is strong decrease in perceived product safety, for products with a BBD;
- Perceived product safety is higher for products without a date mark (ND) compared to products with a BBD, mainly for products with a long shelf-life (see T4: 1/9/2016, long shelf-life);
- Providing a production date (PD) is not effective, as compared to the BBD and ND perceived safety is equal or lower across all time points when a production date is provided. The PD never outperforms ND or BBD, this effect is even stronger for products with a long perceived shelf-life.

3.2.3 Perceived product quality

In the experiment, for each time point perceived product quality of the product was investigated for three date marks: (1) BBD, (2) no date (ND), (3) production date (PD). This was investigated for products with a short perceived shelf-life (pasta sauce, orange juice) and a long perceived shelf-life (coffee, pasta). In figure 3.4 it is shown that over time consumers perceive the product as lesser in quality, as indicated by the decreasing lines. In addition, perceived product quality is dependent on the type of date mark (BBD, ND, PD).

Figure 3.4 Perceived product quality for short (left) and long shelf-life products



Note. Circles indicate that the date marks at that time point are significantly different from each other.

Before the BBD is reached, a BBD on products is more effective than providing no date mark or a production date (left part in the graph):

- Presence of BBDs on products leads to higher quality perceptions of consuming a product compared to products without a date mark or products with a production date.

After the BBD is reached, no date mark on product is more effective than providing a BBD or PD (right part in the graph):

- Right after the BBD is reached there is strong decrease in perceived product quality, for products with a BBD;
- Perceived product quality is higher for products without a date mark (ND) compared to products with a BBD, mainly for products with a long shelf-life (see T4: 1/9/2016, long shelf-life);
- Providing a production date (PD) is not effective, as compared to the BBD and ND perceived product quality is equal or lower across all time points when a production date is provided. The PD never outperforms ND or BBD, this effect is even stronger for products with a long perceived shelf-life.

Perceived quality and safety are highly correlated with disposal probability (all $R > .826$). This is also reflected in the graphs, as the lines have similar patterns. Together, this indicates that while making judgments about keeping or disposing a product people are strongly influenced by quality and safety perceptions of consuming the product.

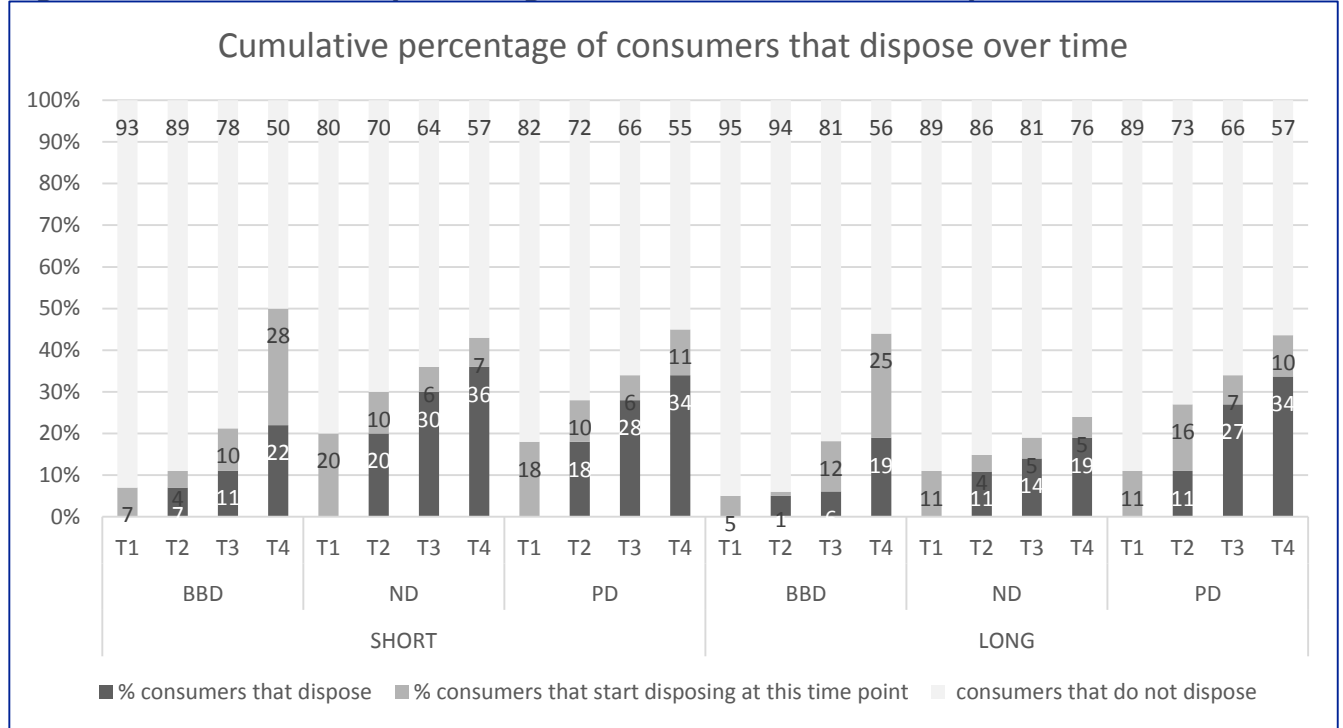
It can be concluded that before the BBD is reached, it is better to provide BBDs on products as this leads to less disposal compared to when no date mark is present or when the production date is present. There is less disposal if no date marks are provided (after the BBD but not before). In addition, it can be concluded that adding a production date is less effective than adding a BBD or no date mark.

As such the findings considering perceived food safety and quality are in line with the findings on food disposal, they all point to similar directions for reducing food waste.

3.2.4 Total disposal

In figure 3.5 the cumulative percentage of consumers that certainly dispose the product is displayed⁸, in order to see if the BBD or providing no date marks is more effective in its entirety when it regards total percentage of consumers that dispose.

Figure 3.5 Cumulative percentages of consumers that dispose over time



For short perceived shelf-life products total percentage of consumers that dispose is lower for products without a date mark than for products with a BBD:

- For products with a BBD:
 - At T1 there are 7% of consumers who would like to dispose the product;
 - At T2 the disposal is 11% which is a 4% increase in disposal compared to T1;
 - There is a strong increase in disposal between T3&T4 (28%);
 - At time point 4 50% of consumers would dispose the product.
- For products without a date mark:
 - Disposal at T1 is higher than when a BBD is provided (20% versus 7%);
 - However, there is a less strong increase in disposal over time;
 - At T4 about 43% of consumers disposed the product (compared to 50% with a BBD).

For long perceived shelf-life products total percentage of consumers that dispose is lower for products without a date mark than for products with a BBD: For products with a long shelf-life the difference in cumulative disposal percentages between BBD and no date mark is even larger. In total only 24% of consumers would dispose the product at or before T4 if no date mark is present, compared to 44% if the BBD is present. This illustrates that before the BBD is reached it is better to provide date marks as total disposal is lower compared to when no date mark is provided. After the BBD is reached

⁸ These are the consumers that indicated that they certainly will dispose the product (indicated with -3 on the scale).

no date marks would be best, as total disposal is lower compared to when the BBD is provided on products.

3.3 Conclusions and suggestions for future research on date marking

This study provides unique insights in consumer food waste by taking an experimental approach, in this way we were able to confront consumers with date mark situations which are currently absent in real market situations. It yields the following key insights:

- Before the BBD has been reached, it seems better to have a BBD on products (less disposal; higher perceived product quality and safety perceptions). However, in the long run (i.e. after the BBD has been reached) it is however better to not have a date mark on products. This pattern is even more existent for products with a long perceived shelf-life;
- Providing production dates (PD) on products does not decrease disposal, as for products with a short perceived shelf-life the PD does not decrease disposal better than products without a date mark. And, for products with a long perceived shelf-life the addition of a production date does not decrease disposal more, compared to products with a BBD or no date mark.

The experiment was conducted with a small sample though, mainly Italians. It is useful to replicate it in other member states with larger sample sizes.

Actual storage and cleaning behaviour

To draw policy conclusions about BBD versus no date marking in relation to food waste prevention, it is important to consider at which point consumers typically consume the products stored in their kitchen cabinet. This was not investigated in the current study. If most products with a long perceived shelf-life are consumed before the BBD is reached the recommendation would be to keep the BBD on long perceived shelf-life products. However, if these products are actually stored for a longer time, it would be better to not have date marks on products.

First of all, it is important to understand the percentage of long shelf-life products that is being disposed because of incorrect interpretation of the BBD and how much this contributes to the food waste problem. Research conducted by WRAP (2011) in the United Kingdom indicates that disposal of unopened staple products (such as rice, pasta) contributes little to the food waste problem (compared to other sources of food waste), as only 1.1% of 2277 wasted products were pasta, rice, noodles, and 0.8% were cooking sauces. In addition, WRAP (2014) found that in the UK about 10% of wastage of (opened) staple foods could have been avoided. Although one of the reasons for disposal was expired date marks, the main reason was an incorrect evaluation of portion sizes.

Second, it is important to know the actual stocking behaviour of consumers: how long do consumers store products in their cupboards? And how many products are actually past the BBD? Most staple products seem to be consumed before the BBD, or thrown away before the BBD for different reasons (such as being overcooked / too large portion sizes) (WRAP, 2011). In order to investigate this further, it is recommended to retrieve refresh rates / usage frequencies from retailers which would provide insights on average stocking behaviour of consumers⁹.

⁹ This research idea came up during a discussion with Andrew Parry, WRAP.

Third, it is important to consider the cleaning behaviour of consumers. 17% of food is thrown away when clearing out the cupboards (WRAP, 2011). It is however unknown if this mainly concerns fresh products or imperishable products. Investigating this further, helps determining the volume of long shelf-life food that is unnecessarily wasted.

Altogether, it seems that by removing date marks only a small group of consumers is likely to decrease disposal of food, whereas the majority of the consumers might be put at risk to dispose more. Therefore it seems best to keep the BBD on long shelf-life products. It is however recommended to conduct behavioural experiments in which actual behaviour is measured to further strengthen this conclusion.

Educating the meaning of the best before date to consumers

There are still (too) many consumers that would dispose a product because of incorrect interpretation of the BBD. The current research suggests that understanding of the BBD could be improved. The graphs show that consumers think the BBD works as a signal that one cannot (safely) consume the product anymore and need to dispose the product. This is supported by research conducted by WRAP (WRAP, 2011) showing that there is a peak in food items with best before dates being thrown away shortly after the date on the label. In addition, research by Van Boxtael, Devlieghere, Berkvens, Vermeulen, and Uyttendaele (2014) also shows that there is misunderstanding amongst consumers regarding interpretation of date marks. Thus, misinterpretation of the BBD appears to be an important factor of disposal and this requires better education on the meaning of the best before date to consumers.

A lack of technical understanding did not prevent people from developing their own working definitions around disposing products (WRAP, 2011). Consumers use labelling on a 'need' basis – only after having identified a need for the information will the label be noticed or sought out. Furthermore, different consumer segments can be defined. For instance, young families / couples clearly express to have date marks on products, whereas elderly tend to rely on common sense and ignore date marks. Thus for some consumers BBDs are used as quality cues. Removal of BBDs also removes reference points that consumers use to judge quality of a product. This provides another reason to not remove BBDs on long shelf-life products.

4 Lab experiment 2: Imperfect fruits & vegetables

4.1 Background

Food waste is a big problem in Western societies. On average, between one third and half of all produced food is not consumed by humans but thrown away, used as fertilizers, or given to animals. One way to reduce this spillage of resources would be to motivate consumers to accept and purchase suboptimal or not-perfect looking foods (but with optimal taste/quality) which are normally not supplied in the retail market. **The aim of this study was to investigate how to increase consumer acceptance of imperfect foods.**

The European Union applies marketing standards for fruits and vegetables produced in or imported to European countries. Some of these standards do not only apply to quality aspects, such as soundness or absence of pests, but also to the aesthetic aspects of fruits and vegetables. Even though the list of fruits and vegetables to which specific norms apply has been strongly reduced in 2009, food retailers are likely to keep using high aesthetic standards for the fruits and vegetables they offer even in the absence of EU standards (FAO, 2011; Loebnitz, Schuitema, & Grunert, 2015). An operational argument is that storage and distribution of products with regular shapes and sizes is easier to handle, whereas products with irregular shapes and sizes create inefficiencies in the logistic process (Waarts et al., 2011). In addition, food retailers argue that their customers demand perfect fruit and vegetables. Because they experience that consumers will always go for the perfect food items, they typically sell imperfect fruits at about 30% lower prices¹⁰ (e.g. Intermarché's Inglorious foods initiative and Loblaws¹¹ "Naturally imperfect" initiative¹²). Low consumer acceptance of imperfect fruits and vegetables thus seems to keep these high retailer standards in place (Stuart, 2009).

The question then is how consumer acceptance of imperfect fruits and vegetables can be improved. The typically used strategy of offering imperfect products at lower prices relative to those of perfect products has some clear disadvantages. First, it means that farmers get smaller margins on high-quality food that simply does not look perfect. Furthermore, lowering the value of food actually paves the way for more rather than less food waste: the low price of food is often used as a justification by consumers to throw food away (SlowFood, 2014). The current research therefore explores whether persuasive messages can be used as an alternative to diminish the need for reducing price levels of imperfect fruits and vegetables. In addition, it analyses the impact of price reductions and message framings on consumers' perceptions of the quality and taste of imperfect foods.

In the study we consider anti-food waste messages and authenticity messages. Anti-food-waste messages may provide a motivation that is extrinsic to the purchasing behaviour, e.g. "Embrace imperfection: join the fight against food waste!". Such message aims to motivate consumers with a reason to purchase imperfect foods, but are likely not taking away consumers' expectations that the quality and taste of imperfect foods are worse compared to perfect foods. In contrast, authenticity messages that provide an intrinsic motivation for the purchase of imperfect foods (e.g. naturally imperfect: Apples the way they actually look) may not have that negative effect on perceived taste and quality. In fact, messages that focus on the authenticity of imperfect fruit and vegetables – i.e. imperfect is more natural, genuine, or real – may even lead to *higher* quality and taste perceptions for imperfect compared to perfect foods.

¹⁰ <http://www.mo.be/nieuws/miss-tomaat-en-mister-appel>.

¹¹ <http://www.canadiangrocer.com/worth-reading/french-grocer-tackles-food-waste-with-ugly-fruit-pos-41007>.

¹² http://www.thestar.com/life/food_wine/2015/03/12/loblaws-sells-ugly-fruit-at-a-discount-to-curb-food-waste.html.

Figure 4.1 Visual material used in the study: 1) shelf with perfect and imperfect apples, with an authenticity message and 30% lower price. 2) Shelf with perfect and imperfect carrots, with an anti-food waste message and 30% lower price.



In the experiment consumers were asked to evaluate perfect and imperfect apples and carrots. 500 consumers (mostly Italian) visiting the Milan Expo participated in the study. Participants saw the imperfect food either at the same price as the perfect food, with a moderate price reduction of 15%, or with a sharp price reduction of 30%. In addition, either no additional message was provided to consumers, or an authenticity or anti-food waste message frame was given (2*3 between subjects design):

- Anti-food waste message: "Embrace imperfection: Join the fight against food waste!"
- Authenticity message: "Naturally imperfect: Apples [carrots] the way they actually look!"

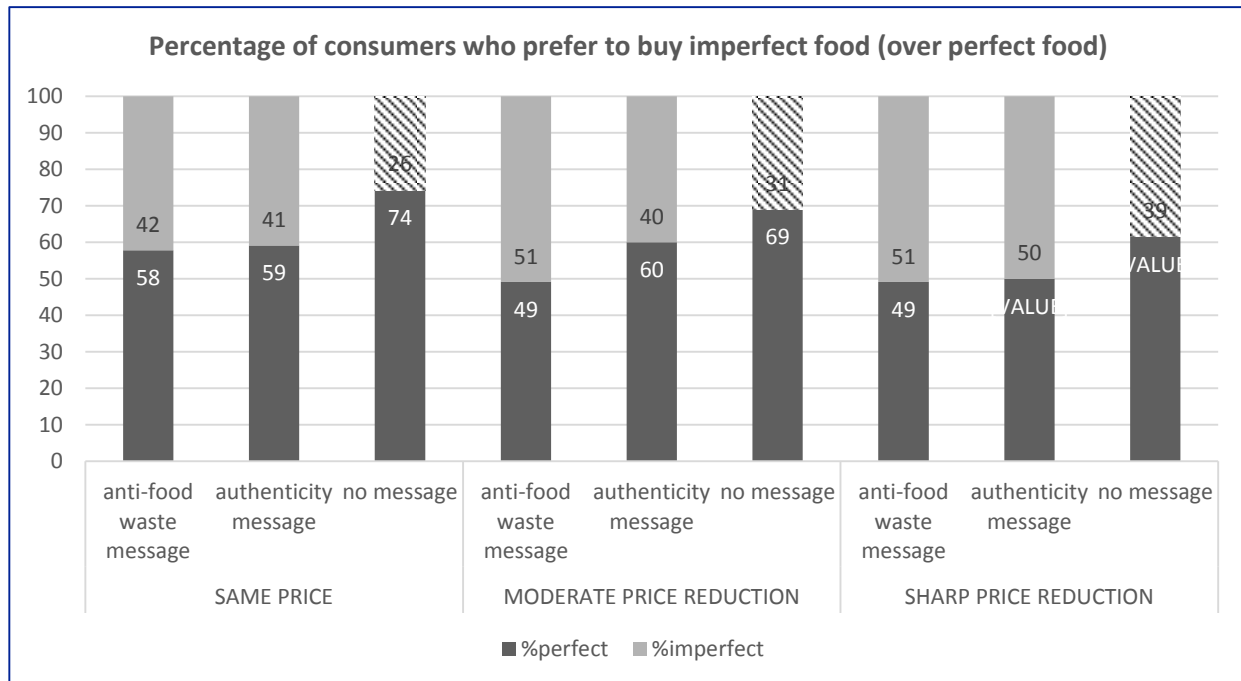
See figure 4.1 for two examples of visual material used in the study.

4.2 Key results

4.2.1 Choosing imperfect foods and vegetables

The experiment shows that adding a promotional message increases consumers' intention to buy imperfect foods. Price reductions also lead to higher intentions to buy imperfect foods. Combining price reductions and promotional messages leads to an even higher intention to buy imperfect foods. The preferred promotional message depends on the price level. The authenticity message leads to highest consumer purchasing in case of moderate price decreases, whereas for no price decrease or 30% price decreases the promotional messages are equally effective. These conclusions will be further explained below. Overall no differences were found between carrots and apples, thus the results are presented jointly in figure 4.2.

Figure 4.2 Percentage of people who prefer to buy perfect versus imperfect foods



Presence of price reduction

In the experiment, the willingness to buy imperfect foods was investigated for three price levels: (1) same as perfect, (2) moderate price reduction of 15%, and (3) sharp price reduction of 30%. In figure 4.2 the percentage of consumers willing to buy imperfect foods with a price reduction is displayed as striped lines.

The higher the price reduction, the more willing consumers are to buy imperfect foods:

- Same price: 74% of consumers would buy perfect foods while 26% would buy imperfect foods;
- Moderate price reduction: slightly more respondents would buy imperfect foods (31%);
- Sharp price reduction: even more respondents would buy imperfect foods (39%).

Message frame

In the experiment, the willingness to buy imperfect foods was investigated for three message frame conditions: (1) no message, (2) authenticity message frame, and (3) anti-food waste message frame. In figure 4.2 the percentage of consumers willing to buy imperfect foods with a message frame is displayed as light grey bars.

Providing a persuasive message increases willingness to buy imperfect foods:

- If no message is provided 74% of consumers would buy perfect foods while 26% would buy imperfect foods;
- If an authenticity message or anti-food waste message was provided, more consumers (41% and 42%) would buy imperfect foods.

Price reduction in combination with message frames

One of the aims of the study was to show if by framing differently (make people accountable for their responsibilities or emphasize the importance of authenticity of fruits and vegetables), price reductions might be less necessary. A lower price of food is often used as a justification by consumers to throw food away. The experiment shows that price reduction in combination with a message frame increases willingness to buy imperfect foods (see fig. 4.2):

- As already mentioned above, 31% of people would buy the imperfect foods with a moderate price reduction, and 39% of people would buy imperfect foods with a sharp price reduction;
- If an authenticity message was provided more respondents (40%) would buy the imperfect foods with a moderate price reduction. Providing an anti-food waste message accompanied with a moderate price reduction is even more effective with 51% of respondents willing to buy imperfect foods;
- If an anti-food waste message or authenticity message was provided, more respondents (51% and 50%) would buy the imperfect foods with a sharp price reduction.

The situation that most likely would work best in practice would be a moderate price reduction with a message frame.

4.2.2 Willingness to pay for imperfect fruits and vegetables

We also investigated how much people would be willing to pay for the imperfect and perfect foods (in euros). As in practice different price levels apply for carrots and apples both are reported separately. People are less willing to pay for imperfect foods ($M_{imperfect\ apple} = €1.59$ vs. $M_{perfect\ apple} = €2.01$; $M_{imperfect\ carrot} = €1.27$ vs. $M_{perfect\ carrot} = €1.67$). This was the case for all message frames and the different price reductions.

We investigated the likelihood of buying perfect versus imperfect foods in relation to the maximum price consumers would like to pay for imperfect apples and carrots. This information can be used to determine the optimum price for imperfect foods. See figure 4.3 and 4.4. The middle line represents the average proportion of all consumers who want to buy the product at a certain price. The other lines represent the extremes, namely consumers who are not willing to buy imperfect foods (indicated with a 1 on the scale), and consumers who would be willing to buy imperfect foods (indicated with a 9 on the scale)¹³. All lines decrease and show the decrease in percentage of consumers who want to buy the product at a certain price.

