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Have you bin doing it right? The effect of disposal instructions on the sorting behaviour of consumers

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Preface

Before you lies the dissertation 'Have you bin doing it right? The effect of disposal instructions on the sorting behaviour of consumers'. There are two main reasons why I chose to study this topic. First of all, I always had the motivation to contribute to the reduction of plastic waste in the environment. Besides, I experienced that people in my environment did not know to which garbage can certain packages belong. Therefore, I wanted to contribute to a solution to both problems.

The study was written at the University of Wageningen, and was part of my bachelor study 'Business and Consumer studies'. Conducting this research has been an educational process, in which I could apply lots of skills I learned during my study. During the research, I have developed new skills that I can use in the future.

I am grateful for the support I received from many people during the research process. In particular, I want to thank dr. Erica van Herpen, who has been my supervisor during the study, for her feedback, enthusiasm and support. I also want to thank Monica Szalma and the members of the thesis ring for their feedback.

Also a special thanks to Nynke Arntzen of the Kennisinstituut Duurzaam Verpakken for the provision of the disposal instructions. Furthermore, I want to thank Wim Schouten and Fons van de Sande of Rijkswaterstaat for their help in distributing the questionnaire. Lastly, I want to thank all respondents who have participated in this research. Without their contribution, I would not have been able to conduct this study.

I hope you enjoy your reading.

Janne Mertens

Wageningen, January 5, 2020

Abstract

The way in which plastic packages are produced, used and thrown away is not able to capture the economic advantages of a circular economy and has a bad impact on the environment (European Commission, 2017). Therefore, the need exists to increase the amount of plastic that is available for recycling. One way to improve the recycling system is to entice consumers to better sort in the intended sorting category (Brouwer & Thoden, 2017).

The recycling behaviour of consumers can be encouraged by improving awareness and knowledge through communication (Sidique, Joshi, & Lupi, 2010). However, it is unknown if, and in which form (textual or visual), information provided on the product itself is effective to improve consumer's sorting behaviour.

By better understanding what type of information format on plastic packages is effective to provide consumers with knowledge, it is possible to improve the sorting behaviour of consumers. Therefore, the following research question is developed: 'What type of information format on packages is effective to improve the sorting behaviour of consumers?'. This question will be answered by looking at three prerequisites for a label to affect behaviour: attention, understanding and liking (Grunert & Wills, 2007).

To answer the research question, a web-based experiment in the form of a questionnaire was distributed among 150 Dutch participants. The participants were randomly assigned to one of the four conditions and saw either packages with disposal instructions in the form of text, icon, text and icon or no disposal instructions. Each participant had to throw away twelve packages in the garbage can for either plastic or residual waste. Afterwards, they had to complete a questionnaire.

Results show that disposal instructions in the form of an icon lead to more attention for and use of the instructions, and results in an improvement of the sorting behaviour of consumers. Whereas textual instructions even increase the time needed to throw packages away. Looking at the combination of visual and textual instructions, it results in an positive effect for attention and use, irrespective of the format of the instructions. However, the combination did result in an improvement of the sorting behaviour. When comparing all formats, visual instructions are effective to improve the sorting behaviour of consumers.

Consequently, it is recommended that companies use this outcome to develop effective disposal instructions for their packages. Besides, knowing that visual instructions are effective could be an inspiration for further research. The next step is to focus on the details of which type of visual instructions is most effective and how to improve the visual information.

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1.Introduction

In the year 2016, Europe has produced 60 million tonnes of plastic, and the expectation is that this amount will double over the next twenty years. 39.9% of all plastic products are plastic packaging, which makes it the most used plastic product (PlasticsEurope, 2018). Plastic has several functions that help society in daily lives (European commission, 2017). However, using plastic packages in this high frequency has a bad impact on the environment (Puji & Sumarno, 2019). Large amounts of plastic waste end in the environment and cause significant financial and environmental damage (Geyer, Jambeck, & Law, 2017). Furthermore, scare metals like petroleum are needed to produce plastic (Milieu Centraal, n.d.). In the past 30 years, only 9% of all plastic was recycled, the other 91% was dumped or burned to generate energy (European Commission, 2017; Geyer et al., 2017). In conclusion, the way in which plastic packages are produced, used and thrown away is not able to capture the economic advantages of a circular economy and has a bad impact on the environment (European Commission, 2017). So, a solution is needed that increases the amount of plastic that is available for recycling and thus improve the conditions for the circular economy and the environment.

Although sustainability seems to become more and more important to consumers (Bemporad, Hebard & Bressler, 2012), a sizable amount of waste is treated non-environmentally friendly and inefficiently (Ghiani, Laganà, Manni, Musmanno, & Vigo, 2014). One way to improve the Dutch recycling system for consumer plastic packages is to entice consumers to better sort in the intended sorting category (Brouwer & Thoden, 2017).

The intention to contribute to sustainability might be a good predictor for recycling behaviour. But this will not be the case if people do not have enough skills or knowledge to perform this behaviour correctly (Árnadóttir, Kok, van Gils, & ten Hoor, 2018). The bottleneck appears to be a lack of knowledge of consumers on how to sort out waste correctly. The recycling behaviour can therefore be encouraged by improving the awareness and knowledge through education and communication (Sidique et al., 2010). People suggested that information on the product itself in terms of plastic, paper or general waste is the most promising approach to provide the consumer with knowledge about sorting waste (Árnadóttir et al., 2018). However, it is unknown if the information on the product itself is effective to improve consumer's sorting behaviour.

Several studies showed that text-based and picture-based information are important tools for communicating with consumers (Lewis, Whitler & Hoegg, 2013). On the one hand, textual information can improve consumers' perceptions of a label and lead to a better understanding of them (Kim & Jang, 2019). On the other hand, visual labels communicate more information and are remembered more than words, which is referred to as the picture superiority effect (Baadte & Meinhardt-Injac,2019; Childers & Houston, 1984; Gardner & Houston, 1986; Stenberg, Radeborg, & Hedman, 1995). However, it is not extensively studied which format of the information is effective to communicate the right garbage can with consumers.

By better understanding what type of information format on plastic packages is effective to provide consumers with knowledge, it is possible to improve the sorting behaviour of consumers. Therefore, the central research question is 'what type of information format on packages is effective to improve the sorting behaviour of consumers?' This question will be answered by looking at the three prerequisites for a label to affect behaviour: attention, understanding and liking (Grunert & Wills, 2007). These perquisites are the bases for the following sub-questions:

a. Do consumers pay attention to the disposal instructions on packages?
b. Do consumers understand the disposal instructions on packages?

c. What type of disposal instructions on packages do consumers like?
d. Do the disposal instructions on packages improve the sorting behaviour of consumers?

To investigate what type of information format is effective, a literature study is necessary to set the direction for the research and to constitute the basis for the quantitative data collection, followed by the experiment. The results of the experiment will be analysed to conclude the effects of information about sorting waste on packages on consumer's sorting behaviour.

The results of this study could contribute to the theory of the picture-superiority effect. There is lots of knowledge about the picture-superiority effect in the field of advertising, but there is not enough knowledge about this in the field of labelling. In particular, which effects pictures have on the attention, understanding and liking of a label could be added.

The results could also lead to the development of an effective information format to improve the sorting behaviour of consumers. If the amount of waste that is sorted out correctly increases, it could be beneficial for consumer, business and environment. It may support the consumer with choosing the correct garbage can and it can contribute to the circular economy. Perchance, it can contribute to reducing even more environmental damage.

2. Background of recycling

2.1 Waste development

Traditionally, recycling waste occurred because it had particular economic reasons. But in the past years, the environmental consciousness of people is increasing, which expresses in an upsurge scale of recycling (Berglund, 2006). Although sustainability seems to become more and more important to consumers (Bemporad et al., 2012), a sizable amount of waste is treated non-environmentally friendly and inefficiently (Ghiani et al., 2014).

2.2 Circular economy

New insights show that waste is not only an economic and environmental burden, but also an opportunity for a secondary source (Eiselt, & Marianov, 2015). This concept named 'circular economy' could be a possible solution to sustainable development by stimulating reduction, recycling, reuse, energy recovery and disposal of waste (Geissdoerfer, Morioka, de Carvalho, & Evans, 2018; Payne, McKeown, & Jones, 2019). A circular economy is an industrial system of closing material loops that focuses on restoring and regenerating waste (Figure 1) (World Economic Forum, 2016). The system is based on three main principles: decreasing waste and pollution by using product design, keeping resources in use and maintaining and reanimate natural systems (Payne et al., 2019).

The circular economy increases the productivity of resources and captures more material value regenerating (World Economic Forum, 2016). Moreover, by (re)using discarded materials, fewer commodities, energy and agricultural land are needed (Wageningen Food & Biobased Research, n.d.). To ensure that companies can function in a circular way, there must be sufficient and appropriate quantities of recycled material available (Hoog, 2018). Therefore, it is important that consumers correctly sort out their waste.

