# The influence of date marking related visual cues on consumers' interpretation and choices to discard or use food

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Two consumer studies in The Netherlands

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# Preface

This report is the result of the research that was carried out in the context of the BO-project (BO-43-110-011: "The influence of date marking related visual cues on food packages on discarding behaviour of consumers at home". The research activities within this project were executed independently by Wageningen Food & Biobased Research, and commissioned and financed by the Dutch Ministry of Agriculture, Nature and Food Quality. The aim of this research was to contribute to a better understanding of how consumers interpret date-related information, such as visual cues, in addition to use-by and best-before date marking, and how this influences their self-reported behaviour on either using or discarding food. The WFBR research team was supported by a supervision committee, consisting of five stakeholders in the Netherlands, including the Ministry of Agriculture, Nature and Food Quality, Ministry of Health, Welfare and Sport, the Netherlands Nutrition Centre, the Foundation Food Waste Free United and as representative of the business community, Too Good To Go. We thank the committee for their involvement and feedback. Too Good To Go is greatly acknowledged for organizing the design sessions, designing the visual cues and providing the product pictures for the online choice-experiment in consumer study 2. Anke Janssen, senior scientist at WFBR, is thanked for advising the research team on the scientific approach, set-up and analysis of the experiments. Finally, we are grateful to the consumers that participated in study 1 and 2.

On behalf of Wageningen Food & Biobased Research,

Gertrude G. Zeinstra,
Scientist and project leader

# Summary

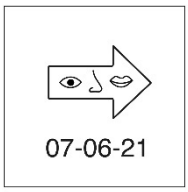
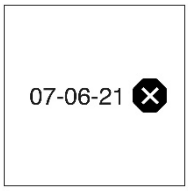
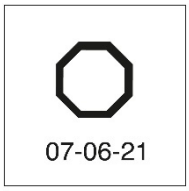
This report describes the results of two consumer studies conducted in The Netherlands as part of project BO-43-110-011: The influence of date marking related visual cues on food packages on discarding behaviour of consumers at home (=Invloed van Visual Cues op verpakkingen t.a.v. houdbaarheidsinformatie op het weggooigedrag bij consumenten thuis). The research activities within this project were executed independently by Wageningen Food & Biobased Research, and were commissioned and financed by the Dutch Ministry of Agriculture, Nature and Food Quality.

About one third of all food produced globally is wasted. Because food waste has a detrimental impact on the economy, climate and society, the UN Sustainable Development Goal 12.3 aims to halve food waste and food losses in 2030. A large part of food loss and waste is generated by consumers. Earlier research has identified date marking as one of the key drivers for household food waste, accounting for approximately 10% of household food waste. In particular, uncertainty or confusion about the two date marking types (use-by and best-before) that are obligated under current EC legislation, could contribute to unnecessary food waste at home. It would therefore be relevant to develop effective strategies that will improve consumers' understanding of the two expiry dates, in order to prevent food waste due to misinterpretation. Additional information on food product packages, in the form of visual cues, may be a promising strategy to help consumers. However, little is known about its effectiveness. This research aims to contribute to a better understanding of how consumers interpret date-related information, such as visual cues in addition to use-by and best-before date marking, and how this influences their behaviour on either using or discarding food. The results of this project need to be understood against the backdrop of developments within the European policy domain. The issue of date marking is one of the focus areas in the European Farm to Fork Strategy (2020) to achieve the SDG12.3 aim. The European Platform on Food Loss and Food Waste as multi-stakeholder platform consisting of representatives of all EU Member States and a selection of other stakeholders from business, science and society has investigated the role of date marking (2018), and is currently working on new legislation in the area of Food Information by the end of 2022.

This project consisted of four parts. First, a literature scan was done to get insight in the requirements for the visual cue design from a consumer perspective. Subsequently, several design sessions were held together with various stakeholders to decide which cues could be suitable for implementation in practice and for inclusion in the consumer study. Thirdly, an explorative study was executed among a small group of Dutch adult consumers (N=11; Consumer study 1). The aim was to explore associations and first impressions in response to the developed visual cues. Fourth, an online survey among a representative sample of Dutch consumers (N=1506 adults) was executed to get insight in consumers' perceptions and interpretations of the visual cues, the perceived added value of the cues, and whether the visual cues can help to reduce food waste (Consumer study 2). The first part of the survey consisted of a choice experiment, where the developed visual cues were tested. The sample was split in five comparable groups, and each group was exposed to one use-by visual cue and one best-before visual cue, with the fifth group being exposed to textual information only (between-subject design). Respondents were presented with pictures of food products on the expiry date or one day past the expiry date, and had to choose whether they would eat, look-smell-taste or discard the products. The food pictures were first shown without additional (visual) information, and in the second round with (visual) information. Subsequently, respondents performed several tasks (grouping task, rank-order task) and answered various questions about the different visual cues as well as about different text options that could accompany the current date marking. Ethical clearance was obtained from the 'Social Ethics Committee' (SEC) of Wageningen University for both consumer studies.

The literature scan suggested that, although little research has been performed in this field, a combination of a visual cue and a short text is most promising. Cue and text should be congruent (convey the same message). The use of intuitive colours may be helpful, cues should not be too small and easy wording should be used. Based on the literature study, the design sessions and several discussion rounds, eight icons were selected for the consumer studies (see Figure below).

Consumer study 1 showed that desired associations for best-before occurred most frequently with the face and arrow. For use-by, the stop-cross and hand resulted mostly in a stop association. The fast-forward and stop-outline icons seemed less clear.

| | Icon 1: Face | Icon 2: Fast-forward | Icon 3: Magnifying class | Icon 4: Arrow |
|---|---|---|---|---|
| Best-before icons |   |   |   |   |
| Use-by icons |   |   |   |   |
| | Icon 5: Meter | Icon 6: Stop-cross | Icon 7: Stop-outline | Icon 8: Hand |

In the online choice experiment, respondents were less likely to discard (vs. look-smell-taste; p=0.045) best-before products in the presence of a (visual) cue regardless of the expiry date. For eat (vs. look-smell-taste) choices, the cue triggered respondents to eat (vs. look-smell-taste) best-before products on the expiry date (p=0.021) and triggered them to look-smell-taste best-before products past the expiry date (p<0.001).

For use-by products, a significant Cue x Date interaction was found for both eat (vs look-smell-taste; p<0.001) and discard (vs look-smell-taste, p=0.009) choice probability. Past the expiry date, respondents were less likely to eat (vs. look-smell-taste; p<0.001) and more likely to discard (vs. look-smell-taste; p<0.001) use-by products in the presence of a cue. On the expiry date, respondents were more likely to eat (vs look-smell-taste; p<0.001) use-by products in the presence of a cue, but the cue had no effect on the likelihood to discarding versus look-smell-taste use-by products (p=0.24). These results indicate that the cue affected respondents' choice behaviour in the desired direction for use-by products.

So, although the majority of respondents showed similar choices with and without cue, the respondents who changed their behavioural choice due to adding the cue, the cue affected their choice behaviour in the desired direction. This suggests a small positive effect of adding date-related information on food packages on consumers' behaviour in relation to expiry dates.

The choice patterns were similar for all five subgroups, suggesting that the effect of the four visual cues were similar as the text-only cue in relation to consumers' choices to eat, look-smell-taste or discard a product. When respondents directly compared the four visual cues on several aspects, consistent differences were observed between the cues. For best-before icons, the ones with eyes, nose and mouth were best evaluated (face and arrow). For use-by icons, those with a clear stop association (hand and stop-cross) were best evaluated. The most preferred texts were 'Often still good after the expiry date. Look, smell and taste' (for best-before) and 'Do not use after date' (for use-by).

Strengths of the current study are the large representative sample (N>1500), the combination of more indirect tasks and more direct questions, as well as combining a qualitative (study 1) and quantitative approach including a choice experiment (study 2). A limitation is the fact that - to be applicable in the online experiment - the visual cues were shown larger on the package than would be the case in reality. Other limitations are the self-reported online behavioural choices with regard to eat, look-smell-taste or discard as well as the complexity of the study design by including both use-by and best-before products.

In conclusion, adding additional date marking related information to product packages can support consumers in making correct decisions regarding the use or discard of food products. In the case of best-before products, adding these cues may lead to less food waste for a small proportion of consumers. For best-before products, look-smell-taste icons are recommended in combination with the text 'Often still good after the expiry date. Look, smell and taste'. For use-by products, icons with a clear "stop" association in combination with the text prompt 'Do not use after date' are recommended.

As the study was done in an online setting and the research design did not allow for actual use or discard measurements, it is recommend to perform additional research. This will contribute to deepened insights on the usage of visual cues for improving understanding of date marking and prompting consumers to the correct use of best-before and use-by products on and after their expiry date. During the consultations with the supervising committee and in the design sessions, it became apparent that changing date marking information on packaging is not necessarily an easy process. Space is very limited, the colour scheme needs to neutral, and the (visual) cues also need to be understood outside the Dutch context. Further alignment with business stakeholders on options, demonstrations in practice and harmonised implementation is therefore strongly advised by the research team.

# List of definitions and abbreviations

| | |
|---|---|
| CBL | Central Bureau for Food Trade (=Dutch trade association for retail) |
| FNLI | Federation of the Dutch Food Industry (=Dutch branch organisation for food industry) |
| Icon | Visual picture without any text |
| LST | Look, smell, taste |
| NZO | Dutch Dairy Organisation (=Dutch branch organisation dairy industry) |
| Project team | Researchers from Wageningen University & Research |
| SEC | Social Ethics Committee |
| STV | Stichting Samen Tegen Voedselverspilling (Foundation Food Waste Free United) |
| Supervision Committee | Dutch Ministry of Agriculture, Nature and Food Quality (LNV); Dutch Ministry of Health, Wellbeing and Sports (VWS); Too Good To Go, Netherlands Nutrition Centre, Foundation Food Waste Free United (STV) |
| TGT | Te Gebruiken Tot (Use-by) |
| THT | Tenminste Houdbaar Tot (Best-before) |
| Visual Cue | Visual picture (icon) in combination with text |
| WUR | Wageningen University & Research |
| WFBR | Wageningen Food & Biobased Research |

# 1 Introduction

About one third of all food produced globally is wasted (Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011). Because food waste has a detrimental impact on the economy, climate and society, the UN Sustainable Development Goal 12.3 aims to halve food waste and food losses by 50% in 2030. In the European Union, approximately 88 million tons of food are wasted each year; the associated costs have been estimated at 143 billion euros (Stenmarck et al., 2016). A large part of food loss and waste is generated by consumers. In this European study, it was estimated that two thirds of the total cost of food loss and waste are caused by household food waste, with associated costs of about 98 billion euros (Stenmarck et al., 2016). In The Netherlands, it is estimated that Dutch households waste about 34kg of food and thick (dairy) liquids per person per year (Voedingscentrum, 2019), which is about 23-35% of all food wasted in The Netherlands (Soethoudt & Vollebregt, 2020). Earlier research has identified date marking as one of the key drivers for household food waste, accounting for approximately 10% of household food waste (Commission, 2018). In particular, uncertainty or confusion about the two date marking types (use-by and best-before) that are obligated under current EC legislation (n. 1169/2011), could contribute to unnecessary food waste at home. This research aims to contribute to a better understanding of how consumers interpret date marking related information, such as visual cues in addition to use-by and best-before marking, and how this influences their self-reported behaviour on either using or discarding food.

This reports describes the results of two consumer studies conducted in The Netherlands as part of project BO-43-002-02 originally entitled 'Invloed van Visual Cues op verpakkingen t.a.v. houdbaarheidsinformatie op het weggooigedrag bij consumenten thuis' (="The influence of date marking related visual cues on food packages on discarding behaviour of consumers at home"). The aim of this project was to explore the effect of adding visual cues to product packages on consumers' understanding of expiry dates and their discarding behaviour. The research activities within this project were executed independently by Wageningen Food & Biobased Research, and commissioned and financed by the Dutch Ministry of Agriculture, Nature and Food Quality. The research team of Wageningen Food & Biobased Research was responsible for the design, execution, data analysis and reporting of the research activities within this project. Five stakeholders in The Netherlands were involved in the supervision committee, advising and supporting the WUR project team: the Ministry of Agriculture, Nature and Food Quality; the Ministry of Health, the Netherlands Nutrition Centre, the Foundation Food Waste Free United and as representative of the business community, Too Good To Go.

In 2017, a Dutch collaboration between the Ministry of Agriculture, Nature and Food Quality, the Ministry of Health, Centraal Bureau Levensmiddelenhandel (=CBL: trade association for retail), Federatie Nederlandse Levensmiddelen Industrie (=FNLI: branch organisation for food industry), Nederlandse Zuivel Organisatie (=NZO: branch organisation dairy industry), Wageningen University & Research (=WUR) and the Netherlands Nutrition Centre was started under the voluntary agreement Green Deal 'Over de datum' (="Beyond the expiry date"). The aim of this Green Deal was to reduce food waste among consumers via a better understanding and improved use of the two expiry dates. A series of joint activities was implemented during the runtime of the Green Deal, including a CASI behaviour analysis that was executed to identify possible interventions related to date marking. CASI stands for Communicatie Activatie Strategie Instrument (="Communication Activation Strategy Instrument") and is a form of dialogue for cocreation of consumer interventions. The results of the CASI and other consumer behaviour research including results of the EU-funded H2020 project REFRESH were integrated in a consumer campaign #verspillingsvrij (food waste free), that was launched in June 2020 together with the Foundation Food Waste Free United (Samen Tegen Voedselverspilling=STV). The campaign included several flights of TV and radio commercials as well as other media channels. The partners of the Green Deal and STV also organised consumer-facing activities. The campaign intended to inform Dutch consumers on the two date markings, as well as the desired, associated behaviour: use it before the use-by date expires, and look, smell, taste if the best-before date expires.

The Green Deal partners were however also interested to seek out further opportunities that support consumers in improved understanding and use of the date markings to avoid food waste at home. Various ideas were coined, of which the option to utilise additional information in wording and other visual cues to the project package were expected to be promising for increasing understanding and reducing food waste. To gain scientific insights on this topic, the Ministry of Agriculture commissioned WUR to implement a consumer research study.

This research and its results must be understood against the backdrop of developments at EU level. Date marking is also a priority topic of the EU Platform on Food Loss and Food Waste, a mandated multi-stakeholder platform that engages national governments, business and societal actors, including academia, to support the EU targets of halving food loss and waste by 2030 as laid down in the Farm to Fork Strategy, and adhering to the UN Sustainable Development Goal 12.3. As called for by the new Farm to Fork Strategy, the Commission will propose the revision of EU rules on date marking by the end of 2022. In doing so, the Commission aims to prevent food waste linked to misunderstanding and/or misuse of these dates, whilst ensuring that any proposed change meets consumers' information needs and does not jeopardise food safety. The Commission will carry out an impact assessment (with public and targeted consultations) as well as consumer research to support its proposal. The Commission has published its inception impact assessment on 23 December 2020, which considers different policy options and describes the work that will be carried out in this regard. The findings of this research will therefore also feed into these developments at EU level.

## 1.1 Background

The majority of studies with regard to household food waste have focused on identifying factors that are associated with consumers food waste behaviour (Hebrok & Boks, 2017; Secondi, 2019; Zeinstra, Van der Haar, & Van Bergen, 2020), with an impressive list of determinants that influence the amount of food wasted by an individual consumer. Several personal factors have been linked to food waste behaviour, such as age, gender, motivational aspects such as attitudes, awareness, social norms and aspects related to personal capabilities such as knowledge and skills (Aschemann-Witzel, de Hooge, Amani, Bech-Larsen, & Oostindjer, 2015; Van Geffen, Van Herpen, & Van Trijp, 2016; Zeinstra et al., 2020). In addition to individual factors, food waste behaviour is also influenced by external and situational factors in the environment. Aspects such as busy time schedules, financial constraints, or certain regulations typically reduce the opportunity to engage in food waste reduction behaviours (Aschemann-Witzel et al., 2015; Van Geffen et al., 2016; Zeinstra et al., 2020). Furthermore, food waste is not a single action, but the result of multiple complex factors and several behaviours (Quested, Marsh, Stunell, & Parry, 2013; Secondi, Principato, & Laureti, 2015; Van Geffen et al., 2016). In addition, many of these behaviours occur often unconsciousness, and consumers do not intentionally waste food (Quested et al., 2013; Russell, Young, Unsworth, & Robinson, 2017; Van Geffen et al., 2016). The fact that the act of wasting food is influenced by many factors, which may partly be unconscious, makes it a challenging task to prevent and reduce food waste among consumers. On the other hand, the knowledge about these various drivers and barriers of food waste generation is essential for the development of effective interventions that can change consumers' behaviours.

One of the factors contributing to food waste is the fact that many consumers do not know the difference between use-by (TGT) and best-before (THT) expiry dates (Aschemann-Witzel et al., 2015; Parfitt, Barthel, & MacNaughton, 2010; Ludovica Principato, Secondi, & Pratesi, 2015). The results of the Flash Eurobarometer of 2015 confirms that expiry dates on food products are easily misunderstood. On average, only 47% of European consumers comprehend the meaning of best-before labels, whereas 40% understands the meaning of use-by (Commission, 2015). It has to be mentioned that there are large differences between countries. For example, a recent study showed that Italian consumers may have a better understanding of the meaning of food labels compared to the European average, with 56% of the Italians perfectly understanding the meaning of the best-before date and 51% knowing the meaning of the use-by expiry date (Secondi, 2019).

Research in The Netherlands shows that about 60% of Dutch consumers state to know the difference between the two expiry dates, whereas 40% states not to know this. Of these 60%, still 2 out of 10 cannot define the two dates correctly, meaning that around 50% of Dutch consumers do not know the difference between use-by and best-before dates. Approximately 10% of Dutch consumers discards food which has passed the best-before date (Voedingscentrum/GfK, 2017).

Several studies have indicated that confusion and misunderstanding about the meanings of expiry dates is one of the most important causes of food waste (L. Principato, Pratesi, & Secondi, 2018; Toma, Costa Font, & Thompson, 2020). Consumers who misinterpret the meaning of use-by and best-before tend to waste more food (Roni A. Neff et al., 2019), as they may not be sure whether the food is still safe to eat (Wilson, Rickard, Saputo, & Ho, 2017). It has been estimated that about 10% of the total amount of food waste is due to misunderstanding of expiry dates (Commission, 2018), and this may concern mainly main food categories such as fruit and vegetables, bakery products, meat and fish, and dairy products. It would therefore be relevant to develop effective strategies that will improve consumers' understanding of the two expiry dates, in order to prevent food waste generation due to misinterpretation.

One of the strategies that could be helpful in this respect and has been proposed by the Dutch Green Deal collaboration, is the addition of information on food product packages, which can be presented either in the form of text, visual cues or a combination of both. Additional information on a product package could help consumers in understanding the difference between the use-by date and best-before date, and thereby prevent them from discarding food that is still safe and good to eat. Until now, it is not known which type of information would be most effective in reducing food waste at a household level. Several studies have been conducted about the influence of front-of-pack healthiness labels on consumers' understanding, appeal and buying behaviour. These studies indicate that such labels have potential to influence consumers perceptions and food choices (Carrillo, Fiszman, Lähteenmäki, & Varela, 2014; Cecchini & Warin, 2016; Goodman, Vanderlee, Acton, Mahamad, & Hammond, 2018; Hersey et al., 2013). However, little is known about the effect of additional information and visual cues on a food package that indicate how to handle expiry dates.

The project described in this report has been executed in The Netherlands, which means that the European legislation for date marking guided the context of the study. The EU-regulation n. 1169/2011 defines two ways of expressing expiry dates on food packages to inform consumers. On the one hand, the best-before date indicates the date (minimum durability) that a product maintains it quality (when stored correctly). This type of date marking is generally applied to non-perishable products, which encompasses a broad range of refrigerated, frozen, dried, and tinned foods. On the other hand, the use-by date is generally applied to highly perishable foods, as this date refers to the maximum date to which the food can be eaten safely. The guiding principle behind these two data labels is that this system helps consumers in making a distinction between whether the data refers to a threshold of safety (use-by date) or to a threshold of quality (best-before date). However, several studies indicate that consumers misinterpret these two date labels, and that this misunderstanding may cause unnecessary food waste.

## 1.2 Objectives

The aim of this study was to investigate whether date marking related visual cues on food packages can contribute to less food waste in Dutch households.

Three research questions were defined for this project. This report focuses mainly on the first two research questions.

1) How should visual cues on food packages look like in order to enhance the understanding of use-by and best-before dates (which requirements) and reduce food waste behaviour?
    a. What is known from scientific literature and (international) examples from practice regarding the use of visual cues to guide consumer behaviour in relation to food quality and food safety?
    b. Which visual cues can be developed for food waste reduction initiatives?
2) What is the effect of visual cues on discarding behaviour of consumers?
    a. How are visual cues interpreted by consumers?
    b. Do these visual cues have an added value for consumers?
    c. Do these visual cues help in food waste reduction (self-reported)?
3) How can visual cues be successfully implemented in practice?
    a. Which requirements are needed for consumer acceptance?
    b. Which requirement are needed for stakeholder acceptance throughout the food chain?

# 2 Methods

This project consisted of four subsequent parts:

- Part 1: First, a literature scan was done to get insight in the requirements for the visual cue design from a consumer perspective (research question 1).
- Part 2: Subsequently, several design sessions were held to decide which cues could be suitable for implementation in practice and for inclusion in the consumer study (research question 1).
- Part 3: Thirdly, an explorative study was executed among a small group of adult consumers (N=11; Consumer study 1). The aim was to explore associations and first impressions in response to the developed visual cues (research question 2).
- Part 4: Fourth, an online survey among a representative sample of >1500 Dutch consumers was executed (Consumer study 2) to get insight in consumers' perceptions and interpretations of the visual cues, the perceived added value of the cues, and whether the visual cues help to reduce food waste (research question 2).

Ethical clearance was obtained from the 'Social Ethics Committee' (SEC) of Wageningen University for both consumer studies (see Annex 1).

## 2.1 Literature quick scan (part 1)

A quick scan of literature was executed to get insight in how consumers perceive visual cues on food packages and which criteria need to be fulfilled in order to enhance understanding and impact of visual cues on food packages (research question 1). Some first criteria for visual cues and a requirement list for application in practice were defined based on various discussion meetings in a previous working group prior to the start of this project (See Annex 2). The literature quick scan was aimed to add scientific insights to these initial criteria.

Table 1 shows the search terms that were used for the quick scan. Because there were practically no papers on consumers' understanding of date marking, the search was extended to the broader area of food waste and health labels on food packages. The literature search was performed by an information specialist of the WUR library. A selection of eleven papers, which were regarded most relevant, were read and used in this quick scan.

***Table 1 Overview of search terms that were used for the quick scan of literature***

| Main term: Visual Cue | Behaviour/ topic 1 | Behaviour/ topic 2 (broader) | Target group | Understanding | Food products |
|---|---|---|---|---|---|
| Visual cue | Food waste | Health | Consumer | Understanding | Food |
| Symbol | Discard(ing) | Nutrient | Household | Acceptance | Product(s) |
| Picture | Food quality | Diet | Adults | Perception | FOP (front of pack) |
| Icon | Date marking | Claims | | Usability | |
| Labels | Shelf-life | Healthy eating | | Response | |
| Cue | Food management (practices) | | | Effectiveness | |
| Image | | | | | |
| Logo | | | | | |
| Explainer/ explanation | | | | | |
| Information Panel | | | | | |
| (Visual) Guidance | | | | | |
| Indication | | | | | |
| Markings | | | | | |
| Illustrations | | | | | |

## 2.2 Design sessions (part 2)

The insights of the quick scan as well as the first design criteria and requirement list from this previous working group (Annex 2) were taken into account during the design process. Several other criteria were considered important according to the project group, such as feasibility in practice and the appeal for the intended purpose (giving the right action message to consumers about what they should do with the product being on or passed its expiry date). Also these aspects were taken into account. Furthermore, it was decided that the use-by and best-before icons should be sufficiently different (in order to prevent confusion among consumers). Finally, from a research design point of view, it was important that the four icons per category were sufficiently different in order to be able to pick up differences in consumer responses. Several discussion rounds were held to decide which icons were most promising taking all these requirements into account.

Two design sessions were organized by Too Good To Go (with input from WFBR) with seven stakeholders present from the field (retail, industry, fresh produce sector etc.) to discuss the designs and decide which cue designs could be promising and should be developed further (research question 1). The first session was organized on 26-02-2021; the second session on 16-03-2021. In addition, two discussion rounds were held within the project group to exchange ideas and discuss the findings from the design sessions in order to come to a final selection of four cues designs for the best-before date (THT) and four cue designs for the use-by date (TGT).