¹³ Consumers were asked to what extent they were willing to buy the imperfect food on a 9-point scale. Consumers who are very willing to buy the imperfect food indicated this by check-marking the value 9 on the scale. For these consumers (the consumers that are likely to buy imperfect foods) a split file procedure was conducted and for this segment the percentage that was willing to buy the product for a certain maximum price was estimated. This same procedure was repeated for the segment that indicated that they were not willing to buy imperfect foods. And across all consumers (the average consumer).

Figure 4.3 Maximum price consumers are willing to pay for apples

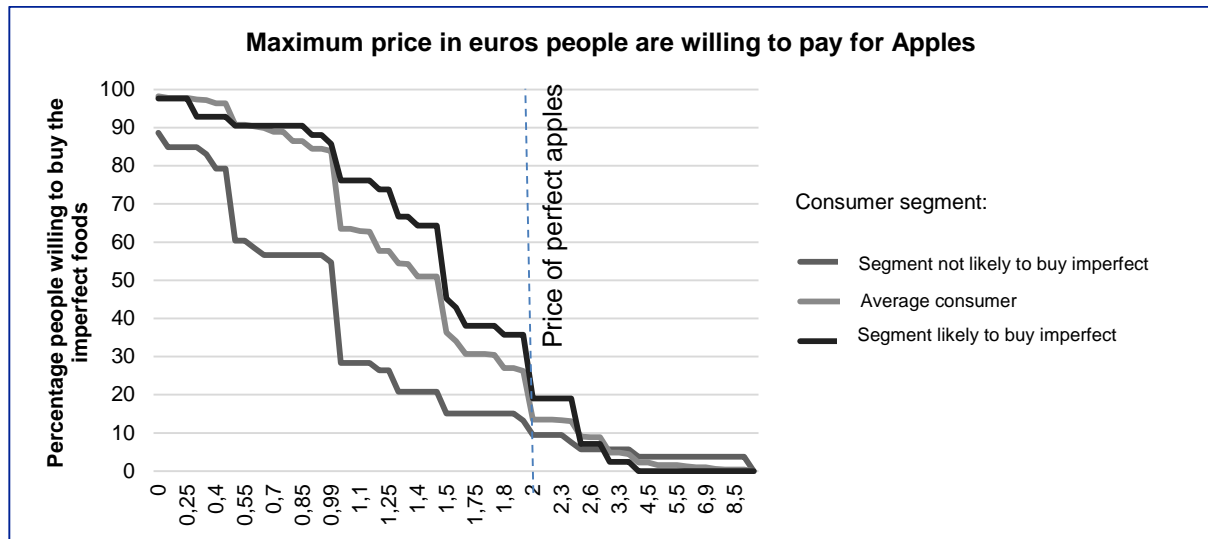
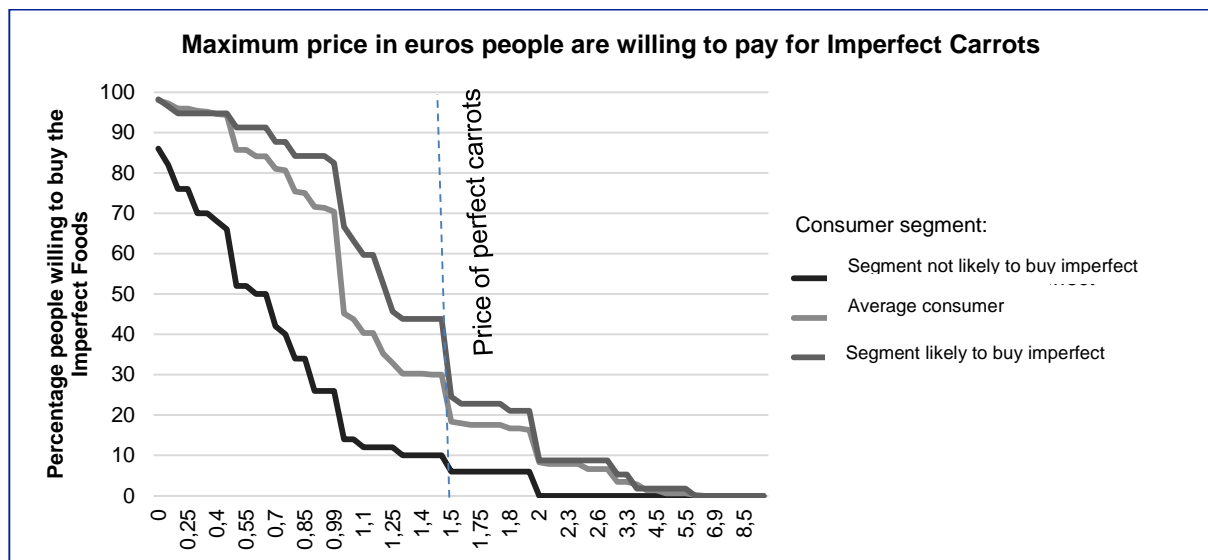


Figure 4.4 Maximum price consumers are willing to pay for carrots



At a price of €0, close to 100% of consumers would “buy” the imperfect foods. If the price of imperfect foods increases (moving to the right in the graph), the percentage of consumers who would be willing to pay that price for imperfect foods drops. A strong drop indicates that the maximum price for a large number of people has been reached.

Consumers who are not willing to buy imperfect foods consistently indicate a lower maximum price that they would be willing to pay for imperfect foods. For instance, for apples this is typically around €0.99 for consumers who are not willing to buy imperfect foods, as indicated by a sharp drop. There are less than 30% of consumers wanting to pay more than €1 for imperfect apples if they are not willing to buy the imperfect food. For carrots the maximum price that consumers who are not willing to buy the imperfect food want to pay is between €0.70 and €0.99, as can be seen by the sharp drop (50% of consumers who are not willing to buy imperfect foods do not want to pay more than €0.70 for such imperfect foods). For people who are willing to buy imperfect foods, the maximum price they want to pay for imperfect foods is higher. Now most people would want to pay around €1.50 and €2 for apples, and €1 and 1.50 for carrots.

4.2.1 Quality perceptions of imperfect foods and vegetables

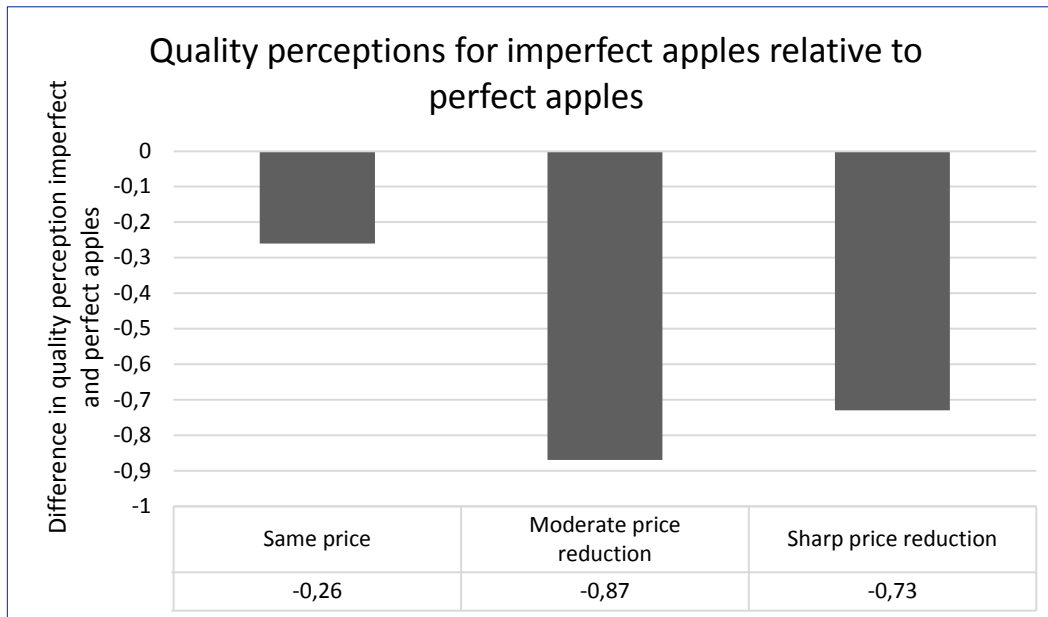
Whereas lowering the price of imperfect products might signal that the quality is lower, the authenticity framing in contrast aims to emphasize the higher quality of the product (original, unprocessed, the way they actually are). We investigated whether adding an authenticity framing to imperfect fruits and vegetables might increase quality perceptions, in such a way that lowering the price of these products is not necessary anymore – or to a lesser extent than is currently done (15% instead of 30%).

Perceived product quality of foods considered as perfect is higher than of imperfect foods. Specifically for apples we found that if prices for imperfect and perfect apples are the same, an authenticity message leads to higher quality perceptions compared to the situation in which no message is provided (see fig 4.5). When prices of imperfect foods are 15% lower, this is the case for the anti-food waste message, and for 30% lower price levels it is again the authenticity message that increases quality perceptions of imperfect apples. This signals that both extrinsic (anti-food waste) and intrinsic (authenticity) message framing leads to increased quality perceptions for imperfect foods, but that for intrinsic message framing to yield higher quality perceptions, a price reduction is not necessary (and may in fact diminish the effect).

Figure 4.5 Product quality perceptions for imperfect apples



In addition, we further investigated the quality perceptions of imperfect foods relative to perfect foods. For imperfect relative to perfect foods quality perceptions are closer together when the same price level is used (see fig 4.6). Quality perceptions for imperfect relative to perfect foods are further apart when price reductions are used. Price reductions signal that the imperfect food is of lesser quality compared to perfect foods with the same price reduction.

Figure 4.6 Quality perceptions for imperfect apples relative to perfect apples

Note. Bars close to 0 indicate that there are no differences in quality perceptions between perfect and imperfect foods.

Imperfect foods are assessed worse in quality relative to perfect foods when no message is provided to consumers than when messages are provided. Quality perceptions for perfect and imperfect foods are closest together when an authenticity message frame is used. This indicates that providing no message signals that the imperfect food is of lesser quality, whereas an authenticity message does not decrease quality perceptions relative to perfect foods. This confirms that authenticity message framing (intrinsic) increases quality perceptions and decreases the necessity of price reductions of imperfect foods.

4.3 Conclusions and suggestions for future research on imperfect foods and vegetables

The findings of the experiment suggest that:

- Providing a price reduction makes consumers more willing to buy imperfect foods, but lower price levels also signal that the quality of these products is lower;
- Providing promotional messages also leads to a higher choice to buy imperfect foods;
- The combination of promotional messages and price reductions further increases the choice to buy imperfect foods;
- Authenticity message frames prevent that consumers consider the quality of imperfect foods lower relative to perfect foods. Also, the authenticity message is more effective in stimulating consumer preferences in case of moderate price decreases.

Optimum combination of price reduction and message frames

Lower prices for imperfect foods signal that the food is of lower quality, which might mitigate the effectiveness of a message that emphasizes the intrinsic (quality) aspect of imperfect foods (Slow Food, 2014). The current research shows that choice of imperfect foods is highest when promotional messages and price reductions are provided jointly.

On the one hand anti-food waste messages seem to be effective as they increase willingness to buy imperfect foods. Especially with a moderate price reduction, more than half of consumers is willing to buy the imperfect food when an anti-food waste message is provided. On the other hand, message frames that emphasize the authenticity of a product increase quality perceptions and decrease the necessity of price reductions of imperfect foods. A moderate price reduction accompanied by a message frame is in practice probably the most likely option. In that respect it would be good to further investigate the effectiveness of other types of message frame, in a behavioural experiment where consumers actual are asked to buy imperfect vs. perfect foods¹⁴. In addition, better understanding regarding how message frames influence quality perceptions is recommended.

Quality perceptions differ across products

Regarding choices to buy imperfect foods over perfect foods there are no differences in consumers willing to buy imperfect carrots over perfect carrots or imperfect apples over perfect apples. However, when it regards quality perceptions there are differences in the effectiveness of message frames for apples, but not for carrots. This suggests that quality perceptions might differ across product categories (fruits, vegetables) and products. Therefore in future research the effectiveness of price reductions and message frames for other types of vegetables and fruits should be taken into account.

Willingness to buy imperfect foods across countries

The sample in the current study mainly consisted of Italians. Italians might be critical to imperfect foods as they might have different fairness perceptions than other EU countries. Even though this could be the case, they are more willing to buy imperfect foods when message frames and/or price reductions are provided. In addition different consumer segments might be more motivated to buy imperfect foods, such as students (money-savers), or consumers with pro-environmental self-identities (Loebnitz et al., 2015). For future research it is recommended to further investigate this across other EU countries with larger sample sizes. Moreover this will help identify consumer segments that are willing to buy imperfect foods.

Actual waste of imperfect foods

At the same time it is important to further investigate what percentage of imperfect foods is actually wasted. For instance, in Europe in total 20-30% of fruits and vegetables is discarded in agricultural production, and post-harvest fruit and vegetable grading, caused by quality standards set by retailers (FAO, 2011). In the Netherlands 5-10% of total vegetables is harvested but wasted, because retailers think there is no outlet for such products¹⁵. Imperfect foods are often further processed, for instance for soups and sauces, because there is no outlet or market yet for imperfect foods. There are several initiatives that seek to create a market for imperfect fruit and vegetables, and to raise consumer awareness (see for instance the Kromkommer initiative in the Netherlands)¹⁶.

¹⁴ This can for instance be done in a pop-up store of Kromkommer where imperfect foods are sold to consumers.

¹⁵ Source: Kromkommer, 2015. In addition, in Europe

¹⁶ In the Netherlands Kromkommer is active in raising consumer awareness and to create a market for imperfect foods. They believe that story telling is more important than price reductions, which is in the end beneficial to all parties. See for instance: <https://www.youtube.com/watch?v=vzmI95AWAGI>

Appendix 1: Background information

Lab study date marks

The following information and references can be consulted to get a more extensive overview of the background of the lab study on date marks:

Date mark indicators have a considerable safety margin and quality margin included to capture deviation from optimal handling in the supply chain (Pereira de Abreu, Cruz, & Paseiro Losada, 2011; Yngfalk, 2012). What is problematic is that such safety margins can lead to unnecessary food waste among consumers as the products are perceived as inferior in quality after the best before date is reached (Soethoudt et al., 2012). However, most products with a best before date only lose little of their sensory quality after the date has passed, but do not harm the health of consumers (Yngfalk, 2012).

Consumers collect information about the quality of a product, based on cues, heuristics, arguments, prior knowledge and information of others (Kruglanski & Webster, 1996; Mitra, Reiss, & Capella, 1999). Date marks enable the consumer to assess expected microbiological-related quality of products, when it is not yet visible. It is therefore not surprising that date marks provide important cues to assess quality when buying or eating food (Harcar & Karakaya, 2005; Marietta et al., 1999; Terpstra et al., 2005; Tsiros & Heilman, 2005). For perishable foods consumers believe that product quality is consistent until the expiration date, after which it is perceived to be directly spoiled (Anderson, Verrill, & Sahyoun, 2011; Harcar & Karakaya, 2005; Rozin & Fallon, 1980; Wansink & Wright, 2006). In that sense consumers tend to choose the product with the longest expiration date, even when the consumer's intention is to consume it before the shortest expiration date is expired (Soethoudt et al., 2012; Tsiros & Heilman, 2005). The way consumers perceive the product quality of long shelf-life products beyond the date mark is unknown. The current study therefore focuses on non-perishable products, and takes into account the best before date. The use-by date will not be taken into account in this study as this mainly applies to perishable products.

Lab study imperfect foods

The following information and references can be consulted to get a more extensive overview of the background of the lab study on imperfect foods:

The European Union applies marketing standards for fruits and vegetables produced in European countries and imported or exported. Some of these standards are specific ones not only applying to quality aspects, such as soundness or absence of pests, but also to the aesthetic aspects of fruits and vegetables. Even though the list of fruits and vegetables to which specific norms apply has been strongly reduced in 2009, the norms still apply to around 70% of the value of fruits and vegetables traded in Europe (10 types of fruits and vegetables).¹⁷ Multiple parties argue that these EU standards should be adjusted or abolished to decrease European food waste (Waarts et al., 2011), but we are not aware of any empirical evidence which demonstrates this. Others argue that the abolition of EU norms for fruits and vegetables might not have the desired impact on food waste. Research by AND International (2010) concludes that in multiple countries, European marketing standards simply have been replaced by UNECE (United Nations Economic Commission for Europe) standards, which are almost similar to the former EU standards. In addition, food retailers are likely to keep using high aesthetic standards for the fruits and vegetables they offer even in the absence of EU standards (FAO, 2011; Loebnitz, Schuitema and Grunert, 2014). One reason for the use of such private standards, sometimes even stricter than the EU standards for fruit and vegetables, is that the

¹⁷ <http://www.mo.be/fr/node/41047>.

storage and distribution of products with regular shapes and sizes is easier to handle compared to products with irregular shapes and sizes, creating efficiencies in the logistic process (Waarts et al., 2011). Second and important for the present study, food retailers argue that their customers demand perfect fruit and vegetables. They argue that if given the choice between perfect and imperfect fruits and vegetables, consumers will always go for the perfect food items.¹⁸ Low consumer acceptance of imperfect fruits and vegetables thus seems to keep these high retailer standards in place (Stuart, 2009).

An overview and examples of previous marketing campaigns

In various countries, marketing campaigns have been conducted to promote the purchase of imperfect foods (e.g., the Inglorious Foods & Vegetables campaign by Intermarché and the “Les Gueules Cassées” initiative in France¹⁹, the Ugly Foods project in Germany²⁰, and the “Kromkommer” initiative in the Netherlands²¹). In general, these campaigns often use one or a combination of the following marketing tactics (some examples are provided in Figure A.1.1-1.3):

- **Anti-food waste messages;** which emphasize how embracing imperfect foods help to reduce the food waste problem;
- **Persuasive messages that downgrade the importance of the aesthetic aspect** of fruit and vegetables; e.g. by focusing on the end product (e.g. the “Ugly carrot in a soup, who cares?” in Intermarché’s Inglorious Foods & Vegetables campaign);
- **Personification and sympathy/empathy-evoking messages** (Delbaere, McQuarrie & Phillips, 2011); campaigns in which imperfect fruit and vegetables are represented as having human characteristics (e.g. the “Crazy vegetables” from the Kromkommer initiative in the Netherlands or the “Imperfect produce” initiative by Imperfect in the US);
- **Persuasive messages that stress the authenticity** of imperfect fruits; arguing that “less perfect is more real” (e.g. the “Naturally imperfect” campaign in Canada).

¹⁸ <http://www.mo.be/nieuws/miss-tomaat-en-mister-appel>.

¹⁹ <http://itm.marcelww.com/inglorious/> and <http://blog.lesqueulescassees.org/linitiative/>.

²⁰ <http://www.uglyfruits.eu/>.

²¹ <http://www.kromkommer.com/>.

Figure A.1.1 Downgrading the importance of aesthetics: example

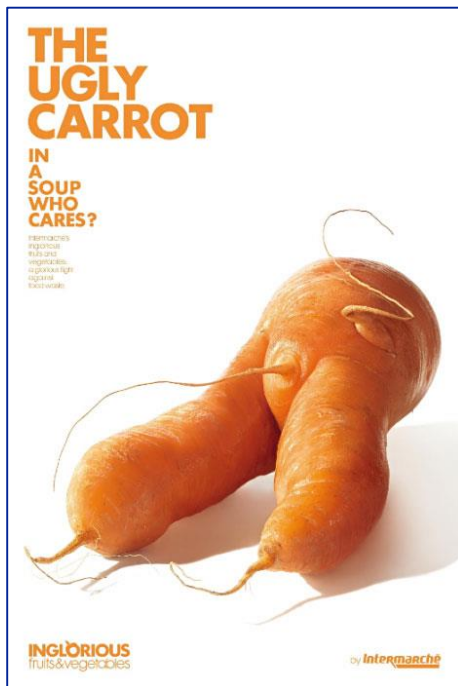


Figure A.1.2 Personification and sympathy/empathy-evoking messages: examples



Figure A.1.3 Authenticity message: example



Appendix II: Experimental set-up and sample size

Field study

Sample characteristics

Data were collected between 7 July and 11 July, by GFK, at the Milan Expo. Data collection for the first group took place next to the entrance of the COOP Supermarket of the Future for the pre-visit questionnaire and at the exit of the Supermarket of the Future for the post-visit questionnaire. Data collection for the second group took place at the exit of the Supermarket of the Future. Data collection for the third group took place at a different location at the Milan Expo, not in the Future Food District area. In total three hundred and three Milan Expo visitors participated in the study (about 100 per group)²². Socio-demographic make-up of the sample, regarding gender, age, nationality, and education level can be found in table A.2.1. 274 questionnaires were administered in Italian, 19 in English, and 10 in French.

Table A.2.1 Socio-demographic make-up field study

Demographic information		Percentage
Gender	Male	51.2%
	Female	48.8%
Age	< 18	0.3%
	18-24	20.8%
	25-34	34.3%
	35-44	21.8%
	45-54	15.2%
	55-64	5.0%
	65+	2.6%
Nationality	Italian	87.78%
	Other European country	6.92%
	Asia / North & South America	5.3%
Education level	University degree	44.1%
	Senior high school	50.2%
	Junior high school	5.0%
	Elementary school	0.7%

Study design and predictions

Figure A.2.1 Overview of experimental groups

Group	Pre-visit contact	Visit	Post-visit contact
1	Sustainable behavior activation	Supermarket of the future	Questionnaire + Donation behaviour
2	X	Supermarket of the future	Questionnaire + Donation behaviour
3	X	X	Questionnaire + Donation behaviour

²² Two responses can be considered as non-serious, leading to a net response of 301. There was one test response that was not yet removed from the database, and for one respondent there was zero variance on all variables, which indicates that this person answered all questions with the same extreme value (7).