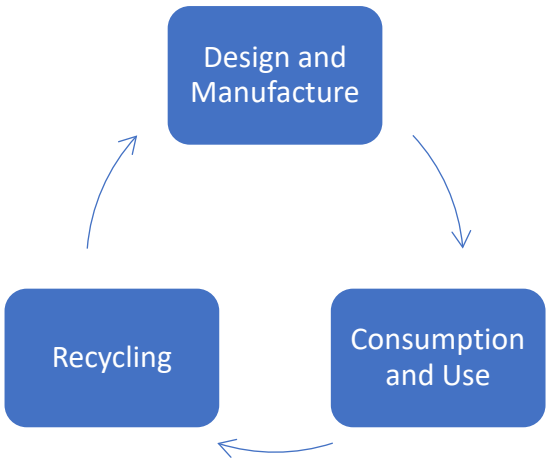

Figure 1. Flow diagram of the circular economic model

2.3 Plastic waste in the Netherlands

The Netherlands has a leading position concerning the collection, sorting and recycling of waste (Hoog, 2018). At this moment significant amounts of waste are sorted out and collected. This amount is even increasing, like the awareness about the usefulness of sorting out waste. However, the waste management system is not perfect yet: large amounts of waste are collected, while there is only a small amount that can be recycled purely. Recycling is defined as the waste-collecting behaviour of individuals to permit the reuse of materials (Geiger, Steg, Van der Werff, & Unal, 2019).

The Dutch recycling system for consumer plastic packages can be improved on three bases: (1) plastics that are non-recyclable should be replaced by recyclable plastics (design for recycling), (2) packages that could not be replaced by recyclable plastics should be treated with new recycle technologies (design from recycling) and (3) consumers have to sort better in the intended sorting category (better sorting) (Brouwer and Thoden, 2017). This study will focus on the third option.

In the Netherlands, 14% of all household residual waste consists of plastic in the year of 2017, of which the biggest part is plastic packages (Rijkswaterstaat, 2019). The proportion of plastic was increasing until 2008 with 20%. Around 2010, some municipalities started with the separate collection of plastic packages, which leads to a reduction in the amount of plastic in residual waste.

In the past years, most attention was paid to the number of packages that were sorted out, so for the coming years, it is important to improve the correctness of sorting out waste (Hoog, 2018). In Figure 2 the composition of residual waste in the Netherlands can be found (Rijkswaterstaat, 2019). The figure shows that most of the residual waste consists of organic waste (32%), followed by paper (19%) and plastics (14%).

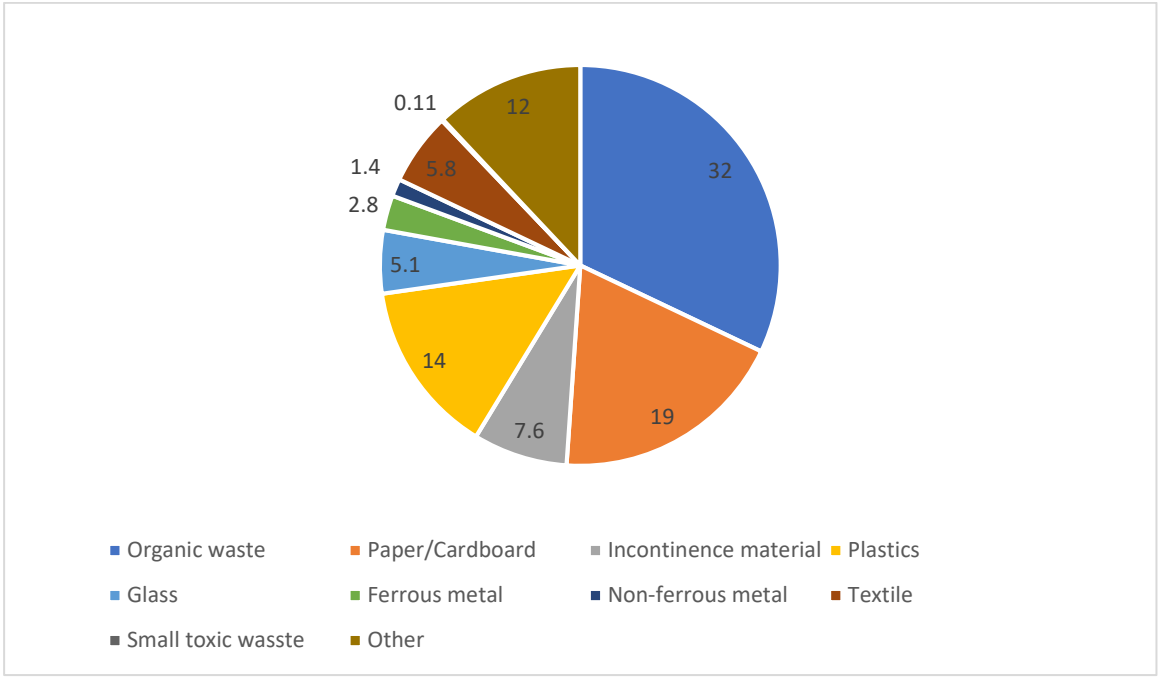

Figure 2. The triennial average composition of Dutch household residual waste in 2017

2.4 Intention-behaviour gap

Many people have a positive attitude towards recycling and have the intention to act in a pro-environmental way (Árnadóttir et al., 2018). They think it is important to sort out waste, with the reason that it is better for the environment (Árnadóttir et al., 2018; Ordoñez, Harder, Nikitas, & Rahe, 2015). However, people do not always act the way they intend to (Diddi, Bloodhart, Bajtelsmit & McShane, 2019; Sheeran & Webb, 2016). On the one hand, people have goal intentions, which are referred to as self-instructions to reach the desired outcome. On the other hand, people have behavioural intentions, these are self-instructions to act in a certain way to achieve the desired outcome (Sheeran & Webb, 2016). The relation between the intention to perform a behaviour and the actual performance of a certain behaviour is denoted as ' the intentional-behaviour gap' (Carrington, Neville & Whitwell, 2014; Gomes, Gonçalves, Maddux & Carneiro, 2017). In this study behaviour is more relevant, so the focus will be on the sorting behaviour of consumers.

2.5 The importance of providing information

The consumer's behaviour towards recycling waste is determined by the degree of his consciousness towards the environment and his knowledge (Ahmad, Bazmi, Bhutto, Shahzadi, & Bukhari, 2014). Knowledge about recycling corresponds to the extent to which individuals know how to recycle waste (Geiger et al., 2019). It appears that when knowledge about the correct way to sort waste is insufficient, consumers cannot improve their recycling behaviour. People suggested that disposal instructions on the product itself in terms of plastic, paper or general waste is the most promising approach to create knowledge (Árnadóttir et al., 2018). So, recycling behaviour can be encouraged by improving the awareness and knowledge through education, communication and information (Ahmad et al., 2014).

3. Effect of labelling

3.1 Conceptual model

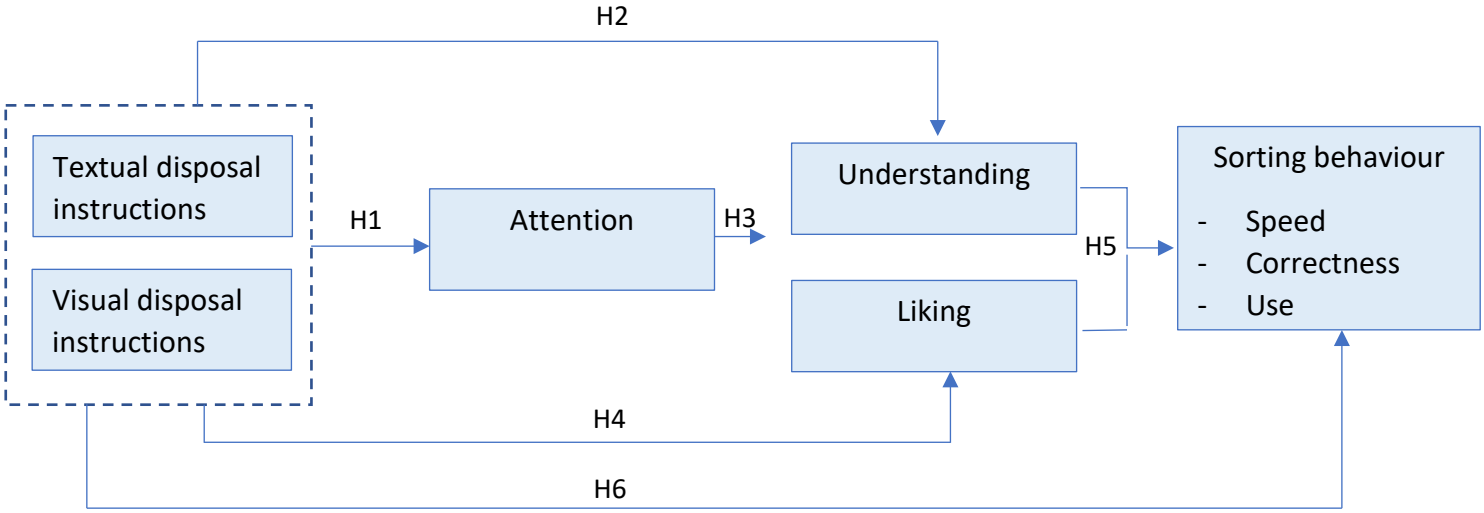

Figure 3. Conceptual model

3.2 The prerequisites for an effective label

As clarified in the previous parts, it is important that consumers sort out their waste correctly. Although consumers consider sustainability as important (Bemporad et al., 2012), 14% of the residual waste in the Netherlands still consist of plastic (Rijkswaterstaat, 2019). This study will investigate if people sort out their waste better if the package contains disposal instructions.