## 2.3 Consumer study 1: Symbass study (part 3)

The Symbass (SYMbols ASSociations) study was an explorative study, and was conducted online with the aim to get insight into consumers first impressions and interpretations (research question 2) with regard to the visual cues that were developed in part 2. The study consisted of a free association task, a grouping task and a few questions related to date marking.

Participants were recruited via the WUR-AFSG consumer database. Eleven consumers were invited to participate in the study, coming from three age groups: 18-30 years, 31-60 years and 61-90 years. By a balanced selection process beforehand, it was ensured to include both males and females in each age group. An invitation email was send, informing subjects about the study aim and procedures. Subjects could participate in the free association task by clicking on the link in the invitation. Inclusion criteria were: 18 years or older, not working at WUR and Dutch speaking and writing. Participants received a gift card (€5,-) for their participation.

### 2.3.1 Survey questions Symbass study

After giving their consent for participation (first page), participants were shown the eight visual cues one by one (in random order) and asked to describe their first thoughts and associations that came into their mind when seeing these visual cues (free association task). During the study, the icons were shown together with the expiry date. Subsequently, they were asked to make two groups of four icons each, according to their own insight (grouping task). Both tasks were included to get insight into participants' perceptions of and associations with regard to the icons. The subsequent question showed nine text options that could be applied to the best-before (THT) date, and participants were asked to rank-order these nine options according to their opinion about how well the text would be helpful in not discarding a product after its expiry date (most helpful =1; least helpful =9). A multiple-choice question was included to explore which information participants use when they want to know more about the shelf-life of a product. Finally, some food waste related questions (statements) were asked as well as demographic characteristics to describe the sample. The final survey can be found in Annex 3. Completion of the survey took about 15 minutes.

### 2.3.2 Data analysis Symbass study

For the free association task, the average number of associations that participants came up with was calculated, including the range (minimum – maximum). Per icon, participants' associations were categorized according to similarity in the associations. A category name (theme) that covered the associations was derived based on the responses. The themes were tabulated for the four best-before (THT) icons and separately for the four use-by (TGT) icons. The number of associations per theme was shown, as well as the number of respondents mentioning these associations. For the grouping task, the various groupings that participants made were tabulated, including the criteria they had used for the grouping and whether they grouped it in line with the intended use-by and best-before groups. For the demographic characteristics and the food waste related statements, means and SD were calculated. For the other questions, frequencies and percentages per calculated.

## 2.4 Consumer study 2: ICO-study (part 4)

Consumer study 2 consisted of a large survey with > 1500 participants, and included a choice experiment. Its main aim was to investigate consumers' interpretations of the visual cues as well as the effects of the visual cues on discarding behaviour of consumers.

Participants for the ICO-study (ICOnen) were recruited via market research agency MSI-ACI. The participants were informed about the study aim and procedures. Inclusion criteria were 18 years or older and Dutch speaking and writing. Vegetarians and vegans were excluded, as chicken, cheese and dairy were used as product stimuli in the survey. A representative sample of 1506 Dutch respondents was recruited based on age, gender, education, household size and urban-rural distribution. For the between-subject choice experiment (section 1), the sample was divided in five groups. Each group tested one of the four visual cues (both for use-by and best-before), and a fifth group tested a text-only cue. Also these five sub-groups were balanced on age, gender, education level, household composition and urban-rural distribution. The data was collected in the period May 26$^{th}$ – June 11$^{th}$ 2021.

The survey consisted of four section, that are explained below (see also Table 2):

1) A between-subject choice experiment with five groups;
2) A grouping and rank-order task;
3) Scoring the icons on several attributes/ statements as well as scoring several use-by and best-before text options; and
4) General food-waste related questions and demographics.

In the first section of the survey, participants were divided into five groups, based on the specific cue they were exposed to (four groups were shown one use-by and one best-before cue each, group 5 the additional text only). They were asked to imagine themselves that it was the 7$^{th}$ of June (07-06-2021), and they wanted to prepare an evening meal. They would check the foods available in their home and were asked what to do with several products: eat the food, look-smell-taste or discard it. Participants were shown twelve pictures of the six food products (3x use-by + 3x best-before) with two remaining shelf life's (0 days + 1 day overdue) in random order (2 categories [THT+TGT] * 3 products * 2 dates=12). In this first round (control), the set of 12 food pictures was shown without a visual cue. In the second round (visual cue condition), they were shown the 12 food pictures with the visual cue (or the text-only option in group 5), again in random order. Participants indicated their response for all 24 stimuli (eat the food, look-smell-taste or discard it), and response times were collected.

In section 2 of the survey, consumers were shown the eight icons and were asked to make two groups of icons: one use-by group and one best-before group (grouping task). Participants could choose the number of icons in each group, as long as they made two groups. In the next question (rank-order task), participants received a description of the meaning of the best-before date and were shown the four best-before icons (as initially designed) with the expiry date. Participants ranked these four icons according to their perception of the best fit to the best-before description, including the reason behind this grouping. The same was done for the use-by icons.

In section 3 of the survey, participants were asked to evaluate the visual cues via scoring several statements. In order to keep the survey doable, 50% of each group (N=150) scored the four use-by icons and the other 50% of each group (N=150) scored the four best-before icons. These statements were scored on a 7-point scale ranging from totally disagree (=1) to totally agree (=7). The six statements were derived from several sources: literature (Carrillo et al., 2014), the results of the free association task (consumer study 1) and discussions with the project team. Subsequently, participants scored five best-before text options and four use-by text options on a 7-point scale ranging from not at all useful (=1) to very useful (=7). The selection of these options were based on the results of the Symbass-study.

In the final section of the survey, respondents were asked to provide demographic information and they answered various food-waste related statements on a 7-point scale ranging from totally disagree (=1) to totally agree (=7). These statements were based on the MOA/Refresh model (Van Geffen et al., 2016) and encompassed motivation, ability and food waste behaviours in relation to date marking. Respondents also indicated their habitual eating frequency for the six products used in the choice task of the survey (section 1). See Table 2 for the design of the study including the between-subject choice experiment in the first part of the survey. The final survey can be found in Annex 4. Completion of the survey took about 15 minutes.

***Table 2 Study design showing the different stimuli and tasks for the five sub-groups in the four sections of the survey***

| | **Section 1: Between-subject choice experiment** | | | | **Section 2** | | **Section 3** | | **Section 4** |
|---|---|---|---|---|---|---|---|---|---|
| | *Control condition* | *Visual cue condition* | *Use-by icon* | *Best-before icon* | *Grouping task* | *Ranking task* | *Six evaluation statements* | *Scoring text options* | *Demo-graphics* |
| Group 1 | 12 pictures | 12 pictures + icon + text | Face | Hand | All 8 icons | All 8 icons | 50% Use-by 50% Best-before | 5 Best-before + 4 Use-by | Similar for all |
| Group 2 | 12 pictures | 12 pictures + icon + text | Fast-forward | Stop-outline | All 8 icons | All 8 icons | 50% Use-by 50% Best-before | 5 Best-before + 4 Use-by | Similar for all |
| Group 3 | 12 pictures | 12 pictures + icon + text | Magnifying glass | Meter | All 8 icons | All 8 icons | 50% Use-by 50% Best-before | 5 Best-before + 4 Use-by | Similar for all |
| Group 4 | 12 pictures | 12 pictures + icon + text | Arrow | Stop-cross | All 8 icons | All 8 icons | 50% Use-by 50% Best-before | 5 Best-before + 4 Use-by | Similar for all |
| Group 5 | 12 pictures | 12 pictures + text (no icon) | Text only – no icon | Text only – no icon | All 8 icons | All 8 icons | 50% Use-by 50% Best-before | 5 Best-before + 4 Use-by | Similar for all |
| Shown as | • Expiry date<br>• Legally required text | • Expiry date<br>• Legally required text<br>• Icon<br>• Additional text | | | Icon only – without expiry date | Icon including the expiry date | Icon including the expiry date | | |

### 2.4.1 Selection of survey variables: Product selection (use-by products & best-before products), expiry date selection and visual cue presentation

#### *2.4.1.1 Product selection*

For both the use-by and best-before product category, three products were selected based on five criteria:

1) Familiar products to most Dutch consumers;
2) Important contributors to food waste in The Netherlands (Voedingscentrum, 2019);
3) Potentially leading to misunderstanding among consumers: it is not too obvious whether the products are in the use-by or best-before category (so, no dry pasta or rice was used);
4) Varying food categories (i.e. not all use-by products of animal origin);
5) Fitting the situation of a Dutch evening meal (dinner time).

This resulted – after a few discussion rounds - in the selection of chicken filet, a pre-cut vegetable mix for stir-frying and a meal salad for the use-by product category. For the best-before product category, grated cheese, quark (~fromage frais) and prebaked baguette were chosen.

#### *2.4.1.2 Expiry date selection*

Two expiry dates were perceived as most relevant for this study, as for these particular two dates, most could be gained concerning food waste reduction and safe food use. Therefore, one expiry date referred to the hypothetical used date in the study (07-06-2021: on its expiry date), and the other expiry date referred to one day overdue (06-06-2021). Different actions are desired from consumers for the different expiry dates and product categories (See Table 3).

***Table 3 Desired consumer actions for the hypothetical situations in consumer study 2***

| Product category | Expiry day = day of today (07-06-2021 in survey) | Expiry date = yesterday (06-06-2021 in survey) |
|---|---|---|
| Use-by products | Use and eat it (or freeze when possible) | Don't use (Discard) |
| Best-before products | Use and eat it | Look, smell and taste first |

#### *2.4.1.3 Visual cue presentation decisions*

How the visual cues should be presented in the survey was discussed several times with the research and project team. It was clear that the presentation should fit the purpose of the specific question at hand. Table 2 shows the decisions about the presentation of the visual cues. The rationale for these decisions was as follows.

In section 1, the conditions should match the normal real-life situation as much as possible. It is obligatory to show the expiry date including the description whether this is a use-by date or a best-before date, so this information was shown always in section 1. In the visual cue condition, an icon and extra text was added in group 1-4, whereas group 5 only text was added (no icon) to explore whether additional text only was as effective as the combination of an icon plus additional text. Table 4 shows how the pictures were presented in section 1 (the online choice experiment).

In the grouping task in section 2, the focus was on the picture (icon) only, so here, no additional information was provided. For the rank-order task, it was decided to show the icon including the expiry date to give some context to participants. The expiry date was the same for all stimuli and all groups: not overdue (07-06-21). The same presentation mode was used for the statement scoring in section 3 (icon + expiry date).

***Table 4*** ***Presentation of the visual cues in the online-choice experiment for best before (cheese – top [a]) and use-by (pre-cut vegetables – bottom [b])***


[a] *Vaak goed na datum; kijk, ruik, proef = Often good after date; look, smell, taste*

[b] *Niet gebruiken na datum = Do not use after date*

## 2.4.2 Data analysis ICO-study

The between-subject choice task (section 1) was analysed with logistic mixed effects regression analyses. Choices with a response time exceeding 60 seconds were considered outliers and excluded from further analysis (90 data points; 0.24% data loss). Analyses were performed separately for best-before (THT) and use-by (TGT) products.

For each product group (use-by products versus best-before products), two logistic mixed effects regression analyses were performed. Since this analysis works with binary responses, the following two models were used:

1) Model 1: predicting the odds of eating products (over looking-smelling-tasting) based on Date, Cue and their interaction.
2) Model 2: predicting the odds of discarding products (over looking-smelling-tasting) based on Date, Cue and their interaction.

To control for variation across respondents and products within each category, all models included random intercepts for participants and products.

In addition, a linear mixed-effects regression analysis was performed for each product type to predict reaction times for the choices made on the basis of Date, Cue, Group (1-5) and their interactions. Models again included random participant and product intercepts.

In all models, simple coding was applied to Group, whereby group 5 (Text-only) was chosen as the reference level (such that each visual cue is compared to the text-only cue in the model output). Significant Date x Cue interactions were followed up with separate analyses per date (on expiry date versus passed expiry date).

For the grouping task (section 2), the frequencies of the different groupings were calculated and shown in a table. For the rank-order task (section 2), the distribution of ranks was shown in a table and the result were analysed with Friedman, non-parametric test, with post-hoc sign tests.

For the attribute (statement) scoring in section 3, means and SD were calculated for the individual icons. The mean scores of the four use-by icons were compared with a repeated-measures ANOVA with Bonferroni post-hoc tests. The same analysis was done for the four best-before icons. Means and standard deviations (SD) were calculated for the five best-before text options and four use-by text options. In addition to the means, also the percentage of respondents that gave a positive score (i.e. 5, 6, or 7) or a negative score (i.e. 1, 2 or 3) was calculated and shown. The text options for use-by and best-before were analysed with ANOVA and Bonferroni post-hoc tests.

For section 4, means and SD or frequencies were calculated for the demographic characteristics, the food waste related statements and habitual consumption of the six products used in the survey.

# 3 Results

## 3.1 Results quick scan

The results of the quick scan that was delivered to the visual cue designers is shown in Annex 5. Most important key points for the design of the cues from a consumer perspective, that were derived from eleven papers, were:

- Cues do have an effect on consumer perceptions and behaviours (Carrillo et al., 2014; Cecchini & Warin, 2016; Goodman et al., 2018; Hersey et al., 2013)
- Although there are not a lot of studies available in this field, a combination of a visual cue and short text seems to work best (Goodman et al., 2018; Hersey et al., 2013; Shearer, Gatersleben, Morse, Smyth, & Hunt, 2017)
- The use of (intuitive and symbolic) colours can be helpful (Cecchini & Warin, 2016; Goodman et al., 2018; Shearer et al., 2017; Vermeir & Roose, 2020)
- The logo should not be too small (Chu et al., 2019; Deng & Zhang, 2019; Hersey et al., 2013)
- Keep it simple: use easy wording and easy intuitive symbols (Chu et al., 2019; Deng & Zhang, 2019; Goodman et al., 2018)
- Pictures/ icons and text should be congruent (and not conflicting) (Jae, Delvecchio, & Cowles, 2008; Shearer et al., 2017)
- Reading takes time and consumers will probably read text when it is there (especially when they participate in a study), so the advice is to keep the text short (Vermeir & Roose, 2020).

## 3.2 Results design sessions

Figure 1 shows the eight icons that were designed and chosen to be included in the two consumer studies of this project. One of the four best-before icons was located directly next to the expiry date (icon 2), and two of the four use-by icons were located directly next to the expiry date (icon 6 and 8).

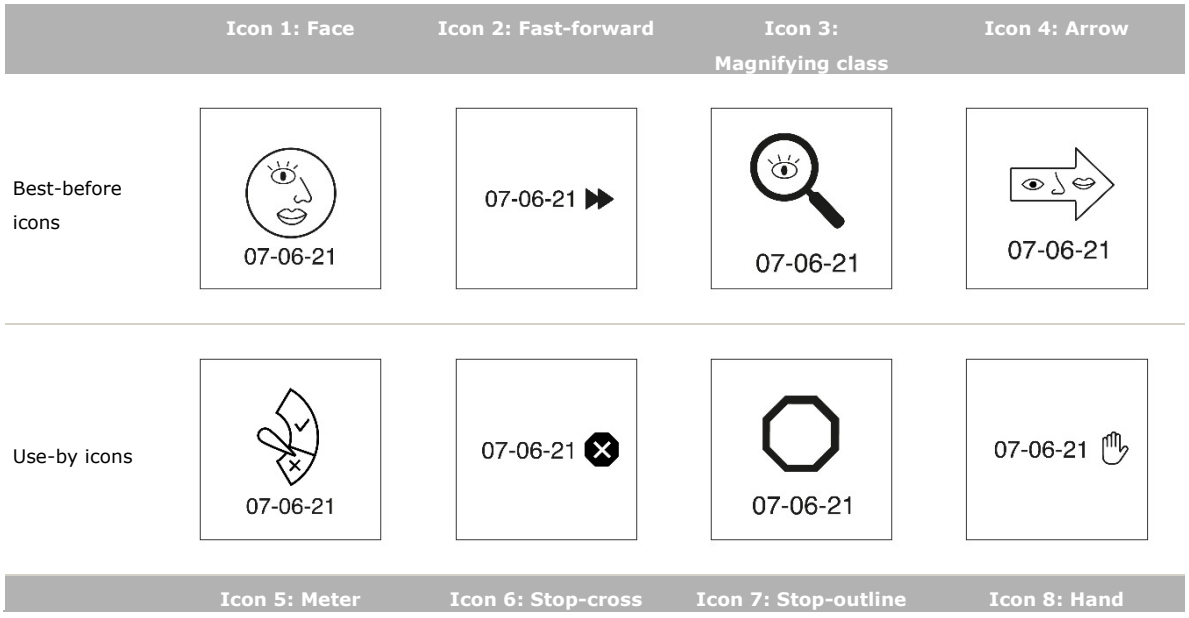



***Figure 1 The eight icons that were used in consumer study 1 and 2***

## 3.3 Results consumer study 1 (Symbass)

### 3.3.1 Participants study 1

The sample consisted of eleven participants, five males and six females. Three participants were in the age group 18-30 years, three participants in the age group 31-60 years, and five participants in the age group 61-90 years. The average age was 51.5 ± 18.3 years. Table 5 shows the participant characteristics. Household composition varied from one to six persons, and the majority of participants had no children. Eight of them had a higher education level, one participant had a medium education level, and two participants had a lower education level.

***Table 5 Characteristics of participants in consumer study 1 (N=11)***

| | Age | Gender | Household size | Number of children | Educational level |
|---|---|---|---|---|---|
| Participant 1 | 25 | Female | 1 | 0 | High |
| Participant 2 | 27 | Male | 6 | 0 | High |
| Participant 3 | 30 | Female | 3 | 1 | High |
| Participant 4 | 35 | Female | 3 | 1 | High |
| Participant 5 | 51 | Male | 2 | 0 | Low |
| Participant 6 | 58 | Female | 3 | 0 | Low |
| Participant 7 | 61 | Male | 2 | 0 | High |
| Participant 8 | 65 | Male | 2 | 0 | High |
| Participant 9 | 66 | Male | 3 | 0 | High |
| Participant 10 | 69 | Female | 3 | 0 | Medium |
| Participant 11 | 80 | Female | 2 | 0 | High |

Table 6 shows the participants' responses to the food waste related statements. The results show that these eleven participants reported to be relatively conscious about food waste: they aim to discard as little food as possible and report to know the difference between the use-by and best-before date (average score >6). They did not agree on always discarding food that has expired (average ~ 2.5). Checking expiry dates before use had an average score of five, a more neutral to slightly positive answer, indicating that this seems a less common practice.

***Table 6 Results food waste related statements* in consumer study 1 (N=11)***

| Statement | Mean (± SD) | Range: min-max |
|---|---|---|
| I try to discard as little food as possible | 6.6 ± 0.6 | 5-7 |
| I always check the expiry dates of food products before using them | 5.1 ± 1.7 | 2-7 |
| I always discard foods that are expired | 2.5 ± 2.0 | 1-7 |
| I know the difference between the best-before date and the use-by date | 6.1 ± 1.0 | 4-7 |

** Answers were given on a 7-point scale ranging from 1=totally disagree to 7=totally agree (4=neutral)*

When participants were asked which information they use in order to know more about the shelf-life of a product (see Table 7), most participants indicated to look at the expiry date in combination with using their own senses (9 out of 11) or in combination with the type of product (8 out of 11). A few participants (4 out of 11) indicated to look at the expiry date and the additional information elsewhere on the package.

***Table 7 Where do you look at when you want to know the shelf life of a product (N=11)?***

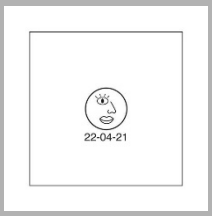
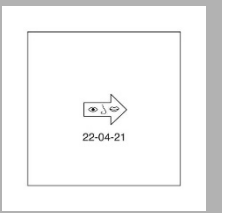
| Answer options * | Frequency |
|---|---|
| The expiry date and my own senses | 9 |
| The expiry date and the type of product | 8 |
| The expiry date and the explanation elsewhere on the package (i.e. use-by text or best-before text) | 4 |
| Only the expiry date | 1 |
| Other, namely: "You know how long you have the food in stock" | 1 |

** Participants were allowed to choose multiple options*

### 3.3.2 Results study 1: Free association task

Table 8 shows the summarized results of the free association task for the four best-before icons and Table 9 for the four use-by icons. The individual associations (their own words) that the respondents provided for the icons are shown in Annex 6.

***Table 8 Results of the free association task for the four best-before (THT) icons in consumer study 1 (N=11)***

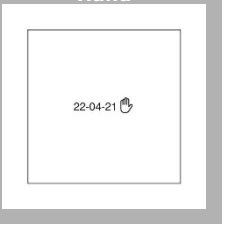
| | Icon 1 "Face" | Icon 2 "Fast-forward" | Icon 3 "Magnifying-glass" | Icon 4 "Arrow" |
|---|---|---|---|---|
| |   |   |   |   |
| Number of associations: mean ± SD, and range: (min-max) | 2.4 ± 1.2 (1-4) | 2.1 ± 1.0 (1-4) | 1.9 ± 0.8 (1-3) | 2.3 ± 1.2 (1-4) |
| Associations * | Look, smell, taste (a=8, n=5) | Fast forward (a=4, n=4) | Look closely (a=5, n=5) | Look, smell, taste (a=12, n=7) |
| | Stick to date (a=4, n=4) | Next, further (a=4, n=3) | Shelf-life (a=3, n=3) | Proceed, next (a=3, n=3) |
| | Art (a=3, n=2) | Longer shelf life (a=4, n=2) | Search (a=2, n=2) | Shelf-life (a=2, n=2) |
| | Face (a=3, n=2) | Only afterwards (a=3, n=2) | Pay attention to date (a=2, n=2) | Art (a=1, n=1) |
| | | No idea (a=2, n=2) | Pay attention, watch out (a=2, n=1) | Check (a=1, n=1) |
| | Unclear (a=1, n=1) | Unclear (a=2, n=1) | Unclear (a=2, n=2) | Unclear (a=5, n=4) |
| | Other (a=7, n=5) | Other (a=4, n=4) | Other (a=5, n=5) | Other (a=1, n=1) |

** a = number of associations mentioned in the category; n= number of participants who mentioned associations in the category*

Respondents gave on average two associations per best-before icon, with somewhat more associations for the face icon with 2.4 associations and somewhat less for the magnifying glass (1.9 associations). Whereas look, smell and taste were the most prominent associations for the face and arrow, these associations were less present for the fast-forward and magnifying glass. The most frequently mentioned associations for the fast-forward icon referred to further, next, and fast forward.

The most prominent association for the magnifying glass was 'look closely'. For the fast forward icon, a prolonged shelf-life was mentioned a few times, whereas for the other three icons, the associations referred more often to 'stick to the date'. The fast-forward icon and the arrow seemed to be the least clear, with responses only afterwards (3x), no idea (2x) and unclear (2x) for the fast-forward icon and 5x unclear for the arrow (4 respondents).

***Table 9*** ***Results of the free association task for the four use-by (TGT) icons in consumer study 1 (N=11)***

| | **Icon 5 "Meter"** | **Icon 6 "Stop-cross"** | **Icon 7 "Stop-outline"** | **Icon 8 "Hand"** |
|---|---|---|---|---|
| |  |  |  |  |
| Number of associations: mean + SD, and range: (min-max) | 2.4 ± 1.0<br>(1-4) | 2.3 ± 1.0<br>(1-4) | 1.9 ± 0.7<br>(1-3) | 2.6 ± 1.1<br>(1-5) |
| Associations | Not good, date has passed<br>(a=6, n=4) | Do not use after<br>(a=8, n=6) | Traffic sign<br>(a=5, n=5) | Stop, halt, wait<br>(a=12, n=8) |
| | Meter, oil, gasoline<br>(a=4, n=3) | Expiry date<br>(a=5, n=5) | Date indication<br>(a=2, n=2) | Not good anymore, do not eat<br>(a=6, n=6) |
| | Shelf-life<br>(a=3, n=2) | Stop, wait<br>(a=3, n=2) | | Shelf-life, stick to date<br>(a=3, n=3) |
| | Almost overdue<br>(a=2, n=2) | Traffic sign<br>(a=1, n=1) | | Attention, danger<br>(a=2, n=2) |
| | | Art<br>(a=1, n=1) | | |
| | | Dangerous after date<br>(a=1, n=1) | | |
| | Clear<br>(a=1, n=1) | Clear<br>(a=1, n=1) | | Clear<br>(a=1, n=1) |
| | Unclear<br>(a=3, n=2) | Unclear<br>(a=1, n=1) | Unclear<br>(a=7, n=7) | Unclear<br>(a=1, n=1) |
| | Other<br>(a=7, n=5) | Other<br>(a=3, n=3) | Other<br>(a=7, n=7) | Other<br>(a=4, n=4) |

** a = number of associations mentioned in the category; n= number of participants who mentioned associations in the category*

For the use-by icons, respondents gave on average two associations per icon, with somewhat more associations for the stop icon with 2.6 associations and somewhat less for the stop-outline (1.9 associations). As expected, the meter was associated with the car (4x), but more often with 'not good, passed the date (6x)'. Two participants indicated that this sign was unclear, and being clear was mentioned once. 'Do not use after (8x)' and 'expiry date (5x)' were the most frequent associations for the stop-cross icon, with 'traffic sign', 'art', 'clear' and 'dangerous after date' each mentioned once. The stop-association was clearly present (12x) for the hand icon, with the associations 'do not eat (6x)' and 'stick to date (3x)' coming next. The stop-outline seemed to be less clear, with the majority of associations referring to the 'traffic sign' (5x) and to 'unclear' (7x).