We measured the extent to which consumers paid attention to sustainability information in the supermarket of the future, the extent to which consumers find sustainability information important and the extent to which consumers are more likely to use this information in future food choices. We compared attention across group 1 and group 2, and importance and future food choices across all experimental groups (see figure A.2.1).

Group 2 serves as a control group. Participants in this group are also supermarket visitors, but they are not contacted prior to their visit (i.e. they are not asked to make choices in non-food domains). The potential spill-over effect of sustainable behaviour in non-food domains was compared against this control group. This group thus serves to provide information on the magnitude of positive and negative spill-over effects in the other groups (i.e. sustainable behaviour versus no supermarket visit).

An alternative explanation for the spill-over effect of sustainability behaviour could be that the supermarket of the future in itself leads to heightened awareness of sustainability issues, because it can be seen as an important sustainability cue in itself. To gain insight into the impact of a supermarket visit on the outcome measures of interest, a third control group is added to the design, consisting of participants who did not visit the Supermarket of the Future. It is predicted that participants in this group show the least sustainable behaviour compared to the other groups.

Individual differences in pro-environmental self-identity

The extent to which consumers see themselves as environmentally-friendly and value sustainability in general is likely to influence both the attention they pay to sustainability information in the supermarket, as well as their food choices. Therefore, we also measured the extent to which consumers have a pro-environmental self-identity (Whitmarsh & O'Neill, 2010; Robison et al. 2010).

In analysing the effects of attention to sustainability information on food choices, we also took into account individual differences in pro-environmental self-identity since these might drive both attention and choice. That is, consumers who see themselves as more environmentally friendly are more likely to pay attention to sustainability information and are more likely to make choices accordingly.²³

The questionnaire can be found in appendix III.

Lab study date marks

Since we predict the disposal probability over time to depend on the perceived perishability of food products, we studied this for a set of products that vary in their perceived shelf-life beyond the best before date. For instance, it can be expected that products as rice, pasta, coffee are perceived to have a longer shelf-life after the date mark is reached than products like orange juice and sauce. Two products with relatively short (**orange juice** and **sauce**) and two products with relatively long perceived shelf-life (**coffee** and **pasta**) beyond the BBD were selected for the study based on a pre-study among a convenience sample in the Netherlands ($N = 15$).

Sample characteristics

Data were collected between 30 June and 6 July, by GFK, at the Milan Expo. Data collection took place in a quiet room (with climate control) located near the main street (Decumano) of the Milan Expo. Five hundred Milan Expo visitors participated in both the date mark and the imperfect food study. The socio-demographic make-up of the sample, regarding gender, age, nationality, and education level can be found in table A.2.2. 444

²³ It could be that visitors of the Milan Expo may have a more than average interest in sustainability.

questionnaires were administered in Italian, 46 in English, and 10 in French. Four responses can be considered as non-serious²⁴, leading to a net response of 496. Both lab studies were administered to the same respondents, the order of which lab study was presented first to the participants was counterbalanced (randomized) (see table A.2.3 for an overview). Within each lab study participants were assigned to different conditions, which were also randomized. This will be further explained per study, under experimental design.

Table A.2.2 Socio-demographic make-up lab studies

Demographic information		Percentage
Gender	Male	50.8%
	Female	49.2%
Age	< 18	3.0%
	18-24	30.6%
	25-34	22.4%
	35-44	14.8%
	45-54	17.8%
	55-64	9.2%
	65+	2.2%
Nationality	Italian	87%
	Other European country	9.6%
	Asia / USA	3.4%
Education level	University degree	36.8%
	Senior high school	47.0%
	Junior high school	14.2%
	Elementary school	2.0%

Table A.2.3 Overview of experimental conditions and sample sizes

Lab study 1*	<i>N per condition</i>	Condition	BBD / no date / production date	Short / long shelf-life	Products (order will be randomized)
Date marks (N = 500)	± 83	1	BBD	S	Juice, sauce
	± 83	2	BBD	L	Pasta, coffee
	± 83	3	Production date	S	Juice, sauce
	± 83	4	Production date	L	Pasta, coffee
	± 83	5	No date	S	Juice, sauce

²⁴ There was zero variance in responses, which indicates that they answered all questions in the questionnaires (thus also questions that should be answered in the opposite direction) with the same extreme values (7 or 1).

	± 83	6	No date	L	Pasta, coffee
Lab study 2*	<i>N per condition</i>	Condition	Message type	Price level	Products (order will be randomized)**
Imperfect fruits (N = 500)	± 55	1	Anti-food waste	Same price	Apple, carrot
	± 55	2	Anti-food waste	15% lower price	Apple, carrot
	± 55	3	Anti-food waste	30% lower price	Apple, carrot
	± 55	4	Authenticity	Same price	Apple, carrot
	± 55	5	Authenticity	15% lower price	Apple, carrot
	± 55	6	Authenticity	30% lower price	Apple, carrot
	± 55	7	No Message	Same price	Apple, carrot
	± 55	8	No Message	15% lower price	Apple, carrot
	± 55	9	No Message	30% lower price	Apple, carrot

* Same participants as in study 1 (order of experiments is counterbalanced).

** Participants will compare imperfect and perfect apples, and imperfect and perfect carrots.

Experimental design

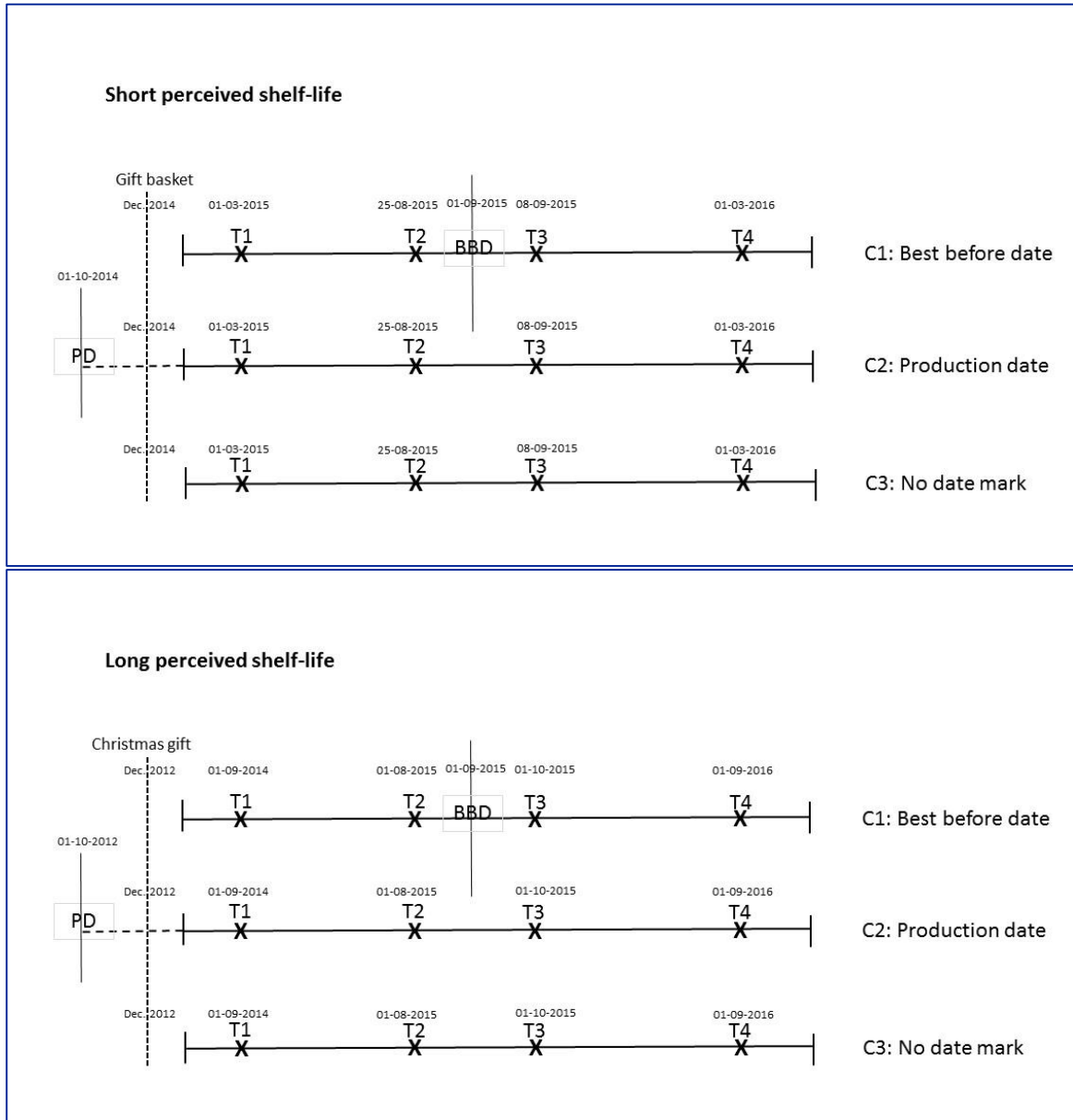
- The experiment employed a 3 (date marking: best before date vs. production date vs. no date) x 2 (perceived shelf-life: short vs. long) x 4 (timing) mixed design with date marking and perceived shelf-life as between-subjects factors and timing as within-subjects factor;
- Each participant evaluated two products from the same category (either long shelf-life or short shelf-life). This was done so that perceptions regarding the shelf-life in one category will not influence subsequent perceptions in the other category;
- Participants were randomly assigned to one condition of the between-subjects design (see Table A.2.4). That is, a third of them was exposed to products with a best before date (BBD), a third to products with a production date, and a third to products with no date at all. Furthermore, half of the participants was exposed to products with a relatively short perceived shelf-life and half of the participants was exposed to products with a relatively long perceived shelf-life;

- The sample size was approximately 65 per experimental condition (400/6).

Table A.2.4 Experimental design

Condition	BBD / no date / production date	Short / long shelf-life	Products (order will be randomized)
1	BBD	S	Juice, sauce
2	BBD	L	Pasta, coffee
3	No date	S	Juice, sauce
4	No date	L	Pasta, coffee
5	Production date	S	Juice, sauce
6	Production date	L	Pasta, coffee

- Participants were confronted with different timing conditions (in a scenario) and were asked to indicate (a) willingness to use/keep versus throw away the product (i.e. "food acceptability"). Subsequently they were asked to indicate the (b) product quality and safety, at each time point. Strong coherence (correlations) can be expected between a and b. Assessing both the food acceptability and quality helps to distinguish whether disposal probability is driven by safety perceptions or quality perceptions, or both;
- Perceived product quality and food acceptability were measured at four time points (see Figure A.2.2):
 - T1: A substantial amount of time before the BBD;
 - T2: Just before the BBD;
 - T3: Just after the BBD;
 - T4: A substantial amount of time after the BBD.
- The points were selected in such a way that they represented time points at various distances before and after the best before date (BBD). However, in the scenarios, the time points were described in a neutral way (in terms of the distance to the day the product was purchased), because in the "production date" and "no date" conditions, participants were obviously not informed about the BBD. They were given a reference point by providing them with a date when they received the product (gift / Christmas package);
- Time points for short perceived shelf-life and long perceived shelf-life were chosen in such a way that consumers would believe this. For instance, pasta that one buys now has expiration dates of 2018. This is a time span of three years from now. Therefore, taking 2015 as year of the BBD, makes a Christmas gift in 2012 a realistic reference point. Currently the actual BBDs for sauce and UHT orange juice are March 2016 and May 2016 respectively. Currently the actual BBDs for coffee and pasta are November 2016 and June 2018 respectively;
- The time span was made symmetric, with half year before and after the BBD for the short shelf-life condition, and one year before and after the BBD for the long shelf-life condition;
- The experiment took about five minutes to complete.

Figure A.2.2 Time points across the different conditions

Measured constructs

Perceived product quality and safety (Spratt & Shimp, 2004) were investigated to check whether removal of a BBD influences quality and safety perception of a product.

Food acceptability (Fennis & Bakker, 2001; Tavassoli & Lee, 2003) was used as an indicator for food waste. This construct provided insights into the willingness to use the product. Food acceptability was operationalized as willingness to use the product vs. throwing away the product.

Perceived risk (related to having a date mark or not; (Campbell & Goodstein, 2001) was used as an indicator for concerns people will experience without the date mark on the packaging, and the need for date marks on a product. Perceived risk was operationalized as concerns and worries when no date mark is provided, the necessity of date marks, being able to decide with/without date marks about the expiration of the product.

In addition, *general reliance on self-judgment versus date marks* (Nysveen, Pedersen, & Thorbjørnsen, 2005) was measured (in the post-experiment questionnaire). This

measure provided insight into the extent to which consumers feel that they are capable of deciding for themselves whether the food product is still of high quality or not. It is the ability of the consumer to decide whether a product is expired, based on its own judgment. In this way, both *product*-related concerns and expiration estimates, and *person*-related factors were taken into account.

Lab study imperfect foods

Experimental design

The experiment employed a 2 (type of product: perfect vs. imperfect) x 3 (message type: anti-food waste vs. authenticity vs. no message) x 3 (price level: same as perfect, 15% lower, 30% lower) mixed design. Type of product is a within-subjects factor, message type and price level are between-subjects factors. Table A.2.5 shows the experimental design.

Table A.2.5 Experimental design

	Imperfect fruit/vegetable is offered at:	Message type		
		Anti-food waste (1)	Authenticity (2)	No message (3)
Price level	same price (a)	Condition 1a	Condition 2a	Condition 3a
	15% lower price (b)	Condition 1b	Condition 2b	Condition 3b
	30% lower (c)	Condition 1c	Condition 2c	Condition 3c

In the experiment, participants were exposed to a picture of a product shelf with perfect and imperfect products (see Figure A.2.3). The imperfect products:

- are either offered at the same price as the perfect products, at a 15% lower price or at a 30% lower price;
- Are presented either with an anti-food waste message, with an authenticity message, or without a message.

Figure A.2.3 Visual material used in the study: shelf with perfect and imperfect apples, with an authenticity frame and 30% lower price



- Each participant evaluated perfect and imperfect products in two categories: one fruit product and one vegetable product. The order of the products was counterbalanced: half of the participants evaluated fruit products first and half of the participants evaluated the vegetable products first;
- **Apples** and **carrots** were selected as target products for the study, as these are locally produced in almost all EU countries (see also Loebnitz, Schuitema & Grunert, 2015) and production is relatively high in Italy²⁵;
- Participants were randomly assigned to a price level. If a participant was assigned to the "15% lower" price level for example, s/he was exposed to perfect and imperfect apples with the imperfect apples being offered at a 15% lower price than the perfect ones, and to perfect and imperfect carrots with the imperfect carrots being offered at a 15% lower price than the perfect ones;
- Message types were rotated across the conditions, such that each participant was randomly assigned to one of the three message conditions (anti-food waste message, authenticity message or no message) in the apple choice task, and was randomly assigned to a different message condition in the carrot choice task. This means that a single participant did not see the same message for apples and carrots. This was done so that people would not become suspicious because they had to judge the same message multiple times. By analysing the data by means of general linear mixed models, person-specific differences can be taken into account (and one can thus correct for spill-over effects);
- The following specific messages were used in the experiment:
 - Anti-food waste message: "Embrace imperfection: Join the fight against food waste!"
 - Authenticity message: "Naturally imperfect: Apples [carrots] the way they actually look!"

²⁵ Dr. Natasha Loebnitz from Aarhus University in Denmark, who has conducted several studies together with prof. Klaus Grunert using pictures of perfect and imperfect fruits and vegetables, gave permission to use the apples and carrots that she used in her studies. The apple and carrot pictures were extensively pretested by her, and vary only on the dimension of shape abnormality, while everything else is kept constant (e.g. size, colour). Photo credits go to Uli Westphal. For the current study these specific pictures of the shelves were designed by CentERdata.

Appendix III: Questionnaires Field study

[screen 0: information about the study]

Thank you for participating in this research! This research consist of two parts. The first part is about choices people make and the actions they take to protect the environment. In this part, we will ask you what you think people can do to be more environmentally friendly.

The second part of this research will take place after you have visited the Supermarket of the Future and will be about how you have experienced your visit.

Feel free to ask me for any doubt or need you may have.

<interviewer please give I-pad to respondent>

[screen 1: pro-environmental self-identity]

First, consumers' pro-environmental self-identity was measured. In this way, it cannot be affected by the experimental manipulation and it reflects a "true" personality trait. Pro-environmental self-identity was measured on a 7-point scale, using the following items (Robinson & Smith, 2002; Tarkiainen & Sundqvist, 2005; Whitmarsh & O'Neill, 2010):

I think of myself as an environmentally-friendly consumer.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

I think of myself as someone who is very concerned with environmental issues.

Totally disagree	1	2	3	4	5	6	7	Totally agree
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Manipulation of sustainable behaviour in non-food domains, part 1

To manipulate sustainable behaviour in non-food domains, participants in group 1 performed a number of choice tasks in domains other than food (e.g. purchase of household products, holidays, recycling), Participants in group 1 were instructed to make sustainable choices. We designed the choice task in such a way that participants were involved and needed to make trade-offs, and at the same time we took into account that we did not overestimate cognitive abilities of our participants who are in leisure mode and had never been confronted with such kind of tasks before.

[Screen 2: choice task – sustainability mindset intro; if necessary divide into two screens]

Imagine that you have decided for yourself that you want to act more environmental-friendly. From now on, you are determined to make more sustainable choices, that is, choices that help protect the environment. In a moment, you will be asked to make a number of choices on different topics, for instance the purchase of household products and booking of holidays.

As an example, you could be asked to select a TV out of four different options. The TV's differ on 4 characteristics (screen quality, sound quality, carbon footprint and price). You are asked to select the TV of your preference. The following applies:

☹☹ = very unfavourable;

☹ = unfavourable;

☺ = reasonable;

☺ = favourable;

☺☺ = very favourable.

The more smiling little faces (☺☺), the more favourable the product scores on a certain characteristic.

For instance, a TV has the following characteristics: screen quality☺, sound quality☺, carbon footprint☺☺, and a price of €499.

This means that the TV has a favourable screen quality (☺), a reasonable sound quality (☺) and a very favourable carbon footprint (☺☺). The carbon footprint indicates the amount of CO₂ and other greenhouse emissions associated with the product. A favourable carbon footprint thus indicates that the product has a relatively low environmental impact.

Please keep in mind that your main goal is to act environmentally-friendly, so please make your choices with this goal in mind.

[Screen 3: choice task 1 – sustainability mindset; THE CORRECT ANSWER IS MARKED WITH [X]]

Q3. Imagine you want to buy a new **television**. From these four televisions, which television would you buy?

Figure A.3.1 Example of choice task

	Screen Quality	Sound quality	CO ₂ emission	Price
TV 1	☺	☺☺	☹	€499
TV 2	☺☺	☺	☹☹	€470
TV 3	☺	☺	☺☺	€525
TV 4	☺	☺☺	☺	€505

Note: The more smiling little faces (☺☺), the more favourable the product scores on a certain characteristic.

- TV 1
- TV 2
- TV 3 [X]
- TV 4

Note that in the example in Figure A.2.1, option 3 would be the most sustainable option.

In total, participants will make six choices, namely for:

- Household products: Least CO2 emission TV;
- Household products: Most energy-efficient washing machine;
- Holidays: Least CO2 emission holiday;
- Household products: Least carbon footprint light bulb;
- Car: Least CO2 emission car;
- Notebook: Most energy-efficient notebook.

Manipulation of sustainable behaviour in non-food domains, part 2

In this part of the pre-visit questionnaire we wanted respondents to think about things that are related to act in a more sustainable way. The questionnaire was composed in such a way that there were:

- Key statements (e.g. recycling, carpooling, etc.);
- Less obvious statements (e.g. wear warm sweaters);
- Non-related statements; the non-related statements are based on health-related scales and scales related to money (for instance the statement about credit cards). These statements had nothing to do with sustainability. They were included because in this way consumers needed to think about each and every statements and they could not simply mark all statements in one go (without reading them).

By including this distinction for the statements we were later on able to distinguish between groups of consumers scoring high – intermediate – low on sustainability. A high score indicated that respondents identified all key statements and less obvious statements. An intermediate score reflected a group of respondents that were able to identify all key statements. A low scoring group was not able to identify the statements related to sustainability (or alternatively have not paid enough attention).

There are no statements related to sustainability in the food domain as we were interested in the spillover effect of sustainable behaviour in other domains, to the food domain.

In the next task participants were asked to list the things that one could do for a more sustainable world.

[Screen 9: introduction next choice task- sustainability mindset]

On the next screen you will find a list with actions. Some of these are actions people can take to help protect the environment and contribute to a more sustainable world. Others are actions that do not have this effect. Please go through the list and mark the actions you think people can take to help protect the environment and contribute to a more sustainable world. Note that it does not matter whether you yourself have taken these actions or not: we ask you to mark the action people in general can take to help protect the environment and contribute to a more sustainable world.

[Screen 10: choice task – sustainability mindset, CORRECT ANSWERS ARE MARKED WITH [X]]

Indicate the things that you think contribute to a more sustainable world (random):

- Cycle to work or school (instead of going by car) [X];
- Replace technological devices regularly;
- Make a walk during lunch time;
- Recycle waste [X];
- Wait 30 days before you buy something;
- Buy second hand goods [X];
- Quit smoking;
- Use renewable forms of energy [X];
- Carpooling [X];
- Cut your own hair;
- Recycle garden waste [X];
- Exercise more;
- Wear a warm sweater when it starts to get cold [X];
- Join up with a volunteer program;
- Lend / borrow / share items with friends and family [X];
- Install LEDs [X];
- Quit using credit cards;
- Repair clothes [X].