Several studies showed that text-based and picture-based information are important tools for communicating with consumers (Lewis, Whitler & Hoegg, 2013). However, it is not extensively studied which format of the information is most effective to communicate the right garbage can with consumers. Therefore, this study will investigate which format of disposal instructions is most effective to improve the sorting behaviour of consumers. The conceptual model can be found in Figure 3, and is based on three prerequisites for a label (attention, understanding and liking) to affect behaviour (Grunert & Wills, 2007).

3.2.1. Attention

Attention is defined as the selection and filtering in perception (Diddi, Yan, Bloodhart, Bajtelsmit, & McShane, 2019). Contradictory to older decision theories as bounded rationality (Simons, 1955), more recent studies showed that attention actively serves in constructing a decision. A distinction can be made in people's exposure to labels. On the one hand, people may be accidentally exposed to the label and may or may not process this information, this is called bottom-up attention. On the other hand, people can actively search for information on the product, this is called top-down attention (Diddi et al., 2019). People who actively search for information will process it more in-depth, so the chance is higher that the information will affect their behaviour (Grunert & Wills, 2007). Also when people use a product for the first time, the chance is higher that they read the label.

Attention can be influenced by the format of the label (Rihn, Wei & Khachatryan, 2019). Consumers pay more attention to visual labels than textual labels. Moreover, visual labels communicate more information and are remembered more than words, which is referred to as the picture superiority effect (Baadte & Meinhardt-Injac, 2019; Childers & Houston, 1984; Gardner & Houston, 1986; Stenberg, Radeborg, & Hedman, 1995).

However, the literature about advertisements stated that in advertisements the size of the text has the most influence on attention, followed by the size of the brand and the size of the pictures (Aribarg, Pieters, & Wedel, 2010). This could indicate that consumers pay more attention to textual instructions.

The literature about infographics showed that people pay attention to infographics, because they are outstanding and attractive (Ganapathy, Ranganathan, & Sankaranarayanan, 2004). An infographic is a visualisation of information that consists of both visual and textual information and it presents the information in a structured way (Mekel, 2017). In line with this literature, it might be that people also pay more attention to the instructions when they consist of a combination of visual and textual information.

Summarizing, visual information get lots of attention due to the picture superiority effect. Contradictory, the literature about advertisements showed that it is the size of the text that plays an important role in attention, which could also be the case for the disposal instructions. Looking at infographics, people pay lots of attention to this combination of visual and textual information. So, the literature is contradictory about the most effective format for attention. Taking the literature into account, the following hypotheses are formulated:

Hypothesis 1a. *Visual information has a more positive effect on the attention for disposal instructions compared to no visual information.*

Hypothesis 1b. *Textual information has a more positive effect on the attention for disposal instructions compared to no textual information.*

Hypothesis 1c. *Textual information in combination with visual information has a more positive effect on the attention for disposal instructions compared to only text or only visual information.*

3.2.2. Understanding

How information is structured has a significant influence on the acquirement and processing of new information by consumers (Huffman & Kahn, 1998; Jang & Kim, 2015). Visual information is processed faster and more accurate (Chau et al., 2000; Holcomb & Grainger, 2006; Paivio, 1979). It is easier to draw conclusions from graphics than from written text, because elements of a picture can be understood at a glance (Zacks & Tversky, 1999). People cannot understand text at a glance, because it takes time and attention to read and comprehend text (Sorapure, 2019). The brain has to translate each letter to convert it into a word. This process has a duration of a fraction of a second, but it takes people a lot of effort (Smickiklas, 2012). Since people understand visual information faster and more accurate, visual instructions could be preferred when it comes about understanding.

A label serves its intended purpose if consumers understand the information it presents (Hamilton & Raison, 2019). Therefore, two important functions of text in information conception are establishing a context and giving an explanation (Sorapure, 2019). The behaviour of consumers may differ based on their knowledge and direct experience with a label (Liang and Kale, 2012). So, consumers who have less prior knowledge may have difficulty processing visual information that leads to an

improvement in their behaviour (Kim & Jang, 2019). Contrary to what was mentioned earlier, textual information can, in this case, improve consumers' perceptions of a label and lead to a better understanding of it (Kim & Jang, 2019). Furthermore, these consumers are highly motivated to gain factual information and want to actively search for it (Lewis et al, 2013). Therefore, textual information can be an option for consumers with less prior knowledge about disposal garbage.

People are different in their preferences and consistency in using visual and textual information (Blazhenkova & Kozhevnikov, 2009). Some people are better at processing pictures (visualizers) and some people are better at processing words (verbalizers), which is referred to as the visualizer-verbalizer dimension (Mayer & Massa, 2003). Therefore, the disposal instructions might be more effective when they consist of both visual and textual information. In this way, people with conflicting preferences for processing information can understand the disposal instructions.

The literature about the most effective format to understand information is contradictory. On the one hand, people understand visual information faster and more accurate. However, consumers who have less prior knowledge may have difficulty processing visual information. For them, textual information leads to a better understanding of the instructions. Looking at the visualizer-verbalizer dimension, it might be useful to provide both visual and textual information. Building on this stream of research and in the context of this study, the following hypotheses are formulated:

Hypothesis 2a. *Visual information has a more positive effect on the understanding of the disposal instructions compared to no visual information.*

Hypothesis 2b. *Textual information has a more positive effect on the understanding of the disposal instructions compared to no textual information.*

Hypothesis 2c. *Textual information in combination with visual information has a more positive effect on the understanding of the disposal instructions compared to only text or only visual information.*

Furthermore, the expectation is that consumers first have to see the disposal instructions before they can understand them. The same assumption holds for liking. This leads to the following hypotheses:

Hypothesis 3a. *Attention for the disposal instructions has a positive effect on understanding.*

Hypothesis 3b. *Attention for the disposal instructions has a positive effect on liking.*

3.2.3. Liking

Another factor that influences information processing is the liking of the label. The liking of the label can affect the perception of a product in a more positive way, even when people do not understand the label (Grunert & Wills, 2007), which is referred to as the peripheral information process. The peripheral information process takes place when a person evaluates a message on the basis of appearance instead of content (Petty, Heesacker, & Hughes, 1997). Understanding the information has therefore not necessarily an influence on the liking of a label.

There are three considerations for liking a label (Grunert & Wills, 2007). First, it is important that the label is clear. People do not have much time to read the label and are irritated when the label has bad legibility. Therefore, people prefer a simple label. Secondly, people like it when they know what

the label stands for. Third, people do not want to have the feeling that they are pushed in a direction they do not like.

When a label is well-designed, it can avoid consumer confusing and improves the clarity of the message (Testa, Iraldo & Ferrari, 2015). People can like a label because of the symbols and colours used (Grunert & Wills, 2007). So, visual information could favour the liking of the instructions. On the other hand, people prefer a clear label and they like it when they know what the label stands for. The expectation is that textual information can contribute in clarifying the label. So, this could indicate that consumers like textual information. Based on the visualizer-verbalizer dimension, that states the differences of people's preferences and consistencies in using visual and textual information (Blazhenkova & Kozhevnikov, 2009), the prediction is made that the combination of textual and visual information will influence consumer's liking of the instructions. Taking this into account, the following hypotheses are formulated:

Hypothesis 4a. *Textual information has a more positive effect on the liking of the disposal instructions compared to no textual information.*

Hypothesis 4b. *Visual information has a more positive effect on the liking of the disposal instructions compared to no visual information.*

Hypothesis 4c. *Textual information in combination with visual information has a more positive effect on the liking of the disposal instructions compared to only text or only visual information.*

If people are unconscious of the purpose and meaning of a label, it is difficult to have an impact on their behaviour (Golan, Kuchler, Mitchell, Greene, & Jessup, 2001). Furthermore, both conscious and unconscious liking can influence behaviour (Berridge & Winkielman, 2003; (Litman, 2005). So, people must understand and like the disposal instructions to improve their behaviour, leading to the following hypothesis:

Hypothesis 5. *Understanding and liking of the disposal instructions have a positive effect on sorting behaviour.*

3.2.4. Sorting behaviour

Information influences the behaviour of consumers (Aday & Yener, 2014; Chang & Huang, 2010; Samoggia & Riedel, 2020; Taufique, Vocino, & Polonsky, 2016). The literature about healthy eating states that providing people with information decreases the barriers to eat healthier (Samoggia & Riedel, 2020). Moreover, when it comes to genetically modified food, information on the product packaging affects consumers' behaviour towards genetically modified technology (Chang & Huang, 2010). Information on eco-labels has a positive effect on consumers' attitudes towards the environment, which thereafter affects their pro-environmental behaviour (Taufique, Vocino, & Polonsky, 2016). Finally, purchasing behaviour is mainly influenced by packaging attributes and labels (Aday & Yener, 2014). Regarding this stream of research, information on packages in the form of disposal instructions might influence the sorting behaviour of consumers.