### 3.3.3 Results study 1: categorization of the eight icons

Table 10 shows that four of the eleven respondents made the correct classification according to four intended use-by and four intended best-before icons. Three of them used a reasoning that was in line with the intended associations; the other respondent actually wanted to make three groups (3x eyes, 3x stop, and 2x other). Three other participants also made three groups, with the fast-forward and stop-outline most often exchanged. In addition, the hand was exchanged once, because this depicts also a human sense, whereas the fast-forward icon indicated an act. Four respondents made - based on various arguments - more than two groups, suggesting that the grouping task was not that easy for them.

***Table 10 Results of the grouping task in consumer study 1 (N=11)***

| Partici-pant | Icon 1 "Face"  | Icon 2 Fast-for."  | Icon 3 "Glass"  | Icon 4 "Arrow"  | Icon 5 "Meter"  | Icon 6 "Cross"  | Icon 7 "Outline"  | Icon 8 "Hand"  | Number of groups | Grouping correct | Motivation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | Correct | Warning Stop |
| 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | Correct | Stop/ don't do it versus judge it yourself |
| 3 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 * | Correct | 3x eyes; 3x stop/cross; 2x different |
| 4 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | Correct | Has expired versus longer shelf-life if ... |
| 5 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 ** | x | 4x hands-off/ don't eat it 3x evaluate it, stop would be third |
| 6 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | x | Clear versus unclear |
| 7 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | x | 1 group senses; 1 group act to continue or stop |
| 8 | 2 | 4 | 1 | 1 | 7 | 5 | 6 | 3 | 7 | x | Human characteristics |
| 9 | 1 | 5 | 2 | 1 | 4 | 7 | 6 | 3 | 7 | x | Senses versus other signs |
| 10 | 1 | 7 | 4 | 2 | 3 | 5 | 6 | 8 | 8 | x | Pictures versus no pictures |
| 11 | 2 | 4 | 3 | 5 | 7 | 6 | 1 | 8 | 8 | x | Doesn't understand the task |

** This participant perceived two icons as an additional different group*
*** This participant wanted to add a third group (reflecting stop)*

### 3.3.4 Results study 1: Consumer text preferences

Figure *2* shows that respondents indicated that the combination of 'look, smell and taste' and 'often good after expiry date' would help them best in order to prevent discarding food. The three most preferred descriptions included a reference to the action (use senses) as well as to the knowledge that the product may be good after the expiry date. The most preferred description seemed to be: 'Often still good after the expiry date. Look, smell, and taste', which was chosen 8x in the top 3. The second preferred description was 'Look, smell and taste to check if it is still good after expiry date' and 'Often good after expiry date. Look, smell, and taste' came third. 'Often longer good' and 'Often good after expiry date' were the least favourite text options. Remind that the text options were presented in Dutch to the respondents.

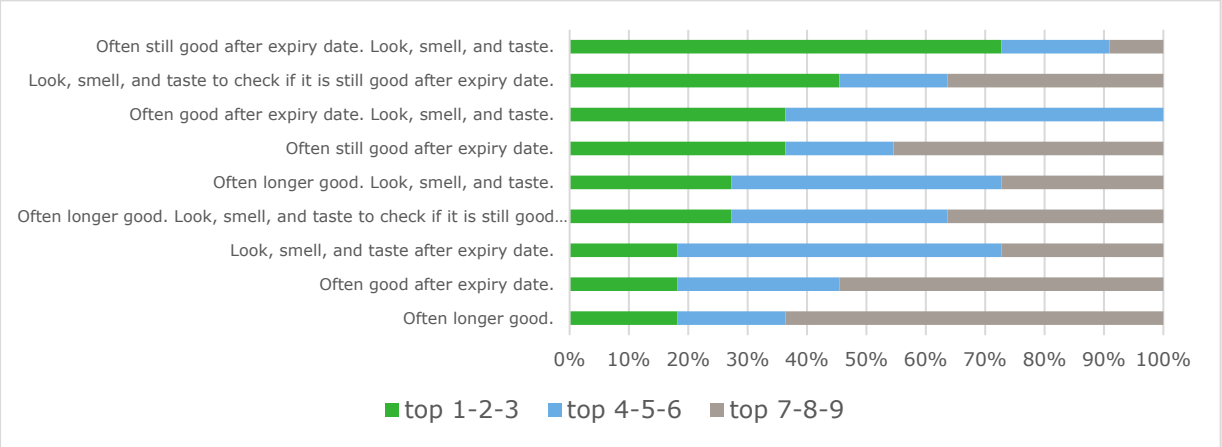



***Figure 2 Overview of respondents' preferences for the best-before text descriptions.***

## 3.4 Results consumer study 2 (ICO-study)

### 3.4.1 Participants study 2

A total of 1506 consumers participated in the ICO-study. Their average age was 47.0 ± 15.9 years and 51% was female. The majority of respondents lived with a partner without children (36%) or with children (32%), whereas 20% of the participants lived alone. Almost half of the sample had a higher education level (48%), 39% had a medium education level and 12% a low education level.

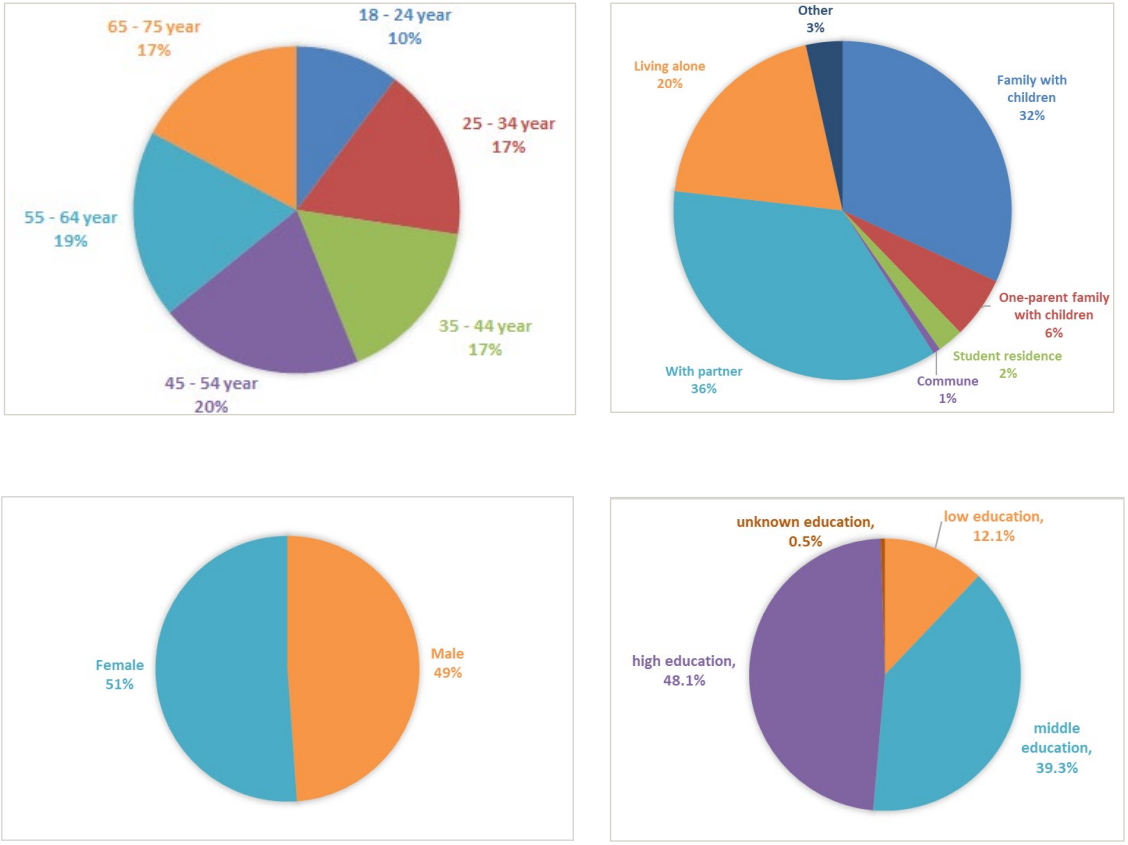



***Figure 3 Demographic characteristics of the participants in consumer study 2***

Participants' responses to the food waste-related statements are shown in Table 11. In general, respondents scored relatively high on their intention to prevent food waste and their food waste awareness, with over 80% agreeing a little to a lot on these two statements. Almost 80% of the participants indicated that they pay attention to the shelf-life of a product when deciding what to eat, and about one third of the sample (31%) indicated that they find it hard to determine whether foods are still safe to eat after the expiry date. Almost 70% of the respondents indicated to feel guilty after discarding food.

The majority of participants (>75%) reported to look-smell-taste after foods have expired according to the date marking, whereas 18-27% of the respondents reported to discard foods immediately after the foods are overdue. However, there were significant differences between use-by date and best-before date regarding these two behaviours (both $p<0.001$). Immediate discarding was higher for the use-by date than for the best-before date, whereas looking-smelling-tasting was higher for best-before products compared to use-by products. These numbers suggest that a small group of respondents behave differently according to the use-by and best-before date (approximately 8%: difference in agree between statement 1 and 2 26.8%-18.3%=8.5% and difference in agree between statement 3 and 4 84.3%-76.0%=8.3%), and that the majority of consumers report to behave relatively similarly.

***Table 11 Average scores for food waste related behaviours according to 9 statements on a 7-point scale (ranging from 1=totally disagree to 7=totally agree) in consumer study 2 (N=1506)***

| Statement | Average ± SD | % negative (Score 1-2-3) | % positive (Score 5-6-7) |
|---|---|---|---|
| 1. I immediately discard foods that are expired according to the best-before date. | 2.88 ± 1.75 * | 64.4% | 18.3% |
| 2. I immediately discard foods that are expired according to the use-by date. | 3.39 ± 1.84 | 52.3% | 26.8% |
| 3. When foods are expired according to the best-before date, I look, smell or taste to check whether the foods are still good. | 5.76 ± 1.28 * | 4.6% | 84.3% |
| 4. When foods are expired according to the use-by date, I look, smell or taste to check whether the foods are still good. | 5.39 ± 1.53 | 10.4% | 76.0% |
| 5. I try to discard as little food as possible. | 6.05 ± 1.21 | 3.3% | 86.6% |
| 6. Discarding food gives me a feeling of guilt. | 5.16 ± 1.62 | 13.5% | 68.4% |
| 7. I am aware of the food that I discard. | 5.71 ± 1.25 | 4.0% | 83.3% |
| 8. When deciding what to eat, I pay attention to the shelf-life of foods. | 5.61 ± 1.34 | 6.3% | 79.7% |
| 9. I find it hard to determine whether foods are still safe to eat after the expiry date. | 3.64 ± 1.7 | 45.2% | 31.4% |

** Score statement 1 differed significantly from statement 2; idem for statement 3 and 4 (paired t-test; p<0.001)*

### 3.4.2 Results study 2: Choice task (survey section 1)

#### 3.4.2.1 Results choice task best-before products

Figure 4 shows the results of the choice task, averaged over the best-before products. There was a main effect of date: although respondents rarely responded to discard products, they were more likely to discard (versus look-taste-smell [LST]; p<0.001) and less likely to eat (vs LST; p<0.001) best-before products past the expiry date in comparison with on the date.

The presence of the visual cues had a small significant effect in respondents' choice behaviour. In the presence of the cue, respondents were less likely to discard (vs. LST; p=0.045) best-before products compared to no cue regardless of the expiry date, although the choice to discard occurred not frequently in the online experiment. For eat (vs. LST) choices, the cue effect differed according to the expiry date (Cue x Date interaction, p=0.001): in the presence of a cue, the likelihood to eat (vs LST) best-before products increased on the expiry date (p=0.021), but decreased past the expiry date (p<0.001). This implies that the cue triggered respondents to look-smell-taste best-before products past the expiry date.

There was no evidence for a main effect of group, nor for any interactions with group (all p's> 0.10), which implies that the cue effects on food waste behaviour were similar for all five cue types; i.e. the text only group showed similar choice behaviour as the visual cues from group 1 to 4.

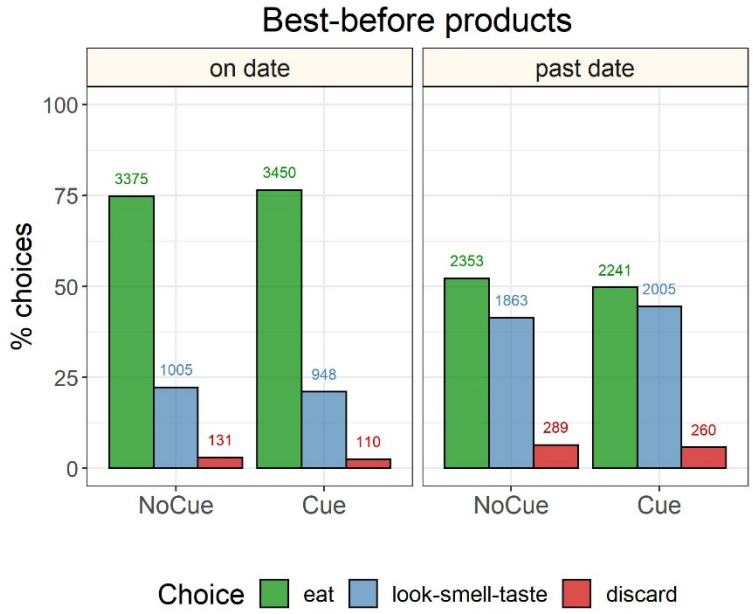



***Figure 4*** ***Percentages of eat, look-smell-taste and discard choices for best-before products on vs. past the expiry date with or without cue in the online choice experiment***

Figure 5 shows the results on the expiry date for the three different best-before food products separately. The results show that discarding best-before food products on its expiry date occurred rarely. For most respondents, adding a cue did not change their choice, they chose the same answer in the no-cue and cue condition (90% of initial eaters; 60% of initial look-smell-tasters). About one third of respondents that chose LST in the no-cue condition, changed towards EAT in the cue-condition, suggesting that the visual cue confirmed that the product is still good to eat on the expiry date. The figure also indicates that - on the expiry date - more respondents changed in the desired direction in the cue-condition (from LST to EAT ~ 36%) than in the undesired direction (EAT to LST ~ 10%).

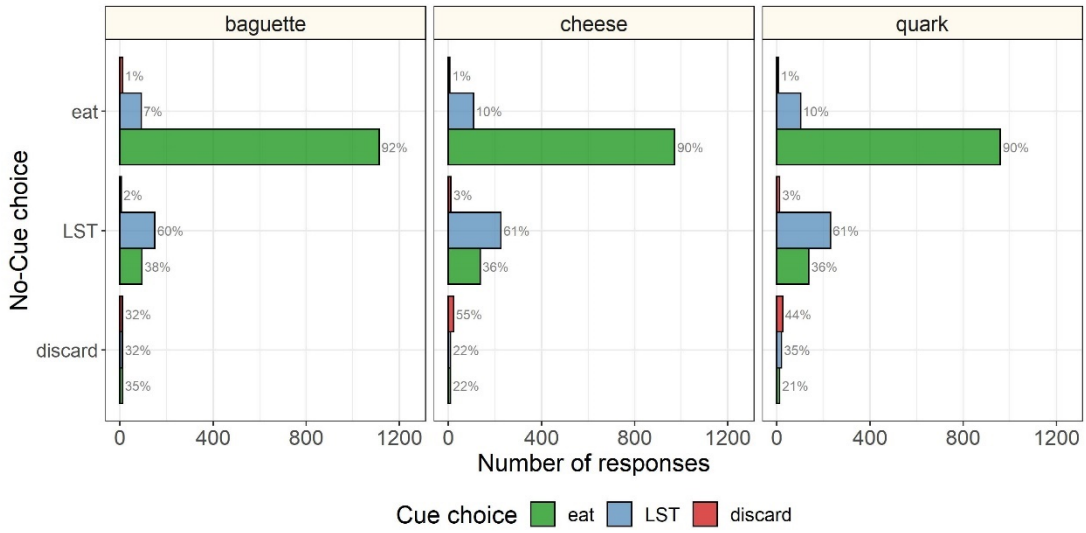



***Figure 5*** ***Percentages of consumer choices for best-before products <u>on</u> the expiry date without (three choices on y-axis) or with cue (bars) in the online choice experiment. LST=look-smell-taste***

The results of the respondents' choices for the three best-before products past the expiry date are shown in Figure 6. Again, the majority of respondents (60-84%) chose the same answer in the no-cue and cue condition. If respondents changed their choice when the cue was added to products past the expiry date, this was mainly in the desired direction, namely:

- Respondents who chose EAT in no-cue condition moved to LST in the cue-condition (~16%), suggesting that the visual cue triggered respondents to look-smell-taste best-before products that are past the expiry date.
- Respondents who chose LST in no-cue condition moved to EAT in the cue-condition (~15%), suggesting that the visual cue confirmed that best-before products past the expiry date are often still good to eat.
- Respondents who chose discard in no-cue condition moved to LST in the cue-condition (~28%), suggesting that the visual cue triggered respondents to look-smell-taste best-before products past the expiry date instead of discarding.

When looking at the absolute numbers on the x-axis, about 600 respondents responded with LST (blue bars) when it concerns cheese and quark, whereas for baguette, this was lower with 400 participants, indicating that respondents seemed a bit more cautious for cheese and quark compared to pre-baked baguette.

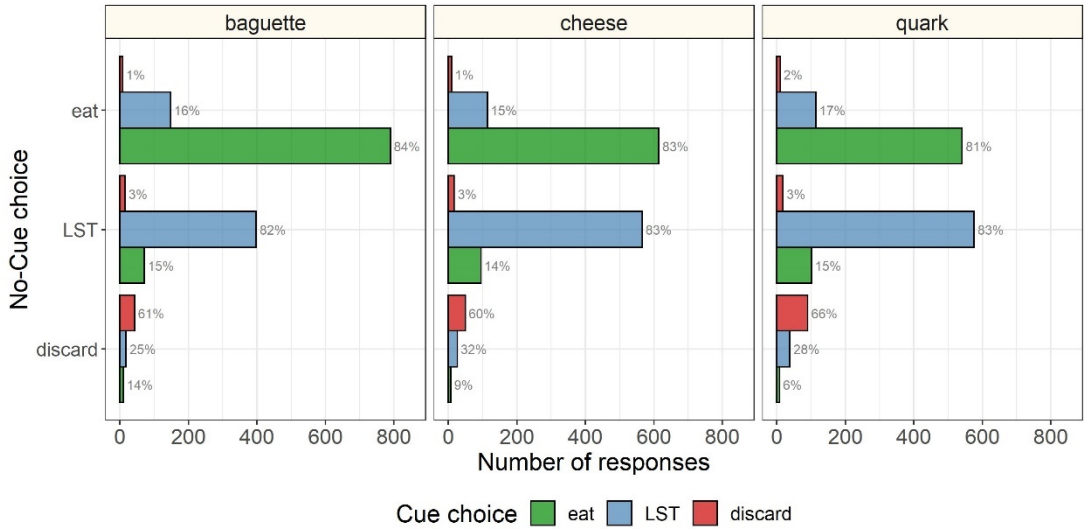



***Figure 6*** ***Percentages of consumer choices for best-before products <u>past</u> the expiry date without (three choices on y-axis) or with cue (bars) in the online choice experiment. LST=look-smell-taste***

### 3.4.2.2 Results choice task use-by products

Figure 7 shows the results of the choice task, averaged over the use-by products. There was a main effect of date for both models: respondents were more likely to discard (vs LST; $p<0.001$) and less likely to eat (vs LST; $p<0.001$) use-by products past the expiry date compared to on the expiry date.

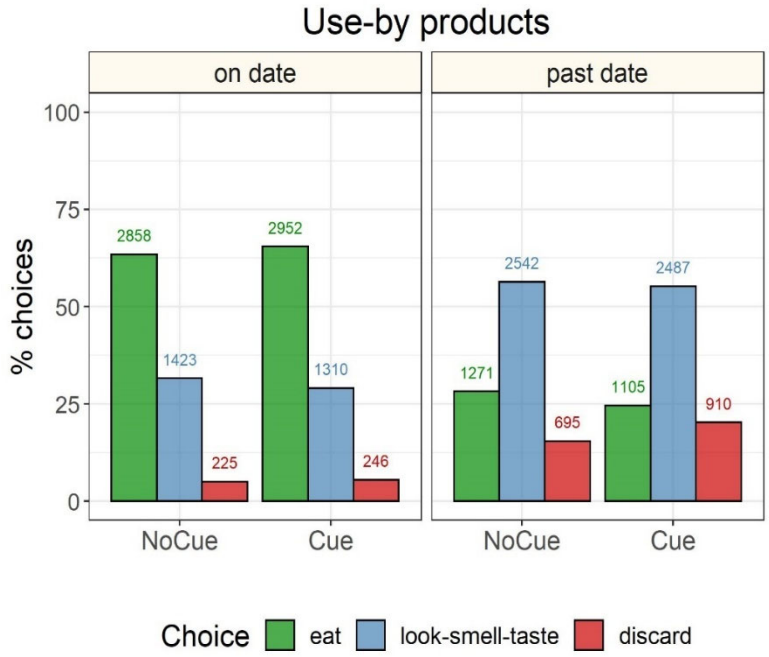



***Figure 7*** ***Percentages of eat, look-smell-taste and discard choices for use-by products on vs. past the expiry date with or without cue in the online choice experiment***

A significant Cue x Date interaction was found for both eat (vs LST; $p<0.001$) and discard (vs LST, $p=.009$) choice probability (p's <.001). Past the expiry date, respondents were less likely to eat (vs. LST; $p<0.001$) and more likely to discard (vs. LST; $p<0.001$) use-by products in the presence of a cue. On the expiry date, respondents were more likely to eat (vs LST; $p<0.001$) use-by products in the presence of a cue, but the cue had no effect on the likelihood to discarding versus LST use-by products ($p=0.24$). Together, these results indicate that the cue affected respondents' choice behaviour in the desired direction.

There was no evidence for a main effect of group, nor for any interactions with group (all p's> 0.10); suggesting that the cue effects were similar across all five groups; i.e. the text alone (group 5) triggered similar choice behaviour as any of the visual cues (groups 1 to 4).

Figure 8 shows the results of the choice experiment on the expiry date for the three different use-by food products separately. The percentage of respondents that discarded use-by products on the expiry date was very small, both with and without cue. Nevertheless, discarding behaviour occurred more often for these use-by products when compared to best-before products.

When the cue was added to the use-by products, the majority of respondents (42-85%) sticked to their initial choice in the no-cue condition, especially in initial eaters: 85% of the respondents who chose EAT in no-cue condition, also chose EAT in the cue-condition. About a third of the respondents who chose LST in no-cue condition switched to EAT in the cue-condition for use-by products on the expiry date, which suggests that these respondents interpreted the visual cue as signalling that use-by products on the expiry date are good to eat. More respondents switched in the direction from LST to EAT (~ 35%) than the other way around (EAT to LST ~ 13%).