[Screen 11: feedback score -> based on previous choices. SHOULD BE CALCULATED BASED ON THE [X]' S. If they have more than 5 choices correct and indicated at least 6 sustainable behaviours they will receive the following feedback]

Manipulation of sustainable behaviour in non-food domains, part 3

Based on the tasks a fictitious score will be computed.

Participants receive the following feedback:

[Screen 11: feedback score -> based on previous choices. SHOULD BE CALCULATED BASED ON THE [X]' S. If they have more than 5 choices correct and indicated at least 6 sustainable behaviours they will receive the following feedback]

Well done! The choices you made in this questionnaire show that you are well aware of how you can help protect the environment and contribute to a more sustainable world. We are happy to see that!

[Screen 12: end op pre-visit questionnaire]

This was the first part of the research. After your visit to the Supermarket of the Future you will be contacted for the second part of the research. We will then ask you how you experienced your visit to the Supermarket of the Future. When leaving the supermarket we would like to ask you to inform the researcher. You will receive a token of reward after you have completed the second part of the research.

Enjoy your visit to the Supermarket of the Future!

<Please give back I-pad to the researcher>

Participants in groups 2 and 3 did not answer this questionnaire.

Post-visit: questionnaire

The post-visit questionnaire measured the following constructs:

- (Self-reported) attention to sustainability information in the supermarket;
- Importance of sustainability information in food choices;
- Importance of sustainability information in future food choices;
- Past sustainable behaviour and future sustainable behavioural intentions.

The sustainability information provided by COOP in the supermarket concerns:

- The origin of the raw materials;
- Carbon footprint;
- Biological / organic product logos;
- Sustainability product logos.

Regarding the logos, background information about the logos at a general level and example logos were given to participants in the post-questionnaire. The selected logos were based on a list of logos that COOP uses for biological/ organic and sustainability standards. Each logo has its own story, though in general, the presence of sustainability or organic labels (independent of which label) could be a reason why consumers buy such products if they have positive attitudes towards sustainability.

We based the questionnaire on the above four sustainability-related concepts. For an example of the interactive screens, use the following (online) link:

[CLICCARE QUI PER IL DOWNLOAD](#)

In addition, we aimed to record consumers' food choices (via their receipt) and merged these data with data from Coop on the sustainability (and, if available, also on the nutritional value and prices) of the products offered in the supermarket. This constituted a measure of the sustainability of supermarket visitors' food choices. We compared groups that were randomly assigned to a treatment vs. a control group and were exposed to the same assortment. Because participants were randomly assigned there is no reason to expect differences in basket size. However, to be sure we also controlled for basket size, and by asking participants how long they were in the supermarket and for how many products they checked the information on the interactive screens.

Besides collecting the information from respondents receipts in the supermarket (which provided information about sustainable buying), we measured in the post-visit questionnaire behavioural intentions (likelihood to buy more sustainable products in the near future) and actual behaviour by means of the donation task. In the donation task, participants in all groups were asked to make a choice related to food sustainability outside of the supermarket.

Individual differences

Individual differences were measured as the extent to which consumers see themselves as environmentally-friendly and value sustainability in general.

Control variables

As a control variable, participants in groups 1-3 were asked how much time they spent in COOP supermarket. It can be expected that people who visited the supermarket longer will also have been disposed to more information and have inspected more product information on the interactive screens.

Experimental part

[Screen 1: introduction]

[group 1 & 2]

We hope you have enjoyed your visit to the Supermarket of the Future! We hope you have a good idea now of what a supermarket might look like in the future.

One thing you might have noticed is that a lot of product information was presented in the supermarket, such as on the interactive screens above the shelves, probably far too much to remember. Perhaps, you have looked at some of the screens and read some of the information about the products that you thought was most interesting.

In this part of the research, we ask you some questions about how you experienced your visit to the supermarket. More specifically, we ask you which types of information about the products you have attended to most during your visit to the supermarket, and how important you considered the information. After that, some general questions will be asked.

[group 3]

This questionnaire is about grocery shopping. When you go out for grocery shopping, different factors might play a role in your product choices. In supermarkets, much information about the products is typically presented to customers. Some of the information might be very important to you when making product choices, while other information might not be important to you at all.

In this questionnaire, we will first ask you how important various types of information are for you, when shopping for groceries. After that, we will ask you some general questions about your shopping behaviour.

Note: Participants in group 1 and 2 receive the following questionnaire. Participants in group 3 receive a different questionnaire, where only questions 2 & 3 are asked for each characteristic. An example is provided at the end.

[screen 2: price]

Q1. Probably, you have just seen a lot of product information for different products. Most likely, there was too much information presented to process all information.

Please indicate to what extent you have paid attention to information about the price of products:

Did not pay attention to	1	2	3	4	5	6	7	Paid a lot of attention to
--------------------------	---	---	---	---	---	---	---	----------------------------

Q2. In the Supermarket of the Future, much information about the products was presented to you as a visitor. Perhaps, some of the information was very important to you and might have influenced your purchasing decisions. Other information might not have been important to you at all.

Please indicate how important or unimportant information about the price of the products was to you when shopping in the Supermarket of the Future:

Not at all important	1	2	3	4	5	6	7	Very important
----------------------	---	---	---	---	---	---	---	----------------

Q3. Your visit to the supermarket perhaps makes you think about products in a different way than you did before. It might even influence your future shopping behaviour at home... or not.

Please indicate to what extent you think you will more consciously take into account information about the price of products in your daily grocery shopping, after your visit to the Milan EXPO:

				No change				
Will take into account much less	1	2	3	4	5	6	7	Will take into account much more

[screen 2: nutritional values]

Nutritional information indicates how much energy consumers get from a serving of this food (provided in kcal and kj). In addition it shows how some key nutrients (such as sugar, fats, saturated fats and salt levels) impact on consumers' health.

Q4. Probably, you have just seen a lot of product information for different products. Most likely, there was too much information presented to process all information.

Please indicate to what extent you have attended to information about the nutritional values of products:

Did not pay attention to	1	2	3	4	5	6	7	Paid a lot of attention to
--------------------------	---	---	---	---	---	---	---	----------------------------

Q5. In the Supermarket of the Future, much information about the products was presented to you as a visitor. Perhaps, some of the information was very important to you and might have influenced your purchasing decisions. Other information might not have been important to you at all.

Please indicate how important or unimportant information about the nutritional values of products was to you when shopping in the Supermarket of the Future:

Not at all important	1	2	3	4	5	6	7	Very important
----------------------	---	---	---	---	---	---	---	----------------

Q6. Your visit to the supermarket perhaps makes you think about products in a different way than you did before. It might even influence your future shopping behaviour at home... or not.

Please indicate to what extent you think you will more consciously take into account information about the nutritional values of products in your daily grocery shopping, after your visit to the Milan EXPO:

				No change				
Will take into account much less	1	2	3	4	5	6	7	Will take into account much more

[randomize screen 4 to 7]

[screen 4: raw materials used in the product]

Product information about the raw materials that are used in the product give consumers an idea about the origin of the unprocessed subcomponents of the product.

Q7. Probably, you have just seen a lot of product information for different products. Most likely, there was too much information presented to process all information.

Please indicate to what extent you have paid attention to the origin of raw materials used in products:

Did not pay attention to	1	2	3	4	5	6	7	Paid a lot of attention to
--------------------------	---	---	---	---	---	---	---	----------------------------

Q8. In the Supermarket of the Future, much information about the products was presented to you as a visitor. Perhaps, some of the information was very important to you and might have influenced your purchasing decisions. Other information might not have been important to you at all.

Please indicate how important or unimportant information about the origin of raw materials used in products was to you when shopping in the Supermarket of the Future:

Not at all important	1	2	3	4	5	6	7	Very important
----------------------	---	---	---	---	---	---	---	----------------

Q9. Your visit to the supermarket perhaps makes you think about products in a different way than you did before. It might even influence your future shopping behaviour at home... or not.

Please indicate to what extent you think you will more consciously take into account information about the origin of raw materials used in products in your daily grocery shopping, after your visit to the Milan EXPO:

				No change				
Will take into account much less	1	2	3	4	5	6	7	Will take into account much more

[screen 5: Carbon footprint]

Carbon footprint information indicates the amount of CO2 and other greenhouse emissions associated with the product, from cultivation to distribution. Carbon emissions are usually measured in units of kg carbon dioxide, a bigger carbon footprint is bad for the planet.

Q10. Probably, you have just seen a lot of product information for different products. Most likely, there was too much information presented to process all information.

Please indicate to what extent you paid attention to information about the carbon footprint of products:

Did not pay attention to	1	2	3	4	5	6	7	Paid a lot of attention to
--------------------------	---	---	---	---	---	---	---	----------------------------

Q11. In the Supermarket of the Future, much information about the products was presented to you as a visitor. Perhaps, some of the information was very important to you and might have influenced your purchasing decisions. Other information might not have been important to you at all.

Please indicate how important or unimportant information about the carbon footprint of products was to you when shopping in the Supermarket of the Future:

Not at all important	1	2	3	4	5	6	7	Very important
----------------------	---	---	---	---	---	---	---	----------------

Q12. Your visit to the supermarket perhaps makes you think about products in a different way than you did before. It might even influence your future shopping behaviour at home... or not.

Please indicate to what extent you think you will more consciously take into account information about the carbon footprint of products in your daily grocery shopping, after your visit to the Milan EXPO:

				No change				
Will take into account much less	1	2	3	4	5	6	7	Will take into account much more

[screen 6: Sustainability logo]

"Sustainability logos are used by industry to indicate that the product is produced in an environmentally friendly and socially responsible fashion. When it regards food, an environmentally friendly system could encompass for instance: less waste in the production system, environmentally friendly farming conditions, better production conditions at producer sites abroad. In addition, climate change, biodiversity, water and soil quality are taken into account. When it regards food, social responsibility could encompass for instance: fair treatment of producers, sustainable maintenance of forests and mountain economies, meeting minimum social standards (no child-labour etc.)".

Examples of sustainability logos are:



Q13. Probably, you have just seen a lot of product information for different products. Most likely, there was too much information presented to process all information.

Please indicate to what extent you paid attention to logos indicating that products are sustainably produced:

Did not pay attention to	1	2	3	4	5	6	7	Paid a lot of attention to
--------------------------	---	---	---	---	---	---	---	----------------------------

Q14. In the Supermarket of the Future, much information about the products was presented to you as a visitor. Perhaps, some of the information was very important to you and might have influenced your purchasing decisions. Other information might not have been important to you at all.

Please indicate how important or unimportant logos indicating that products are sustainably produced were to you when shopping in the Supermarket of the Future:

Not at all important	1	2	3	4	5	6	7	Very important
----------------------	---	---	---	---	---	---	---	----------------

Q15. Your visit to the supermarket perhaps makes you think about products in a different way than you did before. It might even influence your future shopping behaviour at home... or not.

Please indicate to what extent you think you will more consciously take into account logos indicating that products are sustainably produced in your daily grocery shopping, after your visit to the Milan EXPO:

				No change				
Will take into account much less	1	2	3	4	5	6	7	Will take into account much more

[screen 7: Biological logo]

Biological logos, or organic product labels, indicate that the product has been grown within sustainable cultivation systems. Foods may only be marked as organic if at least 95% of their agricultural ingredients are organic.

Examples of biological / organic product labels are:



Q16. In the Supermarket of the Future, much information about the products was presented to you as a visitor. Perhaps, some of the information was very important to you and might have influenced your purchasing decisions. Other information might not have been important to you at all.

Please indicate to what extent you paid attention to logos indicating that products are biologically produced when shopping in the Supermarket of the Future:

Did not pay attention to	1	2	3	4	5	6	7	Paid a lot of attention to
--------------------------	---	---	---	---	---	---	---	----------------------------

Q17. It may be that not all information provided on the interactive screens was important to you. Please indicate, in general, how important logos indicating that products are biologically produced are, in your shopping purchases:

Not at all important	1	2	3	4	5	6	7	Very important
----------------------	---	---	---	---	---	---	---	----------------

Q18. Your visit to the supermarket perhaps makes you think about products in a different way than you did before. It might even influence your future shopping behaviour at home... or not.

Please indicate to what extent you think you will more consciously take into account logos indicating that products are biologically produced in your daily grocery shopping, after your visit to the Milan EXPO:

				No change				
Will take into account much less	1	2	3	4	5	6	7	Will take into account much more

[Screen 8: past behaviour and future behavioural intentions]

When you go out for shopping, different factors might play a role in your product choices. One of the things that could be of importance in your product choices are environmental factors. These concerns relate to the impact of your choices in the environment, such as how they affect climate change, food waste, or the exploitation of natural resources (e.g. exploitation of non-renewable energy sources, overfishing and deforestation). On the other hand, it may be that environmental concerns do not play a role in your product choices, for instance because you routinely buy products.

When you go out for shopping, different factors might play a role in your product choices. One of the things that could be of importance in your product choices are environmental factors. These concerns relate to the impact of your choices in the environment, such as how they affect climate change, food waste, or the exploitation of natural resources (e.g. exploitation of non-renewable energy sources, overfishing and deforestation). On the other hand, it may be that environmental concerns do not play a role in your product choices, for instance because you routinely buy products.

Q20. To what extent did environmental concerns, during the past 12 months, play a role in your choices for modes of travelling for work or school-related purposes?

Not at all	1	2	3	4	5	6	7	Very much
------------	---	---	---	---	---	---	---	-----------

Add separate option:

- I did not buy/do this during the past 12 months.

Q21. To what extent did environmental concerns, during the past 12 months, play a role in your choices for modes of travelling for leisure-related purposes?

Not at all	1	2	3	4	5	6	7	Very much
------------	---	---	---	---	---	---	---	-----------

Add separate option:

- I did not buy/do this during the past 12 months.

Q22. To what extent did environmental concerns, during the past 12 months, play a role in your choices for household products (e.g. washing machines, fridges, electrical devices)?

Not at all	1	2	3	4	5	6	7	Very much
------------	---	---	---	---	---	---	---	-----------

Add separate option:

- I did not buy/do this during the past 12 months.

Q23. To what extent did environmental factors, during the past 12 months, play a role in your choices for food products?

Not at all	1	2	3	4	5	6	7	Many
------------	---	---	---	---	---	---	---	------

Add separate option:

- I did not buy/do this during the past 12 months.

Q24. Compared to the food choices you made in the past 12 months, how important do you think environmental concerns will be in your future food choices when you are back home?

				Equally important				
Much less important	1	2	3	4	5	6	7	Much more important

[Screen 10: control questions]

Q25. How much time did you approximately spend in the Supermarket of the Future?

- A) < 5minutes;
- B) 5-10 minutes;
- C) 10-15 minutes;
- D) 15-30 minutes;
- E) Longer than 30 minutes.

Q26. Of how many products did you approximately check the information on the interactive product screens?

- A) 1 or 2;
- B) 2-5;
- C) 5-10;
- D) 10-15;
- E) More than 15.

[Screen 10b: receipt section]

Please give back I-pad to the researcher

QREIC. Did you buy anything in your visit of the supermarket?

- Yes
- No -> skip to screen 11
- Don't answer -> skip to screen 11

<interviewer please ask the respondent to show you what he/she have bought and insert code bar

<For scripiter, please>

Qreic1

1st item Insert code bar_____

2st item Insert code bar_____

3st item Insert code bar_____

4st item Insert code bar_____

5st item Insert code bar_____

6st item Insert code bar_____

7st item Insert code bar_____

8st item Insert code bar_____

9st item Insert code bar_____

10st item Insert code bar_____

11* if more than 10 items, please take the picture of the further items

[Screen 11: pro-environmental self-identity]

Below are a number of statements. Please indicate the extent to which you agree or disagree with each of these statements. There are no right or wrong answers.

Q27. I think of myself as an environmentally-friendly consumer

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q28. I think of myself as someone who is very concerned with environmental issues

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q29. I think that buying organic food is important

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q30. I think that buying ecologically-friendly produced food is important

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q31. The price of a product is very important to me

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q32. How familiar in general would you say you are with organic product labels, provided on products?

Not at all	1	2	3	4	5	6	7	Very much
------------	---	---	---	---	---	---	---	-----------

Q33. How familiar in general would you say you are with sustainability logos, provided on products?

Not at all	1	2	3	4	5	6	7	Very much
------------	---	---	---	---	---	---	---	-----------

Q34. Age

Q35. Gender

Q36. Country

Q37. Educational level

Q38 occupation – (if you are a student or retired please indicate it). (Please indicate it also if you are unemployed, a student or retired person)

Please give back I-pad to the researcher.

[Screen 12: donation behaviour- introduction text]

WE PREFER THAT THE INTERVIEWER CAN EXPLAIN THIS IN PERSON TO PARTICIPANTS

Thank you for participating in this research! As a token of appreciation for your participation we have a small gift for you; a €5 voucher (for GasOline). Instead, you can also choose to donate your participation reward to a charity. You can choose between 3 different charities. Here, you can read which charities you can donate to.

The selected charities are:

- Fairfood International: Fairfood envisions a world free from hunger and poverty. Fairfood international believes the best way to achieve this is through a fair and sustainable food system that produces and provides nutritious food for all in a way that respects human rights, creates thriving economies and preserves the environment and natural resources for future generations;
- [One Acre Fund](#): Working in Kenya, Rwanda, and Burundi, the One Acre Fund helps some 130,000 small-scale farmers turn their fields into profitable sustainable enterprises that can support their families and contribute to the local economy;
- Age International: Age International has a vision of a world in which all older people can lead dignified, active, healthy, and secure lives. Older people often go ignored and uncared for by governments and NGOs. Age International works to make the voices of older people heard. We work with people in later life so they can lift themselves – and others – out of poverty.

<Interviewer now asks: "Would you like to receive the gift (the €5 voucher) or donate the money to charity?">

<Interviewer: please give back I-Pad to the respondent>

<If respondent selects the voucher:

Respondent receives voucher from interviewer and is thanked for participation>

<If respondent chooses to donate:

[Screen 13: donation behaviour]

[Participants should be able to type an amount in euros, for instance 3.50 in the boxes below the charity]

Q39. Thank you for donating your participation reward to charity. You can choose to donate the full amount of €5 to a single charity, but you can also distribute the money across the different charities, as long as the total amount adds up to €5. Please indicate how much you would like to donate to each charity.

	Fairfood international	One Acre Fund	Age International
Amount			

Thank you for your participation.

Example question group 3:

[screen 4: raw materials used in the product]

The next question is about the importance of the origin of raw materials used in products, when shopping for groceries.

Product information about the raw materials that are used in the product give consumers an idea about the origin of the unprocessed subcomponents of the product.

Q6. Please indicate how important the origin of raw materials used in products is to you when shopping for groceries:

Not at all	1	2	3	4	5	6	7	Very much
------------	---	---	---	---	---	---	---	-----------

Q7. Your visit to the Milan Expo perhaps makes you think about products in a different way than you did before. It might even influence your future shopping behaviour at home...or not.

Please indicate to what extent you think you will more consciously take into account the origin of raw materials used in products in your daily grocery shopping, after your visit to the Milan Expo:

				Equally important				
Much less important	1	2	3	4	5	6	7	Much more important

Appendix IV: Questionnaires lab studies

[Randomize order depending on the products, according to A.2.4]

[Screen 0.A: Introduction screen]

Thank you for participating in this research. This research is about how consumers make decisions regarding whether to use or throw away a product.

In this research, we ask you to provide answers on a scale from -3 to +3, where, for example, -3 indicates that you would certainly throw the product away and +3 indicates that you would certainly use the product. If you are less certain about what you would do, you can click on a scale point closer towards the middle of the scale. Clicking on 0 – which is exactly in the middle of the scale – means that you are indifferent.

[Screen 0.B: overall product quality and liking]:

Imagine you have just bought this product. [show product picture]

Q0A. How would you rate the product?

This product...

Has a poor quality	-3	-2	-1	0	1	2	3	Has an excellent quality
--------------------	----	----	----	---	---	---	---	--------------------------

Q0B. To what extent do you like the product?

Not at all	-3	-2	-1	0	1	2	3	Very much
------------	----	----	----	---	---	---	---	-----------

[Screen 1: Instruction randomized]

[Screen 1B: Introduction juice/coffee]

Now, imagine you are home late from work or school. You want to sit down and relax for a while with something to drink. You look into your kitchen cabinet and in the back of one of your cabinets you find the following product:

[Screen 2: Presentation product see table A.2..4]

[display product for 7 seconds]

[Screen 1A: Introduction pasta / sauce]

Now, imagine you are home late from work or school. You did not have any time for shopping so you decide to prepare a meal for yourself based on the products stored in your kitchen cabinet. In the back of one of your cabinets you find the product presented on the next screen, which you would like to use as part of your meal.

[Screen 2: Presentation product see table A.2.4]

[Display product for 7 seconds]

Figure A.4.1 Example of coffee with production date, best before date, no date.



*Condition 1: Production date
date*

Condition 2: Best before date

Condition 3: No

- Participants will see one out of three date marks (either a BBD, production date, or no date mark);
- Participants will see two products: one with short expected shelf-life one with long expected shelf-life;
- In total participants are exposed to two of 12 product pictures: 4 products (sauce, orange juice, coffee, pasta) x 3 date marks (BBD, production date, no date).

[After participants saw the product picture they receive the following text, next to the product] [Screen 3A long shelf-life products: pasta/coffee]

You remember that you received this product a long time ago in your Christmas gift package that you received in December 2012. You've completely forgotten about this product. The product is still unopened.