Consumer behaviour is the study of all actions of persons in the acquiring, use and disposal of products and services to satisfy their needs (Wieringa & van Raaij, 1987). Building on this definition, sorting behaviour is defined as the actions and decisions of persons in the disposal of products.

If consumer's changed behaviour will not be profitable for their own, consumers will only perform pro-environmental behaviour if they (1) are well informed about the problem, (2) are able to perform the desired behaviour and (3) can contribute to solving the problem by changing their

behaviour (Kraup & Russel, 2005). As stated earlier, consumers have a positive attitude towards recycling and have the intention to act in a pro-environmental way (Árnadóttir et al., 2018). A positive attitude towards an environmentally friendly act (like sorting out waste) is more likely to be transformed into behaviour the more knowledge the person has about the topic (Thøgersen, in Kraup & Russell, 2005). The sorting behaviour can thus be stimulated by making people aware and providing them with knowledge about sorting out waste (Ahmad et al., 2014).

When a product contains visual information, it has a positive influence on buying behaviour (Mekel, 2017). This could indicate that visual instructions will influence the sorting behaviour of consumers. However, people who are not familiar with the instructions will better understand the textual information (Kim & Jang, 2019), which could lead to a positive change in behaviour. Based on the visualizer-verbalizer dimension, the prediction is made that the combination of textual and visual information will influence consumer's sorting behaviour. Taking this into account, the following hypotheses are formulated:

Hypothesis 6a. *Textual information has a more positive effect on the sorting behaviour of consumers in comparison with no textual information.*

Hypothesis 6b. *Visual information has a more positive effect on the sorting behaviour of consumers in comparison with no visual information.*

Hypothesis 6c. *Textual information in combination with visual information has a more positive effect on the sorting behaviour of consumers compared to only text or only visual information.*

Summarizing, this study wants to investigate which format of disposal instructions is effective to improve the sorting behaviour of consumers. The literature shows conflicting results regarding the influence of textual information, visual information and a combination of both. Therefore, this study will investigate which formats of instructions affect the three prerequisites of a label (attention, understanding and liking) and the sorting behaviour of consumers.

4. Method

4.1 Design

By better understanding what type of information format on plastic packages is most effective to provide consumers with knowledge, it will make it possible to improve the sorting behaviour of consumers. The hypotheses were tested in a 2 (icon versus no icon) x 2 (text versus no text) between-subjects experimental design. The participants received combinations of various levels, leading to four experimental conditions (see table 1). The data was gathered using a web-based questionnaire in combination with a sorting task. The sorting task was used to see if information about sorting waste on a package improves the sorting behaviour of the participants. The questionnaire was used to see which form of disposal instructions participants prefer.

Table 1
The four experimental conditions

	Icon	**No icon**
Text	Group 1	Group 2
No text	Group 3	Group 4

4.1.1. Products

The packages used had to represent plastic and residual products that were problematic to throw away. This to avoid that participants would not use the disposal instructions on the package if provided. Five waste companies were approached by mail if they possessed lists of plastic and residual packages which were often thrown away in the wrong garbage container. Two companies had such lists at their disposal, but these lists were not sufficient as they only contained a few packages. Therefore, a preliminary investigation had to be done. Packages from the provided lists along with packages from the waste companies websites (ACV Groep, n.d.; AVU, n.d.; Gemeente Wageningen, 2019) were used to compose a list of twenty products (Appendix A). For the preliminary investigation, twenty respondents (11 females and 9 males; aged 17-54 years) had to indicate which packages from this list belonged to the plastic waste and which to the residual waste. The twelve packages which were most often thrown away incorrectly were used in the experiment. See for the results of the preliminary investigation Appendix A, Table 1. The visual representation of the final twelve packages can be found in Appendix C, Table 2.

4.1.2. Disposal instructions

The used disposal instructions were developed by 'Kennisinstituut Duurzaam Verpakken' (2018) and are free to use. Two original icons were requested: 'package in plastic waste' and 'package in residual waste'. The text 'verpakking' (package) was cut out of all original icons, to make it better readable on the package. For the disposal instructions with only text, the image was cut out of the disposal instructions (Figure 5). For the disposal instructions with only an icon, the text was cut out of the disposal instructions (Figure 6). All disposal instructions were shown in the colours black and white, as these are the standard colours of the icon. The dark colour is often in contrast with the background of the package and therefore readable (Kennisinstituut Duurzaam Verpakken, 2018). All disposal instructions had the same surface, to avoid confound.

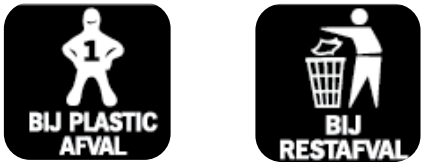

Figure 4. Disposal instructions in the form of an image with text

Figure 5. Disposal instructions in the form of text

Figure 6. Disposal instructions in the form of an image

4.2 Participants

The experiment was conducted using a convenience sample, by distributing the survey via email and on the social media platforms Facebook and WhatsApp. A convenience sample was chosen because of time and budget constraints. The participants must be 16 years or older. Furthermore, participants had to indicate if their municipality collected plastic and residual waste separately. Otherwise, it eliminates participants' need to separate waste. Only the participants who indicated that their municipalities collected waste separately were allowed to start with the questionnaire. No differences were made between educational attainment and gender.

In total 200 participants started the survey, of which 28 were not allowed to finish the survey, as their municipalities did not collect waste separately. This data was excluded from all analyses. The data of 22 other participants could not be used for the analyses, due to missing data (*N*=13), extreme outliers (*N*=6) or notable remarks (*N*=3). This resulted in a study population of 150 participants (98 females and 52 males; aged 16-74 years).

Each participant took part in one of the four experimental conditions: 36 participants saw disposal instructions in the form of an icon, 37 participants saw textual instructions, 40 saw both text and icon and 37 participants were in the control condition. The questionnaire was filled in between November 25th and December 4th, 2019 and took approximately 5 minutes. The participants knew upfront that the survey was about garbage disposal. They did not know that it was specifically about sorting waste, to not deter people who did not sort out their waste.

4.3 Procedure

The participants were approached by either email, Facebook or WhatsApp. By clicking on the provided link they could start the questionnaire. The participants had to fill in a questionnaire which consisted of six parts, see for the flow chart Appendix D, Figure 1. When participants began the survey, they first had to answer five demographic questions about their gender, age, living situation, municipality and if their municipality collects waste separately. The choice has been made to start with the demographic questions, because two of them were selection questions. The participants who were younger than 16 years or participants whose municipality did not collect waste separately, did not meet the requirements and were therefore exempt from completing the questionnaire.

The participants who did meet the requirements were assigned to one of the four experimental designs (image, text, image and text, none). In this part, the participants viewed twelve packages with disposal instructions in either the form of an image, text, an image and text, or no disposal instructions. The packages were set to be shown in a random order to control for order bias. The participants were asked to throw away each package in the corresponding garbage container. They could only choose between the garbage containers for plastic or residual waste, since in this experiment only products were used which belong to the plastic or residual waste. The option 'I do not know' was not included, because people also have to choose daily life.

The third part consisted of eight statements about the use, understanding, liking and attention of the disposal instructions. The participants had to indicate if they used the material and information on the package for their choice for a garbage container. Understanding was asked with the subjective question if they had understood the disposal instructions. Liking was asked with statements about their feelings towards the package. Lastly, the participants had to indicate if they had seen disposal instructions on the package.

In the fourth part, participants were showed two icons and were asked questions about their familiarity and knowledge about these icons. The fifth part was about the respondent's previous knowledge and value of sorting out waste. The choice had been made to ask these questions after the experiment, to avoid that the questions influenced the experiment. In the last parts, participants were asked if they had any remarks or wanted to be in the run for a reward. In the end, the participants viewed the message that they had completed the survey and were thanked for their participation.

4.4 Measures

The questionnaire was based on the three prerequisites of a label (understanding, attention and liking) to affect the sorting behaviour of consumers. The questionnaire consisted of six parts: (1) demographic questions, (2) sorting of stimuli, (3) questions about attention, understanding, use and liking, (4) familiarity and knowledge of icons, (5) value and knowledge of sorting out waste and (6) remarks. The questions presented using the Dutch language. A pilot with seven participants was conducted to check if all questions were clear. The questionnaire can be found in Appendix B.

The sorting task examined which form of disposal instructions improved the sorting behaviour of the participants. The participants saw twelve packages and were asked to drag each package to either the garbage can for plastic waste or for residual waste. Before the start of the sorting task, the online survey program Qualtrics split the participants up into four groups and assigned them randomly to one of the four experimental conditions. For example, the first group only saw packages with disposal instructions in the form of an icon and the second group only saw packages with disposal instructions in the form of text. The last group served as the control group, they did not have any disposal instructions on the packages (Appendix C, Table 1).

Table 2 shows which items were used to measure each construct. Table 3 shows the alpha's for foreknowledge, value and liking.