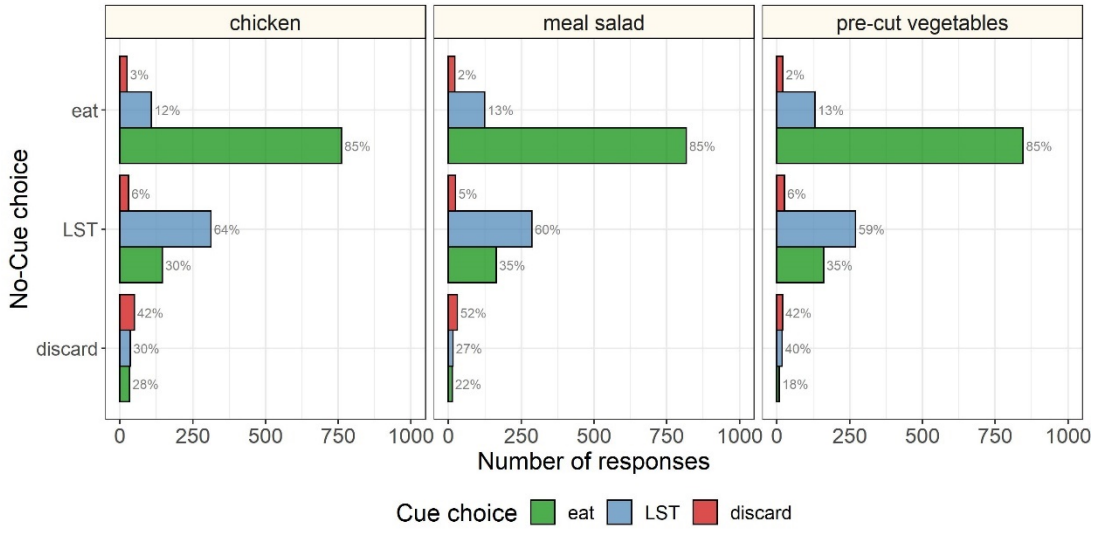



***Figure 8*** ***Percentages of consumer choices for use-by products <u>on</u> the expiry date without (three choices on y-axis) or with cue (bars) in the online choice experiment. LST=look-smell-taste***

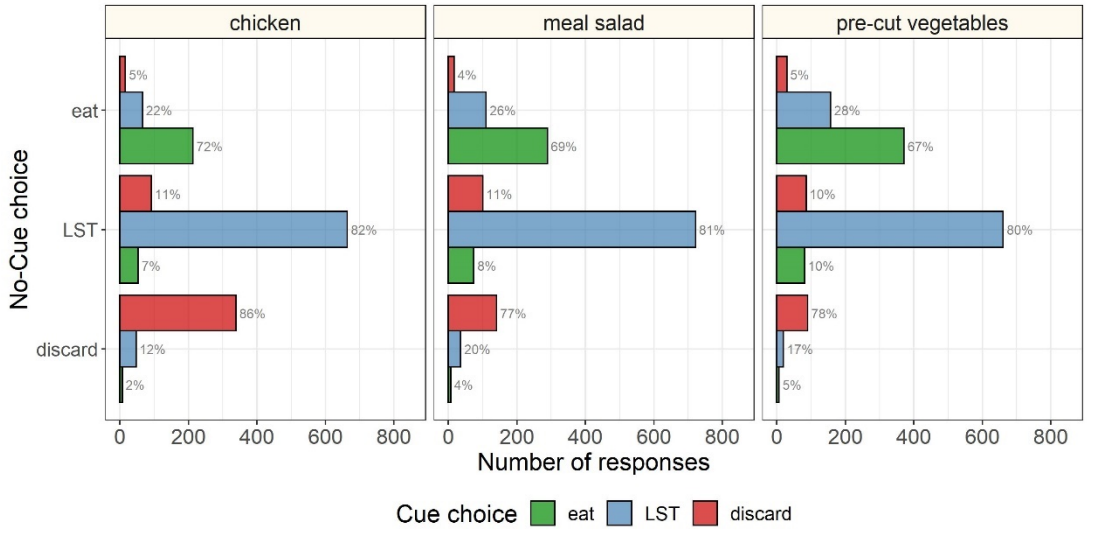



***Figure 9*** ***Percentages of consumer choices for use-by products <u>past</u> the expiry date without (three choices on y-axis) or with cue (bars) in the online choice experiment. LST=look-smell-taste***

The results of the respondents' choices for the three use-by products past the expiry date are shown in Figure 9. The majority of respondents (>600-700) look-smell-taste use-by products past the expiry date in both the no-cue and cue condition. Again, the majority of respondents (67-86%) sticked to their initial choice (in the no-cue condition) when the cue was added. For respondents who did change their choice when a cue was added to products past the expiry date, the following patterns were observed:

- Respondents who initially chose EAT (in the no-cue condition) switched more often to LST (~26%) than to discarding (~5%), which implies that the cue triggered some cautiousness and triggered respondents to use their senses.
- A similar number of respondents who LST in the no-cue condition switched to discarding (~11%; desired direction) or to EAT (~8%; undesired direction). This 8% of respondents who made an unfavourable switch was not due to a specific group (visual cue), but seems a more arbitrary finding.
- Respondents who initially discarded use-by products past the expiry date switched more often to LST (12-20%) than to EAT (2-5%), but the absolute numbers are small.

When comparing the three products and looking at the absolute numbers, about 100-150 respondents indicated to discard meal salad or pre-cut vegetables one day past the expired date, whereas a larger group of respondents (>300) discards chicken, suggesting that respondents are more cautious with chicken.

#### 3.4.2.3 Results choice task response times

Figure 10 shows the response times for the choice task with the best-before products. The figure shows that respondents were overall faster to make choices in the presence of a cue than without a cue, which is likely a practice effect (task performance becomes easier over time) as the no-cue condition always preceded the cue condition.

The cue effect on response time was modulated by cue type ($p<0.001$), such that the difference between the no-cue and cue condition was smaller for the face-arrow cue relative to the text-only cue ($p=0.006$). This means that it took relatively longer to make a choice for best-before products with the face-arrow cue (group 4) relative to products with a text-only cue (group 5). This suggests that the face-arrow cue was processed more thoroughly and/ or triggered more attention than the text-only.

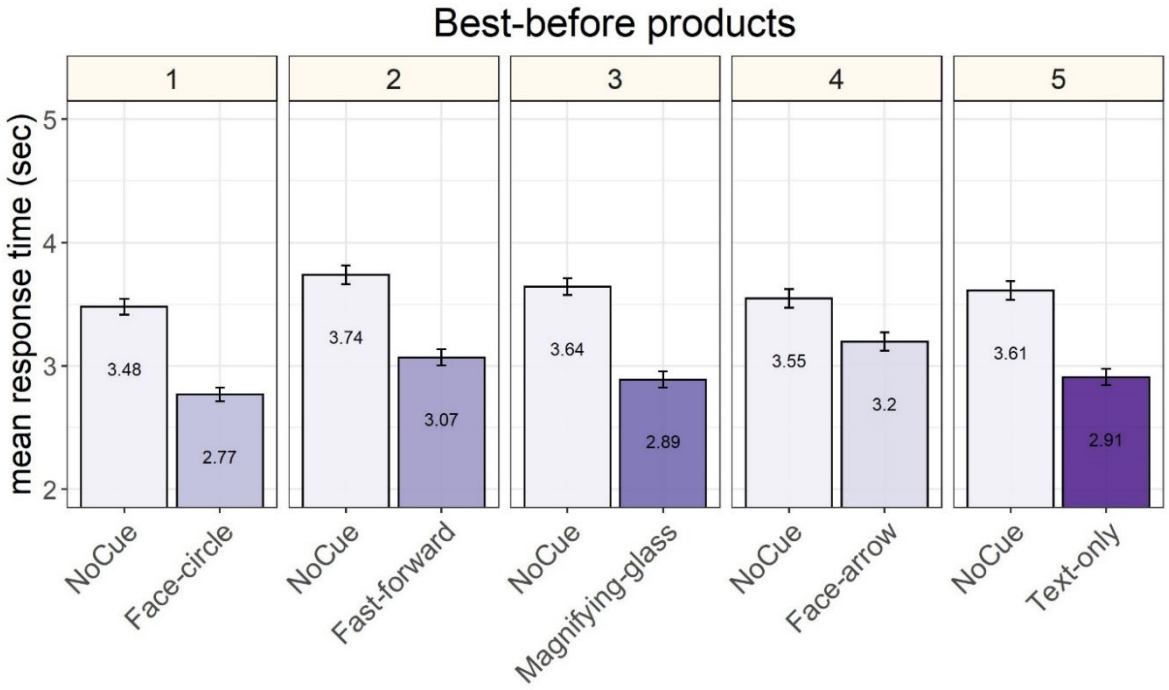



***Figure 10*** ***Response times of the consumer choices for the best-before products with and without cue in the online choice experiment per cue type***

Figure 11 shows the response times for the choice task with the use-by products. Similarly as for the best-before products, respondents were overall faster to make choices in the presence of a cue compared to no cue, which is likely a practice effect (task becomes easier over time). The cue effect on choice response times was again modulated by cue type ($p<0.001$). First, the cue-no-cue difference in reaction times for use-by products with a stop-cross cue was significantly reduced when compared with a text-only cue ($p<0.001$). This means that making a choice for products with a stop-cross cue took longer (although this additional processing time did not lead to different choices). Secondly, the cue-no-cue difference in reaction times for use-by products with a hand cue was also smaller relative to the text-only cue ($p=0.001$), but this was due to a baseline difference in the no-cue condition between group 1 (Hand) and group 5 (text-only; $p=0.01$). In the cue-condition, the difference between group 1 (2.77 seconds) and 5 (2.91 seconds) was not significant.

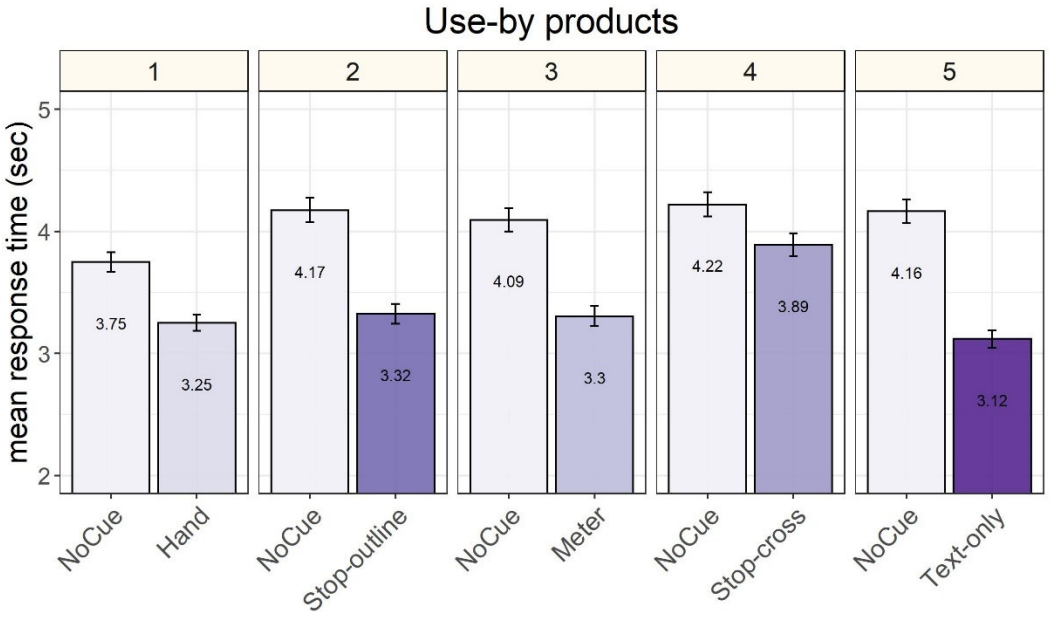



***Figure 11 Response times of the consumer choices for the use-by products with and without cue in the online choice experiment per cue type***

### 3.4.3 Results study 2: Icon grouping task (survey section 2)

Table 12 shows that respondents used all different sized groupings in the grouping task, ranging from seven use-by icons and one best-before icon to one use-by icon and seven best-before icons. The majority of respondents (almost 70%) made a similar sized grouping with four best-before icons and four use-by icons. Approximately 17% of the respondents categorized five icons into the best-before group and three in the use-by group, whereas this was 9% for the other way around (three best-before icons + five use-by icons).

***Table 12 Frequency of the different grouping sizes that respondents made in the grouping task in consumer study 2 (N=1506)***

| Number of icons in group Best before | Number of icons in group Use by | N (%) |
|---|---|---|
| 7 | 1 | 11 (0.7%) |
| 6 | 2 | 52 (3.5%) |
| 5 | 3 | 249 (16.5%) |
| 4 | 4 | 1030 (68.4%) |
| 3 | 5 | 129 (8.6%) |
| 2 | 6 | 23 (1.5%) |
| 1 | 7 | 12 (0.8%) |

Respondents made 161 different groupings of the eight icons in the grouping task. The top 10 of groupings is shown in Table 13. One fifth (20.5%) of the respondents made the correct grouping as the eight icons were designed, with an additional 2.5% making this grouping the other way around (use-by was grouped as best-before and vice versa). The second largest grouping, made by 7.2% of the respondents, added the stop-icon into the best-before group, resulting in five best-before icons and three use-by icons. In the next two most frequent grouping, the meter was grouped into the best-before group, and in one of them the forward icon was grouped in the use-by group. Overall, for the best-before icons, the forward icon was most often mistakenly grouped, followed by the magnifying glass. For the use-by icons, the stop icon and the meter were most often mistakenly grouped.

***Table 13 Main results of the icon grouping task in consumer study 2 (N=1506)****

| Icon 1 Face | Icon 2 Forward | Icon 3 Glass | Icon 4 Arrow | Icon 5 Hand | Icon 6 **Stop** | Icon 7 Meter | Icon 8 Cross | N (%) |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  | |
| Best before | Best before | Best before | Best before | Use by | Use by | Use by | Use by | 308 (20.5%) |
| Best before | Best before | Best before | Best before | Use by | Best before | Use by | Use by | 108 (7.2%) |
| Best before | Use by | Best before | Best before | Use by | Use by | Best before | Use by | 89 (5.9%) |
| Best before | Best before | Best before | Best before | Use by | Use by | Best before | Use by | 78 (5.2%) |
| Best before | Use by | Best before | Best before | Use by | Best before | Use by | Use by | 67 (4.4%) |
| Best before | Best before | Best before | Best before | Use by | Best before | Best before | Use by | 44 (2.9%) |
| Best before | Best before | Use by | Best before | Use by | Use by | Best before | Use by | 44 (2.9%) |
| Best before | Best before | Use by | Best before | Use by | Best before | Use by | Use by | 43 (2.9%) |
| Best before | Use by | Best before | Best before | Use by | Use by | Use by | Use by | 38 (2.5%) |
| Use by | Use by | Use by | Use by | Best before | Best before | Best before | Best before | 38 (2.5%) |

** Green cell indicates correct categorization; white cell with red font indicates incorrect categorization*

### 3.4.4 Results study 2: Rank order task (survey section 2)

The results of the rank-order task are shown in Table 14. The average rank differed between the four best-before icons (Friedman $p<0.001$). Post-hoc pairwise comparisons indicated that all pairs were significantly different (sign tests: $p<0.006$). This means that respondents indicated that the arrow-icon fits best to the best-before date, followed by the face-icon. The magnifying-glass-icon came third and the fast-forward-icon was considered as least fitting the best-before date.

For the use-by icons, the hand-icon was considered as best fitting the use-by date, with the lowest average rank of 1.97. Also for the use-by icons, Friedman showed a significant difference ($p<0.001$) and the post-hoc pairwise comparisons showed significant differences between all pairs (sign tests: $p<0.001$, except the difference stop-cross and hand $p=0.029$). The second best icon was the stop-cross with an average rank of 2.10, followed by the meter-icon and finally the stop-outline icon.

***Table 14 Results of the ranking task in consumer study 2 (N=1506) for best-before icons (left 2 columns) and use-by icons (right 2 column)***

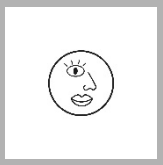
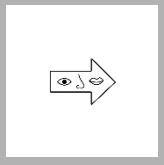
| Best-before icons | Mean rank * | Use-by icons | Mean rank * |
|---|---|---|---|
|  | 2.25 ± 0.99 (a) |  | 1.97 ± 0.93 (a) |
|  | 2.38 ± 1.06 (b) |  | 2.10 ± 1.00 (b) |
|  | 2.43 ± 1.07 (c) |  | 2.59 ± 1.06 (c) |
|  | 2.94 ± 1.22 (d) |  | 3.34 ± 0.92 (d) |

** Different letters in brackets indicate significantly different means in a column ($p<0.05$)*

### 3.4.5 Results study 2: Scoring six statements (survey section 3)

The best-before icons were evaluated by 50% of the respondents of each group. The average scores and standard deviations (SD) for the six statements are shown per best-before icon in Table 15. There were significant differences between the four icons for all six statements ($p<0.001$). The fast-forward icon had consistently lower or the lowest scores for all five 'benefit' statements, whereas it scored highest on 'this icon raises confusion'. In contrast, both the face and arrow scored better than the other two icons on four of the six statements, suggesting that these two are most clear in indicating look-smell-taste after the date (scores > 5 on a 7-point scale) and most helpful in how to handle a product past the expiry date and discarding less (scores around 4.5 on a 5-point scale), as well as least confusing.

***Table 15 Average scores for the six statements to evaluate the best-before icons in consumer study 2 (N=758)****

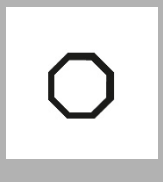
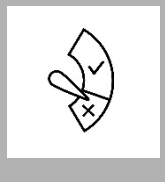
| | Icon 1 "Face"  | | Icon 2 "Fast-forward"  | | Icon 3 "Magnifying-glass"  | | Icon 4 "Arrow"  | | P-value difference (ANOVA) |
|---|---|---|---|---|---|---|---|---|---|
| | **Mean**** | **SD** | **Mean**** | **SD** | **Mean**** | **SD** | **Mean**** | **SD** | |
| With this icon I understand it applies to a 'best-before' date | 4.65[a] | 1.80 | 4.16[b] | 1.92 | 4.58[a] | 1.73 | 4.71[a] | 1.79 | <0.001 |
| This icon clearly indicates that I can look-smell-taste whether the product is still good after the date | 5.23[a] | 1.69 | 3.51[c] | 1.82 | 4.61[b] | 1.64 | 5.32[a] | 1.63 | <0.001 |
| This icon helps me to decide how to handle a product past the expiry date | 4.85[a] | 1.73 | 3.87[c] | 1.82 | 4.63[b] | 1.65 | 4.88[a] | 1.72 | <0.001 |
| This icon raises confusion | 3.47[c] | 1.84 | 4.30[a] | 1.90 | 3.63[b] | 1.80 | 3.36[c] | 1.82 | <0.001 |
| This icon has added value beyond the current best-before date | 4.49[a] | 1.86 | 3.79[b] | 1.86 | 4.42[a] | 1.79 | 4.55[a] | 1.85 | <0.001 |
| The presence of this icon on a package helps me to discard less | 4.41[a] | 1.89 | 3.87[c] | 1.86 | 4.28[b] | 1.81 | 4.40[a] | 1.90 | <0.001 |

** Statements were scored on a 7-point Likert scale ranging from 1=totally disagree to 7=totally agree (4= neutral)*

*** Superscript letters indicate significant differences between the means (p<0.05)*

The use-by icons were evaluated by the other 50% of each group. Table 16 shows the mean values for the six statements for each use-by icon. Also for the use-by icons, there were significant differences between the four icons for all six statements ($p=0.001$). The stop-outline-icon was consistently evaluated worst of the four icons: it had the lowest score compared to the other three icons for its added value, its helpfulness with regard to handling past the date and waste prevention, whereas it had the highest score for confusion. In contrast, the hand-icon and stop-cross-icon were evaluated most positively on all six statements. These two icons seem most useful in helping respondents in their decision how to handle the product after its expiry date, in respondents' understanding that it concerns a use-by date, and indicates to consumers that they should consume the product before or on the expiry date (mean score >5 for all three statements). The mean scores for 'added value beyond the current use-by date' and 'helping to discard less' were slightly below 5 on a 7-point scale.

***Table 16 Average scores for the six statements to evaluate the use-by icons in consumer study 2 (N=748)****

| | Icon 1 "Hand"  | | Icon 2 "Stop"  | | Icon 3 "Meter"  | | Icon 4 "Cross"  | | P-value difference (ANOVA) |
|---|---|---|---|---|---|---|---|---|---|
| | **Mean **** | **SD** | **Mean**** | **SD** | **Mean**** | **SD** | **Mean**** | **SD** | |
| With this icon I understand it applies to a 'use-by' date | 5.28[a] | 1.58 | 3.24[c] | 1.86 | 4.51[b] | 1.85 | 5.19[a] | 1.60 | <0.001 |
| This icon clearly indicates that I should consume the product before or on the date | 5.19[a] | 1.62 | 3.29[c] | 1.83 | 4.57[b] | 1.80 | 5.14[a] | 1.64 | <0.001 |
| This icon helps me to decide how to handle a product past the expiry date | 5.33[a] | 1.53 | 3.22[c] | 1.85 | 4.52[b] | 1.82 | 5.43[a] | 1.54 | <0.001 |
| This icon raises confusion | 3.09[c] | 1.76 | 5.29[a] | 1.64 | 3.84[b] | 1.91 | 3.05[c] | 1.79 | <0.001 |
| This icon has added value beyond the current use-by date | 4.74[a] | 1.75 | 3.06[c] | 1.81 | 4.23[b] | 1.86 | 4.70[a] | 1.77 | <0.001 |
| The presence of this icon on a package helps me to discard less | 4.89[a] | 1.75 | 3.23[c] | 1.78 | 4.38[b] | 1.82 | 4.86[a] | 1.78 | <0.001 |

** Statements were scored on a 7-point Likert scale ranging from 1=totally disagree to 7=totally agree*

*** Superscript letters indicate significant differences between the means (p<0.05)*

### 3.4.6 Results study 2: Text preferences

Table 17 shows how respondents evaluated the different text options for the best-before date on usefulness in preventing them from discarding. These text options were presented in Dutch to the respondents. ANOVA and post-hoc tests showed that the average scores for the five text options differed significantly. 'Often still good after expiry date. Look, smell, and taste' was the most preferred option, with more than 82% of the respondents agreeing that this text would help them in not discarding the product after its expiry date. The text 'Often good after expiry date. Look, smell, and taste' – which is almost similar – came second. 'Look, smell, and taste whether it is still good after expiry date' was the third preferred text, with 76.7% agreeing that this text would be helpful in discarding prevention. The two shorter statements seemed less preferred, although the majority of consumers (>67%) indicated that also these texts would help them in not discarding the product after its expiry date.

***Table 17 Respondents' evaluation of different text options for the best-before date marking in consumer study 2 (N=1506)*: How well does this text help you not to discard the product after its expiry date?***

| Best-before text options | Average +/- SD | % negative evaluation (Score 1-2-3) | % positive evaluation (Score 5-6-7) |
|---|---|---|---|
| Often still good after expiry date. Look, smell, and taste. | 5.64[a] ± 1.28 | 5.0% | 82.3% |
| Often good after expiry date. Look, smell, and taste. | 5.55[b] ± 1.28 | 5.6% | 81.9% |
| Look, smell, and taste to check whether it is still good after expiry date. | 5.40[c] ± 1.30 | 6.0% | 76.6% |
| Look, smell, and taste after expiry date. | 5.22[d] ± 1.36 | 9.4% | 72.4% |
| Often still good after expiry date. | 5.03[e] ± 1.34 | 10.8% | 67.1% |
| *p-value difference (ANOVA)* | *<0.001* | | |

** Statements were scored on a 7-point Likert scale ranging from 1=not at all helpful to 7=very helpful*

Respondents preferences for the use-by text options are shown in Table 18. There were significant differences between the four text options (p<0.001), but these seem smaller than for the best-before options. Respondents preferred the short option 'Do not use after date', with 76.9% indicating that this text would be helpful to eat the product before or on its expiry date. The option 'Use before or on date. Do not use after date' was not significantly different from the preferred one, with about 75% of the respondents agreeing that this text would be helpful in eating the product before or on its expiry date. The text option 'Use before or on date' was preferred least, but still >70% indicated that this text would be helpful. Remind that these text options were presented in Dutch to the respondents.