[Screen 3B short shelf-life products: juice/sauce]

You remember that you received this product some time ago in a gift basket for your birthday in December 2014. You've completely forgotten about this product. The product is still unopened.

[Screen 4, text next to the product]

[Screen 4A: Condition 1, 2 (best before date available)]

You notice that the unopened product that was stored in your cabinet has a best before date, namely XXXX. The *best before date* shows the date by which the optimal product quality is guaranteed.

[Screen 4B: Condition 3, 4 (production date available)]

You notice that the unopened product that was stored in your cabinet has no expiration indicator. Instead there is information available on the *production date* of the product, namely XXXX.

[Screen 4C: Condition 5, 6 (no expiration date available)]

You notice that the unopened product that was stored in your cabinet has no best before date. There is no information available on the product regarding the date before the product should preferably be used.

[Screen 5: information about questions]

In this research we take you through time. We will start on a certain date and ask **you to imagine that it really is this date**. We will ask you to rate the product on quality and whether you would consume the product. Then we will take you to the next time point. **Again, we ask you to imagine that it really is this date**. The time points are selected randomly and hence may sometimes be close together or far apart.

It is important that you keep the (imagined) date in mind while answering the questions.

Perceived product quality and food acceptability will be measured at four time points (see Figure A.2.2):

- T1: long time period before BBD;
- T2: Shortly before BBD;
- T3: Shortly after BBD;
- T4: long time period after BBD.

Importantly, in the scenarios in the “no date” and “production date” conditions, no reference will be made to the BBD.

For the first product (e.g. coffee in the long shelf-life condition), participants answer the following questions for each time point:

[Screen 6: product quality T1 -> according to table 3.2 and 3.3 depending on condition]

Imagine that today is the XXX of XXX of the year XXX.

How would you rate the product you just saw if it really would be XXX?

Q1. I would...

Definitely throw the product away	-3	-2	-1	0	1	2	3	Definitely use the product
-----------------------------------	----	----	----	---	---	---	---	----------------------------

How would you rate the product you just saw?

Q2. This product...

Is very unsafe to consume	-3	-2	-1	0	1	2	3	Is very safe to consume
Has a poor quality	-3	-2	-1	0	1	2	3	Has an excellent quality

[Screen 7: product quality T2 -> according to table 3.2 and 3.3 depending on condition]

Imagine that today is the XXX of XXX of the year XXX.

How would you rate the product you just saw if it really would be XXX?

Q1. I would...

Definitely throw the product away	-3	-2	-1	0	1	2	3	Definitely use the product
-----------------------------------	----	----	----	---	---	---	---	----------------------------

How would you rate the product you just saw?

Q2. This product...

Is very unsafe to consume	-3	-2	-1	0	1	2	3	Is very safe to consume
Has a poor quality	-3	-2	-1	0	1	2	3	Has an excellent quality

[Screen 8: product quality T3 -> according to table 3.2 and 3.3 depending on condition]

Similar as screen 7 but now for T3.

[Screen 9: product quality T4 -> according to table 3.2 and 3.3 depending on condition]

Similar as screen 7 but now for T4.

[Screen 9: importance of date-mark]

Next, consumers will be exposed to the product picture (coffee) again, and answer the following questions. These questions are about whether people feel they can judge for themselves whether the specific product is still of high quality (or whether they feel they need an expiration indicator for this specific product, such as the BBD, to decide). If they think they can decide their selves about expiration of this specific product, they would not be concerned when there was no BBD mark on this specific product.

Q3. To me, information provision about the best before date of this product is:

Not at all important	-3	-2	-1	0	1	2	3	Very important
----------------------	----	----	----	---	---	---	---	----------------

Q4. The absence of a best before date for this product would make me feel:

Very concerned	-3	-2	-1	0	1	2	3	Not at all concerned
----------------	----	----	----	---	---	---	---	----------------------

Q5. To what extent are you certain you can decide for yourself about the expiration of this product?

Not at all certain	-3	-2	-1	0	1	2	3	Very certain
--------------------	----	----	----	---	---	---	---	--------------

[Screen 10-18: repetition of procedure and question for the second product in each condition]

This procedure is repeated for the second product (e.g. pasta in the long shelf-life condition).

Experimental part

[Screen 0: Introduction screen]

Thank you for participating in this research. This research is about daily food choices.

[Screen 1: Instruction]

Imagine that you are doing your weekly grocery shopping at a local supermarket. Among others, you are planning to buy apples and carrots. You are browsing the aisles of the fresh fruit and vegetables department to see what the supermarket has to offer.

In a moment, you will see two supermarket shelves, one with different types of apples and one with different types of carrots. Please take a look at these shelves as if you were actually in the supermarket and really intending to buy apples and carrots. Which apples and carrots would you choose to buy? After you have indicated your choice, some additional questions will be asked about the products.

On the next screen, you will see the first product shelf.

[Randomize apples/carrots; let's assume we start with apples].

[Screen 2: Picture of product shelf with perfect and imperfect apples; full-screen 7sec]



[Screen 3: Choice]

[Participants see a smaller version of the picture with the following questions below the picture]



Q1. Which apples would you most likely buy? (Participants need to be able to click on the apples)

[Screen 4: Purchase intention – perfect product]

Imagine that you really intend to buy apples in the supermarket.



Q2. How likely is it that you would buy these specific apples?

Not likely at all	1	2	3	4	5	6	7	8	9	Very likely
-------------------	---	---	---	---	---	---	---	---	---	-------------

[Screen 5: Purchase intention – imperfect product]



Q3. How likely is it that you would buy these specific apples?

Not likely at all	1	2	3	4	5	6	7	8	9	Very likely
-------------------	---	---	---	---	---	---	---	---	---	-------------

<Order of Q2 and Q3 is randomized>

Note: Q1 is a choice between perfect and imperfect fruits, which more closely aligns to behavioural intentions. Q2/3 answers a different question: If singled out, would people buy imperfect fruits? People could generally be more willing to choose the perfect fruits, but Q2/3 can show how close preferences for perfect and imperfect fruits are. It could be that willingness to buy imperfect and perfect fruits is close together, but if given a choice between perfect and imperfect foods they will opt for the perfect ones. Together these questions give us an idea about consumer preferences and actual behaviour. Therefore, the combination of questions will provide us with a much richer insight.

[Screen 6: Taste and quality perceptions – perfect product]



Q4. What do you think about the quality and taste of these specific apples?

Very poor taste	1	2	3	4	5	6	7	8	9	Very good taste
Flavourless	1	2	3	4	5	6	7	8	9	Flavourful
Not at all delicious	1	2	3	4	5	6	7	8	9	Very delicious
Very poor quality	1	2	3	4	5	6	7	8	9	Very good quality

[Screen 7: Taste and quality perceptions – imperfect product]



Q5. What do you think about the quality and taste of these specific apples?

Very poor taste	1	2	3	4	5	6	7	8	9	Very good taste
Flavourless	1	2	3	4	5	6	7	8	9	Flavourful
Not at all delicious	1	2	3	4	5	6	7	8	9	Very delicious
Very poor quality	1	2	3	4	5	6	7	8	9	Very good quality

<Order of Q4 and Q5 should be consistent with order of Q2 and Q3, i.e. if perfect fruits are evaluated first in Q2/Q3 then perfect fruits should be evaluated first in Q4/Q5 as well>

[Screen 8: WTP – perfect product]



Q6. What is the *maximum price* you would be willing to pay for a kilo of these apples (which is about 6 apples)?

[Screen 9: WTP – imperfect product]



Q7. What is the *maximum price* you would be willing to pay for a kilo of these apples (which is about 6 apples)?

<Order of Q6 and Q7 should be consistent with order of Q2 and Q3, i.e. if perfect fruits are evaluated first in Q2/Q3 then perfect fruits should be evaluated first in Q6/Q7 as well>:

- This procedure is repeated for the second type of product (carrots);
- The order of the two products (apples and carrots) is randomized, such that about half of the participants first evaluated perfect and imperfect apples, and half of the participants first evaluated perfect imperfect carrots.

[Screen 11-17: repetition of procedure and questions for second product type]

Lab: Post-experiment questionnaire

The post-experiment questionnaire measured relevant consumer characteristics to provide deeper insight into the effects of the interventions (omitting the BBD, price reductions, and message types) employed in the lab studies. These measures included relevant background information, personality traits, as well as socio-demographic information. Participants answered the post-experiment questionnaire at the end of the session, after the two experiments.

Post-experiment questionnaire after lab study 1 and 2

[This questionnaire should be given to participants after lab study 1 and lab study 2 are completed].

[Screen 1: Instruction]

Finally, we would like to ask you some general questions.

[Screen 2: Problem awareness]

Below are a number of statements. Please indicate the extent to which you agree or disagree with each of these statements.

Q1.1. We can avoid food waste by buying and selling fruits and vegetables with 'abnormal' shapes.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q1.2. Most fruits and vegetables that do not meet strict standards related to their shape are wasted.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q1.3. Nowadays, you can count on supermarket offering only perfect looking fruits and vegetables.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

[Screen 3: expiration indicator necessary]

Below are a number of statements. Please indicate the extent to which you agree or disagree with each of these statements.

Q2.1. In general, I have the knowledge to decide how long a food can be consumed, even if a best before date is absent.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q2.2. I am perfectly capable of assessing the quality of food products, even if a best before date is absent.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q2.3. I always draw conclusions on whether I can still consume a food product based on the best before date indicated on the food package.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q2.4. For non-perishable products, I decide for myself until when I can consume a product.

Totally disagree	1	2	3	4	5	6	7	Totally agree
------------------	---	---	---	---	---	---	---	---------------

Q2.5. Even if the product still looks fine, if the best before date has been reached, I would...

Definitely throw the product away	1	2	3	4	5	6	7	Definitely keep the product
-----------------------------------	---	---	---	---	---	---	---	-----------------------------

[Screen 4: Pro-environmental self-identity]

Below are a number of statements. Please indicate the extent to which you agree or disagree with each of these statements.

Q5.1. Acting environmentally friendly is an important part of who I am.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree
-------------------	---	---	---	---	---	---	---	----------------

Q5.2. I am the type of person who acts environmentally-friendly.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree
-------------------	---	---	---	---	---	---	---	----------------

Q5.3. I see myself as an environmentally-friendly person.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree
-------------------	---	---	---	---	---	---	---	----------------

[Screen 5: Familiarity with initiatives promoting the purchase of imperfect foods]

Q6. To what extent do you know the meaning of the best before date?

Never heard of	1	2	3	4	5	6	7	Know very well
----------------	---	---	---	---	---	---	---	----------------

Q7. Which statement about the best before date is true?

- The best before date is usually used on products that go bad quickly;
- The best before date indicates the final date after which it is no longer safe to consume the product;
- *The best before date marks the end of the period for which a food can reasonably be expected to retain its optimum quality.*

Q8. In general, have you ever seen or heard of a campaign promoting the purchase of imperfect looking fruits and/or vegetables?

- Yes;
- No;
- I don't know.

Q9. How well would you say your English language understanding is?

Very poor	1	2	3	4	5	6	7	Very good
-----------	---	---	---	---	---	---	---	-----------

Q10. Age;

Q11. Gender;

Q12. Country;

Q13. Educational level;

Q14. Occupation – (Please indicate it also if you are unemployed, a student or retired person).

Appendix V: Statistical and technical appendix

Statistical and technical information field study

Data analyses

In order to test differences across groups, separate multilevel regression models were estimated with attention, importance, impact on future food choices, and behavioural intentions as dependent variable, and the groups (visitors with a sustainability pre-task, store visitors, non-visitors) as predictor. These models improve over standard ANOVAs and single-level regression models in that they properly take into account the multilevel structure of the data, that is, the fact that responses to purchase situations are “nested” within individuals.

At some points multilevel regression models were conducted using orthogonal contrast-coding. The coding is described in text. In addition, some variable required chi²-analyses.

Consumer visit to the supermarket

Past sustainable behaviour consisted of four items (Q20-Q23 on traveling, leisure, household products, and food products)²⁶. The Cronbach’s alpha for this construct was .90, these items thus formed a reliable construct²⁷. These four items were added and averaged. In general, consumers across all experimental groups indicated that they were relatively pro-environmental in their purchases and choices during the past year (all means > 5.12 on a 7-point scale). There were no differences across experimental groups in their choices ($F(2,277) = .36, p = .70$).

In addition, pro-environmental self-identity was measured with four items (Q27-Q30) and formed a reliable construct. Pro-environmental self-identity was high ($M = 5.40$ on a 7-point scale), and as desired there were no differences in pro-environmental self-identity across experimental groups ($F(2, 300) = .10, p = .90$). Therefore, in further analyse we did not take into account pro-environmental self-identity (as there were no differences).

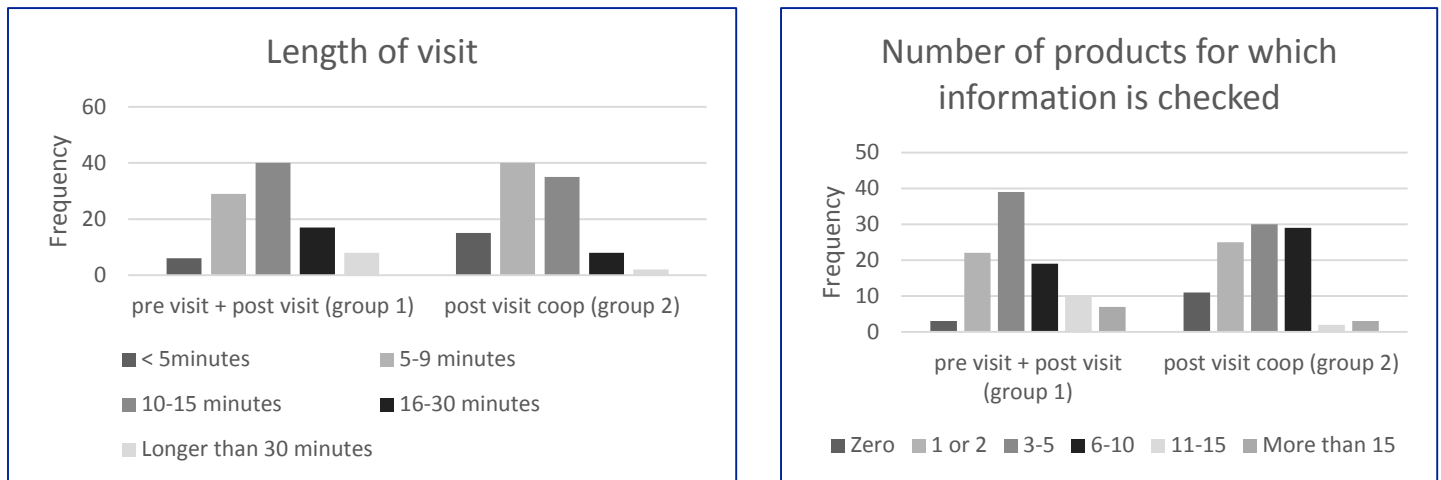
Consumers stayed around 5-15 minutes in the Supermarket of the Future (Q25). Visitors with a sustainability pre-task (group 1) stayed somewhat longer in the supermarket compared to store visitors (group 2), $\chi^2(4) = 11.68, p = .020$, see figure A.5.1. Most consumers checked for 3-5 products the product information provided on the interactive screens (Q26)²⁸. Visitors with a sustainability pre-task inspected more product information in the supermarket compared to store visitors, $\chi^2(5) = 15.35, p = .009$, see figure A.5.2. As expected, there is no significant difference in the percentage of consumers that reported buying one or more products in the supermarket, between visitors with a sustainability pre-task (34%), or store visitors (22%), prior to their supermarket visit, $\chi^2(1) = 3.59, p = .058$.

²⁶ This was measured in the post-visit questionnaire.

²⁷ The Cronbach’s alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability.

²⁸ Based on self-report.

Figure A.5.1 & A.5.2 Length of visit in the Supermarket of the Future and number of products for which information is checked in the Supermarket of the Future



Sustainability mindset

The first group filled out a pre-supermarket visit questionnaire about sustainability in other domains than the food domain (Q3 to Q10). Participants were asked to make sustainable product choices for TVs, washing machines, holidays, light bulbs, cars and notebooks. In addition, they indicated from a list of statements which actions they thought would contribute to a more sustainable world. Based on both tasks a sustainability score was computed²⁹, so that three categories of sustainable consumers came forward (high, intermediate, low). There were 41 participants who only made a few sustainable choices in the choice tasks (low score), 38 participants who made some but not all sustainable choices (intermediate score), and 20 participants who most accurately made sustainable choices (high score). It is worthy to note that among the participants that fell in the category that most accurately made sustainable choices, there were only 6 participants who were very sustainable minded and received additional feedback (“You are well aware of how you can help protect the environment and contribute to a more sustainable world”). However, the self-reported pro-environmental self-identity was high, indicating that consumers thought they were very sustainable. Thus, there is a discrepancy in what people report about how pro-environmental they are, and what choices they actually make (as seen in the pre-visit questionnaire).

Attention and importance of product information and impact on future choices

Participants were asked to what extent they paid attention to the different information components (Q1. price, Q4. nutritional values, Q7. origin of raw materials, Q10. carbon footprint, Q13. sustainability logos, Q16. and organic logos). In addition, they were asked how important each of the information components was when shopping for groceries (q2, q5, q8, q11, q14, q17) and to what extent they would take each of the information components more consciously into account in their future shopping (q3, q6, q9, q12, q15, q18).

²⁹ This index was based on a score where each sustainability statement that was marked correctly was added and each incorrect sustainability statement was subtracted so that a final sumscore could be computed. In addition, a different index was computed where for each correct statement (true sustainability or true non-sustainability) was added. This led to similar conclusions.

Spill-over effects

First we investigated whether visitors with a sustainability pre-task had (a) increased attention to sustainability information, (b) considered sustainability information more important, and (c) had a higher probability of using this information in future food choices, compared to store visitors (group 1 versus group 2)³⁰. There were no differences between visitors with a sustainability pre-task (group 1), and store visitors (group 2) on (a) how much attention is paid to sustainability information components presented in the Supermarket of the Future ($z = -1.01, p = .31, \chi^2 = 1.03, p = .31$), (b) increased importance of sustainability information ($z = -.074, p = .46, \chi^2 = 4.91, p = .09$), and (c) future food choices ($z = -0.09, p = .93, \chi^2 = 18.09, p < .001$).

Visit to the supermarket

Next, we investigated whether a visit to the Supermarket of the Future led to (b) increased importance of sustainability information, and (c) higher probability of using this information in future food choices, compared to non-visitors³¹. There were no differences between visitors (group 1 and 2) and non-visitors (group 3) on (b) which information components they would consider as important ($F_{importance}(10,1490) = .82, p = .61$), and (c) which information components are taken into account in future purchases ($F_{future\ food\ choices}(10,1490) = 1.20, p = .28$).

For an overview of all averages, across the groups, for attention, importance and future food choices see also table A.5.1³². As there are no differences between the groups of consumers who visited the supermarket (group 1 and group 2), it seems that asking consumers to make sustainable food choices in non-food domains does not positively spill-over to the food domain. In addition, there are no differences between consumers who visited the supermarket versus those who did not visit the supermarket, which indicates that the Supermarket of the Future itself did not lead to heightened awareness on attention and importance to sustainability cues, also in relation to future food choices.

Table A.5.1 Averages for attention, importance and future food choices for all information components across groups

Group	Information component	Group 1: pre-sustainability task	Group 2: supermarket visitor	Group 3: Non-visitor
Attention	Price	5.08	4.94	-
	nutritional values	4.75	5.09	-
	origin raw materials	5.12	5.13	-
	organic logos	4.77	4.77	-
	sustainability logos	4.36	4.76	-
	carbon footprint	4.28	4.73	-
Importance	price	5.12	5.19	5.55

³⁰ These analysis was performed using multilevel regression models in Stata.

³¹ Note that it is not possible to compare attention to information components, because consumers in the no-visit group have not seen the interactive screens that were presented in the Supermarket of the Future.

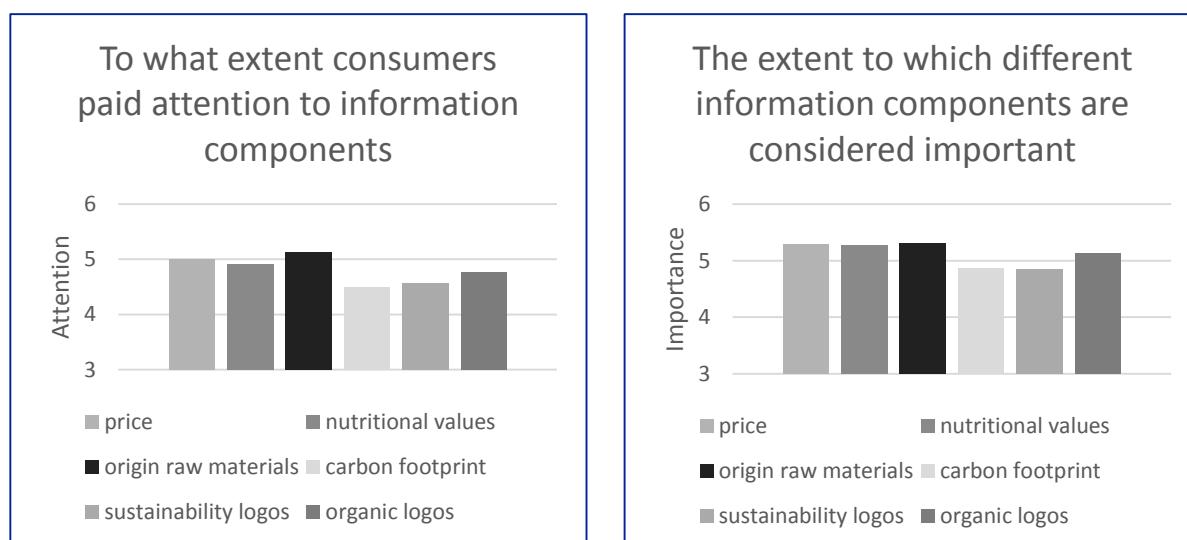
³² These averages are based on post-hoc comparisons (LSD) in general linear mixed model analyses in SPSS.