Table 2

Measurement of the constructs

Research Questions	**Construct**	**Items**	**Scale**
Demographic questions	-	What is your gender?	A. Man B. Woman C. Neutral
		What is your age? [a]	Open question
		What is your living situation?	A. Single-person household B. Multi-person household without children C. Multi-person household with children
		Does your municipality collect plastic and residual waste separately?	A. Yes B. No C. I do not know
		In which municipality do you live? [b]	A. Municipality of Wageningen B. Municipality of Peel & Maas C. Municipality of Venlo D. Municipality of Rotterdam
Do the disposal instructions on packages improve the sorting behaviour of consumers? [c]	Sorting behaviour	Drag the package to the correct garbage can.	A. Residual waste B. Plastic waste
	Time needed	The survey program keeps track of time	Seconds
	Use	'I used the information on the package for my choices.'	1 (disagree) – 7 (agree)
Do consumers pay attention to the disposal instructions on packages?	Attention	At the section 'drag the package to the correct garbage can', I have seen disposal instructions.'	1 (disagree) – 7 (agree)
What do consumers understand about the disposal instructions on packages?	Understanding	'Through the package, I understood to which garbage can the package belonged to'.	1 (disagree) – 7 (agree)
What type of disposal instructions on packages do consumers like?	Liking	'I liked it that the package helped me with my choice for the right garbage can'.	1 (disagree) – 7 (agree)
		'I liked the way the package helped me with my choice for the right garbage can.	1 (disagree) – 7 (agree)
Background questions	Value for sorting out waste	'I separate my waste in daily life.'	1 (disagree) – 7 (agree)
		'I think it is important to separate waste.'	1 (disagree) – 7 (agree)
	Foreknowledge	'I know which products belong in the garbage can for plastic waste.'	1 (disagree) – 7 (agree)
		'I know which products belong in the garbage can for residual waste.'	1 (disagree) – 7 (agree)
	Familiarity (icon plastic waste)	'I am familiar with this logo in daily life.'	1 (disagree) – 7 (agree)
	Familiarity (icon residual waste)	'I am familiar with this logo in daily life.'	1 (disagree) – 7 (agree)
Remarks	-	Do you have any comments or things you want to say?	→ Open question
Reward	-	Do you want to win one of the three Tony Chocolonely bars? Then leave your e-mail address. [d]	→ Open question

[a] Age was presented as an open question, because this provided more accurate data. No more than two characters were allowed.

[b] As a control question also the name of the participant's municipality was asked with multiple choice.

[c] Participants had to separately dispose of twelve packages in the corresponding garbage container. All answers were tested on the dependent variables speed, quality and use. The online survey program measured how long it took each participant to pull all the products in the garbage can. The quality of sorting out waste was measured by looking at how often a product was thrown away correctly.

[d] Considering ethics, participants can choose whether or not they want to leave their email address.

Table 3
Alpha of the constructs

Construct	**Alpha**
Liking	.804
Value for sorting out waste	.884
Foreknowledge	.764

4.5 Data analysis

To stimulate participants to finish the questionnaire, the survey contained a progress bar. Besides, participants could not skip questions. In this way, there was no missing data from the participants who had finished the survey.

Before the start of the analyses, the data of the participants who were not allowed to finish the survey as their municipalities did not collect waste separately, will be excluded from all analyses. Also, the participants who did not finished the questionnaire and thus have any missing data will be deleted from the database. Moreover, the data will be checked on extreme outliers on the variables for submit time of the sorting task and total time to complete the questionnaire. When it would take participants longer than one day to fill in the questionnaire, or when they have finished the questionnaire in less than two minutes, they will be excluded from the analysis. Besides, for the sorting task will be checked if participants deviate three times or more of the standard deviation for submit time. Lastly, there will be checked for notable remarks. If participants indicate that they do not understand the questionnaire, they will be excluded from the analyses.

Statistical analyses were performed using IBM SPSS Statistics (version 25), with a value of $p < 0.05$ as a criterion for statistical significance. A two-way ANCOVA was used that examined the effects of disposal instructions in the form of text and icon on the sorting behaviour of consumers, whilst controlling for the covariates foreknowledge and value for sorting out waste. Also, the questions about attention, use, liking and understanding were examined using a two-way ANCOVA. To analyse the open questions about the meaning of both icons, the answers were categorized and descriptive statistics were used. To test the model, Spearman's correlation and single and multiple linear regression were used. Lastly, the sample and the items for value and knowledge were analysed using descriptive statistics.

5. Results

5.1 Constructs

Reverse coding was applied to the two items that questioned 'annoying' as part of the liking construct. After that, exploratory factor analysis was used to determine the factor structure for liking. The principal component analysis recommended a two-factor solution and the scree plot also indicated a two-factor solution. Factor 1 was comprised of two items reported on a 7-point Likert scale that explained 77.1% of the variance with factor loadings from .593 to .805. The liking construct with two items have a Cronbach's alpha of .804.

The two items for foreknowledge and the two items for value were also viewed with Cronbach's alpha. Cronbach's alphas for the two foreknowledge items was .764 and Cronbach's alphas for the two value items was .884.

The constructs value and foreknowledge will serve as covariates in the analyses for sorting behaviour, attention, liking, understanding and use, to prevent that value and foreknowledge will have an influence on them. The adjusted means and standard deviations can be found in Appendix C, Table 3 and the results of the analyses without the covariates can be found in Appendix C, Table 4.

5.2 Demographics

The household composition of the sample (*N*=150) can be found in Table 4 along with the household composition of the Dutch population (CBS, 2019). The gender and age of the sample compared with the Dutch population can be found in Tables 5 and 6, respectively. The sample was not a good representation of the Dutch population. Looking at household composition, the single-person household was underrepresented and the multi-person household with children was overrepresented. Furthermore, the ratio of male and females was not equally distributed with disproportionally more females. Lastly, the age distribution of the sample was not in proportion with the age distribution of the Dutch population, with a remarkably large amount of participants in the age of 16-24 and 50-54. The other age groups were underrepresented.

Table 4

Representativeness for the Dutch population concerning household composition

Household composition	Sample	CBS
Single person household	9.3 %	38.3 %
Multi-person household without children	34.7 %	28.8 %
Multi-person household with children	56.0 %	32.9 %
Total	100.0 %	100.0 %

Table 5

Representativeness for the multi-year Dutch population concerning age

Gender	Sample	CBS
Male	34.7%	49.7%
Female	65.3%	50.3%
Total	100.0%	100.0%

Table 6

Representativeness for the multi-year Dutch population concerning age

Age	Sample	CBS
16-19 years	18.0 %	7.2 %
20-24 years	36.7 %	7.4 %
25-29 years	4.0 %	7.7 %
30-34 years	2.7 %	7.4 %
35-39 years	3.3 %	7.1 %
40-44 years	4.0 %	7.0 %
45-49 years	4.7 %	8.5 %
50-54 years	14.0 %	8.8 %
55-59 years	8.0 %	8.4 %
60-64 years	3.3 %	7.5 %
65 years and older	1.3 %	23.0 %
Total	100.0 %	100.0 %

5.3 Value and knowledge of sorting out waste

Descriptive statistics show that participants find it very important to sort out waste (*M*=5.95; *SD*=1.20), and that they sort out their waste usually (*M*=5.92; *SD*=1.25). Furthermore, participants think that they moderately know to which garbage cans plastic and residual waste belong (*M*=5.10; *SD*=1.21, *M*=5.05; *SD*=1.25), respectively.

5.4 Attention, understanding and liking of disposal instructions

A two-way ANCOVA was conducted that examined the effects of the different disposal instructions on attention, understanding and liking, whilst controlling for foreknowledge and value for sorting out waste. See for the means and standard deviations for the different conditions Table 7. The participants had on average occasionally seen the disposal instructions. It was found that disposal instructions in the form of text did not increase the attention for the disposal instructions, $F(1, 144) = 1.10$, $p = .297$, partial $\eta^2 < .01$. However, participants who saw disposal instructions in the form of an icon did, as predicted, significantly paid more attention to the disposal instructions (M = 4.10, SD = .26) than those who did not see an icon (M = 2.82, SD = .26), $F(1, 144) = 11.79$, $p = .001$, partial $\eta^2 = .08$. Moreover, there was a statistically significant interaction between icon and text on the attention, $F(1, 144) = 8.26$, $p = .005$, partial $\eta^2 = .05$. Further pairwise comparisons showed that participants paid significantly less attention to disposal instruction in the control condition (when no instructions were present), whereas the other conditions did not significantly differ from each other (see Appendix C, Table 5). In other words, attention for disposal instructions was present, irrespective of whether these instructions were provided as text, icon, or a combination of text and icon.

For liking, the disposal instructions were on average moderately liked. The data did not support hypothesis 4, as no significant effects were found for text, icon or their interaction (Text: $F(1, 144) = .37$, $p = .543$, partial $\eta^2 < .01$; Icon: $F(1, 144) = 2.04$, $p = .155$, partial $\eta^2 = .01$, Interaction: $F(1, 144) = 2.91$, $p = .090$, partial $\eta^2 = .02$).