***Table 18 Respondents' evaluation of different text options for the use-by date marking in consumer study 2 (N=1506)*: How well does this text help you to eat the product before or on its expiry date?***

| Text options | Average +/- SD | % negative evaluation (Score 1-2-3) | % positive evaluation (Score 5-6-7) |
|---|---|---|---|
| Do not use after date. | 5.52[a] ± 1.46 | 7.5% | 76.9% |
| Use before or on date. Do not use after date. | 5.45[a,b] ± 1.44 | 8.9% | 74.9% |
| Use before or on date. Do not use after. | 5.44[b] ± 1.45 | 8.2% | 75.2% |
| Use before or on date. | 5.19[c] ± 1.33 | 7.8% | 71.6% |
| *p-value difference (ANOVA)* | *<0.001* | | |

** Statements were scored on a 7-point Likert scale ranging from 1=not at all helpful to 7=very helpful*

### 3.4.7 Results study 2: shelf life information & usage frequency

When respondents were asked where they look at when they want to know the shelf-life of a product, 'the expiry date and my own senses' was chosen by >75% of the respondents (see Table 18). 'The expiry date and the type of product' came second and was ticked by 65% of the respondents. About 30% of the respondents indicated to read the expiry date with the legally required text elsewhere on the package. Only 5% of the respondents indicated that they look at the expiry date only, without considering other information.

The category 'Other' consisted mostly of different combinations of expiry date, senses, and type of product, and to a lesser extent experience with the product, or the length of the period after buying the product (how long it's in the house).

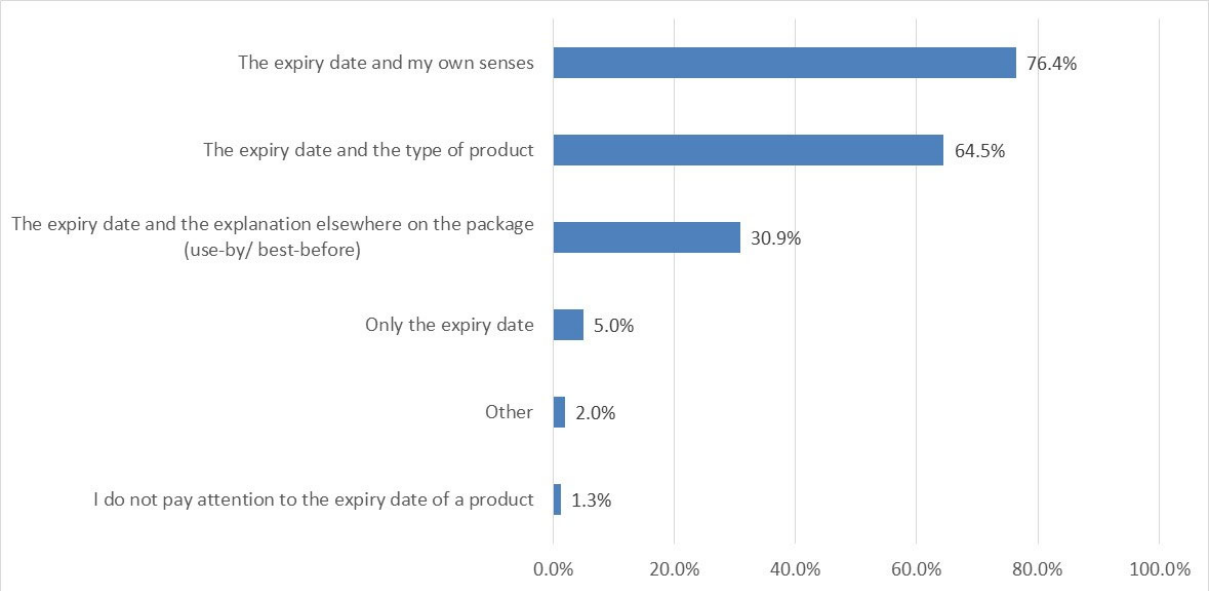



***Figure 12*** ***Respondents responses to the question: Where do you look at when you want to know the shelf life of a product (N=1506); multiple answers possible***

Table 19 shows that the six products used in the study were commonly used by the respondents, with most respondents using the products 1-3 times per month or less than once a month or 1-4 times per week. Few respondents did not use the products in the study, but since these were spread evenly over the five groups, concerned only a few respondents per group and respondents were their own control, we decided to include all respondents in the online choice experiment (section 1).

***Table 19*** ***Habitual consumption frequency of the products used in study 2 (N=1506)***

| | Never | Less than 1 time per month | 1-3 times per month | 1-4 times per week | (almost) every day |
|---|---|---|---|---|---|
| **Best-before products** | | | | | |
| Bake-off bread | 123 (8.2%) | 478 (31.7%) | 581 (38.6%) | 293 (19.5%) | 31 (2.1%) |
| Grated cheese | 147 (9.8%) | 351 (23.3%) | 635 (42.2%) | 345 (22.9%) | 28 (1.9%) |
| Quark | 334 (22.2%) | 378 (25.1%) | 332 (22%) | 285 (18.9%) | 177 (11.8%) |
| **Use-by products** | | | | | |
| Chicken breast | 41 (2.7%) | 216 (14.3%) | 663 (44%) | 557 (37%) | 29 (1.9%) |
| Meal salad | 292 (19.4%) | 561 (37.3%) | 467 (31%) | 165 (11%) | 21 (1.4%) |
| Cut vegetables | 139 (9.2%) | 288 (19.1%) | 650 (43.2%) | 400 (26.6%) | 29 (1.9%) |

# 4 Discussion

The main aim of this study was to investigate whether visual cues on food packages can contribute to less food waste in Dutch households. This chapter summarizes and compares the results of the two consumer studies, by interpreting the findings, giving the strengths and limitations of the study, and providing implications and recommendations.

## 4.1 Main findings

### 4.1.1 Effect of visual cues on choice behaviour

Concerning the main question whether visual cues on food packages can contribute to less food waste, the findings showed that the majority of consumers showed similar choices with and without cue. The group of consumers who changed their behaviour due to the cue, did this in the desired direction, suggesting a small positive effect of adding date-related information on food packages on consumers' behaviour in relation to expiry dates. Table 20 shows these effects summarized. For best-before products on its expiry date, the cue encouraged a small group to eat (instead of look-smell-taste) and encouraged to look-smell-taste instead of discarding. For best-before products past the expiry date, the cue encouraged a small group to look-taste-smell instead of eat or discard, which is exactly the desired behaviour that the cue should stimulate. For use-by products on its expiry date, the cue encouraged to eat (instead of look-smell-taste); the cue supports that the product can be eaten on its expiry date. There was no effect on the choice to discard verses look-smell-taste. For use-by products past the expiry date, the cue encouraged to discard (instead of look-smell-taste), and discouraged to eat instead of look-smell-taste. This indicates that consumers became a bit more cautious with use-by products past the expiry date, which is desirable from a food safety perspective.

***Table 20 Summary of online choice experiment in study 2: effect of adding a cue for the different situations***

| Situation | Desired behaviour | Main response without cue | Effect of adding the cue |
|---|---|---|---|
| Best-before on expiry date | Eat | ~75% chose eat<br>~24% chose LST<br>Few chose discard | Respondents more likely to eat versus LST with a cue and less likely to discard versus LST.<br>90% of initial eaters similar choice with and without cue |
| Best-before past expiry date | Look-smell-taste (LST) | ~50% chose eat<br>~40-45% chose LST<br>~5-10% chose discard | Respondents less likely to eat versus LST with a cue and less likely to discard versus LST.<br>60-84% similar choice with and without cue |
| Use-by on expiry date | Eat | ~67% chose eat<br>~30% chose LST<br>~5% chose discard | Respondents more likely to eat versus LST with a cue; cue no effect on likelihood to discard versus LST.<br>42-85% similar choice with and without cue |
| Use-by past expiry date | Do not eat (discard) | ~27% chose eat<br>~55% chose LST<br>~15% chose discard | Respondents more likely to discard (versus LST) and less likely to eat (versus LST) with a cue.<br>67-86% similar choice with and without cue |

It is important to note that the choice to discard the product did not occur frequently in this online choice experiment, but that respondents chose to discard more often past the date compared to on the expiry date (both for best-before and use-by products). In addition, the choice to discard occurred more often for use-by products than for best-before products, suggesting that (part of) the respondents did make a difference between these products. This latter finding is in line with previous research (Roni A. Neff et al., 2019; Voedingscentrum/GfK, 2017; Wilson et al., 2017).

It was remarkable that - both for the best-before products and the use-by products - there were no differences in behavioural response patterns between the five sub-groups, implying that the four visual cues had a similar effect on respondents' choices as the additional text-only cue.

Both for the arrow-icon (best-before) and the stop-cross-icon (use-by), respondents took more time to make their choice when compared with the other icons. This finding could be due to these particular two cues or it could be due to this particular group (since both cues were presented in group 4). Although group 4 was not slower overall, it cannot be ruled out that respondents in group 4 were more sensitive to the presence (versus absence) of any visual cue. A longer processing time could be positive in the sense that these icons were more interesting (attracted more attention), or it could be negative in the sense that these icons were more difficult to interpret for respondents. The fact that these two cues were best evaluated by the respondents (see 4.1.2) strengthens the interpretation that this difference in response times was a cue effect rather than between-group differences. It also supports a positive interpretation; the cues were more interesting rather than more difficult.

So, to summarize, the majority of consumers showed similar choices with and without cue, but for the consumers who changed their choice due to adding the cue, the cue affected their choice behaviour in the desired direction. For best-before products, respondents were somewhat less likely to discard in the presence of a cue, showing that adding a cue may help in food waste reduction. For use-by products, the cue triggered respondents to eat (vs look-smell-taste) on the expiry date, whereas past the expiry date, the cue triggered to discard use-by products instead of look-taste-smell. The choice patterns seen were similar for all five groups, suggesting that the four visual cues had similar effects as the text-only cue.

Our finding that visual cues influenced consumer's choices to a certain extent is in line with previous research in the area of healthy food choices. Food labels have been found to influence consumer perceptions and their food choices (Carrillo et al., 2014; Cecchini & Warin, 2016; Goodman et al., 2018; Hersey et al., 2013). A few studies indicate that also in relation to sustainable consumer behaviour, labels or visual cues may support consumers' recycling behaviour (Deng & Zhang, 2019), turning off lights (Sussman & Gifford, 2012), and waste separation (Shearer et al., 2017). Our study adds to these studies that (visual) cues may also be valuable for consumers' date marking use and understanding.

### 4.1.2 Consumer perceptions of the visual cues

The consumer studies also aimed to shed light on how consumers perceived the various visual cues that were developed. Respondents answered several questions and performed various tasks with the aim to get insight into how the visual cues were interpreted by consumers, whether they have an added value for consumers and whether consumers perceive the cues as helpful in food waste reduction. Despite the fact that the four different visual cues showed a similar influence on consumers' choice behaviour in the online choice experiment, there were significant differences between the icons in how consumers perceived and evaluated them. The results pointed to a consistent picture. The face-icon and arrow-icon were the most preferred best-before icons, whereas the hand-icon and stop-cross-icon were the most preferred use-by icons. The fast-forward icon (best-before) and the stop-outline-icon (use-by) were evaluated worst.

The grouping task showed that it is not obvious for consumers which four icons belong to the best-before group and which ones to the use-by group, as only 20% of the respondents made the grouping of four by four as intended. The face-icon and arrow-icon were most often correctly categorized, whereas the forward-icon and magnifying glass were most often incorrectly categorized. This is in line with Symbass-pilot, where the forward-icon was most often incorrectly grouped. For the use-by group, the hand-icon and stop-cross-icon were most often correctly categorized, whereas the meter and stop-outline-icon were most often incorrectly categorized. Again this finding was in line with the results of the Symbass-pilot, where the stop-outline was often mis-categorized.

In the ranking task, respondents indicated that the arrow-icon matched best and the forward-icon matched least with the best-before date. For the use-by date ranking task, respondent considered the hand as best match with the use-by date, whereas the stop-outline was regarded as worst match.

It has to be mentioned that absolute differences between the mean rankings were small in this task, implying that the differences between the cues were not extremely large and individual respondents may have had different preferences.

Evaluating the best-before icons according to six different statements showed that respondents perceived the face-icon and arrow-icon as most clear in indicating look-smell-taste after the date, most helpful in how to handle a product past the expiry date and discarding less, and as least confusing. The fast-forward-icon was evaluated worst. Also for the four use-by icons, a consistent picture was observed. The stop-outline-icon was consistently evaluated worst of the four icons and the hand-icon and stop-cross-icon were evaluated most positively on all six statements. So, the hand and stop-cross-icon were regarded as most useful in helping respondents in their decision how to handle the product after its expiry date, in respondents' understanding that it concerns a use-by date, and most clear in that they should consume the product before or on the expiry date (mean score >5 for all three statements on a 7-point scale). The mean scores for 'added value beyond the current use-by date' and 'helping to discard less' were slightly below 5 on a 7-point scale. Both the hand and the stop-cross icon are familiar signs that are used in Dutch traffic. This may have contributed to the positive evaluation and the clear stop association.

To summarize (see Figure 13), based on respondents' answers, the face and arrow were considered best icons for the best-before date, with the arrow scoring a bit worse in the free association task (few times unclear) and slightly better in the survey ranking task (matched the best-before date best). For the use-by icons, the hand and stop-cross were regarded as best icons for the use-by date, with a slightly better performance for the hand in the free association task (clear stop-association; study 1) as well as in the ranking task (best match with use-by date; study 2).

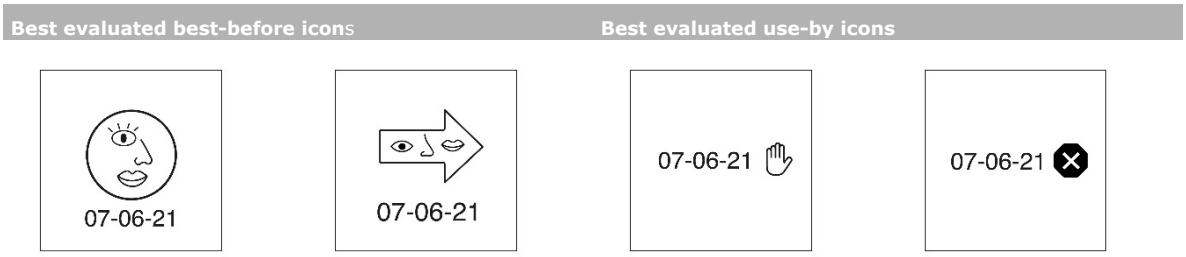



***Figure 13 Top 4 icons that were best evaluated by the respondents***

### 4.1.3 Consumer text preferences

Both in study 1 and study 2, respondents showed a preference for the longer text variants that could accompany the best-before date. The top 3 text preferences from both studies contained both the message 'often good after expiry date' as well as the required action 'look, smell and taste'. The most preferred text option – based on both studies – was the formulation: 'Often still good after the expiry date. Look, smell and taste'. This formulation is almost similar to the one that was used in the online choice-experiment (study 2), with the exception that the word 'still' was left out. It is important to note the exact phrasing of this question for respondents, which was: Which text helps you not to discard a product past the best-before expiry date? So, respondents might have thoughtfully searched for the best option with regard to this particular question, whereas they may have chosen another text option when this question was phrased differently (such as which one is most attractive or easiest to read?). In addition, when doing groceries, consumers may not take the time to read such a text phrase.

The preference for four different text options for the use-by date was investigated in study 2 only. The most preferred option was the shortest statement: Do not use after date. It is remarkable that this formulation contains a negative formulation, with the word 'not', which is generally considered as difficult. It is possible that a familiarity effect played a role, since exactly this formulation was used in the choice-task (first section of study 2). The visual cues used in this study were also congruent with this text option via a stop-association.

On the other hand, the specific phrasing of the question (Which text helps you best to eat or use a product before the use-by expiry date?) was less congruent with this text option. It is also possible that the direct formulation was easy and therefore preferred. This latter explanation is in line with a previous study in the area of healthy consumer choices, where a directive text was most helpful for nutrient amount labels (Goodman et al., 2018).

The most preferred text options for both the best-before and use-by date are shown in Table 21. Previous research has shown that the wording of a date label has a large influence on how consumers perceive the date label (Roni A. Neff et al., 2019).

***Table 21 Most preferred text options***

| | Best best-before text option | Best use-by text option |
|---|---|---|
| 1 | Often still good after the expiry date. Look, smell and taste. | Do not use after date. |
| 2 | Often good after expiry date. Look, smell, and taste*. | Use before or on date. Do not use after date. |
| 3 | Look, smell, and taste to check whether it is still good after expiry date*. | Use before or on date. Do not use after. |

** Number 2 and 3 were reversed in Study 1 results*

### 4.1.4 Where do consumer look at when they want to know the shelf-life of a product?

The results of the two consumer studies were in agreement. The majority of respondents indicated to habitually look at the 'expiry date and their own senses' (>75%) when they want to know the shelf-life of a product. Sixty-five percent ticked the option 'the expiry date and the type of product'. This implies that the majority of respondents look at the printed date in combination with their own (implicit) knowledge to evaluate the shelf-life of a product. A smaller group of 30% indicated to look at the legally required text elsewhere on the package. This implies that only one third of consumers actually reads the explanation of use-by ('Te Gebruiken Tot') and best-before ('Tenminste Houdbaar Tot'). It is possible that the general low understanding of the difference between use-by and best-before is due to the fact that a large part of Dutch respondents (70%) indicated not to read the explanation of the two date marking methods.

## 4.2 Strengths and limitations of the research

To our knowledge, this is the first study investigating the effect of visual cues on product packages to support consumers' understanding of date marking in relation to consumers' choice behaviour (food use and food waste). A strength of this study was the combination of a qualitative (free association study) and a quantitative approach (survey). The combination of these two approaches helps interpreting the findings and strengthens the findings (supports generalizability), as results were in the same direction. Another strength is the combination of more indirect (implicit) measures (choice-task, grouping task) in combination with more direct (explicit) questions (evaluation statements), which gives a more comprehensive view on consumer perceptions and responses towards the different visual cues. Consumers cannot always explicitly tell you what they decide and why, they will rationalize their decisions afterwards and more indirect tasks can be helpful in this respect (Köster, 2003). The fact that a large sample (N>1500), representative for the Dutch population, was used in study 2 is another strength of this study.

It is important to keep in mind that few respondents chose to discard products in the no-cue condition (<15%). The majority of respondents chose eat on the expiry date (67-75%), and to look-smell-taste products after the expiry date (42-55%). As a result, there was little room for improving discarding behaviour by means of the cues. This was in part due to the study design: the use of use-by and best-before products within the same study resulted in three complexities. First, the conditions that were created in the online choice-experiment needed to be relevant and applicable for both product categories, without concealing the difference between these two product categories.

In simple words, it was not desirable that respondents noticed the difference between best-before and use-by products simply because they were shown differently in the choice-experiment (for example: best-before products were three days overdue and use-by products only one day overdue). Secondly, the desired behaviour was also different for these two product categories, but answer options in the online experiment should be the same for all, since again, the difference between these two product categories should not be revealed by providing different answer categories. This led to the fact that it was not possible for respondents to choose the desired behaviour in the situation 'use-by date 1 day passed expiry date' (desired behaviour would have been: already eaten before this situation occurred). Thirdly, this set-up led to the fact that discarding was mainly expected when the food products were passed the date (50% of the stimuli), and preventing food waste due to a cue was mainly expected for the situation 'best-before products past the date' (25% of the stimuli). Despite the complexities of the study requirements and this potential threshold effect for discarding, we still found a small significant effect of the cues on consumers' choice behaviour, with a proportion of consumers changing their choice in the desired direction.

This study has also several limitations that need to be acknowledged when interpreting the findings. First, the visual cues were enlarged in the online choice experiment to ensure that respondents could see and read them from the screen. Also other product information (ingredients, nutrient declaration, branding) was left out in this online choice experiment, as the aim was to investigate the effect of a visual cue and not respondents' search capacities. Therefore, it is important that the results of our study are further studied in more realistic settings, where (a) consumers can have the products in their own hands before making a decision and (b) the visual cues are placed on the product in a more realistic way. Secondly, using a survey ensures that a large group of respondents can be included, but the drawback is that behavioural choices are self-reported, which is less accurate than using objective measures for behaviour. We know from previous studies that food waste is often underreported (R.A. Neff, Spiker, & Truant, 2015; Quested, Parry, Easteal, & Swannell, 2011; Ventour, 2008). This could partly explain why the option discard was infrequently chosen in our online experiment. In addition, being part of a study may affect consumers in their behaviour and responses, e.g. leading to enhanced alertness or to social desirable answers (Köster, 2003). By using more indirect tasks and including a choice-experiment in the survey, where participants were asked to make a quick and intuitive choice, we tried to diminish social desirability. Furthermore, in our study, two sets of four icons were tested. These icons were selected after careful consideration and several design sessions. Nonetheless, another set of icons might have led to different results. Finally, respondents were asked to compare different visual cues directly in the two consumer studies, which would probably not be the case in reality (one cue would be on each product). Nevertheless, by directly comparing the four visual cues, useful insights about consumer preferences and perceptions were obtained which aids in future choices with regard to the different visual cues.

## 4.3 Implications and recommendations

The results of the online choice experiment indicate that adding additional information to product packages (additional text with or without visual icon) can be helpful to reduce discarding behaviour for best-before products to a small extent, and seems to support desired behaviour for use-by products. As a next step, it would be relevant to extent these findings to a more real-life setting to overcome the limitation of self-report and the limitations of an online setting. An online choice-experiment is already a stronger measure for behavioural choices than asking hypothetical questions, and various design choices were made to approximate actual behaviour as much as possible: the use of concrete products as stimuli, a concrete situational story for respondents and a choice task where respondents had to make a quick, intuitive choice. Nevertheless, the findings need to be strengthened in a real-life study, where actual behaviour is observed and respondents have real products in their hands.

Since the positive effect of adding a cue was present in a small part of the sample, it could be interesting to focus on a sample that discards most. However, it will be difficult to find such a group of consumers and it can be questioned whether this is desirable. First of all, when consumers are asked whether they discard food, they will generally respond that they do not discard (R.A. Neff et al., 2015). This is likely due to the fact that food waste is an unintentional and unconscious process (R.A.

Neff et al., 2015; Quested et al., 2013; Russell et al., 2017) and to the fact that social desirability plays a role (Graham-Rowe, Jessop, & Sparks, 2014; Williams, Wikström, Otterbring, Löfgren, & Gustafsson, 2012). The responses to the general food waste questions in our study confirm that consumers generally indicate to waste little food, whereas Dutch households waste about 34kg of food and thick liquids per person per year (Voedingscentrum, 2019). Secondly, a representative sample was deliberately chosen in order to be able to generalize to the Dutch population and evaluate the impact on food waste reduction for The Netherlands. If a particular sample would be selected, that might have a small share in The Dutch population, the expected impact on food waste would be small. Finally, when studying food waste behaviours of consumers, it is undesirable to prime participants on this topic beforehand, as this may induce less natural behaviour as well as social desirability.

Several recommendations for future research can be derived from this first study on adding date marking related visual cues to product packages. In the online choice-experiment, all four visual cues were tested in combination with additional text, since this seemed most effective based on previous studies (Goodman et al., 2018; Hersey et al., 2013; Shearer et al., 2017). Since verbal information may require more processing time, consumers generally prefer pictorial information over verbal information and people may have a better memory for pictorial information (Vermeir & Roose, 2020), it would be interesting to investigate whether the visual icon alone would be as effective as the combination of visual icon and additional text. Linked to this, it would be valuable to study the effect of different placing of texts and cues on the package. For example, is the effect of a visual cue larger when this cue is located next to the expiry date or when it is located elsewhere on the package. In our study, consumers showed a preference for the stop-cross and hand-icon for use-by date (for both, the intended location was next to the date), whereas the best-before icon with intended location next to the date, was evaluated worst (fast-forward icon). However, the effect of positioning the icon relative to the expiry date could not be accurately studied in this experiment, and needs to be tested in future studies. In our experiment, the additional text and icons on the product were larger than would be the case in reality, and both were located on the front of the product pack. Therefore, an avenue for future study would be to explore the influence of realistically sized visual cues including a realistic positioning (front or back of pack). In addition, in our study, all icons and text were in black, which might be easier for real-life implementation in practice, and was also essential to keep the experiment clean and focused (Carrillo et al., 2014): varying additional factors like colour would have rendered interpretation of the results impossible. Nevertheless, it would be interesting for future studies to explore the influence of using colour to clarify differences between the use-by date and best-before date. This would be particularly relevant as previous research has shown that intuitive colours can help consumers to make healthier food choice decisions (Cecchini & Warin, 2016; Goodman et al., 2018; Shearer et al., 2017; Vermeir & Roose, 2020). Moreover, it would be valuable to investigate the effect of adding a visual cue only to best-before products, since the largest impact on food waste reduction is expected for this product category. In such a study, it would be valuable to assess whether consumers maintain their habitual behaviour for use-by products or whether they transfer behavioural changes due to adding a visual cue to best-before products also towards use-by products. Finally, since our study was executed in The Netherlands, it would be valuable to investigate the interpretation and effects of visual cues related to date marking in other countries. The meaning of signs and symbols may vary in different cultures, and this may influence consumers' interpretation and behavioural choices.