Group	Information component	Group 1: pre-sustainability task	Group 2: supermarket visitor	Group 3: Non-visitor
	nutritional values	5.15	5.39	5.26
	origin raw materials	5.19	5.32	5.39
	organic logos	5.12	5.06	5.19
	sustainability logos	4.70	4.84	4.98
	carbon footprint	4.76	4.92	4.92
Future food choices	price	5.04	4.90	4.83
	nutritional values	5.15	5.10	4.97
	origin raw materials	5.36	5.40	5.09
	organic logos	5.30	5.34	5.10
	sustainability logos	5.10	5.38	5.11
	carbon footprint	5.22	5.23	5.10

Note. In the no visit group attention to the different information components could not be measured. All items were measured on 7-point scales (from 1 to 7).

Store visitors paid most attention to the price, nutritional values and origin of raw materials, compared to the other information components, see figure A.5.3. The same pattern was reflected for importance of information components (figure A.5.4).

As the carbon footprint was presented for all products and compared to the other sustainability cues was most notable to consumers (because it was displayed as a foot), we compared to what extent other information components were more or less important than the carbon footprint. Compared to the carbon footprint people pay significantly more attention to nutritional values ($b = .37, t = 1.98, p = .048$) and origin of the raw materials ($b = .16, t = 2.21, p = .028$).

Figure A.5.3 & A.5.4 The extent to which consumers paid attention to different information components and consider this important

In addition, we statistically compared whether price and nutritional values information were more important than all the presented sustainability information (raw materials, carbon footprint, sustainability and organic logos), using multilevel regression analyses in Stata. The specific contrast coding that was used is presented in table A.5.2.

Table A.5.2 Orthogonal contrast-coding of information components

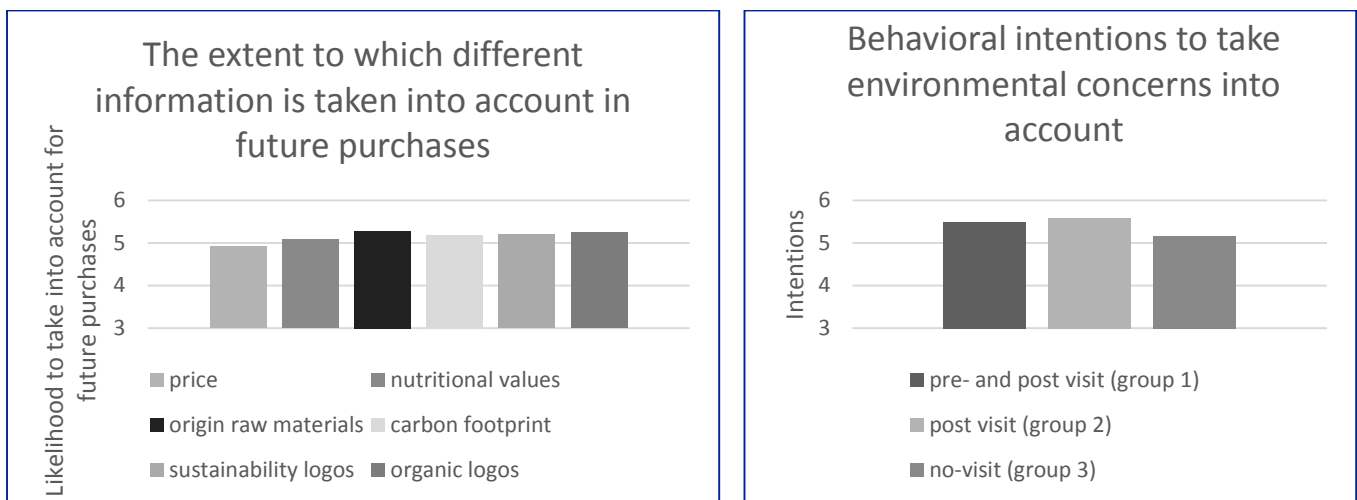
Information component	1. Importance of sustainability information	2. Carbon footprint versus other sustainability cues	3. Organic logo vs. sustainability logos and raw materials	4. Raw materials vs. sustainability logos	5. Price vs. nutritional values
price	-2/6	0	0	0	-1/2
nutritional values	-2/6	0	0	0	1/2
origin raw materials	1/6	1/4	1/3	1/2	0
Carbon footprint	1/6	-3/4	0	0	0
sustainability logos	1/6	1/4	-2/3	-1/2	0
Organic logos	1/6	1/4	1/3	0	0
Test	B = -.49, Z = -4; P < .001	B = .22, Z = 2.71, p < .001	B = -.06, Z = -.64, p = .52	B = .46, Z = 4.61, p < .001	B = .02, Z = 0.2, p = .85

Based on these analyses it can be concluded that price and nutritional values are considered more important than sustainability information (1). Of all sustainability information that was presented, carbon footprint is considered less important compared to origin of raw materials, sustainability logos, and organic logos (2). Information on the origin of raw materials and sustainability logos is not more important than organic logos (3). Information on raw materials is more important than sustainability logos (4). Price and nutritional values are equally important (5).

The higher importance of price, nutritional values (and origin of raw materials) can be explained by the fact that these information components were shown first on the interactive screens. Consumers thus seem to pay more attention to the first screen than the screens that follow³³.

Regarding future food purchases, all consumers (all groups) will take price and nutritional values into account in the same way as they already do this. Compared to price, consumers indicate that they will especially take the carbon footprint of products more into account in their future shopping ($b = -.27, t = -2.66, p = .008$). People thus seem to value sustainability cues more in their future shopping (figure A.5.5).

Figure A.5.5 & A.5.6 The extent to which different information components are taken into account in future food purchases and behavioural intentions to take environmental concerns into account



Future behavioural intentions to take environmental concerns into account

Participants were asked how likely it would be that they take environmental concerns into account in their future food choices (Q24). Store visitors (group 1 and group 2) consider environmental concerns more important in their future food choices than non-visitors (group 3) ($F(2,234) = 3.92, p = .021$), see figure A.5.6. This shows that the supermarket triggers consumers to think about environmental concerns, more so than asking consumers to make sustainable choices in non-food domains (e.g. the sustainability pre-task).

Actual behaviour – donation

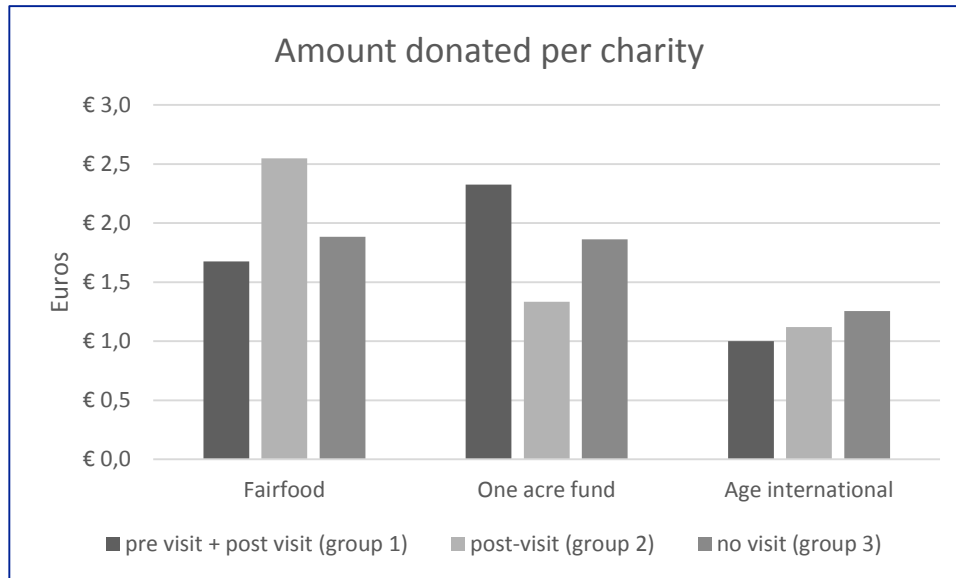
Respondents could indicate whether they were willing to donate money to a charity (Q39). There were three different charities selected. Fairfood was selected as a charity that relates to sustainability in the food domain, One Acre fund was selected as a charity

³³ For future research it might be interesting to manipulate the order in which information components are presented to consumers.

emphasizing general sustainability. And, Age international was selected as a charity in a different domain. Visitors with sustainability pre-task in general would donate more to charities that relate to sustainability.

In total, 45.5% of all respondents indicated that they wanted to donate money to a charity instead of receiving a gift voucher. There were no differences across groups in willingness to donate, $\chi^2(2) = 1.21, p < .55$. As expected, there were however differences regarding which *specific* charity (Fairfood, One acre fund, Age international) consumers donated to across groups $F(4,408) = 2.41, p = .049$, see figure A.5.7.

Figure A.5.7 Average amount of money donated per charity



Non-visitors (group 3) donated on average an equal amount of money to all charities. Visitors with a sustainability pre-task (group 1), however, donated on average more money to One Acre Fund and Fairfood international, which were both defined as charities related to sustainability (see also table A.5.3). Store visitors (group 2) donated on average more money to Fairfood international, which relates to both food and sustainability. Thus, if consumers visited the Supermarket of the Future they were more likely to donate more to a food-related charity.

Table A.5.3 Post hoc comparisons donation behaviour

	Fairfood	Oneacre	Ageinternational	Test
Pre- & post-visit	€1.67 ^a	€2.33 ^a	€1.00 ^b	$F(2,399) = 4.52, p = .011$
Post-visit	€2.55 ^a	€1.33 ^b	€1.12 ^b	$F(2,399) = 5.96, p = .003$
No visit	€1.88 ^a	€1.86 ^a	€1.26 ^a	$F(2,399) = 1.55, p = .21$

The total amount of money donated per charity, across groups, is displayed in table A.5.4.

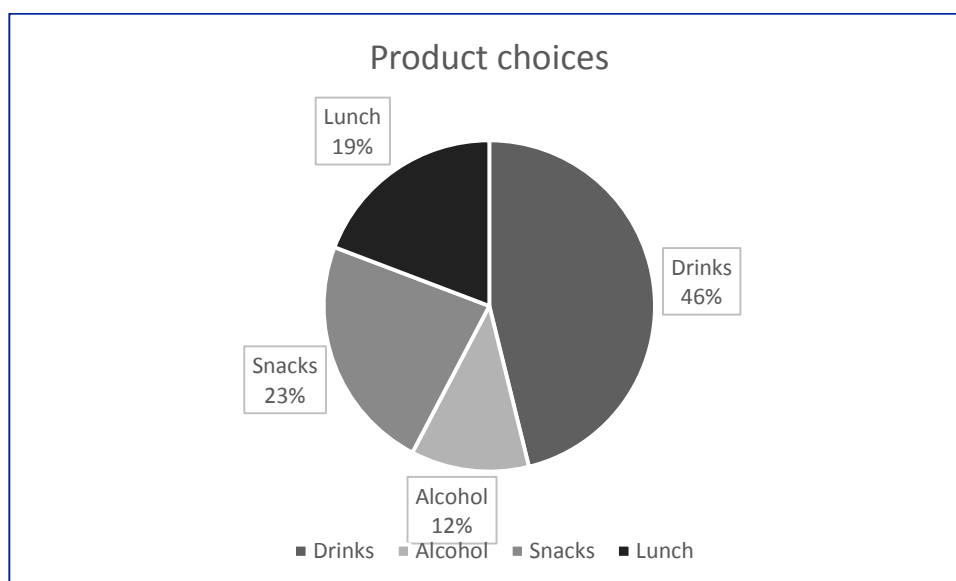
Table A.5.4 Total amount of money donated per charity for each group

	Fairfood	Oneacre	Ageinternational
Pre- & post-visit	€72	€100	€43
Post-visit	€107	€56	€47
No visit	€96	€95	€64
Total	€275	€251	€154

Actual behaviour – shopping in the Supermarket of the Future

Actual behaviour of consumers in the Supermarket of the Future is atypical compared to normal store-visits. The focus of the key findings presented in Chapter 2 of this report is therefore not on actual behaviour.

Together respondents bought a total of 71 products in the Supermarket of the Future (group 1 and group 2). Visitors with sustainability pre-task bought 46 products in total and store visitors bought 25 products in total. Most consumers bought drinks (46%), see figure A.5.9.

Figure A.5.9 Product choices in the Supermarket of the Future

For 50 out of 71 products, detailed product information is available. We examined whether visitors with sustainability pre-task also made more sustainable choices than store visitors. To do so, we compared whether people opted for organic products and whether people took into account the production process.

COOP provided a data file with detailed product information of each product. For each product the production process category to which the product belongs is known. In total there were two visitors who bought products with organic logos in the Supermarket of the Future (one in group 1: San Pellegrino sparkling water (gradone); and one in group 2: Organic cakes (cereals & beers)). This is too little to further investigate.

Table A.5.5 summarizes the average carbon footprint for each production process category across all the products available in the Supermarket of the Future (1589 products in total). For instance, the average carbon footprint is 3.44 for the production process of coffee and colonial products.

Table A.5.5 Overall percentage of organic products and average carbon footprints for different production process categories, in comparison to consumers who visited the supermarket

		Total supermarket	Consumer choice	
Production process for following categories (IT):	Production process for following categories (EN):	Average carbon footprint in production process category (supermarket data)	Visitors with sustainability pre-task (group 1)	Store visitors (group 2)
Caffè e Coloniali	Coffee and colonial	3.44 (SD = 2.59)		2.16 (SD = 1.15; N=3).
Carne e Pesce	Meat and fish	10.82 (SD = 7.56)	17.83 (SD=4.91; N=3)	
Cereali e Birre	Cereals and beers	1.69 (SD = .75)	1.69 (SD = .46; N=8)	1.16 (SD=.72; N=5)
Gradone	Products on display	0.66 (SD = .79)	.20 (SD = 0; N = 4)	.20 (SD = 0; N = 8)
Latte e Derivati	Milk and dairy products	5.62 (SD = 3.66)	1.5 (N=1)	7.13 (SD =3.75; N=4)
Ortofrutta e Vini	Fruit and wine	1.48 (SD = 1.63)	1.33 (SD =.77; N=3)	.60 (SD =.16; N =11)

The average carbon footprint per production process category for visitors with sustainability pre-task and store visitors is displayed in A.5.5. For the categories that could be compared (cereals and beers, and products on display), there were no differences between visitors with a sustainability pre-task and store visitors (group 1 vs group 2). For the other production process categories no comparisons are possible. Thus, it seems that in terms of actual buying behaviour, there are no real differences between participants who did a sustainability pre-task and consumers who did not.

Statistical and technical information lab study date marks

Data analyses

In order to test for differences across groups, separate multilevel regression models were estimated with disposal probability, perceived product quality, and perceived product safety as dependent variable and the different date marks (BBD, ND, PD) as predictor. These models improve over standard ANOVAs and single-level regression models in that they properly take into account the multilevel structure of the data, that is, the fact that responses to products with the presence or without date marks are “nested” within individuals.

Background information

First participants were asked to provide their overall liking towards the products (Q0B)³⁴. Participants in general liked all products (coffee, sauce, pasta, orange juice) and thought that products were of high product quality (all means > 4.47 on a 7-point scale). People in general indicated that they understood what a BBD is ($M = 5.86$) (Q6 post-questionnaire). However, only 47% of participants indicated correctly what the meaning is of the BBD when asked to select the correct answer out of 3 options (Q7, post-questionnaire)³⁵. Thus, understanding about the BBD can be improved. Also, people generally think they can decide on their own about the expiration of a product ($M = 4.30$, 7-point scale) (Q2.1 to Q2.5, post-questionnaire).

We predicted that when a best before date is present, a strong increase in the disposal probability occurs right after the BBD expires. When no BBD is available, two different predictions could be made. Either consumers will throw away the product earlier in the absence of a BBD than they would otherwise do (to not take any risk), and even before the BBD. Or, conversely, consumers will keep the product much longer. In addition we investigated the effect of the availability of a production date.

Table A.5.6 provides an overview of the means for disposal, quality and safety (scales from -3 (throw away the product / poor quality / not safe) to + 3 (use the product / high quality / safe)³⁶. The results are presented for short perceived shelf-life and long perceived shelf-life separately.

34 To what extent do you like this product? (On a 7-point scale).

35 This question was asked in the post-visit questionnaire.

36 These averages are based on post-hoc comparisons (LSD) in general linear mixed model analyses in SPSS.

Table A.5.6 Averages for disposal, quality, safety across time points and date marks

Shelf-life	Date mark	Time point	Disposal	Quality perceptions	Safety
Short	BBD	T1 (1/5/2015)	1.61	1.23	1.46
		T2 (25/8/2015)	1.42	1.05	1.23
		T3 (8/9/2015)	0.18	0.16	0.32
		T4 (1/3/2016)	-1.25	-1.14	-1.22
	ND	T1 (1/5/2015)	0.21	0.22	0.06
		T2 (25/8/2015)	-0.24	-0.21	-0.25
		T3 (8/9/2015)	-0.55	-0.39	-0.52
		T4 (1/3/2016)	-0.75	-0.66	-0.75
	PD	T1 (1/5/2015)	0.41	0.34	0.42
		T2 (25/8/2015)	-0.11	-0.03	-0.12
		T3 (8/9/2015)	-0.49	-0.3	-0.33
		T4 (1/3/2016)	-0.84	-0.78	-0.91
Long	BBD	T1 (1/9/2014)	1.71	1.34	1.62
		T2 (1/8/2015)	1.68	1.36	1.64
		T3 (1/10/2015)	0.42	0.18	0.45
		T4 (1/9/2016)	-0.79	-0.61	-0.66
	ND	T1 (1/9/2014)	0.88	0.72	0.8
		T2 (1/8/2015)	0.65	0.57	0.68
		T3 (1/10/2015)	0.58	0.55	0.64
		T4 (1/9/2016)	0.32	0.39	0.46
	PD	T1 (1/9/2014)	0.38	0.32	0.3
		T2 (1/8/2015)	-0.18	0.1	-0.04
		T3 (1/10/2015)	-0.3	-0.13	-0.18
		T4 (1/9/2016)	-0.74	-0.55	-0.61

In further analyses, disposal probabilities for the different date marks are statistically compared at each time point. In addition, for each date mark differences over time are investigated by means of multilevel repeated-measurement models.

We find similar patterns for perceived quality and safety of the product as for disposal probability. Perceived quality and safety are highly correlated with disposal probability (all $R > .826$). This indicates that while making judgments about keeping or disposing of a product people are strongly influenced by quality and safety perceptions of consuming the product.

Disposal probability

There are significant differences across time points in whether people would keep a product or would dispose of a product for short shelf-life ($F_{\text{disposal}}(3,2.54)^{37} = 158.84, p < .001$) and long shelf-life products ($F_{\text{disposal}}(3,2.31) = 121.63, p < .001$). This shows that people are more likely to dispose of a product over time. How strong the increase in the

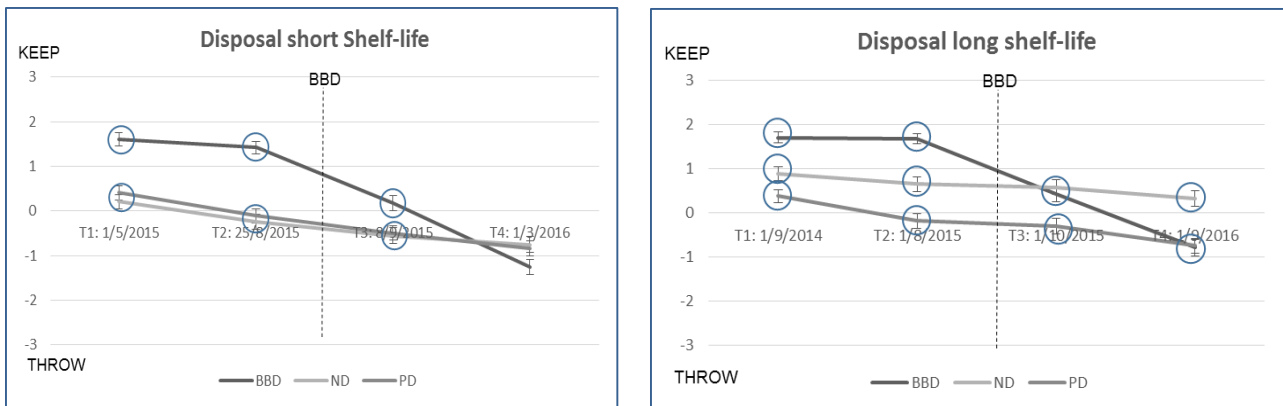
³⁷ A first step in multilevel repeated measures is to check if the assumption of sphericity is violated (which is not a problem, but requires a correction). For disposal the assumption is violated ($\chi^2(5) = 338.50, p < .0001$), therefore the Huyhn-field correction needs to be used (this is based on Green-House Geisser estimate of correction of .806, which is $> .75$). Therefore, the row in the output is used with Huyhn-field [actually there are no differences in sig. level between the different criteria, but it is neater to report this p-value and associated df; df are reported with decimal digits]. For product quality ($\chi^2(5) = 456.36, p < .0001$) also the Huyhn-Field needs to be used. For Safety ($\chi^2(5) = 490.12, p < .0001$), the Greenhouse-Geisser correction should be used.

disposal probability over time is depends on the type of date mark (BBD, ND, PD) to which people were exposed for both short shelf-life ($F_{\text{disposal}*\text{datemark}}(6,5.08) = 26.59, p <.001$) and long shelf-life products ($F_{\text{disposal}*\text{datemark}}(6,4.62) = 29.98, p <.001$). This is displayed in figure A.5.10. Decreasing lines indicate more disposal.