The disposal instructions were on average well understood. A two-way ANCOVA showed that neither disposal instructions in the form of text or icon led to a significant better understanding of the disposal instructions, ($F(1, 144) = .23$, $p = .730$, partial $\eta^2 < .01$; $F(1, 144) = 1.45$, $p = .382$, partial $\eta^2 < .01$) respectively. It was also found that there was no interaction between text and icon on the

understanding of the disposal instructions $F(1, 144) = 2.77$, $p = .098$, partial $\eta^2 = .01$. So, the data did not support hypothesis 2.

Table 7
Means and Standard deviations for the four conditions

	Control condition (*n*=37)	**Text (*n*=37)**	**Icon (*n*=36)**	**Text and Icon (*n*=40)**
Attention	2.11 (1.45)	3.54 (2.42)	4.44 (2.48)	3.75 (2.50)
Liking	4.39 (1.48)	4.97 (1.48)	5.24 (1.28)	4.88 (1.70)
Understanding	4.54 (1.66)	4.92 (1.23)	5.25 (1.38)	4.70 (1.68)

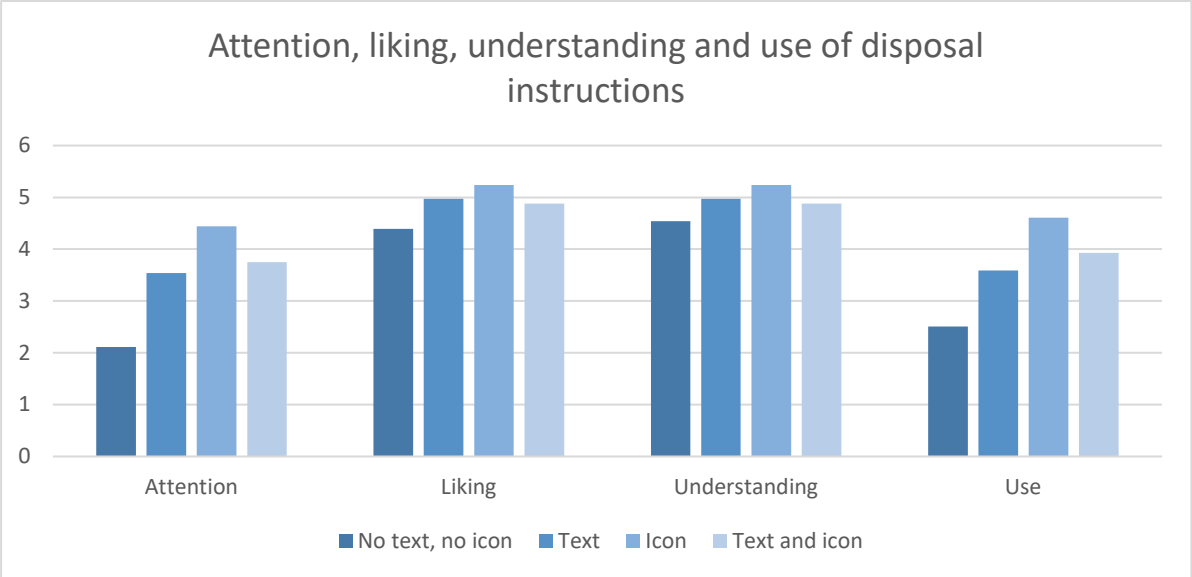

Figure 7. Graphic showing the visual representation of the means for attention, liking, understanding and use of disposal instructions per experimental condition

5.5 Sorting behaviour

Table 8 shows the mean ratings and effect sizes on the number of packages that were sorted out correctly and the total time it took the participants to throw away all packages, for the different disposal instructions. A two-way ANCOVA was conducted, whilst controlling for foreknowledge and value for sorting out waste. It was found that disposal instructions in the form of text did not lead to significantly better sorting behaviour $F(1, 144) = 2.18$, $p = .142$, partial $\eta^2 = .02$, which is not in line with hypothesis 6a. As predicted, disposal instructions in the form of an icon did lead to significantly better sorting behaviour, so the participants who saw an icon did better sort out their waste (M = 9.12, SD = .27) than those who do not saw an icon (M = 8.15, SD = .27), $F(1, 144) = 35.21$, $p = .011$, partial $\eta^2 = .04$. Furthermore, there was no statistically significant interaction between text and icon on the number of packages sorted out correctly $F(1, 144) = .11$, $p = .747$, partial $\eta^2 < .01$. So, the data did not support hypothesis 6c.

When it came about the time participants used to throw all packages away, participants who saw textual disposal instructions needed significantly more time to sorted out their waste (M = 85.88, SD = 3.59) than those who did not see textual instructions (M = 70.40, SD = 3.68), $F(1, 144) = 8.99$, $p = .003$, partial $\eta^2 = .06$. As predicted, participants who saw disposal instructions in the form of an icon

did not need significantly more time to sort out their waste (M = 75.44, SD = 3.60) than those who did not see an icon (M = 80.84, SD = 3.65), $F(1, 144) = 1.11$, $p = .294$, partial $\eta^2 < .01$. The data did not support hypothesis 6c, as there was no statistically significant interaction between text and icon on the time to sort out waste $F(1, 144) = .29$, $p = .592$, partial $\eta^2 < .01$.

Table 8

Means and Standard Deviations for the four conditions

	Control condition (*n*=37)	**Text (*n*=37)**	**Icon (*n*=36)**	**Text and Icon (*n*=40)**
Amount correct	7.92 (1.86)	8.32 (2.61)	8.97 (2.71)	9.35 (2.30)
Total time	71.37 (28.69)	89.49 (46.33)	71.57 (21.28)	80.31 (26.74)

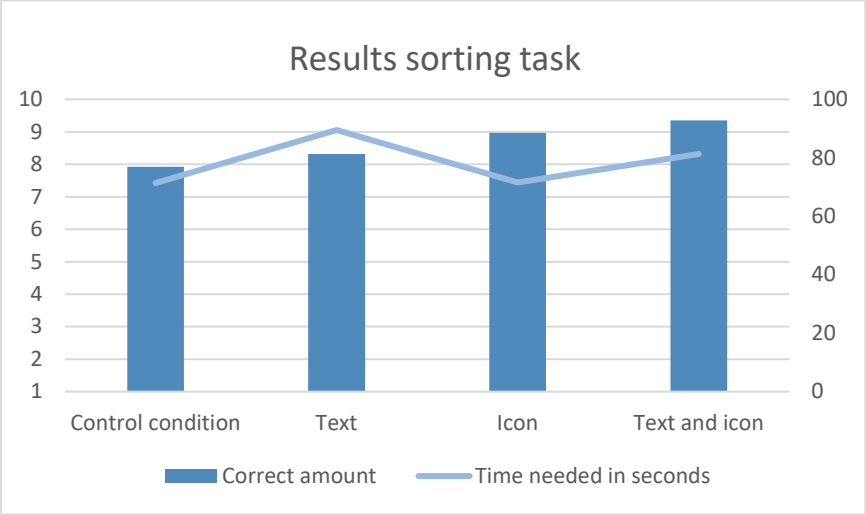

Figure 8. Graphic showing the visual representation of the means for the number of packages sorted out correctly and the total time needed per experimental condition

5.6 Use of the disposal instructions

To examine the effect of the use of disposal instructions a two way ANCOVA was conducted, whilst controlling for foreknowledge and value for sorting out waste. Table 9 shows the mean ratings and effect sizes for the use of material and instructions for the different conditions. On average, participants had sometimes used the disposal instructions. It came out that textual instructions did not increase the use of the information $F(1, 144) = .40$, $p = .527$, partial $\eta^2 < .01$, while, as predicted, disposal instructions in the form of an icon did increase the use information ($F(1, 144) = .12.55$, $p < .001$, partial $\eta^2 = .01$. Furthermore, there was an interaction between text and icon on the use of disposal instructions ($F(1, 144) = 6.02$, $p = .015$, partial $\eta^2 = .04$. Further pairwise comparisons showed that participants used the instructions significantly less in the control condition (when no instructions were present), whereas the other conditions did not significantly differ from each other (see Appendix C, Table 5). In other words, use of disposal instructions was present, irrespective of whether these instructions were provided as text, icon, or a combination of text and icon.

Participants had usually used the material of the packages for their decisions. Generally, there was no significant difference between the different disposal instructions in the use of material, so no effects were found for text, icon or their interaction (Text: $F(1, 144) = 2.44$, $p = .121$, partial $\eta^2 = .02$; Icon: $F(1, 144) = 3.72$, $p = .056$, partial $\eta^2 = .03$, Interaction: $F(1, 144) = .55$, $p = .459$, partial $\eta^2 < .01$).

Table 9
Means and Standard deviations for the four conditions

	Control condition (*n*=37)	**Text (*n*=37)**	**Icon (*n*=36)**	**Text and Icon (*n*=40)**
Use information	2.51 (1.71)	3.59 (2.15)	4.61 (1.95)	3.93 (2.33)
Use material	6.24 (.863)	5.65 (1.38)	5.61 (1.75)	5.35 (1.82)

5.7 Familiarity with icons

Descriptive statistics were used to examine the familiarity of the participants with the icons used. On average, participants were moderately familiar with the icon for residual waste (*M*=5.08; *SD*=1.77). Meanwhile, participants were slightly familiar with the icon for plastic waste in daily life (*M*=3.38; *SD*=2.38).