Because food-waste behaviour is a complex, multi-faceted and often unconscious process, it remains important to develop and implement also other strategies to prevent and diminish household food waste next to strategies related to date marking. Such a broad approach is acknowledged, and aimed for, in several initiatives in The Netherlands. Examples of other strategies are buying only what is needed (making use of shopping lists) or preventing too much food in stock. About 50% of Dutch consumers state to use these strategies as a way to reduce food waste generation (Voedingscentrum/GfK, 2017), suggesting that there is room for improvement for the other 50% to make use of these strategies. Moreover, 42% of the European consumers do not always look at expiry dates when buying and preparing meals (Commission, 2015), underpinning the need for a broader range of food waste reduction strategies. In addition, a previous study indicated that consumers believe that other actions are more effective than additional information about expiry dates (Secondi, 2019). In this Italian study, meal planning and shopping more carefully were considered the best

solutions for food waste reduction (45%), followed by using left-overs instead of wasting them (40%). Only a small group (16%) thought that detailed information about best-before and use-by dates would help them in food waste reduction. On the other hand, it is important to realize that consumers may overestimate their knowledge with regard to date marking (Voedingscentrum/GfK, 2017), and therefore assign little value to this strategy. Also the results of this study show that additional information about how to interpret and act on different expiry dates has potential to help consumers in making correct decisions about using and discarding food.

An important sub-question of this project was how visual cues on food packages should look like in order to enhance the understanding of use-by and best-before dates (which requirements) and reduce food waste behaviour? Although there is little guidance from previous research about the design of visual cues for consumers (Chu et al., 2019), the following recommendations can be deduced from our findings:

- Icons that accompany a best-before date should depict clear symbols for the three senses look, smell and taste to trigger this action.
- Icons that accompany a use-by date should depict a clear stop sign, such as the hand or stop-cross which respondents evaluated as most clear and useful.
- It requires some further study to explore whether and how different text options affect consumers' choice behaviour. However, based on consumer preferences, the text accompanying the use-by date should be short, clear and congruent with the stop association: 'Do not use after date'.
- The most preferred text options for best-before contained both the aspect of 'often good after expiry date' and the action 'look, smell, taste'. Most preferred text best-before: 'Often still good after the expiry date. Look, smell and taste'.
- The size of the symbols and text should be large enough to find, see and read them easily (Chu et al., 2019; Hersey et al., 2013; Sussman & Gifford, 2012), in order to prevent frustration and low usage of this information.
- The majority of consumers indicated to habitually look at the expiry date and additionally use their own (implicit) knowledge to evaluate the shelf-life of a product. Only 30% indicated to look at other information on the package. This advocates for the positioning of icons or symbols next to the expiry date on a package, in order to be noticed by the majority of consumers.

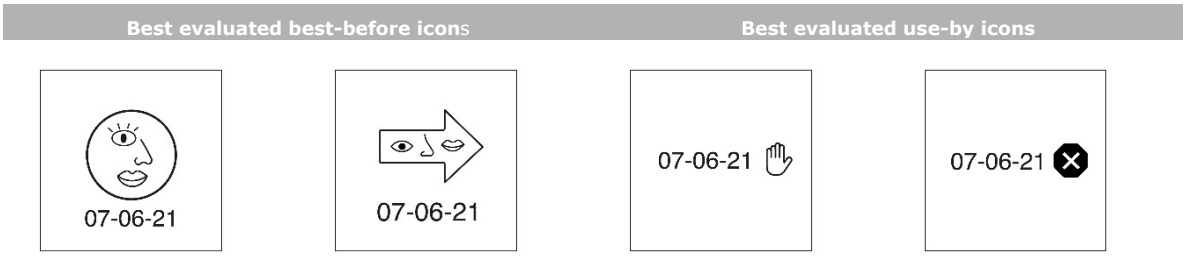
**Aanbevelingen vanuit dit onderzoeksproject voor gebruik van iconen in praktijk**

- Tenminste Houdbaar Tot (THT) iconen bevatten de symbolen voor de drie zintuigen (kijken, ruiken, proeven) om het gebruik van deze zintuigen te stimuleren.
- Te Gebruiken Tot (TGT) iconen moeten een duidelijke stop-associatie overbrengen, zoals een opgestoken hand of een stopbord met kruis.
- Er is aanvullend onderzoek nodig om te weten hoe verschillende tekstopties het keuzegedrag van de consument beïnvloeden. Op basis van de consumentenevaluatie in dit project, zou de TGT tekst kort, duidelijk en in lijn met de stop associatie moeten zijn: 'Niet gebruiken na datum'.
- De tekst bij THT datums moet verwijzen naar zowel de lering 'vaak langer goed' als de actie 'kijk, ruik, proef'. De voorkeurstekst uit dit onderzoek was: 'Vaak nog goed na de datum. Kijk, ruik en proef'.
- De grootte van de iconen en de tekst moet groot genoeg zijn om te vinden, te zien en te lezen (Chu, Wever, Verghese, & Williams, 2019; Hersey, Wohlgenant, Arsenault, Kosa, & Muth, 2013; Sussman & Gifford, 2012). Dit voorkomt frustratie en beperkt gebruik van de informatie.
- De meeste consumenten kijken naar de houdbaarheidsdatum in combinatie met hun eigen (impliciete) kennis (over producten of via zintuigen) om de houdbaarheid van een product te bepalen; slechts 30% gaf aan dat zij de overige, wettelijke tekst op de verpakking bekijken. Dit pleit ervoor om iconen dichtbij de houdbaarheidsdatum te plaatsen, zodat de meeste consumenten deze ook zien.

# 5 Conclusions

The main aim of this study was to investigate whether visual cues on food packages can contribute to less food waste in Dutch households. The online choice experiment showed that the majority of respondents showed similar choices with and without cue, but for a small group, the cue affected their (self-reported) choice behaviour in the desired direction. For best-before products, respondents were somewhat less likely to discard in the presence of a cue, showing that additional information on the product package may help in food waste reduction. For use-by products, the cue affected self-reported behavioural choices in the desired direction for a small group of respondents, suggesting also here a small positive effect of adding date-related information on food packages on consumers' behaviour in relation to expiry dates.

Results from the choice experiment suggested similar effects of the four visual cues as well as the text-alone cue on consumer choices to use, look-smell-taste or discard best-before and use-by products. However, when looking at consumers' perceptions and preferences when they compared the visual cues directly, consistent differences were observed between the four cues, both for best-before and use-by dates. The fast-forward icon (best-before) and the stop-outline-icon (use-by) were consistently evaluated worst. The face-icon and arrow-icon were the best evaluated best-before icons, whereas the hand-icon and stop-cross-icon were the best evaluated use-by icons, with a slightly higher preference for the hand-icon. Respondents preferred the texts 'Often still good after the expiry date. Look, smell and taste' (for best-before) and 'Do not use after date' (for use-by) most.




As the study was done in an online setting and the research design did not allow for actual use or discard measurements, it is recommend to perform additional research. For example, a study with the most preferred icons from this study in a more realistic setting, where the visual cues are shown a more realistic manner (smaller, correct location on package, additional product information also present) and consumers have the products in their own hands. Such additional research will contribute to deepened insights on the usage of visual cues for improving understanding of date marking and prompting consumers to the correct use of best-before and use-by products on and after their expiry date. During the consultations with the supervising committee and in the design sessions, it became apparent that changing date marking information on packaging is not necessarily an easy process. Space is very limited, the colour scheme needs to neutral, and the (visual) cues also need to be understood outside the Dutch context. Further alignment with business stakeholders on options, demonstrations in practice and harmonised implementation is therefore strongly advised by the research team.

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# Annex 1 Ethical clearance

WAGENINGEN
UNIVERSITY & RESEARCH

6706 kn Hollandseweg 1 Wageningen | The Netherlands

To whom it may concern

The following project proposal has been reviewed by the Social Sciences Ethics Committee (SEC):

| | |
|---|---|
| Title: | Invloed van visual cues op verpakkingen t.a.v. houdbaarheidsinformatie op het weggooigedrag bij consumenten thuis |
| Project team: | Gertrude Zeinstra, Sandra van der Haar |
| Funding: | The Ministry of Agriculture, Nature and Food Quality (LNV): BO-43-002-02 |
| Period: | Jan 2021 – Dec 2021 |
| Location: | The Netherlands |

The Committee has concluded that the proposal deals with ethical issues in a satisfactory way and that it complies with the Netherlands Code of Conduct for Research Integrity.

With kind regards,

Professor Dr Marcel Verweij
Chair Social Sciences Ethics Committee

DATE
29-04-2021

SUBJECT
Ethical approval of research project

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# Annex 2 List of design criteria and requirements for implementation

**Criteria voor design**

- Kleurstelling moet praktisch zijn, en keuzevrijheid bieden (kleurvarianten passend bij verpakking, monochroom)
- Overwegen van inclusie 2 of 3 categorieën (THT – TGT + wel/niet lang houdbaar [Annex X]/vers zonder datum [groenten/fruit])
- Nagaan van het effect van toevoegen van een 3e laag informatie (bijv. via QR-code)
- Onderzoeken van verschillende combinaties beeld – tekst – tekst & beeld
- Meertalig aanbieden (in het geval van tekst), vanwege internationale markt en toetsen of de visual cue ook in andere landen (nader te bepalen) begrijpelijk is.
- Rekening houden met beschikbare ruimte op de verpakking (concurrentie met andere informatieverplichtingen en brand-uitingen)
- Positionering van de visual cue (nabij datum-aanduiding/frontside)

**Randvoorwaarden voor implementatie (procescriteria):**

- Implementatietraject liefst laten aansluiten bij lopende cycli van vernieuwingen verpakkingen (kan oplopen tot 4 jaar)
- Implementatie pas laten plaatsvinden na bewezen effect uit onderzoek
- Implementatie branche-breed laten plaatsvinden: geharmoniseerde toepassing voor de Nederlandse voedselketens.
- Er moet rekening worden gehouden met voorwaarden en ontwikkelingen in het Europese beleidsdomein.
- Welke andere interventies moeten naast de introductie van visual cues op de verpakking plaatsvinden om de effectiviteit te bevorderen?
- Goed omgaan met houdbaarheidsinformatie is ook afhankelijk van voedselvaardigheid en kennis rondom kenmerken van bederf onder consumenten.
- Uitvoeren van pilots om een realistisch beeld te krijgen van werking en implementatie.
- Advies voor LNV hoe implementatie en ondersteuning het beste ten uitvoer kan worden gebracht.

# Annex 3 Symbass survey (Consumer study 1)

# Vragenlijst Symbass studie

[Introductiescherm]

### Intro1

**Welkom bij de Symbass-studie**

Deze vragenlijst duurt ongeveer 15 minuten.
Na afloop ontvangt u van ons een Bol-cadeaubon van 5 euro als dank voor uw deelname.

Wilt u de vragenlijst binnen 1 week invullen?
Mocht u tussendoor pauze willen nemen, dan kan dat altijd. U kunt de vragenlijst afsluiten en wanneer u deze op een later tijdstip weer opent (let op: op hetzelfde apparaat), dan gaat deze verder waar u gebleven was. Het invullen van de vragenlijst gaat het beste op een computer/laptop of tablet.

Als u vragen heeft, neem dan contact op met smaakonderzoek@wur.nl
Klik op 'volgende' om verder te gaan.

### Intro2

**Toestemmingsformulier**

Dit onderzoek wordt uitgevoerd door Wageningen Food & Biobased Research. Het doel van dit onderzoek is om associaties en eerste gedachten te verzamelen op basis van plaatjes, die gekoppeld kunnen worden aan houdbaarheidsdatums op verpakkingen van voedingsproducten.

*Toestemmingsverklaring:*

- Ik ben voldoende geïnformeerd over dit onderzoek.
- Ik weet dat de antwoorden anoniem verwerkt worden voor het doel zoals hierboven omschreven.
- Ik weet dat de antwoorden verzameld worden door Wageningen Food & Biobased Research voor data-analyse, en niet met anderen (derden) gedeeld worden.
- Ik weet dat de geanonimiseerde onderzoeksgegevens - volgens de wettelijke bewaartermijn - tot 10 jaar na dit onderzoek bewaard worden.
- Ik weet dat meedoen vrijwillig is, en dat ik altijd kan stoppen zonder opgaaf van reden.

1: **Ik geef toestemming om mee te doen mee aan dit vragenlijstonderzoek:**

- ○ Ja

Indien toestemming gegeven:

2: **Wat is uw leeftijd?** _____ jaar

Indien geen toestemming gegeven:
Helaas, u komt niet in aanmerking voor deelname.

Hartelijk dank voor uw interesse.
We hopen u bij een volgend onderzoek weer te mogen verwelkomen!

Heeft u vragen? Neem dan contact op met smaakonderzoek@wur.nl of 0317-484034.

**U kunt nu het scherm sluiten.**

Vervolg vragenlijst bij wel toestemming:

# Deel 1 Associaties

[Introscherm associaties]

**IntroQ1**
Nu volgen acht plaatjes met een houdbaarheidsdatum erbij.
Bij elk plaatje vragen we u om uw eerste gedachten en associaties op te schrijven.

**Q1.a.**
**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**
*Geef aan in steekwoorden of korte zinnen.*
*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*

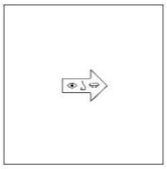
**Q1.b.**
**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**
*Geef aan in steekwoorden of korte zinnen.*
*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*

**Q1.c.**

**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**

*Geef aan in steekwoorden of korte zinnen.*

*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*

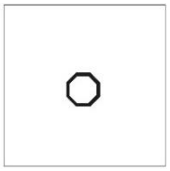


**Q1.d.**

**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**

*Geef aan in steekwoorden of korte zinnen.*

*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*



**Q1.e.**

**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**

*Geef aan in steekwoorden of korte zinnen.*

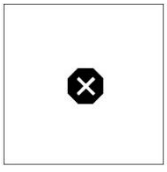
*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*

**Q1.f.**

**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**

*Geef aan in steekwoorden of korte zinnen.*

*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*

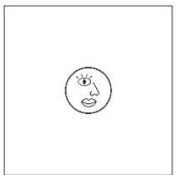


### Q1.g.

**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**

*Geef aan in steekwoorden of korte zinnen.*

*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*



### Q1.h.

**Welke associaties, gedachten, acties of emoties roept dit plaatje bij u op?**

*Geef aan in steekwoorden of korte zinnen.*

*Noteer elke volgende associatie, gedachte, actie of emotie in een nieuw veld.*

## Deel 2 Groeperen

[Introscherm groeperen]

### IntroQ2

**Welke plaatjes vindt u bij elkaar horen?**

Verdeel de volgende plaatjes naar eigen inzicht in twee groepen van elk 4 plaatjes.

Sleep hiervoor een plaatje naar het vak met de stippellijnen hieronder. Een volgend plaatje kunt u in dezelfde groep plaatsen door deze te slepen en bovenop het eerste plaatje los te laten. Dit doet u ook voor de volgende twee plaatjes die u in die groep vindt passen.

Vervolgens maakt u rechts van de eerste groep - ook in het vak met de stippellijnen - een tweede groep aan op dezelfde manier.

*Let op: maak 2 groepen en zorg ervoor dat er 4 plaatjes in elke groep komen.*


[Nieuw scherm]

### Q3

**Wat waren voor u de redenen om de groepen op deze manier in te delen?**

## Deel 3 Stellingen

[scherm stellingen]

### IntroQ4

**In hoeverre bent u het eens met de volgende stellingen?**

| | helemaal mee oneens (1) | (2) | (3) | Neutraal (4) | (5) | (6) | helemaal mee eens (7) |
|---|---|---|---|---|---|---|---|
| Ik probeer zo weinig mogelijk voedingsmiddelen weg te gooien | | | | | | | |
| Ik check altijd de houdbaarheids-datum van voedingsmiddelen voordat ik ze gebruik | | | | | | | |
| Ik gooi producten die over de houdbaarheidsdatum zijn altijd gelijk weg | | | | | | | |
| Ik weet het verschil tussen de Tenminste Houdbaar Tot-datum en de Te Gebruiken Tot-datum | | | | | | | |

[Nieuw scherm]

**IntroQ5**

**Waar kijkt u naar als u wilt weten hoe het met de houdbaarheid van een product zit?**

- ☐ De houdbaarheidsdatum en verder niet
- ☐ De houdbaarheidsdatum en mijn eigen zintuigen
- ☐ De houdbaarheidsdatum en het type product
- ☐ De houdbaarheidsdatum en de toelichting elders op de verpakking *(zoals Tenminste Houdbaar Tot of Te Gebruiken Tot)*
- ☐ Anders, namelijk:

## Deel 4 Teksten

[scherm teksten]

**IntroQ6**

**Welke tekst helpt u het beste om een product niet direct weg te gooien na de datum?**

*Geef aan welke teksten u het beste vindt door eerst op de beste te klikken (deze krijgt dan positie 1), vervolgens klikt u op de op-een-na beste, enz.*

- Vaak goed na datum.
- Vaak nog goed na datum.
- Vaak langer goed.
- Kijk, ruik en proef of het nog goed is na datum.
- Kijk, ruik en proef na datum.
- Vaak goed na datum. Kijk, ruik en proef.
- Vaak nog goed na datum. Kijk, ruik en proef.
- Vaak langer goed. Kijk, ruik en proef.
- Vaak langer goed. Kijk, ruik en proef of het nog goed is.

## Deel 5 Persoonlijke gegevens

[scherm persoonlijke gegevens]

**Q7**

**Wat is uw geslacht?**

- ○ Man
- ○ Vrouw
- ○ Anders / geen antwoord

**Q8**

**Uit hoeveel personen bestaat uw huishouden?**

.... personen

waarvan .... kinderen t/m 17 jaar

waarvan .... volwassenen (18 jaar en ouder)

**Q9**

**Wat is uw hoogst genoten opleiding?**

- ○ LO (Lagere school, LAVO, VGLO)
- ○ LBO (LBO, LTS, ITO, LEAO, Huishoudschool, LLO)
- ○ MAO (MAVO, IVO, MULO, ULO, 3jr HBS, 3jr VWO, 3jr VHMO)
- ○ MBO (MTS, ITS, MEAO)
- ○ HAO (HAVO, VWO, Atheneum, Gymnasium, NMS, HBS, Lyceum)
- ○ HBO (HTS, HEAO, Wetenschappelijk kandidaats, Universiteit onderwijs kandidaats)
- ○ WO (Universitair onderwijs, Doctoraalopleiding, TH)
- ○ Geen antwoord

[Nieuw scherm]

**IntroQ10**

Graag ontvangen wij uw naam en e-mailadres voor het verzenden van de cadeaubon.

**Voornaam**: _____

**Tussenvoegsel**: _____

**Achternaam**: _____

**E-mailadres**: _____

Check e-mailadres

**Vul hier nogmaals uw E-mailadres in**: _____

[Nieuw scherm]

**Heeft u nog opmerkingen?** (niet verplicht)

**Bedankt voor het invullen van deze vragenlijst.**

**U kunt nu op 'verzenden' klikken.**

# Annex 4 ICO Survey (Consumer study 2)

# Survey opzet ICO-studie

[Introductiescherm]

### Intro1

Welkom bij de ICO-studie. Dit consumentenonderzoek wordt uitgevoerd door Wageningen Food & Biobased Research (WFBR). Het doel van deze vragenlijst is om inzicht te krijgen in hoe consumenten omgaan met de houdbaarheidsdatums van verschillende voedingsproducten. Bij voedingsproducten kunt u denken aan eten en drinken dat te koop is in de supermarkt. U kunt deelnemen aan de ICO-studie als u 18 jaar of ouder bent en de Nederlandse taal voldoende beheerst.

De vragenlijst bestaat uit vier delen:

- In deel 1 krijgt u een keuzetaak
- In deel 2 maakt u rangordes voor verschillende plaatjes
- In deel 3 beoordeelt u plaatjes
- In deel 4 vult u een aantal algemene vragen in over uzelf

### Intro2

We zijn steeds geïnteresseerd in uw eigen mening of naar wat u zou doen in een bepaalde situatie. Er zijn dan ook geen goede of foute antwoorden. Het invullen van deze vragenlijst duurt in totaal ongeveer 15 minuten.

Voor dit onderzoek gelden de volgende uitgangspunten:

- Uw antwoorden worden anoniem (zonder naam) verwerkt voor het doel zoals hiervoor omschreven.
- De antwoorden worden verzameld door MSI-ACI, gedeeld met WFBR voor data-analyse en niet gedeeld met derden.
- De geanonimiseerde onderzoeksgegevens worden - volgens de wettelijke bewaartermijn - tot 10 jaar na dit onderzoek bewaard.
- Meedoen is vrijwillig en u kunt altijd stoppen zonder opgaaf van reden.

Ik ben voldoende geïnformeerd over dit vragenlijstonderzoek en geef toestemming om mee te doen:

O JA
O NEE (einde vragenlijst)

Voor gehele vragenlijst geldt: respondenten moeten niet terug kunnen gaan naar een vorig scherm.

Selectiecriteria:

- ≥ 18 jaar
- NL sprekend
- Geen vegetariërs en veganisten

Selectievragen

NL sprekend --> MSI heeft panelbestand met panelleden die de Nederlandse taal goed beheersen

S1. Geslecht: Ik ben een

- Man
- Vrouw
- Anders/wil niet zeggen

S2open. Wat is uw leeftijd? ....
[Indien <18 jaar: U komt niet in aanmerking voor deelname]

S3. Ik zou mezelf omschrijven als een...?

1. Vleeseter
2. Vleesminderaar/ flexitariër (ik eet afwisselend vlees en alternatieven voor vlees)
3. Vegetariër / Pescetariër (geen vlees, maar evt. wel vis)
4. Veganist (helemaal geen dierlijke producten, ook geen ei en zuivel)

[Indien 3 of 4: U komt niet in aanmerking voor deelname]

# Deel 1 Keuzetaak voedingsproducten

In totaal 5 groepen van N=300.

| | **Controle-situatie zonder iconen (alle groepen gelijk):** 12 foto's in random volgorde | **Situatie met icoon (groep 1 t/m 4) of een tekst (groep 5) (elke groep anders):** 12 foto's in random volgorde |
|---|---|---|
| **Groep 1** | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) X 2 datums (6 en 7 juni) | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) met icoon 1 X 2 datums (6 en 7 juni) |
| **Groep 2** | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) X 2 datums (6 en 7 juni) | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) met icoon 2 X 2 datums (6 en 7 juni) |
| **Groep 3** | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) X 2 datums (6 en 7 juni) | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) met icoon 3 X 2 datums (6 en 7 juni) |
| **Groep 4** | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) X 2 datums (6 en 7 juni) | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) met icoon 4 X 2 datums (6 en 7 juni) |
| **Groep 5** | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) X 2 datums (6 en 7 juni) | 6 producten (kaas, kip, kwark, salade, stokbrood, wokgroente) met tekst X 2 datums (6 en 7 juni) |

Zie Excel bestand 'Design_survey_visual_cues' tabjes Q1-Q24 voor productfoto's per groep.

[Introscherm keuzetaak]

### IntroQ1

Stelt u zich de volgende situatie voor:

Het is vandaag 7 juni 2021 en u bekijkt wat u nog in huis heeft voor de avondmaaltijd. U bekijkt verschillende voedingsproducten, deze komen één voor één in beeld. De producten zijn op de datum (7 juni) of 1 dag over de datum (6 juni). De vraag is steeds wat u met het product zou doen. U kunt hierbij kiezen uit de volgende drie opties:

- Weggooien: U gooit het product *direct* weg.

- Kijken-ruiken-proeven: U kijkt, ruikt en/of proeft eerst om te besluiten het product op te eten of weg te gooien.

- Eten: U gebruikt het product in uw avondmaaltijd en eet het dus op.

In totaal krijgt u 24 van deze keuzes voorgelegd. Denk niet te lang na, ga voor uw eerste reactie.