As long as the BBD is not reached, the presence of BBDs on products leads to less disposal compared to products without a date mark or products with a production date (see figure A.5.10, all circles are significantly different). However, after the BBD is reached there is a strong increase in disposal for products with the BBD compared to products without a date mark or products with a production date (see fig. A.5.10). In addition, after the BBD is reached, the product quality perceptions rapidly decrease as well as the perceived safety of consuming the product³⁸.

In the long run there is less disposal when no date mark (ND) is provided on products compared to products with a BBD, even more so for products with a long shelf-life (see T4: 1/3/2016 or 1/9/2016) (see fig. A.5.10). Especially for products with a long perceived shelf-life, the addition of a production date (PD) is not helpful: as compared to the BBD and ND people are more likely to dispose a product across all time points when a production date is provided.

Figure A.5.10 Disposal for short (left) and long shelf-life products



Note. Higher values indicate keeping a product. Circles indicate that the date marks at that time point are significantly different from each other.

Table A.5.7 and A.5.8 provide statistical tests for testing differences across date marks and time points for disposal.

³⁸ For statistical details see table A.6.3 to A.6.6 all row-wise comparisons.

Table A.5.7 Disposal short shelf-life

	BBD	ND	PD	
T1:1/5/2015	1.61 ^a	0.21 ^a	0.41 ^a	F (2,499) = 23.44, p <.001
T2:5/8/2015	1.42 ^a	-0.24 ^a	-0.11 ^b	F (2,499) = 32.69, p <.001
T3:8/9/2015	0.18 ^b	-0.55 ^b	-0.49 ^c	F (2,499) = 5.90, p <.001
T4:1/3/2016	-1.25 ^c	-0.75 ^b	-0.84 ^d	F (2,499) = 2.49, p =.084
	F(3,497)= 119.24, p<.001	F(3,497)= 10.42, p<.001	F(3,497)= 17.26, p<.001	

Superscripts indicate whether there are differences for a certain type of date mark across time points. Same superscripts indicate that there are no differences.

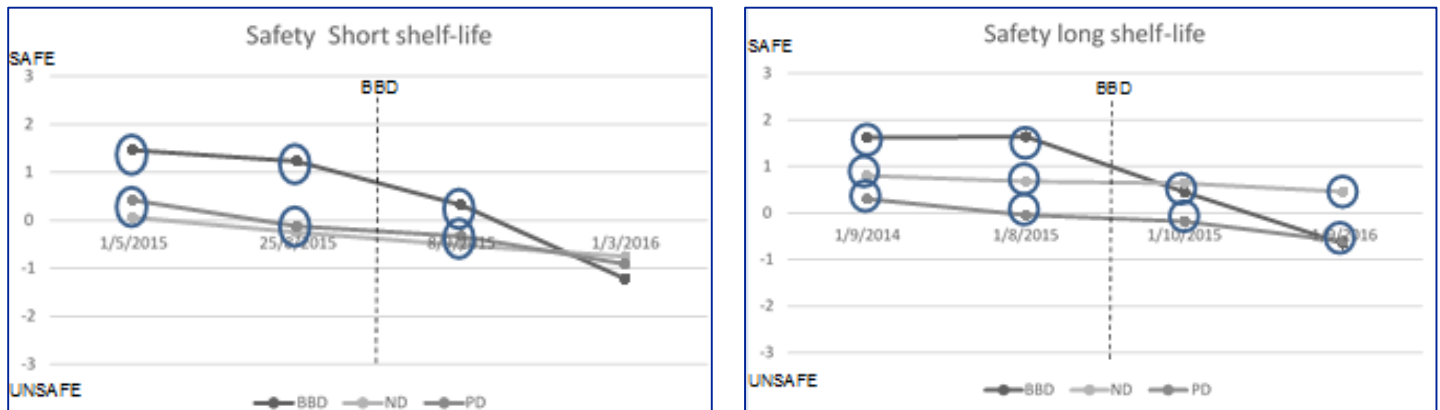
Table A.5.8 Disposal long shelf-life

	BBD	ND	PD	
T1:1/9/2014	1.71 ^a	0.88 ^a	0.38 ^a	F (2,487) = 20.06, p <.001
T2:1/8/2015	1.68 ^a	0.65 ^a	-0.18 ^b	F (2,487) = 36.60, p <.001
T3:1/10/2015	0.42 ^b	0.58 ^a	-0.30 ^b	F (2,487) = 8.31, p <.001
T4: 1/9/2016	-0.79 ^c	0.32 ^b	-0.74 ^c	F (2,487) = 12.94, p <.001
	F(3,485)= 92.05, p<.001	F(3,485)= 3.92, p=.009	F(3,485)= 16.04, p<.001	

Perceived product safety

In the experiment, for each time point, perceived safety of the product was investigated for three date marks: (1) BBD, (2) no date (ND), (3) production date (PD). This was investigated for products with a short perceived shelf-life (pasta sauce, orange juice) and a long perceived shelf-life (coffee, pasta). In figure A.5.11 it is shown that over time consumers perceive the product as less safe, as indicated by the decreasing lines. In addition, perceived product quality is dependent on the type of date mark (BBD, ND, PD).

Figure A.5.11 Perceived safety for short (left) and long shelf-life products



Note. Higher values indicate keeping a product. Circles indicate that the date marks at that time point are significantly different from each other.

Before the BBD is reached, a BBD on products is more effective than providing no date mark or a production date (left part in the graph):

- The presence of BBDs on products leads to higher safety perceptions regarding consuming a product compared to products without a date mark or products with a production date.

After the BBD is reached, no date mark on product is more effective than providing a BBD or PD (left part in the graph):

- Right after the BBD is reached there is a strong decrease in perceived product safety, for products with a BBD;
- Perceived product safety is higher for products without a date mark (ND) compared to products with a BBD, mainly for products with a long shelf-life (see T4: 1/9/2016, long shelf-life);
- Providing a production date (PD) is not effective: as compared to the BBD and ND, perceived safety is equal or lower across all time points when a production date is provided. The PD never outperforms ND or BBD, this effect is even stronger for products with a long perceived shelf-life.

Table A.5.9 and A.5.10 provide statistical tests for testing differences across date marks and time points for safety.

Table A.5.9. Quality short shelf-life

	BBD	ND	PD	
T1:1/5/2015	1.23 ^a	0.22 ^a	0.34 ^a	F (2,499) = 15.98, p <.001
T2:5/8/2015	1.05 ^a	-0.21 ^b	-0.03 ^b	F (2,499) = 21.69, p <.001
T3:8/9/2015	0.16 ^b	-0.39 ^b	-0.30 ^c	F (2,499) = 3.68, p =.026
T4:1/3/2016	-1.14 ^c	-0.66 ^c	-0.78 ^d	F (2,499) = 2.49, p =.084
	F(3,497)= 86.91, p <.001	F(3,497)= 10.33, p <.001	F(3,497)= 15.97, p <.001	

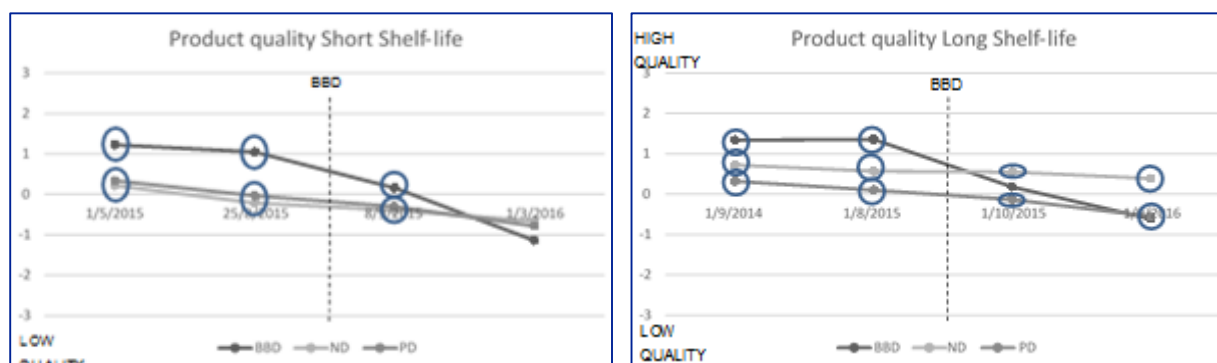
Superscripts indicate whether there are differences for a certain type of date mark across time points. Same superscripts indicate that there are no differences.

Table A.5.10. Quality long shelf-life

	BBD	ND	PD	
T1:1/9/2014	1.34 ^a	0.72 ^a	0.32 ^a	F (2,487) = 14.47, p <.001
T2:1/8/2015	1.36 ^a	0.57 ^a	0.10 ^b	F (2,487) = 20.85, p <.001
T3:1/10/2015	0.18 ^b	0.55 ^a	-0.13 ^c	F (2,487) = 5.22, p =.006
T4: 1/9/2016	-0.61 ^c	0.39 ^a	-0.55 ^d	F (2,487) = 11.82, p <.001
	F(3,485)= 66.28, P<.001	F(3,485)= 1.64, P=.179	F(3,485)= 10.04, P<.001	

Perceived product quality

In figure A.5.12 it is shown that over time consumers perceive the product as lesser in quality, as indicated by the decreasing lines. In addition, perceived product quality appears to be dependent on the type of date mark (BBD, ND, PD).

Figure A.5.12 Perceived product quality for short (left) and long shelf-life products


Before the BBD is reached, a BBD on products is more effective than providing no date mark or a production date (left part in the graph):

- The presence of BBDs on products leads to higher quality perceptions of consuming a product compared to products without a date mark or products with a production date.

After the BBD is reached, no date mark on product is more effective than providing a BBD or PD (left part in the graph):

- Right after the BBD is reached there is a strong decrease in perceived product quality, for products with a BBD;
- Perceived product quality is higher for products without a date mark (ND) compared to products with a BBD, mainly for products with a long shelf-life (see T4: 1/9/2016, long shelf-life);
- Providing a production date (PD) is not effective: as compared to the BBD and ND, perceived product quality is equal or lower across all time points when a production date is provided. The PD never outperforms ND or BBD, this effect is even stronger for products with a long perceived shelf-life.

Table A.5.11 and A.5.12 provide statistical tests for testing differences across date marks and time points for disposal.

Table A.5.11 Perceived product quality short shelf-life

	BBD	ND	PD	
T1:1/5/2015	1.46 ^a	0.06 ^a	0.42 ^a	$F(2,499) = 25.45, p < .001$
T2:5/8/2015	1.23 ^b	-0.25 ^b	-0.12 ^b	$F(2,499) = 28.05, p < .001$
T3:8/9/2015	0.32 ^c	-0.52 ^c	-0.33 ^c	$F(2,499) = 7.56, p = .001$
T4:1/3/2016	-1.22 ^d	-0.75 ^d	-0.91 ^d	$F(2,499) = 2.17, p = .12$
	$F(3,497) = 103.76,$ $p < .001$	$F(3,497) = 7.47,$ $p < .001$	$F(3,497) = 21.85,$ $p < .001$	

Superscripts indicate whether there are differences for a certain type of date mark across time points. Same superscripts indicate that there are no differences.

Table A.5.12 Perceived product quality long shelf-life

	BBD	ND	PD	
T1:1/9/2014	1.62 ^a	0.8 ^a	0.30 ^a	F (2,487) = 22.74, p <.001
T2:1/8/2015	1.64 ^b	0.68 ^a	-0.04 ^b	F (2,487) = 34.67, p <.001
T3:1/10/2015	0.45 ^b	0.64 ^a	-0.18 ^b	F (2,487) = 30.61, p <.001
T4: 1/9/2016	-0.66 ^c	0.46 ^a	-0.61 ^c	F (2,487) = 15.01, p <.001
	F(3,485)= 94.42, P<.001	F(3,485)= 1.66, P=.17	F(3,485)= 11.69, P<.001	

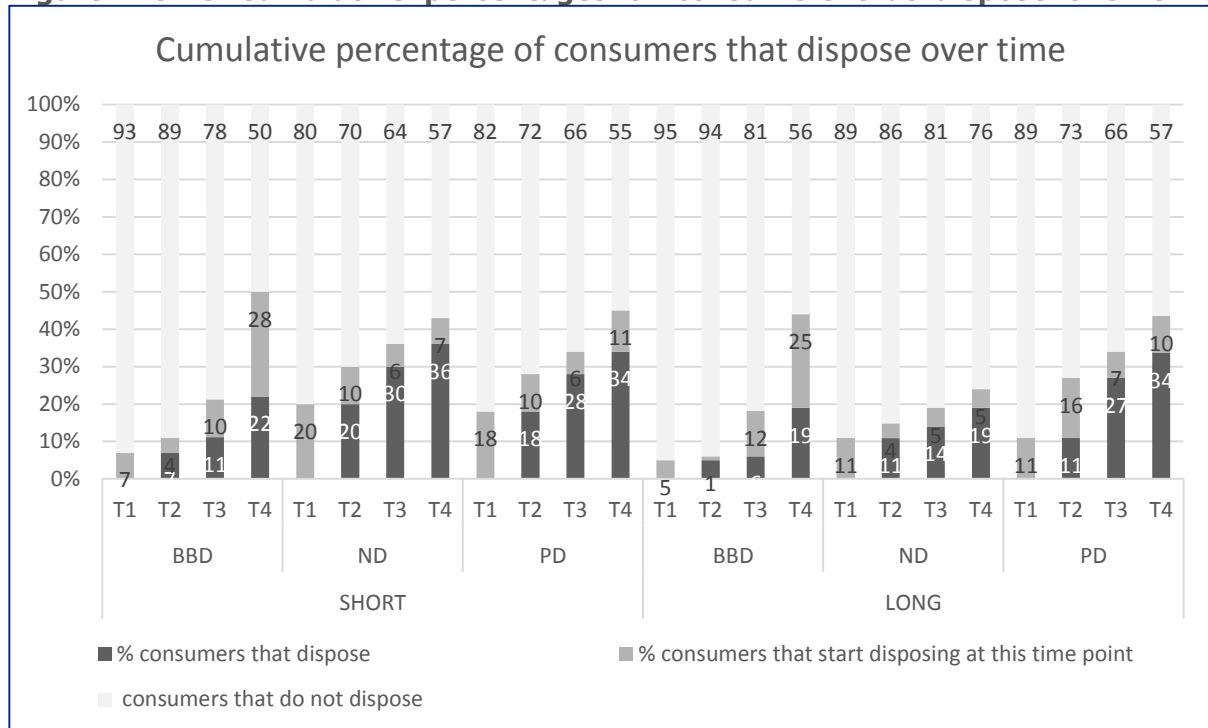
It can be concluded that before the BBD is reached, it is better to provide BBDs on products as this leads to less disposal compared to when no date mark is present or when the production date is present. There is less disposal if no date marks are provided (after the BBD but not before). In the next step the total amount of disposal will be investigated. When consumers make judgments about keeping or disposing of a product this decision is strongly related to quality and safety perceptions of consuming the product (as indicated by high correlations). In addition, it can be concluded that adding a production date is less effective than adding a BBD or no date mark.

Total disposal

In figure A.5.13 the cumulative percentage of consumers that certainly dispose the product is displayed³⁹, in order to see if the BBD or providing no date marks is more effective in its entirety regarding the total percentage of consumers that dispose.

³⁹ These are the consumers that indicated that they certainly will dispose the product (indicated with -3 on the scale). Significant differences in disposal over time can be derived from table 11.6 and 11.7.

Figure A.5.13 Cumulative percentages of consumers that dispose over time



For short perceived shelf-life products, the total percentage of consumers that dispose is lower for products without a date mark than for products with a BBD:

- For products with a BBD:
 - At T1 there are 7% of consumers who would like to dispose the product;
 - At T2 the disposal is 11% which is a 4% increase in disposal compared to T1;
 - There is a strong increase in disposal between T3&T4;
 - At T4 almost 50% of consumers would dispose the product.
- For products without a date mark:
 - Disposal at T1 is higher than when a BBD is provided (20% versus 7%);
 - However, the increase in disposal over time is less strong;
 - At T4 about 43% of consumers disposed of the product (compared to 50% with a BBD).

For long perceived shelf-life products, the total percentage of consumers that dispose is lower for products without a date mark than for products with a BBD: For products with a long shelf-life the difference in cumulative disposal percentages between BBD and no date mark is even larger. In total only 24% of consumers would dispose of the product at or before T4 if no date mark is present, compared to 44% if the BBD is present. This illustrates that before the BBD is reached it is better to provide date marks as total disposal is lower than when no date mark is provided. After the BBD is reached no date marks would be the best option, as total disposal is lower than when the BBD is provided on products.

Perceived risk

Perceived risk is measured per product. Perceived risk is relatively high, thus in general people believe that a BBD helps to make decisions about the product quality, safety and whether people should keep or dispose the product. (M across all products = 2.98 on a 92

7-point scale, with 1 being uncertain). There is no difference across date mark conditions, $F_{\text{datemark}}(2,991) = .053, p = .948$. There are differences across perceived shelf-life, $F_{\text{shelf-life}}(2,991) = 5.27, p = .022$, with shorter perceived shelf-life products judged as more risky if there is no BBD present on the product (3.00 vs 2.89).

Statistical and technical information lab study imperfect foods

Data analyses

In order to test for differences across groups, separate multilevel regression models were estimated with attention, importance, impact on future food choices, and behavioural intentions as dependent variable and the groups (visitors with a sustainability pre-task, store visitors, non-visitors) as predictor. These models improve over standard ANOVAs and single-level regression models in that they properly take into account the multilevel structure of the data, that is, the fact that responses to purchase situations are “nested” within individuals.

At some points multilevel regression models were conducted using orthogonal contrast-coding. The coding is described in text. In addition, some variables required chi2-analyses.

Background information

Product quality was measured with four items: taste, flavour, deliciousness, and quality. Averages for taste, flavour, deliciousness, and quality for perfect and imperfect foods in relation to price level and message framing are presented in Table A.5.13, for both carrots and apples (Q4, Q5). Taste, flavour, deliciousness, and quality items were averaged and formed a reliable quality construct (Cronbach’s alpha = .95)⁴⁰.

⁴⁰ These averages are based on post-hoc comparisons (LSD) in general linear mixed model analyses in SPSS.

Table A.5.13 Average taste, flavour, deliciousness and quality for apples and carrots for imperfect and perfect foods across messages and price levels

			Apples				Carrots			
			Taste	Flavour	Delicious	Quality	Taste	Flavour	Delicious	Quality
imperfect	same price	anti-foodwaste	5.61	5.80	5.15	5.19	6.33	6.45	6.09	5.75
		authenticity	6.28	6.37	5.96	5.74	5.66	5.66	5.70	5.64
		no message	5.68	5.75	5.43	5.00	5.38	5.51	5.42	5.02
	15% lower	anti-foodwaste	6.31	6.31	5.98	5.93	5.55	5.82	5.71	5.44
		authenticity	5.62	5.78	5.40	5.22	5.76	5.60	5.47	5.25
		no message	5.44	5.38	5.33	4.98	5.13	5.38	5.11	5.07
	30% lower	anti-foodwaste	5.86	5.75	5.54	5.29	6.00	5.72	5.50	5.24
		authenticity	6.56	6.43	6.28	6.33	5.83	5.78	5.47	5.52
		no message	5.43	5.54	5.24	4.85	5.35	5.40	5.25	4.89
perfect	same price	anti-foodwaste	6.37	6.13	6.30	6.20	5.75	5.67	5.69	5.65
		authenticity	5.74	5.26	5.80	5.70	5.82	5.52	6.00	5.95
		no message	6.23	5.95	6.20	6.14	6.45	5.94	6.30	6.11
	15% lower	anti-foodwaste	6.38	6.18	6.29	6.49	6.71	6.67	6.85	6.96
		authenticity	6.40	6.38	6.15	6.47	6.16	5.91	6.15	6.33
		no message	6.60	6.27	6.53	6.67	6.27	6.07	6.24	6.60
	30% lower	anti-foodwaste	6.66	6.63	6.63	6.85	6.13	6.30	6.07	6.19
		authenticity	5.94	5.67	6.04	5.94	6.43	6.21	6.16	6.33
		no message	6.74	6.72	6.81	7.00	6.35	6.15	6.16	6.25

In general, quality perceptions of perfect foods ($M = 6.24$, 9-point scale) are higher than these of imperfect foods ($M = 5.62$, 9-point scale), $F(1,1473) = 64.14$, $p < .001$ (Q0). Only 29% of participants indicate that they have heard or ever seen campaigns promoting the purchase of imperfect looking fruits and/or vegetables (Q8, post-questionnaire). Thus, awareness of such campaigns is generally low and unlikely to have influenced the results of the current study.