The meanings participants gave for both icons were categorized, resulting in three categories for residual waste (correct, incorrect, no idea) and four categories for plastic waste (correct, almost correct, incorrect, no idea). Descriptive statistics showed that 44.7% of the participants did correctly know that the icon for residual waste stands for 'throw the package in the garbage can for residual waste', 52% did not know the correct meaning of the icon and 3.3% had no idea (Figure 9). Out of the incorrect answers, 33.3% thought that the icon meant that one has to throw away the package in a garbage can in general.

For the plastic icon, 35.3% of the participants knew that the icon stands for 'throw the package in the garbage can for plastic waste'. 12.7% of the participants almost knew the correct meaning; they thought that the icon stands for 'recycling', instead of the specific waste stream 'plastic'. Contradictory, 10.7% did not know that the correct meaning of the icon and 41.3% had no idea what the icon stands for (Figure 10).

Summarizing, more than half of the participants did not know the correct meaning of the icon for residual waste, even though the results show that the participants were on average moderately familiar with this icon. Looking at the plastic icon, people are not familiar with it and lots of people did not know the meaning of the icon.

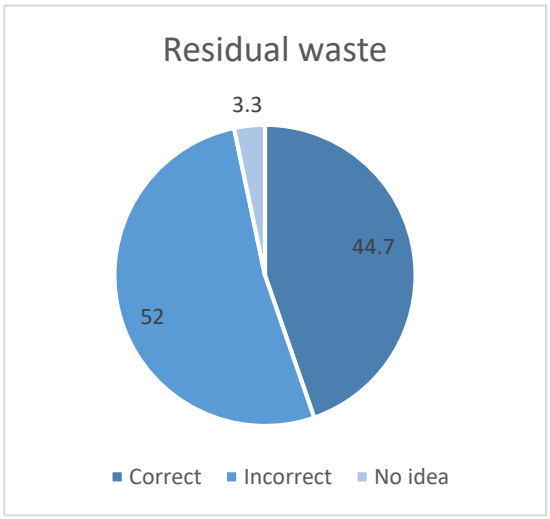

Figure 9. Percentages per category

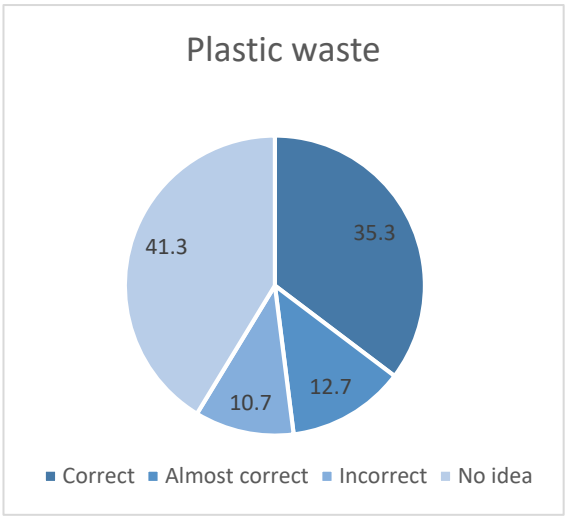

Figure 10. Percentages per category

5.8 Testing the model

A simple linear regression was calculated to predict understanding based on attention. As predicted, a significant regression equation was found $F(1,148)=5.23$, $p = .024$, with a R^2 of .034. It was found that attention has a positive effect on understanding (β = .19, t(1, 148) = 20.67, p < .001). So, the data support hypothesis 3a.

Simple linear regression was also used to predict liking based on attention. A significant regression equation was found $F(1,148)=554.42$, $p < .001$, $R^2= .264$. Attention has a positive effect on liking (β = .52, t(148) = 19.64, p < .001). So, the data support hypothesis 3b.

To determine the relationship between the liking and understanding of a label, Spearman's correlation was used. There was a weak, positive correlation between liking the label and understanding the label, which was statistically significant ($r = .383$; $p < 0.01$; $N = 150$).

Multiple regression was run to predict sorting behaviour from liking and understanding. These variables statistically significantly predicted sorting behaviour, $F(2, 147) = 12.05$, $p < .001$, $R^2 = .141$. Both variables added statistically significantly to the prediction (Understanding: β = .25, t(2, 147) = 2.94, p = .004; Liking: β = .20, t(2, 147) = 2.43, p = .017). So understanding and liking of the disposal instructions have a positive effect on the sorting behaviour (hypothesis 5).

6. Discussion

6.1 Conclusion

This study investigated the effect of disposal instructions on the sorting behaviour of consumers while looking at the three prerequisites for an effective label (attention, liking, understanding).

Looking at attention, participants sometimes had seen the disposal instructions. Textual instructions did not increase the attention, but participants paid significantly more attention to instructions when it contains an icon. This is in line with the literature, that stated that consumers pay more attention to visual information due to the picture-superiority effect (Baadte & Meinhardt-Injac, 2019). When looking at the significant interaction effect, it did not matter if the disposal instructions were provided as text, icon or a combination of them. As long as the package contained disposal instructions, people pay attention to them.

On general, participants had the feeling that they well understood to which garbage can the packages belong. None of the disposal instructions were significantly better understood. So when it comes to understanding, it does not matter if the package contains disposal instructions or not.

The results showed that disposal instructions were moderately liked. However, neither instructions in the form of text, icon or a combination of them were more liked compared with no instructions. Therefore, it does not make a difference for liking if the disposal instructions are provided or not.

Disposal instructions in the form of an icon did lead to better sorting behaviour and an increase in the use of them. Furthermore, visual information did not increase the time needed for people to throw the packages away. Contradictory, textual instructions did not improve the sorting behaviour and use. It even increased the time participants needed to sort out their waste, which is in line with the literature that states that it takes time and attention to read and comprehend text (Sorapure, 2019). When looking at the significant interaction effect, it did not matter if the disposal instructions contained textual information, visual information or a combination of them. People use the disposal instructions when they are provided on the package, irrespective of the format of the instructions.

In conclusion, visual information has a significant positive effect on the attention and use of the disposal instructions. Moreover, they lead to an improvement of the sorting behaviour of consumers and they did not increase the time needed by consumers to throw the package away. On the other hand, textual instructions do not improve the sorting behaviour, they only increase the time needed to throw packages away. Looking at the combination of visual and textual instructions, it results in a positive effect for attention and use, irrespective of the format of the instructions. However, the combination did not results in an improvement of the sorting behaviour. When comparing all formats, visual instructions have most positive effects on the sorting behaviour and prerequisites for a label. So, visual instructions are effective to improve the sorting behaviour of consumers.

6.2 Implications

Companies can use this outcome to develop effective disposal instructions for their packages. By communicating the right garbage can, they can provide consumers with knowledge and encourage them to improve their sorting behaviour (Sidique et al., 2010). When consumers better sort out their waste, this could increase the amount of appropriate plastic that can be used in the circular economy and can contribute to less environmental damage.

The results show that visual disposal instructions are effective, but the icons used are not known by more than half of the participants. Therefore, it is recommended to make consumers more aware of

the meanings of the icons. When more consumers know the meaning of the icons, this may have a positive effect on the amount of waste sorted out correctly.

The results of this study contribute to the theory about the picture-superiority effect in the field of labelling. The results showed that the picture-superiority effect was found on attention and use of labels, but not on understanding and liking. Besides, the result that visual instructions are effective could be an inspiration for further research. The next step is to focus on the details of which type of visual instructions is most effective and how to improve the visual information.

6.3 Limitations and further research

There are a few limitations that should be mentioned. First of all, the sample used was not a good representation of the Dutch population, while looking at age, gender and household composition. Due to time constraints and money, it was not possible to do a random sample. It is recommended to replicate these findings with a more representative group of participants to examine whether the findings apply to the general Dutch population. The expectation is that this will provide other results, as elderly people might not be able to read the disposal instructions and the people aged 30-50 perhaps have less time to read the label.

Second, in this study, the disposal instructions were shown on the front of the package, while in practice the instructions are located on the back. It was not possible to show participants both the front and the back of each package, because of bad legibility on the screen. The expectation is that a position on the back decreases the attention and use of the disposal instructions, as it might be less noticeable. Therefore, further research could investigate if instructions on the back will have another impact on the attention and sorting behaviour of consumers. Also, when logos are placed on consistent locations on a package, it helps consumers to find the logo they were looking for (Bialkova & van Trijp, 2010). As in this study, the disposal instructions were not placed on consistent places, it might be of interest to investigate if a consistent location will be beneficial for the use of the disposal instructions.