**Q1 t/m 24**

Alle groepen eerst 12 producten zonder cue/tekst RANDOM

Vervolgens dezelfde 12 producten met cue/tekst RANDOM
Reactietijd per keuze registreren.
Hieronder 1 voorbeeldproduct zonder en met logo; zie Excel voor gehele uitwerking van het design.

*Q1.*
*'Het is vandaag 7 juni en u bekijkt wat u nog in huis heeft voor de avondmaaltijd. Wat zou u met het volgende product doen?'*


*If 06-06 - Het product is 1 dag over de datum*
*If 07-06 - Het product is op de datum.*

- ☐ Weggooien
- ☐ Kijken-ruiken-proeven
- ☐ Eten

*Q2.*
*'Het is vandaag 7 juni en u bekijkt wat u nog in huis heeft voor de avondmaaltijd. Wat zou u met het volgende product doen?'*


*If 06-06 - Het product is 1 dag over de datum*
*If 07-06 - Het product is op de datum.*

- □ Weggooien
- □ Kijken-ruiken-proeven
- □ Eten

**Q37.** Waar kijkt u naar als u wilt weten hoe het met de houdbaarheid van een product zit? (meerdere antwoorden mogelijk)

- □ De houdbaarheidsdatum en verder niet
- □ De houdbaarheidsdatum en mijn eigen zintuigen
- □ De houdbaarheidsdatum en het type product
- □ De houdbaarheidsdatum en de toelichting elders op de verpakking (zoals de beschrijving Tenminste Houdbaar Tot of Te Gebruiken Tot)
- □ Ik let niet op de houdbaarheid van een product
- □ Anders, namelijk:_____

[Einde deel 1]

# Deel 2 Iconen bij houdbaarheidsdatums

**Part 2 is the same for all respondents**

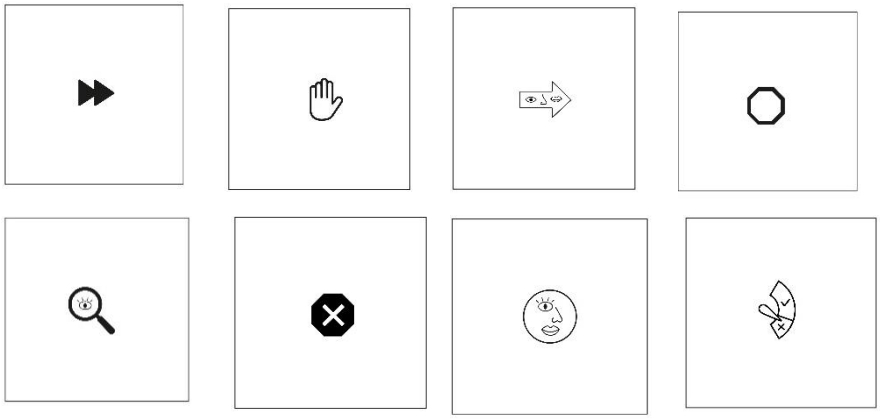
Zie Excel bestand 'Design_survey_visual_cues' tabs Q25, Q26 en Q27 voor productfoto's. Hele sample krijgt dezelfde foto's.

[Introscherm vrije categorisatie THT en TGT]

Q25.

Er zijn twee houdbaarheidsdatums: de 'Tenminste Houdbaar Tot' datum (=THT)' en de 'Te Gebruiken Tot' datum (=TGT).

Hieronder ziet u 8 iconen. Maak twee groepjes: één THT groepje en één TGT groepje. U kiest zelf welke iconen het beste in elk groepje passen. Sleep de plaatjes naar het juiste vak.
Zorg ervoor dat er in elk groepje in ieder geval 1 icoon staat. De iconen mogen dus niet allemaal in dezelfde groep geplaatst worden.



| Passen bij 'Tenminste Houdbaar Tot' datum | Passen bij 'Te Gebruiken Tot' datum |
|---|---|
| | |

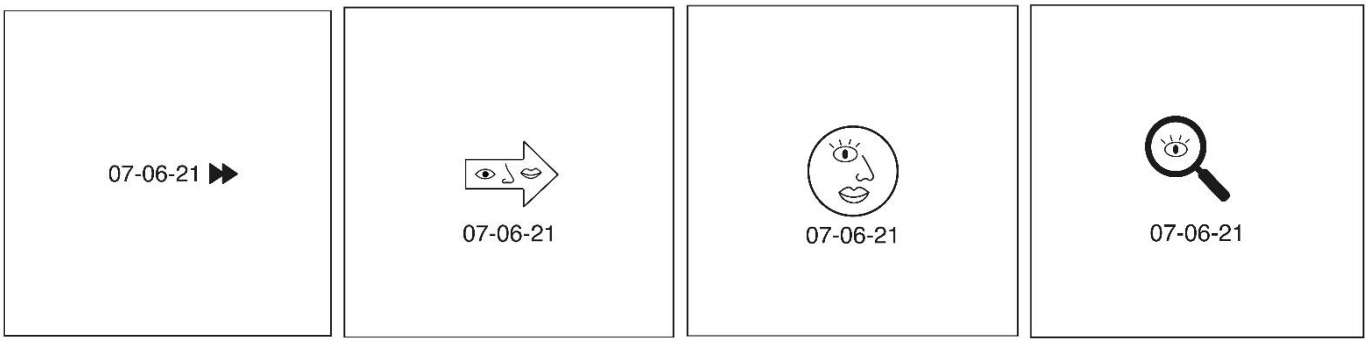
[nieuw scherm]

**introQ26**

Een ‘Tenminste Houdbaar Tot’ datum (THT) staat op producten die niet snel bederven. Na de THT-datum kan de kwaliteit van het product achteruit gaan, maar smaakt het meestal nog goed. Je kunt het dan nog wel veilig eten. Door te kijken, ruiken en/of te proeven kun je beoordelen of je een product nog kunt eten na de THT-datum.

**Q26.** Hieronder ziet u 4 iconen. Welk icoon vindt u het beste passen bij de **‘Tenminste Houdbaar Tot’**-datum??

Klik op het plaatje dat het beste past bij de THT-datum; deze krijgt dan een nummer 1. Kies vervolgens het plaatje dat daarna het beste past. Deze krijgt een 2. Etc.




**Q26a.** Wat waren voor u redenen om de plaatjes op deze volgorde te zetten?

_____

[nieuw scherm]

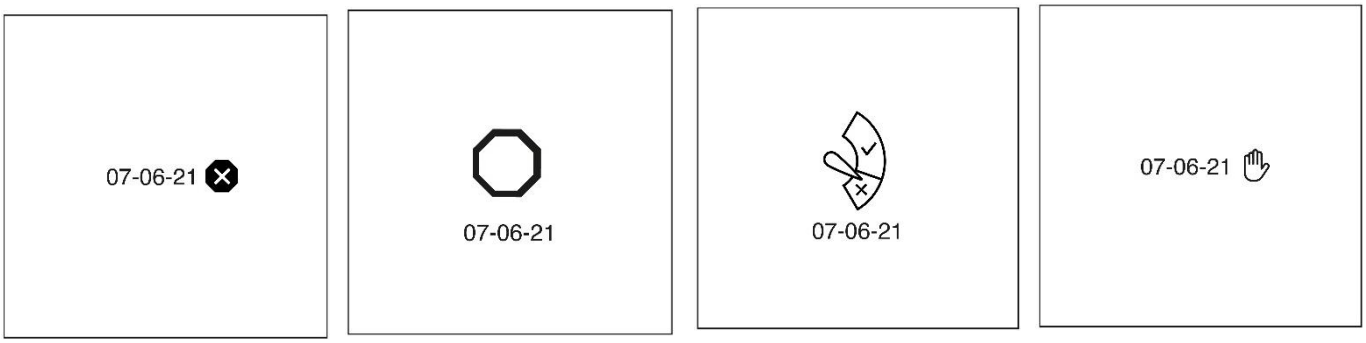
**introQ27**

**Uitleg ‘Te Gebruiken Tot’**

De ‘Te Gebruiken Tot’ datum (TGT) staat op zeer bederfelijke producten. Deze datum is de laatste dag waarop je het product nog veilig kunt eten. Na deze datum kunnen er ziekteverwekkers, zoals bacteriën, gaan groeien. Deze kun je vaak niet zien, ruiken of proeven, maar je kunt er wel ziek van worden. Na de TGT-datum is het product dus niet meer veilig.

**Q27.** Hieronder ziet u 4 iconen. Welk icoon vindt u het beste passen bij een **‘Te Gebruiken Tot’**-datum?

Klik op het plaatje dat het beste past bij de TGT-datum; deze krijgt dan een nummer 1. Kies vervolgens het plaatje dat daarna het beste past. Deze krijgt een 2. Etc.




**Q27a.** Wat waren voor u redenen om de plaatjes op deze volgorde te zetten?

_____

[Einde deel 2]

# Deel 3 Iconen beoordelen

**Same 5 groups as for Q1-Q24.**
**Each Group is split in two (subgroup A & subgroup B)**

50% van elke groep krijgt 4 THT plaatjes (5x150 respondenten)
50% van elke groep krijgt 4 TGT iconen (5x150 respondenten)
Vraag Q28 t/m Q33 in random volgorde aanbieden.

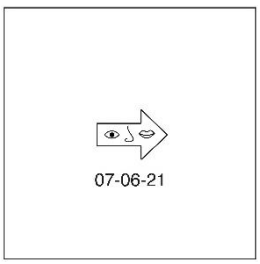
**Show Q28 – Q33 in random order**

Zie Excel-bestand, tab ‘Q28-Q33’ voor productfoto’s

[THT iconen – groepen A]

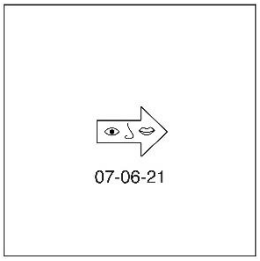
Hierna krijgt u steeds een aantal stellingen te zien over vier iconen. Geef aan in hoeverre u het eens bent met deze stellingen.

**Q28.** Bij dit icoon snap ik dat het om een Ten Minste Houdbaar Tot datum (=THT) gaat:

| | **Helemaal mee oneens** | | | **Neutraal** | | | **Helemaal mee eens** |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2.   | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

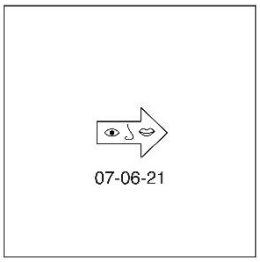
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3. |  | □ | □ | □ | □ | □ | □ | □ |
| 4. |  | □ | □ | □ | □ | □ | □ | □ |

**Q29.** Dit icoon geeft duidelijk weer dat ik kan kijken, ruiken en/of proeven of het product nog lekker is na de datum:

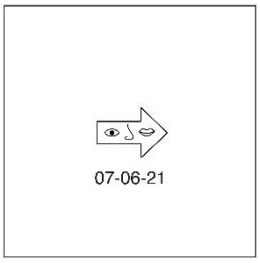
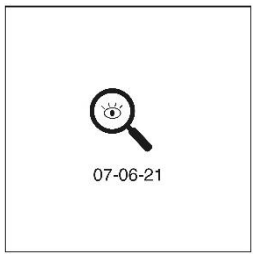
| | | **Helemaal mee oneens** | | | **Neutraal** | | | **Helemaal mee eens** |
|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1. |  | □ | □ | □ | □ | □ | □ | □ |
| 2. |  | □ | □ | □ | □ | □ | □ | □ |
| 3. |  | □ | □ | □ | □ | □ | □ | □ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4.   | □ | □ | □ | □ | □ | □ | □ |

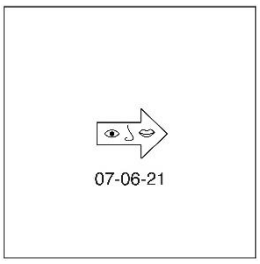
**Q30.** Dit icoon helpt mij te bepalen hoe ik met het product moet omgaan als het over de datum is:

| | **Helemaal mee oneens** | | | **Neutraal** | | | **Helemaal mee eens** |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

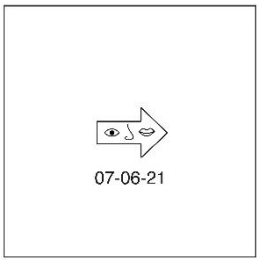
**Q31.** Dit icoon roept verwarring op:

| | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

**Q32.** Dit icoon voegt voor mij iets toe bovenop de huidige houdbaarheidsdatum:

| | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

**Q33.** Het toevoegen van dit icoon op een verpakking helpt mij om minder weg te gooien:

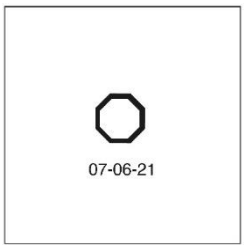
| | **Helemaal mee oneens** | | | **Neutraal** | | | **Helemaal mee eens** |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

[TGT Iconen – groepen B]

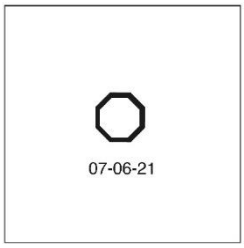
Hieronder krijgt u vier iconen te zien. U wordt steeds gevraagd een stelling te beantwoorden voor deze vier iconen.

Vraag Q28 t/m Q33 in random volgorde aanbieden.

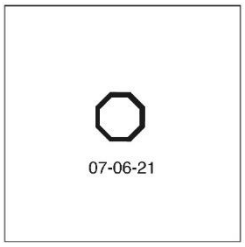
**Q28.** Bij dit icoon snap ik dat het om een Te Gebruiken Tot datum (=TGT) gaat:

| | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2.   | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3.   | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4.   | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

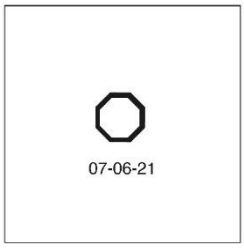
**Q29.** Dit icoon geeft duidelijk weer dat ik het product moet gebruiken vóór of op de datum:

| | **Helemaal mee oneens** | | | **Neutraal** | | | **Helemaal mee eens** |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

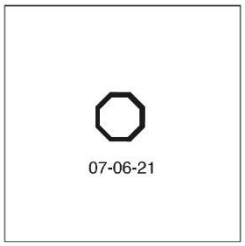
**Q30.** Dit icoon geeft duidelijk weer dat ik het product na de datum niet meer moet eten:

| | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

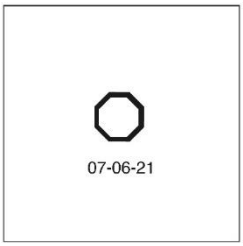
**Q31.** Dit icoon roept verwarring op:

| | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

**Q32.** Dit icoon voegt voor mij iets toe bovenop huidige houdbaarheidsdatum:

| | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

**Q33.** Het toevoegen van dit icoon op een verpakking helpt mij om het product vóór of op de datum op te eten:

| | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1.   | □ | □ | □ | □ | □ | □ | □ |
| 2.   | □ | □ | □ | □ | □ | □ | □ |
| 3.   | □ | □ | □ | □ | □ | □ | □ |
| 4.   | □ | □ | □ | □ | □ | □ | □ |

**Q34.** Hieronder ziet u 5 teksten die kunnen passen bij de ‘Tenminste Houdbaar Tot’ datum. Welke tekst helpt u het beste om een product niet direct weg te gooien na de THT-datum?

| ITEMS RANDOM | Helemaal niet 1 | 2 | 3 | Neutraal 4 | 5 | 6 | Heel erg 7 |
|---|---|---|---|---|---|---|---|
| Vaak goed na datum. Kijk, ruik en proef | □ | □ | □ | □ | □ | □ | □ |
| Kijk, ruik en proef of het nog goed is na datum | □ | □ | □ | □ | □ | □ | □ |
| Vaak nog goed na datum. Kijk, ruik en proef | □ | □ | □ | □ | □ | □ | □ |
| Kijk, ruik en proef na datum | □ | □ | □ | □ | □ | □ | □ |
| Vaak nog goed na datum | □ | □ | □ | □ | □ | □ | □ |

**Q35.** Hieronder ziet u 4 teksten die kunnen passen bij de ‘Te Gebruiken Tot’ datum. Welke tekst helpt u het beste om het product vóór of op de datum te eten?

| ITEMS RANDOM | Helemaal niet 1 | 2 | 3 | Neutraal 4 | 5 | 6 | Heel erg 7 |
|---|---|---|---|---|---|---|---|
| Niet gebruiken na datum | □ | □ | □ | □ | □ | □ | □ |
| Gebruik vóór of op datum | □ | □ | □ | □ | □ | □ | □ |
| Gebruik vóór of op datum. Niet gebruiken na datum | □ | □ | □ | □ | □ | □ | □ |
| Gebruik vóór of op datum. Daarna niet gebruiken | □ | □ | □ | □ | □ | □ | □ |

[Einde deel 3]

# Deel 4 Algemene vragen

Tot slot volgen nog een paar algemene vragen.

[Bewustzijn en gedrag rondom houdbaarheid en FW]

**Q36.** Geef voor de volgende stellingen aan in hoeverre u het hiermee eens bent.

| ITEMS RANDOM | Helemaal mee oneens | | | Neutraal | | | Helemaal mee eens |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1. Voedingsproducten die over de THT-datum zijn, gooi ik meteen weg (FW) | □ | □ | □ | □ | □ | □ | □ |
| 2. Voedingsproducten die over de TGT-datum zijn, gooi ik meteen weg (FW) | □ | □ | □ | □ | □ | □ | □ |
| 3. Als voedingsproducten over de THT-datum zijn, kijk, ruik of proef ik of de producten nog goed zijn (FW) | □ | □ | □ | □ | □ | □ | □ |
| 4. Als voedingsproducten over de TGT-datum zijn, kijk, ruik of proef ik of de producten nog goed zijn (FW) | □ | □ | □ | □ | □ | □ | □ |
| 5. Ik probeer zo min mogelijk voedsel weg te gooien (FW) | □ | □ | □ | □ | □ | □ | □ |
| 6. Weggooien van eten geeft me een schuldgevoel (M) | □ | □ | □ | □ | □ | □ | □ |
| 7. Ik ben me bewust van het voedsel dat ik weggooi (M) | □ | □ | □ | □ | □ | □ | □ |
| 8. Bij het bepalen wat ik ga eten, let ik op de houdbaarheidsdatums van producten (A) | □ | □ | □ | □ | □ | □ | □ |
| 9. Ik vind het lastig om te bepalen of voedingsproducten na de houdbaarheidsdatum nog veilig zijn om te eten (A) | □ | □ | □ | □ | □ | □ | □ |

[consumptiegegevens producten in survey]

**Q38.** Kunt u aangeven hoe vaak u de volgende producten eet?

1. Hoe vaak eet u kwark?
2. Hoe vaak eet u geraspte kaas?
3. Hoe vaak eet u kipfilet?
4. Hoe vaak eet u een maaltijdsalade?
5. Hoe vaak eet u wokgroente?
6. Hoe vaak eet u afbakstokbrood of andere afbakbroodjes?

- □ Nooit
- □ Minder dan 1 keer per maand
- □ 1 tot 3 keer per maand
- □ 1 tot 4 keer per week
- □ (bijna) dagelijks

[socio-demografische kenmerken]

**Q45**. Wat is uw huishoudsamenstelling:

- □ Gezin met kinderen
- □ Eenouder gezin met kinderen
- □ Studentenhuis
- □ Woongroep
- □ Met partner
- □ Anders, namelijk:_____

**Q46**. Uit hoeveel personen bestaat uw huishouden?

... personen, waarvan:
... kinderen 0-12 jaar
... kinderen 13-18 jaar
... volwassenen (18 jaar en ouder)

**Q47.** Wat is uw hoogst genoten opleiding?

- □ Basisonderwijs
- □ Lager beroepsonderwijs (VMBO en LBO, bijv. LTS, LEAO)
- □ Middelbare School (Mavo)
- □ Middelbaar beroepsonderwijs (MBO)
- □ Middelbare school (Havo, Vwo)
- □ Hoger beroepsonderwijs (HBO)
- □ Universiteit (WO)
- □ Wil ik niet zeggen

**Hartelijk bedankt voor uw deelname!**

# Annex 5 Input for cue design based on scientific literature quick scan

# Wetenschappelijke inzichten over wensen en kenmerken cues vanuit consumentenperspectief

Input voor ontwerpsessie

Januari 2021, Gertrude G. Zeinstra & Sandra van der Haar

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## Doel

Inzichten uit consumentenwetenschap rondom visual cues meenemen in de ontwerpsessies voor het project BO Visual Cues

Deze presentatie dient als input voor de design-sessie in het kader van het 'BO-project BO-43-110-011: Invloed van Visual Cues op verpakkingen t.a.v. houdbaarheidsinformatie op het weggooigedrag bij consumenten thuis.

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# Aanpak

- Quick scan literatuur (januari 2021)
  - Op basis van zoektermen
  - Breder dan houdbaarheid, omdat daar weinig onderzoek naar gedaan is → M.n. Front of Pack Nutrition/ health labels

- In resultaten:
  - Gezonde voeding →
  - Duurzaamheid/ food waste →


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# Resultaten - inzichten

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# Cues - labels t.a.v. 'nutrient amounts'

- Gebruik van herkenbare symbolen die makkelijk te begrijpen zijn
- Kleuren kunnen helpen voor aandacht + maken gezondere keuzes
- Eenvoudige directieve tekst
- Kleur met simpele tekst (alle vier: Intro)

- Allen dragen bij aan 'salience': opvallendheid = essentieel, want consument kijkt <10sec op verpakking tijdens boodschappen doen

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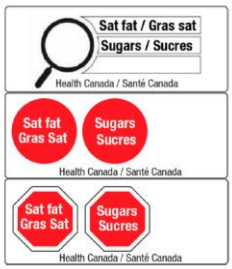
*Goodman, 2018*



# Studie-opzet Goodman, 2018





- 11 condities:
  - 5 verschillende cues zonder (5x) of met tekst "high in fat" + "high in sugar" (5x)
  - 1 controleconditie: geen cue

- N=11317; Deelnemers: 18-64y
- Australia, Canada, UK + USA
- Web-based survey (33 min): Men zag het pak 4 seconden
- Cue op pak ontbijtgranen waar ook het merk op stond
- Uitkomst: # correcte antwoorden op vraag: Is de hoeveelheid vet/ suiker in dit product .....? (laag, gemiddeld, hoog, weet niet; geen antwoord; hoog=correcte antwoord)

*Goodman, 2018*

# Resultaten Goodman, 2018

- Controleconditie (zonder cue) deed het slechter dan met cue: minder vaak correcte antwoord
- Rode stop signaal, waarschuwingsdriehoek met uitroepteken, rode cirkel, vergrootglas met uitroepteken - allen met de tekst “high in”- deden het beter dan controle (zonder cue)
- Rode stop signaal ook effectief zonder tekst
- Alleen vergrootglas (zonder tekst): minst vaak correcte antwoord
- Met tekst beter dan zonder tekst (behalve bij vergrootglas)
- Grootste voorkeur als direct gevraagd aan consument: Rode stop signaal + driehoek!

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*Goodman, 2018*



# Overige tips & inzichten

- Combinatie plaatje + tekst lijkt beste te werken (zeker als het nieuw is) (Goodman, 2018)
- ‘High in’ - health: ‘gevaar/stop’ symbolen meest effectief, daarom vergrootglas minder effectief hier (Goodman, 2018) → Houdbaarheid is een andere situatie: daar zou een vergrootglas misschien wel goed kunnen werken, omdat je het product moet inspecteren, of een ‘!’ in de zin van Let op! – als over de datum, dan ....