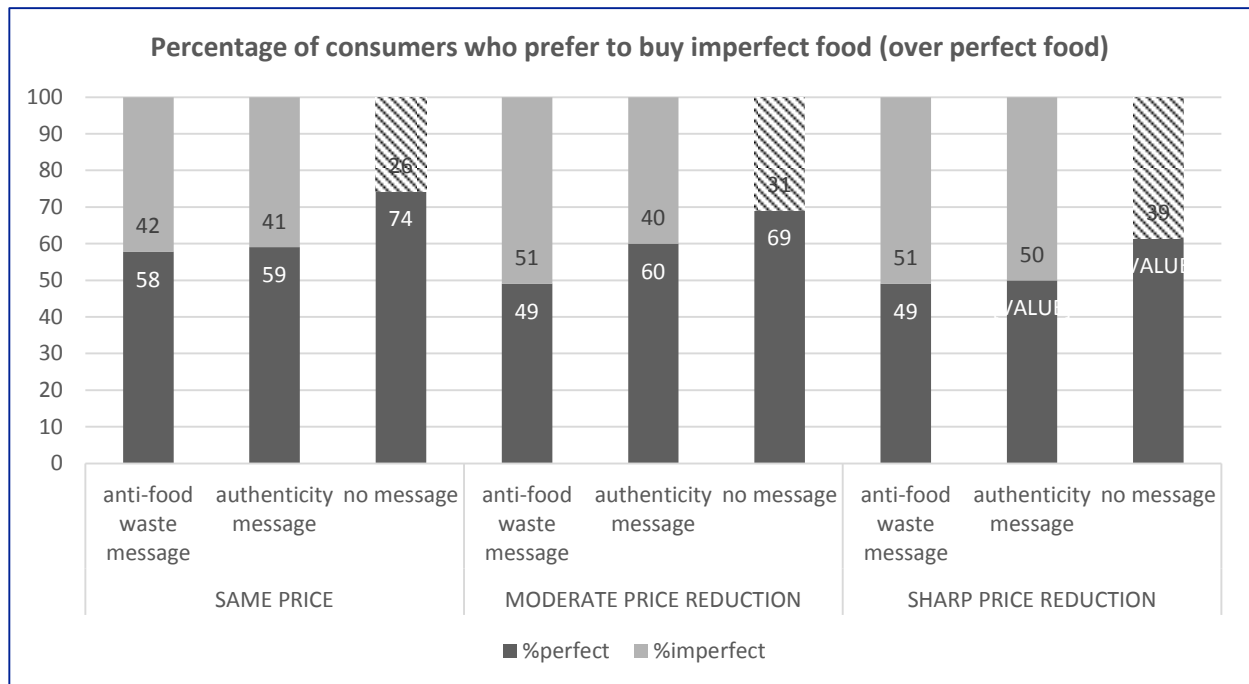
First, choices of buying imperfect foods and the willingness to pay for imperfect foods are discussed, then quality perceptions are more closely investigated.

Choice to buy imperfect versus perfect foods

We investigated whether and when people would opt for imperfect foods when there is a binary choice between perfect and imperfect foods (Q2). In general, consumers prefer to buy perfect foods over imperfect foods if no message or price reduction is given (75% perfect; 25% imperfect, see figure A.5.14: same price – no message). However, if an authenticity or anti-food waste message is presented, about 40% of people choose the imperfect food for the same price. It is thus effective to provide consumers with messages that encourage them to buy imperfect foods. Which specific message, anti-food waste or authenticity, does not seem to matter (see figure A.5.14: same price – anti-food waste and same price – authenticity).

In addition, compared to the situation in which imperfect foods are priced at the same level as perfect foods, when the price is reduced more consumers will opt for the imperfect foods if no message is provided, especially with a price reduction of 30% (for a 15% price reduction: 30% of consumers will choose imperfect foods if no message is provided (no message light grey bar); 30% price reduction: 40% choose imperfect foods if no message is provided (no message light grey bar)). An even stronger intention to buy imperfect foods arises when both a message is presented to consumers and a price reduction (see figure A.5.14: for a 30% price reduction in combination with an anti-food waste or authenticity message frame, more 50% of consumers are willing to buy imperfect foods).

Figure A.5.14 Percentage of people who prefer to buy perfect versus imperfect foods



In addition, we statistically compared whether price reduction and message frames influence willingness to buy imperfect foods, using multilevel logistic regression analyses in Stata. The specific contrast coding that was used is presented in table A.5.14 and A.5.15. First a price reduction compared to no price reduction is tested. Then a price reduction of 15% is compared to a price reduction of 30%. In addition the presence of a message frame versus no message frame is tested. Then an anti-food waste message frame versus an authenticity message frame is tested.

Table A.5.14 Orthogonal contrast-coding of price level

Price level	1.No price reduction vs. price reduction	2.Price reduction of 15% vs. price reduction of 30%
Same	-2/3	0
15% lower	1/3	-1/2
30% lower	1/3	1/2
Test	B =.32, Z= 2.28, P =.022	B =.27, Z= 1.67, p =.10

Table A.5.15 Orthogonal contrast-coding of message frame

Message frame	1.Message frame vs. no message	2.Anti-food waste vs. authenticity message
Anti-food waste	1/3	-1/2
Authenticity	1/3	1/2
No message	-2/3	0
Test	B = .61, Z= 4.31, P <.001	B = -.19, Z= -1.24, p =.21

The results show that a price reduction is more effective than no price reduction ($\chi^2 (2) = 8.13, p <.05$). And that a 30% price reduction is slightly more effective than a 15% price reduction. In addition, it is shown that a message frame is more effective than not providing a promotional message $\chi^2 (2) = 20.18, p <.001$. There is no difference in effectiveness of an authenticity or anti-food waste message. This is the same pattern that is reflected in the graphs.

Based on these results it can be concluded that adding a promotional message leads to higher intention to buy imperfect foods. The same is true for a price reduction. Combining price reductions and promotional messages leads to an even higher intention to buy imperfect foods. Which promotional message does not seem to matter, except for the 15% reduction where an anti-food waste message is more effective.

Where the previous part referred to a binary choice to buy either perfect or imperfect foods, we also investigated the likelihood to buy imperfect foods and the likelihood to buy perfect foods (Q3,Q4). We find the same pattern of results. In general, people are significantly more likely to buy perfect foods ($M = 6.28$) than imperfect foods ($M = 5.30$, 9-point scale) ($F (1, 1473) = 98.76, p <.001$). There is however a higher likelihood to buy imperfect foods if a message frame is provided ($M_{authenticity} = 5.46$; $M_{anti-food\ waste} = 5.49$) than when no message ($M_{no\ message} = 4.96$) is provided ($F (2, 1473) = 8.85, p <.001$). Which specific type of message is used, anti-food waste or authenticity, does not make a difference.

Maximum price / willingness to pay

We have also asked how much people would be willing to pay for the imperfect and perfect foods (they could report the amount of euros, see Q6). The results show that there are differences in how much people are willing to pay for imperfect versus perfect foods, for both apples ($F (1, 487) = 66.14, p <.001$), and carrots ($F (1, 487) = 86.54, p <.001$). People are willing to pay less for imperfect foods ($M_{imperfect\ apple} = €1.59$ vs. $M_{perfect\ apple} = €2.01$; $M_{imperfect\ carrot} = €1.27$ vs. $M_{perfect\ carrot} = €1.67$). The willingness to pay is independent of message frames ($F_{apples} (2, 487) = 1.03, p =.36$; $F_{carrots} (2, 487) =.066, p =.94$) and price reductions ($F_{apples} (2, 487) =.42, p =.66$ $F_{carrots} (2, 487) =.19, p =.83$).

We investigated the likelihood of buying perfect versus imperfect foods in relation to the maximum price consumers would like to pay for imperfect apples and carrots. This information can be used to determine the optimum price for imperfect foods. See figure A.5.15 and A.5.16. The middle line represents the average of all consumers who want to buy the product at a certain price. The other lines represent the extremes, namely consumers who are not willing to buy imperfect foods (indicated with a 1 on the scale), and consumers who would be willing to buy imperfect foods (indicated with a 9 on the scale). All lines decrease and show the decrease in percentage of consumers who want to buy the product at a certain price.

Figure A.5.15 Maximum price consumers are willing to pay for apples

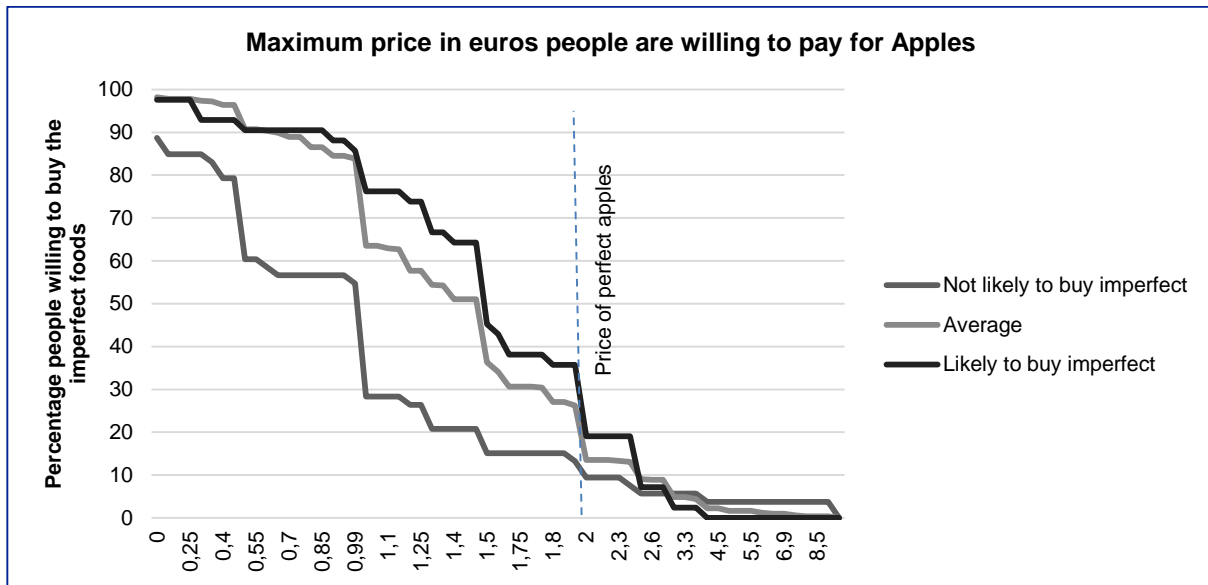
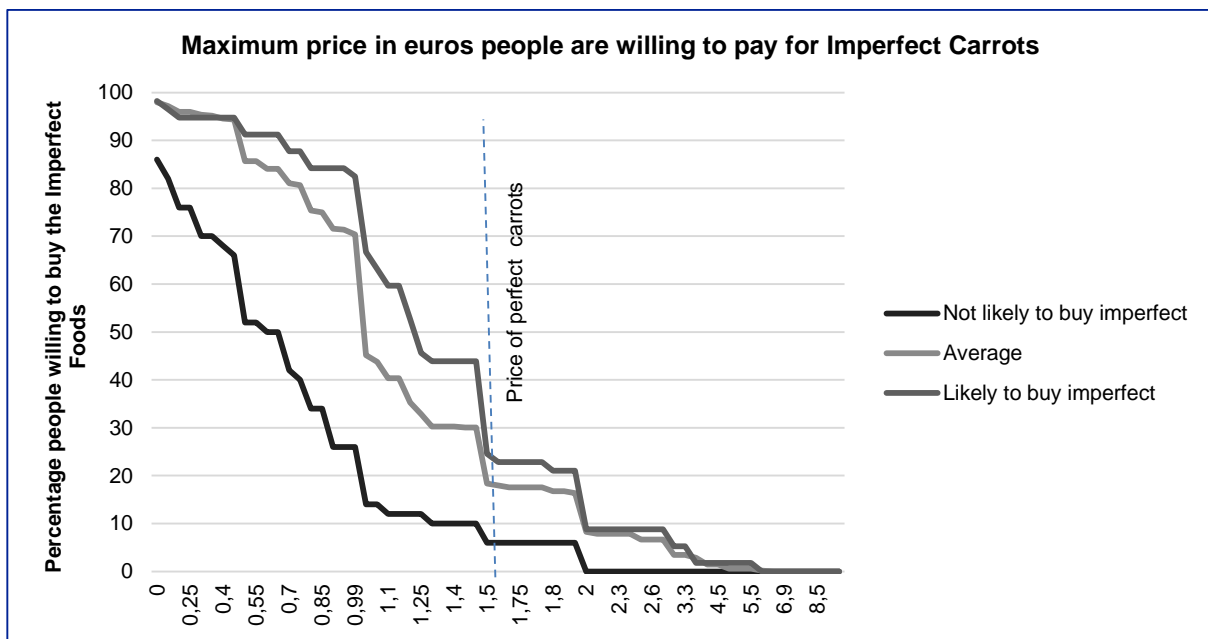


Figure A.5.16 Maximum price consumers are willing to pay for imperfect carrots



At a price of €0, close to 100% of consumers would “buy” the imperfect foods. If the price of imperfect foods increases (moving to the right in the graph), the percentage of consumers who would be willing to pay that price for imperfect foods drops. A strong drop indicates that the maximum price for a large number of people is reached.

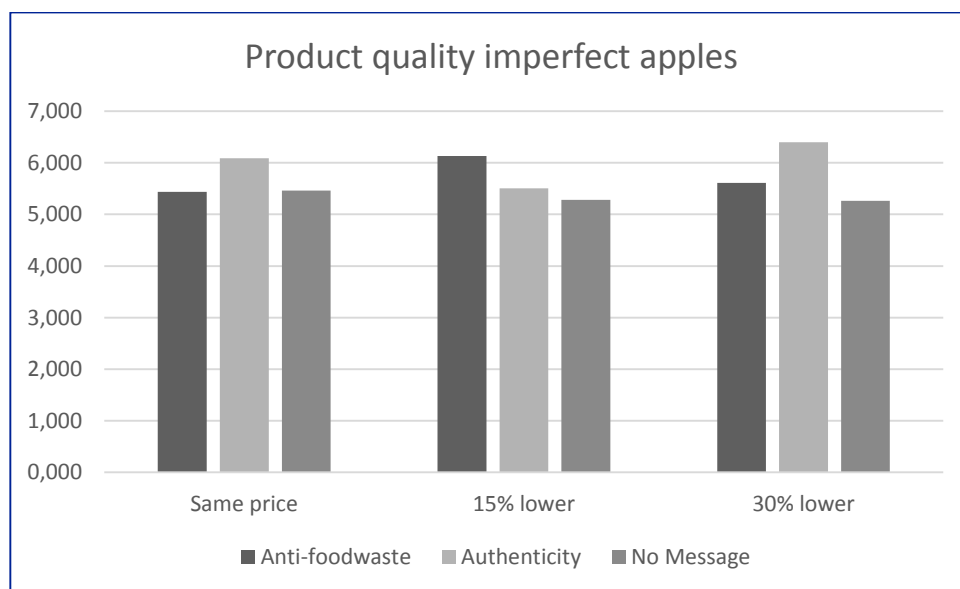
Consumers who are not willing to buy imperfect foods consistently indicate a lower maximum price that they would be willing to pay for imperfect foods. For instance, for consumers who are not willing to buy imperfect foods, this price is typically around €0.99, for apples, as indicated by a sharp drop. There are less than 30% of consumers wanting to pay more than €1 for imperfect apples if they are not willing to buy the imperfect food. For carrots the maximum price that consumers who are not willing to buy the imperfect food want to pay is between €0.70 and €0.99, as can be seen by the sharp

drop (50% of consumers who are not willing to buy imperfect foods do not want to pay more than €0.70 for such imperfect foods). For people who are willing to buy imperfect foods, the maximum price they want to pay for imperfect foods is higher. Most people would want to pay around €1.50 and €2 for apples, and €1 and 1.50 for carrots.

Quality perceptions of imperfect foods versus perfect foods

In general, perceived product quality of foods considered as perfect is higher than perceived product quality of imperfect foods (Q4,Q5), for both apples ($F(2, 487) = 25.58, p < .001$), and carrots ($F(2, 487) = 26.09, p < .001$). For imperfect apples there is a significant interaction between price level and message frame ($F(4, 487) = 3.26, p < .013$) (see figure A.5.17). This means that if prices for imperfect and perfect apples are the same, an authenticity message leads to higher quality perceptions compared to the situation in which no message is provided. When prices of imperfect foods are 15% lower, this is the case for the anti-food waste message, and for 30% lower price levels it is again the authenticity message that increases quality perceptions of imperfect apples. This signals that both extrinsic (anti-food waste) and intrinsic (authenticity) message framing lead to increased quality perceptions for imperfect foods, but that for intrinsic message framing to yield higher quality perceptions, a price reduction is not necessary (and may in fact diminish the effect), as predicted.

Figure A.5.17 Product quality perceptions for imperfect apples



In addition, we further investigated the quality perceptions of imperfect foods relative to perfect foods (see figure A.5.18). This provides insight into how much less in quality imperfect foods are assessed relative to perfect foods⁴¹. Stronger negative values indicate that imperfect foods are assessed lower in quality than perfect foods. Quality perceptions for perfect and imperfect foods are closer together when the same price level is used ($M = -.26$) than when 15% lower price levels ($M = -.87$) or 30% lower price levels are used ($M = -.73$), ($F(2, 492) = 2.90, p = .056$). This indicates that a lower price for imperfect foods signals that the product is of lesser quality compared to perfect foods, as predicted.

⁴¹ This is based on a difference score where $\text{productquality_imperfect} - \text{productquality_perfect}$ is computed, leading to a difference score value from -8 to + 8. The closer the difference score is to 0, the closer together quality perceptions of perfect and imperfect foods are (i.e.0 = no difference in quality perceptions).

Figure A.5.18 Product quality perceptions for imperfect apples relative to perfect apples

Note. Bars close to 0 indicate that there are no differences in quality perceptions between perfect and imperfect foods.

Imperfect foods are assessed worse in quality relative to perfect foods when no messages are provided to consumers ($M = -.99$) than when messages are provided ($F(2, 587) = 9.74, p < .001$)⁴². Quality perceptions for perfect and imperfect foods are closest together when an authenticity message frame is used ($M = -.30$) compared to when no message is used. In addition, anti-food waste messages also render quality perceptions for imperfect foods closer to quality perceptions of perfect foods ($M = -.58$) than when no message is used, but the gap is still larger compared to when an authenticity message is being used. This indicates that providing no message signals that the imperfect food is of lesser quality, whereas an authenticity message does not decrease quality perceptions relative to perfect foods. This confirms that authenticity message framing (intrinsic) increases quality perceptions and decreases the necessity of price reductions for imperfect foods.

Statistical and technical information post-questionnaire

Problem awareness

Problem awareness of the impact of buying imperfect foods to reducing food waste was measured with 3 items (Q1.1; Q1.2; Q1.3). Reliability was low (.51) and therefore this construct was not used in further analyses.

Necessity of an expiration indicator

Consumers' need for an expiration indicator was measured with 5 items (Q2.1 to Q2.5). The Cronbach's alpha for this construct was based on four items (Q2.3 did not fit in) and

⁴² No message is statistically different from authenticity message ($p < .001$) and anti-food waste message ($p = .009$). There is a marginal statistical difference in quality perceptions of perfect relative to imperfect foods between anti-food waste and authenticity messages ($p = .075$).

then formed a reliable construct ($\alpha = .78$). In general consumers think they can decide for themselves about expiration of a product ($M = 4.30$, 7-point scale).

Pro-environmental self-identity

Consumers' pro-environmental self-identity was measured with 3 items (Q5.1 to Q5.3). The Cronbach's alpha for this construct was .87, these items thus formed a reliable construct. In general pro-environmental self-identity was high ($M = 5.60$, 7-point scale).

Knowledge about the best before date

Subjective and objective knowledge about the best before date was measured (Q6 & Q7). Consumers indicated that they understood what a BBD is (subjective knowledge, $M = 5.86$ on a 7-point scale). However, only 47% of participants indicated correctly what the meaning of the BBD is when asked to select the correct answer out of 3 options (objective knowledge). This led to the conclusion that understanding about the BBD can be improved.

Awareness of campaigns promoting the purchase of imperfect foods

Awareness of campaigns promoting the purchase of imperfect foods was measured (Q8). Only 29% of participants indicate that they have heard or ever seen campaigns promoting the purchase of imperfect looking fruits and/or vegetables. Thus, awareness of such campaigns is generally low and unlikely to have influenced the results of the study.

Appendix VI: Stakeholders' event

The results of the studies shall be presented at a stakeholders' event (see box). The stakeholders' event will be held 16 October at the Milan Expo as part of the World Food Day. CentERdata will give 2 x10 min. presentations about the studies focused on the key results, and followed by a 5 minute discussion. These presentations aim to be rigorous in nature, while being accessible for an audience with a heterogeneous background (both researchers and non-researchers). The presentations will be followed with a general discussion in which the audience can ask questions or make comments. Stakeholders will receive a factsheet with the key findings of the studies.

"Tackling Food Waste: The Consumer Co-operative Way"

Coop Italy's Forum at EXPO Milan

16 October 2015, 10:45 – 16:40

EXPO site, Italy



The **European Commission** together with the **European Community of Consumer Co-operatives** and **ANCC/Coop Italy** are pleased to invite you to the conference: **"Tackling Food Waste: The Consumer Co-operative Way"**. Tacking place the day after the European Commission's event: **"Fight Food Waste, Feed the Planet"**, the forum will be occasion to look at food waste from **a hands-on perspective** and explore **new tracks** in addressing the issue.

Featuring keynote speeches from representatives of the **European Commission**, the **European Parliament** and the **Italian Parliament**, the conference will then investigate how **consumer co-operatives** deal with food waste **throughout the supply chain** and vis-à-vis the **consumer**. It will also give attendees the chance to learn about the new **ECORYS behavioural study on food choices and eating habits** as well as to listen to the latest achievements of the **EU project "EU FUSIONS"**. Last but not least, the conference will feature the opportunity to visit the **Coop Italy's "Supermarket of the Future"**: a not-to-miss trip into the future of food retailing.

Appendix V: References

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