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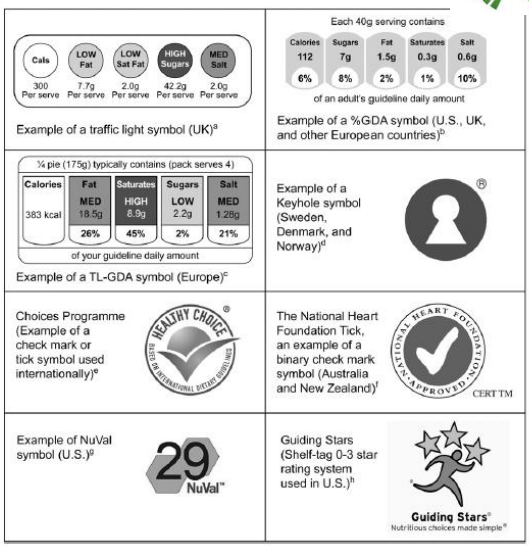
# Review Hersey

- Nutrient-specific info → link gezondheid
- Twee systemen
  - Nutrient-specific symbols (1e 3)
  - Summary system: 1 symbool dat samenvattende score geeft (2e 5)
- Onderscheid in effect op: aandacht & processing, begrip, gebruik, aankoopgedrag, inname (gerapporteerd en/of geobserveerd)




*Hersey et al, 2013*



# Kernleringen Hersey

- Grote labels + op consistente plek op verpakking lijken aandacht te trekken
- Snellere processing van summary icon dan meer complexe nutriënt-specifieke schema's (opm GZ: dit lijkt logisch, want minder informatie om te verwerken)
- Nutriënt-specifieke schema's lijken beter te helpen om gezonde producten te identificeren dan 'summary symbols'.
- Nutriënt-specifieke labels met tekst & symbolische kleuren zijn makkelijker te interpreteren dan nutriënt-specifieke labels die alleen numerieke info geven (% of grammen v/d aanbeveling)
- Summary system labels, met name multiple-level summary icons lijken gezonde aankopen te stimuleren (maar nog weinig onderzocht)

Effecten hangen dus duidelijk af van welke uitkomstmaat gemeten wordt

*Hersey et al, 2013*

# Thinking on the box (Chu 2019)

- Vergelijkbare doelstellingen en aanpak als wij
- Doel: exploreren van de interactie tussen on-pack date labelling en voedselverspillingsgedrag van consumenten →
- Doel 2: Design inzichten verkrijgen om consumenten te helpen om onnodige food waste te voorkomen
- Drie stappen:
    1. Literatuuronderzoek
    2. In-depth interviews (12 consumenten + 10 food industrie)
    3. Design workshops (idem)

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*Chu et al, 2019*



# Resultaten Chu (2019)

- Resultaten literatuuroverzicht onvoldoende om duidelijke inzichten te geven voor de praktische design kansen en implicaties
- Consument met name gemotiveerd door de wens (‘need’) om gemakkelijk de kwaliteit en veiligheid van voedsel af te leiden
- Consumenten klagen over te kleine font t.a.v. date marking
- Beslissingen ‘opeten’ gebaseerd op dynamische interactie van ‘on-pack info’ + interne percepties van zintuigen (verschilt erg per persoon) + sociale interactie
- Design 1: On-pack visueel beeld van hoe het bedorven product eruit ziet → je kunt het eten totdat het er zo uit ziet (gebruik zintuigen, QR code voor hulp/meer info)
- Design 2: Smart sensors → real-time feedback (Out-of-scope voor nu)
- → App ontwikkeld met 3D Augmented Reality + QR code → nog niet getest

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*Chu et al, 2019*

# 7 design tips en implicaties (Chu, 2019)

- Meer interactieve aanpak om zorgen t.a.v. voedselverspilling te verbinden met bestaande consumentenmotivaties rondom bepalen veiligheid en kwaliteit
- Maak verbinding tussen consument en food industrie na aankoop product (shelf-life + bewaaradvies + productgerichte info: recepten, voedingswaarde, duurzaamheid)
- Comprimeer en verzamel info in image marks/QR codes → info toegankelijk maken
- Geef expliciete info over het verschil tussen de TGT/THT labels (hoe nog onbekend)
- Meer concrete en product-specifieke info over bewaren en shelf-life (o.a. na openen)
- Focus op productspecifieke info (i.p.v. algemene kennis), liefst interactief met context
- Stimuleer consumenten om hun zintuigen te gebruiken (behoud deze kennis)

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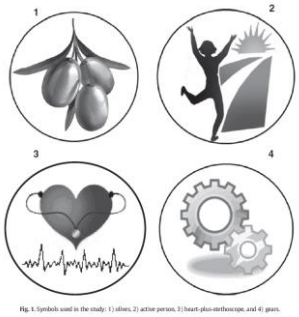
*Chu et al, 2019*



# Studie-opzet Carillo, 2014




- N=296
- Deelnemers: 18-69 y
- Denemarken en Spanje
- Online survey: yoghurt als voorbeeld product
- 4 cues:
  - 1 related to healthy food, 1 related to physical activity, 1 medical health image + 1 non-food/not health-related image

- Word associations task for each cue (without text)
- Conjoint task: 4 cues + 3 target claims of 2 types (risk reduction vs. benefit): 18 combi's presented to consumers: ***appeal*** and ***convincingness*** was rated

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*Carillo, 2014*

# Resultaten Carillo, 2014

- Cues zonder tekst op de verpakking roepen al woordassociaties op gerelateerd aan gezondheid
- De **cue** was het belangrijkst voor aantrekkelijkheid en hoe overtuigend de info was
- Claims hadden een grotere impact wanneer gepresenteerd als health benefit, dan risk reduction
- Laat zien dat symbolen op verpakkingen een sterk effect hebben, maar;
- Met name op aantrekkelijkheid (scoorde hoger dan 'convincingness')

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*Carillo, 2014*



# Overige tips & inzichten

- Hier werd gekozen voor cues in zwart/wit– zodat kleurvoorkeuren geen rol zouden spelen in het experiment → 'aantrekkelijkheid' als uitkomstmaat, dus hier een logische keuze. Dit is iets om over na te denken.

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# Studie-opzet Shearer, 2017

Fig. 1. Sticker prompt design.

- N= 64.284 huishoudens
- Engeland, Surrey
- Field study
- Effect van visual prompt op vuilnisbak op recycling/afval scheiden
- 2 condities: wijken met sticker prompt op vuilnisbakken (Interventie) vs. wijken zonder sticker op vuilnisbakken (Controle)

- Randomized pre-test/post-test design
- Baselineperiode van 15 weken → daarna 16 weken interventie
- Uitkomstmaat: hoeveelheid gescheiden afval in tonnen

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*Shearer, 2017*



# Resultaten Shearer, 2017

- In controle wijken: geen verandering in hoeveelheid gescheiden afval.
- Interventie wijken: significante toename van 20.74% gescheiden afval.
- Kosteneffectief → sticker prompt kost slechts £ 0.35 per huishouden
- Effect bleef bestaan op de lange termijn (5w, 6-10w en 11-16w)

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*Shearer, 2017*

# Overige tips & inzichten (design visual prompt)

- Groene kleuren gebruikt i.c.m. tekst (groot lettertype)
- Het design was gebaseerd op eerdere studies* naar design aspects voor effectiviteit van visual prompts
- In artikel verder weinig info over design keuzes

**Aranson and O'Leary 1983, Jae et al 2008, Roberts et al 2009, Sussman et al 2012, van Meurs 2009 →*

*Opm. WUR: Deze studies zijn kort bekeken, met een paar relevante punten op de volgende slide.*

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*Shearer, 2017*



# Overige studies (referenties uit Shearer paper)

- Plaatjes incongruent met tekst → minder begrip bij laaggeletterde consumenten → dus plaatjes congruent met tekst (Jae et al 2008)
- Simpele, goed ontworpen cue zorgde voor het besparen van energie (prompt om licht uit te doen) (Sussman 2012)
- Gebruikte prompt was een combi van een 'signal-word panel', icoon, foto, tekst (simpele bewoording) en consequenties (Sussman 2012)
- Overige studies erg gedateerd, of niet relevant


*Shearer, 2017*

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# Studie-opzet Deng & Zhang 2019


- N=8000
- China
- Field studie in 2 verschillende wijken (4000 inwoners per area)
- Effect van visual prompt op vuilnisbak op recycling/afval scheiden
- 2 condities: vuilnisbakken met sticker prompt (Interventie) en vuilnisbakken zonder sticker (Controle)

- Zelfde soort studie als Shearer 2019
- 5 weken baseline - 5 weken interventie – 8 weken niets (stickers bleven zitten bij Interventiegroep) – na 5 weken follow-up meting
- Uitkomstmaat: aantal vuilnisbakken met gerecycled afval

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*Deng & Zhang 2019*



# Resultaten Deng & Zhang 2019

- Visual prompt → significant effect op recycling gedrag (positief)
- Lage kosten prompt
- Het effect was er nog steeds bij follow-up meting (~18w)

*(opm. WUR: Enige voorzichtigheid geboden, vanwege rare Engelse zinnen en fouten in het artikel. Kwaliteit artikel kan lager zijn of het komt door non-natives als auteur.)*

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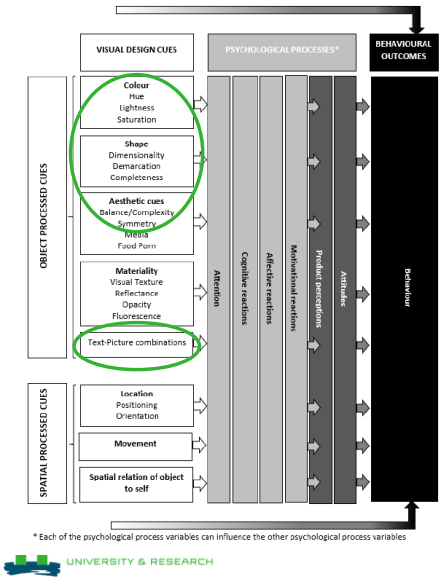
*Deng & Zhang 2019*

# Overige tips & inzichten (design visual prompt)

- Logo = groene kleur, simpel
- Aandacht trekken met grootte van het logo
- In tekst benoemen: gevaren van weggooien van batterijen + aangeven wat er met batterijen gebeurt na recycling (enthousiasmeren om te recyclen)



# Review Vermeir 2020




- Review gaat over alle visual cues, dus ook bijv. verpakkingen, materiaal, locatie etc. Groen omcirkeld = relevant voor onze studie
- Visual design cues + psychologische processen → gedrag (food choice)
- Focus op uiterlijk en vorm van visual cues, niet op inhoud
- Alle studies in deze review zijn in food context uitgevoerd

*Vermeir, 2020*

## Vermeir 2020 – Results "Colour + hue"

- Kleuren in logo → snel laten zien waar een product voor staat
- Kleur-specifieke associaties uit de literatuur:
  - Rood = warning, danger, prohibition
  - Groen = luck and good taste, nature, environmental conscious consumption and sustainability, healthy lifestyle
  - Niet duidelijk of logokleur (en verpakking, product en label) invloed hebben op perceptie van **duurzaamheid**
- Kleur die meeste aandacht trekt: literatuur niet eenduidig over
- Rood roept 'avoidance motivation' op –> bijv. niet kopen
- Limited research over lightness and saturation (op product-perceptie)

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*Vermeir, 2020*



## Vermeir 2020 – Results "Shape" + "Asthetic Cues"

- Puntige vormen zoals driehoek -> geassocieerd met gevaar
- Over het algemeen: cirkel = positieve associatie, omgekeerde driehoek = negatieve associatie – maar geen echte invloed op gedrag, omdat dit meer 'abstract threats' zijn (Wang 2016)
- Symmetrie: een symmetrische weergave van informatie-items rond de verticale as van verpakking van voedingsmiddel → zorgt voor afname in 'visual complexity' en toename in 'processing fluently' (Bigoin-Gagnan 2018)

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*Vermeir, 2020*

## Vermeir 2020 – Results "Text-picture combinations"

- Weinig onderzoek naar combi tekst + picture ('picture-word ratio')
- Caroll et al (1992): lieten proefpersonen naar cartoon met tekst eronder kijken → consumenten gaven bijna geen aandacht aan cartoon, totdat tekst helemaal gelezen was
- Ook in studie van Hegarty (1992): proces van iets snappen is gericht op tekst (en minder op logo/plaatje)
- Rayner (2011): consumenten lezen eerst grote print, dan kleine print, daarna kijken ze pas naar een plaatje; 70% van de tijd aan tekst besteed

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## Vermeir 2020 – Results "Text-picture combinations"

- Consumenten geven zelf juist vaak aan 'pictorial information' te verkiezen boven 'verbal information'
- Verbal information kost meer tijd om te verwerken en we hebben beter geheugen voor plaatjes dan voor tekst

  (dus: consument onthoudt 'pictorial info' wel beter)

  En tekst zou dus kort, maar krachtig moeten zijn.

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# Systematische review Cecchini 2015

- Doel van deze review: beoordelen van effectiviteit van food labelling op kiezen van gezondere producten
- 9 studies die aan selectiecriteria voldeden
- Stoplicht logo's, ADH (GDA) en andere food labels vergeleken (bestaande logo's uit verschillende landen)




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# Results Cecchini

- Food labelling → significant effect op consumenten bij selecteren van gezondere producten
- Stoplichtsystemen meest effectief
- Verder geen details over effectieve elementen uit de logo's ...

*(Opm WUR: Relatief weinig informatief voor designsessie.)*

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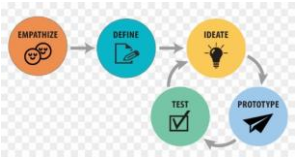
# Samengevat ...




- Cues hebben effect
- Combinatie visual cue en korte tekst mogelijk het beste, al lijkt er nog niet heel veel onderzoek naar gedaan te zijn
- Het gebruik van (intuïtieve/ symbolische) kleuren kan helpen
- Maak het logo niet te klein
- Simpele bewoordingen, simpele (intuïtieve) symbolen
- Plaatjes moeten congruent met tekst zijn
- Lezen kost tijd, en doet men waarschijnlijk toch, dus houd het kort

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Plaatje via: https://www.pikpng.com/pngvi/iwbboxh_empathy-is-the-first-stage-in-the-design-thinking-process-linear-design/



# Daarnaast food for thought:

Persoonskenmerken kunnen een rol spelen bij cues/logo's:

- Leeftijd: Jongeren 18-24y > ouderen (50+) (Goodman, 2018)
- Opleiding: High educated > low educated (Goodman, 2018)
- Land/ cultuur: Canada + UK > USA (Goodman, 2018)
- Gebruik van labels wordt beïnvloed door: Opleiding/ SES, nutrition-consiousness, BMI, family composition (having children/ family members of special diet), concern about weight control, pleasure seeking/ hedonism, price-focused (Hersey 2013)

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# Disclaimer

Deze presentatie is gemaakt om als input te dienen voor de design-sessie in het kader van 'BO-project BO-43-002-02: Invloed van Visual Cues op verpakkingen t.a.v. houdbaarheidsinformatie op het weggooigedrag bij consumenten thuis.


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# Annex 6 Free associations in the Symbass survey (Consumer study 1)

**Associations given by participants**

**Icon 1 "Face"**


**Kijken, ruiken, proeven**

- Mogelijk houdbaar na datum, ruik, proef, kijk?
- Check op uiterlijk, geur en smaak
- ik denk dat de bedoeling is zien, ruiken en proeven vanaf 22-04-2021 maar is niet zo duidelijk
- Zien (* same participant)
- Ruiken (* same participant)
- Proeven (* same participant)
- maar na deze datum mag je proeven of het nog goed is, dan is het nog te eten
- Zo ook kijken en ruiken of het nog goed is, zo ja, goed te eten.

**Datum aanhouden**

- Tot datum
- bruikbaar t/m 22 april 2021
- hou deze datum aan
- Let op; niet meer gebruiken na....

**Kunst**

- kunst van verstandelijk gehandicapte
- Abstracte kunst
- Kleuterschool

**Gezicht**

- een scheel gezicht
- er mist een oog
- raar gezicht met datum

**Onduidelijk**

- Geen ondubbelzinnig symbool. Dan liever een blije smiley, een twijfelende smiley of een 'stop ik had het eerder moeten gebruiken-smiley, desnoods een boze smiley

**Overig**

- Zonnetje. Op 22 april wordt het mooi weer.
- Een oogje dichtknijpen. Het kan nog wel.
- Zo niet? weggooien
- Ergens wordt de aandacht op gevestigd
- positief, vriendelijk
- Mens??
- Eten

**Assocations given by participants**

**Icon 2 "Fast-Forward"**


**<u>Doorspoelen</u>**

- Doorspoelen
- Doorspoelen
- doorspoelen
- Doorspoelen. Niet letterlijk (hoewel?) maar het is het doorspoelen symbool op cassettespeler, video, CD, DVD en smart TV's.

**<u>Volgende/ verder</u>**

- de volgende
- ....en verder
- Na....
- Kan na deze datum vervolg worden

**<u>Langer houdbaar</u>**

- misschien nog langer houdbaar,
- Mogelijk ook houdbaar na gemelde datum
- twee dagen langer houdbaar zoals zuivel?
- de houdbaarheid is rekbaar

**<u>Pas erna</u>**

- Daarna kunt u dit gebruiken
- Pas na 22-04-2021
- wordt steeds beter na 22-04-2021?

**<u>Geen idee</u>**

- Ik heb niet direct een handeling-associatie hiermee
- geen flauw idee

**<u>Onduidelijk</u>**

- Onduidelijk
- 22 april 2021 en dan??

**<u>Overig</u>**

- een kerstboom op zijn kant
- Film
- houdbaar product zoals blik of zakjes soep?
- Tenminste houdbaar tot

## Associations given by participants

## Icon 3 "Magnifying glass"


**Goed kijken**
- Goed kijken
- goed kijken
- Wel goed kijken
- Checken
- inspecteer eten, mogelijk niet meer houdbaar voor verstrijken houdbaarheidsdatum

**Houdbaar tot**
- Tot 22-04-2021
- houdbaar tot de 22e
- Houdbaarheidsdatum

**Let op/ kijk uit**
- Kijk uit
- Let op

**Let op datum**
- Let op de datum
- Hou 22 april 2021 in de gaten.

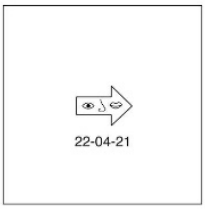
**Zoeken**
- zoek de datum
- op zoek naar het oog

**Onduidelijk**
- Dan is de vorige begrijpelijker
- En dan???

**Overig**
- Uiterlijk van voeding
- Te bekijken tot
- Hmmm... kijk goed of er geen ongedierte in rondloopt of schimmelgroet. Wij gebruiken vergrootglas bij teken...
- Wordt op die datum onder een loep bekeken
- Als je iets verkeerd ziet, weggooien

## Associations given by participants

## Icon 4 "Arrow"




**Kijken, ruiken, proeven**

- een proces van zien ruiken en proeven op 22-04-2021
- Geur, smaak en uiterlijk
- kijk ruik en proef
- Kijken
- Kijken
- Proeven
- Proeven
- Ruiken
- Ruiken
- Zien reuk en smaak op die datum
- zien, ruiken proeven
- daarna langer houdbaar zolang je proeft, ruikt en goed kijkt

**Doorgaan, volgende**

- doorgaan t/m 22 april 2021
- Volgende
- ga door naar de volgende ronde

**Kunst**

- Abstracte kunst

**Houdbaar tot**

- Tot 22-04-2021
- houdbaar tot de 22e

**Checken**

- Na datum checken

**Onduidelijk**

- onduidelijk
- waarom staat dat in een pijl?
- wat doet die datum daar?
- wat doet die pijl boven 22-04-2021
- Ik snap dat je hier moet proeven. (Dat had ik bij het zonnetje niet). Ik weet niet of de pijl het helderder maakt.

**Overig**

- Vanaf.....

## Associations given by participants

## Icon 5 "Meter"


**Niet meer goed, over de datum**

- Na deze datum niet meer eten
- niet meer goed na 22-04-2021
- product is niet meer goed
- over de datum
- Weggooien na datum
- Na 22 april 2021 niet meer te gebruiken

**Houdbaar tot**

- Houdbaar tot
- houdbaar in ieder geval tot de datum
- De laatste dag houdbaar?

**Bijna niet meer houdbaar**

- dit product is al bijna over de datum
- wel opletten, het is bijna niet meer houdbaar

**Meter, olie, benzine**

- 'Metertje'
- Olie niet gebruiken na datum
- Benzine
- Bijna leeg

**Duidelijk**

- Duidelijk

**Onduidelijk**

- Als je deze terugkantelt, dus een 'horizontaal' cirkelsegment en eventueel ook nog in kleur gebruikt dan is dit wel helder. Maar misschien ook nog met een vlakje tussen goed en slecht met het symbool slinger als tussenin.
- De datum heeft een wat twijfelachtige positie. Is dat de startdatum, de einddatum of het streepje tussen goed en slecht?
- Wazig

**Overig**

- Iets wordt op die datum beëindigd
- Goed/fout
- Voor/na
- Vriendelijk
- Niet goed
- Bij nader inzien: zo'n wijzer is heel logisch bij een batterijen-tester, want dynamisch. Gedrukt is ie statisch
- Misschien moet de datum op een of andere manier ín het segment X

## Associations given by participants

## Icon 6 "Stop-cross"


**Stop, wachten**
- Stop
- Wachten
- Stop

**Verkeersbord**
- Verkeersbord

**Niet meer goed, over de datum**
- Niet meer houdbaar na genoemde datum
- Na datum niet meer goed
- Niet meer eten
- Niet gebruiken na....
- Weggooien na 22-04-2021
- Niet te gebruiken na 22-04-2021
- Na 22 april 2021 niet meer te gebruiken
- niet gebruiken na 22-04-2021

**Houdbaarheidsdatum, uiterste gebruiksdatum**
- Houdbaarheidsdatum
- uiterste gebruiksdatum 22-04-2021
- houdbaar tot 22-04-2021
- Houdbaar t/m 22 april 2021
- houd alleen de datum aan i.v.m. houdbaarheid

**Kunst**
- groot wit vlak

**Na datum gevaarlijk**
- Na 22 april 2021 slecht, gevaarlijk, afblijven! (Nou ja... gevaarlijk... dan zou het wel een doodshoofdje of iets geweest zijn.)

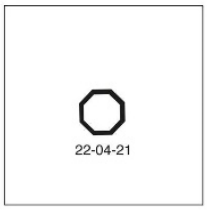
**Duidelijk**
- duidelijk en doeltreffend

**Onduidelijk**
- Let op, laatste dag?

**Overig**
- simpel
- Lijkt ook wel op het on-line symbool voor wegklikken.
- Belangrijke datum

## Associations given by participants

## Icon 7 "Stop-outline"




**Verkeersbord**

- Verkeersbord
- half afgemaakt stopbord
- een stopbord
- Verkeersbord
- Het doet (enigszins) denken aan het verkeersbord met 'stop', Amerikaanse stijl dat de omgekeerde driehoek in NL heeft vervangen

**Datumaanduideling**

- Datumaanduiding
- 22 april 2021

**Onduidelijk**

- wat zouden ze hier mee bedoelen?
- Onduidelijk
- Raadselachtig. Wa betekent dit nu weer?
- snap niet wat hier bedoeld wordt
- Weet niet wat er bedoeld wordt
- wat is er dan?
- De houdbaarheid is rekbaar?

**Overig**

- Speelgoed
- Edelsteen
- Weggooien
- leeg
- Ingepakt tot datum
- houdbaarheid zie datum
- Niet het symbool voor best-before of tenminste houdbaar tot

## Associations given by participants

## Icon 8 "Hand"


**Stop, halt, wachten**

- Stop
- Wachten
- Stoppen
- stop
- stop na 22-04-2021
- Stop
- Halt
- Stop
- Halt
- Stop, niet verder daarna niet meer te gebruiken
- Ja weer 'stop'. Niet eten. Weggooien. Afblijven
- stop

**Niet meer houdbaar, niet meer eten**

- Niet meer gebruiken/consumeren na 22 april 2021.
- Niet meer houdbaar na genoemde datum
- Beslist niet eten na 22-04-21
- Niet meer eten
- Niet meer te gebruiken na 22 april 2021
- niet meer te eten na 22-04-2021

**Datum aanhouden, houdbaar tot**

- Houdbaarheidsdatum
- houdbaar tot 22-04-2021
- die datum aanhouden  22e

**Attentie, gevaar**

- Attentie
- Toch dus weer gevaar. Bijna zo gevaarlijk dat even ruiken eigenlijk ook niet mag.

**Duidelijk**

- Duidelijk

**Onduidelijk**

- Dus als bedoeld wordt te zeggen: vanaf 23 april weggooien. Dan is het goed. Maar ik dacht nou juist dat mensen meer zelf moeten leren oordelen??

**Overig**

- Niet goed
- hoi! (zwaaien)
- Verboden
- Ik geef op deze datum mijn fiat

# Annex 7 Visual cue use in Consumer study 2

Below, four examples are shown of how the visual cues looked like in the online-choice experiment in Consumer Study 2. The two best-before icons and the two use-by icons that were evaluated best in this consumer study are shown on one product.

| Best-Before | Use-by |
| --- | --- |
|  |  |
|  |  |

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