Third, for the experiment only parts of the disposal instructions of Kennisinstuut Duurzaam Verpakken were used. The original instructions consist of three parts, while in this study only the image and accompanying text were used. The one that said which part of the package belongs to which garbage can was left out, because it would make the instructions less legible on a screen. Moreover, in this study, it was not necessary to use these parts, because only packages were used that in its entirety belong to a garbage type. In practice, the part of the instructions that indicate which part belongs to which garbage, can lead to more disposal instructions on one package. The expectation is that an increase in instructions on the package will lead to more attention, but might also create confusion as consumers not understand which one to use. Therefore, future research could examine what effect more disposal instructions on one package will have on the attention and understanding of consumers.

The question remains to which extent better recycling will be the solution, as recycled plastic nowadays is not used in a high-quality way. But each contribution is helpful, and new technologies are developed to use plastic in a high-quality way (University of Eindhoven, n.d.). Another point of discussion is the uncertainty if a lack of knowledge is the only bottleneck. Perhaps more factors pinch the improvement of the sorting behaviour of consumers, like housing situation or consumers' personal environment.

In conclusion, the use of visual disposal instructions seems to be a promising approach to improve the sorting behaviour of consumers. Consumers, companies and the environment could benefit from

the disposal instructions, as the improvement in sorted waste can lead to a reduction of plastic in the environment and can contribute to the circular economy. And not unimportant, consumers are helped in their choice for the right garbage can.

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Appendix

Appendix A. Preliminary investigation

Survey form of preliminary investigation

Gender: male / female / neutral

Age: .....

Tick the box that indicates the correct garbage can for each package.

	Plastic waste (PMD)	Residual waste
Soda bottle		
Fruit juice pack		
Chips bag		
Candy packaging		
Blister		
Plastic packaging engine oil		
Soup can		
Deodorant spray		
Milk carton		
Tube of toothpaste		
Styrofoam		
Spice mix packaging		
Bag of soup		
Butter package		
Yoghurt pack with leftovers		
Can of coke		
Shopper shopping bag		
Liquid detergent packaging		

A spray can of whipped cream		

Table 1

Results of the preliminary investigation

Products	**Correct garbage can**	**Plastic waste (PMD)**	**Residual waste**
Soda bottle	PMD waste	100%	0%
Fruit juice pack	PMD waste	70%	30%
Candy packaging	PMD waste	90%	10%
Soup can	PMD waste	60%	40%
Milk carton	PMD waste	75%	25%
Tube of toothpaste	PMD waste	45%	55%
Butter package	PMD waste	90%	10%
Can of coke	PMD waste	75%	25%
Liquid detergent packaging	PMD waste	65%	35%
Squeeze bottle mayonnaise	PMD waste	70%	30%
Chips bag	Residual waste	50%	50%
Blister	Residual waste	50%	50%
Plastic packaging engine oil	Residual waste	45%	55%
Deodorant spray	Residual waste	50%	50%
Styrofoam	Residual waste	20%	80%
Spice mix packaging	Residual waste	50%	50%
Bag of soup	Residual waste	75%	25%
Yoghurt pack with leftovers	Residual waste	30%	70%
Shopper shopping bag	Residual waste	40%	60%
A spray can of whipped cream	Residual waste	40%	60%

Appendix B. Questionnaire

Introductie

Fijn dat je mee wilt doen aan dit onderzoek! Deze vragenlijst maakt deel uit van mijn bachelor scriptie waarin ik kijk naar de manier waarop consumenten omgaan met afval.

De vragenlijst kan worden ingevuld door personen vanaf 16 jaar. Er zijn geen goede of foute antwoorden, dus wil je invullen wat als eerste bij je opkomt? De enquête bestaat uit vijf onderdelen en het invullen van de vragenlijst zal ongeveer 5 minuten duren.

Om de antwoorden te kunnen gebruiken moet de enquête helemaal zijn ingevuld. De antwoorden op de vragen zullen anoniem worden verwerkt en zijn niet persoonlijk op jou terug te leiden. Er zal vertrouwelijk met de data worden omgegaan. Door op de pijl te klikken ga je er mee akkoord dat je bovenstaande hebt gelezen en jouw antwoorden worden gebruikt voor dit onderzoek.

Als je nog vragen hebt over de enquête kun je een e-mail sturen naar janne.mertens@wur.nl. Alvast bedankt voor het invullen van deze enquête!

De variablen van de vragen staan schuingedrukt.
De page-breakers zijn aangegeven met streepjes.

Deel 1. Demografische vragen

1. Wat is je geslacht? *(D1geslacht)*
    a. Man
    b. Vrouw
    c. Neutraal

2. Wat is je leeftijd? *(D1leeftijd)*
    a. Open vraag (uitgesloten van vragenlijst indien <16)

3. Wat is je woonsituatie? *(D1woonsituatie)*
    a. Eenpersoonshuishouden
    b. Meerpersoonshuishouden zonder kinderen
    c. Meerpersoonshuishouden met kinderen

4. Wordt in jouw gemeente plastic afval en restafval gescheiden van elkaar ingeleverd of opgehaald? *(D1afvalgemeente)*
    a. Ja
    b. Nee (uitgelsloten van vragenlijst)
    c. Weet ik niet (uitgesloten van vragenlijst)

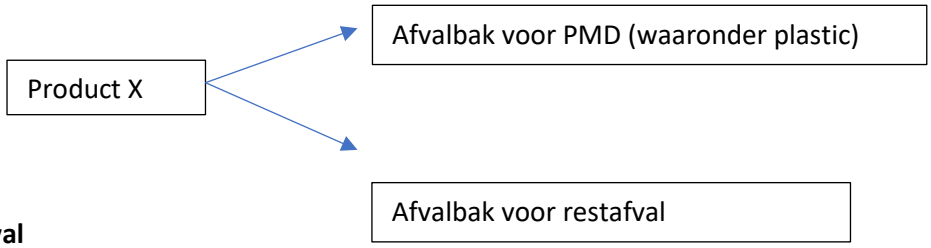
5. In welke gemeente woon je? *(D1gemeente)*
    a. Gemeente Wageningen
    b. Gemeente Peel & Maas
    c. Gemeente Venlo
    d. Gemeente Rotterdam

e. Anders, namelijk …

Deel 2. Afval weggooien

In het volgende deel zie je **twaalf keer** een verpakking. Zou je deze verpakkingen naar de juiste afvalbak willen slepen? Je kan er vanuit gaan dat de verpakkingen **helemaal leeg** zijn.

Sleep de verpakking naar de juiste afvalbak.



Restafval

- Zak soep
- Verpakking kauwgom
- Zakje enchilada kruiden
- Chipszak
- Verpakking motorolie
- Spuitbus deodorant

Plastic afval

- Blikje cola
- Tube tandpasta
- Knijpfles mayonaise
- Drinkpak vruchtensap
- Blik soep
- Verpakking vloeibaar wasmiddel

Deel 3. Gebruik weggooi instructies

De volgende stellingen gaan over het onderdeel **'sleep de producten naar de juiste afvalbak':**

18. (Behaviour/attention) 'Ik heb gebruik gemaakt van het materiaal van de verpakking voor mijn keuzes.' *(D3gebruikmateriaal)*

1 (Zeer oneens) – 7 (helemaal eens)

19. (Behaviour/attention) 'Ik heb gebruik gemaakt van informatie op de verpakking voor mijn keuzes.' *(D3gebruikinformatie)*

1 (Zeer oneens) – 7 (helemaal eens)

20. (Understanding) ‘Ik begreep door de verpakking bij welke afvalstroom de verpakking hoorde’. *(D3begreep)*

1 (Zeer oneens) – 7 (helemaal eens)

21. (Liking) ‘Ik vond het fijn dat verpakking mij hielp bij mijn keuzes voor de afvalstroom’. *(D3hulpfijn)*

1 (Zeer oneens) – 7 (helemaal eens)

22. (Liking) ‘Ik vond de manier waarop de verpakking mij hielp bij mijn keuzes voor de afvalstroom fijn.’ *(D3manierfijn)*

1 (Zeer oneens) – 7 (helemaal eens)

23. (Liking) ‘Ik vond het vervelend dat de verpakking me in een bepaalde richting stuurde.’ *(D3richtingvervelend)*

1 (Zeer oneens) – 7 (helemaal eens)

24. (Liking) ‘Ik vond het vervelend dat ik niet wist waarom de verpakking bij een bepaalde afvalstroom hoorde.’ *(D3wistvervelend)*

1 (Zeer oneens) – 7 (helemaal eens)

---

25. (Attention) 'Bij het onderdeel 'sleep de producten naar de juiste afvalbak' heb ik weggooi instructies gezien.' *(D3zieinstructies)*

1 (Nooit) – 7 (Altijd)

Deel 4. Betekenis icoon

26. ‘Ik ben in het dagelijks leven bekend met dit logo’*(D4kenicoonR)*

1 (Zeer oneens) – 7 (helemaal eens)

27. Wat denk je dat dit icoon betekent? *(D4betekenisicoonR)*
(Open vraag)

28. ‘Ik ben in het dagelijks leven bekend met dit logo’*(D4kenicoonP)*

1 (Zeer oneens) – 7 (helemaal eens)

29. Wat denk je dat dit icoon betekent? *(D4betekenisicoonP)*
(Open vraag)

Deel 5. Kennis en gebruiken

Dan volgen nu nog een aantal stellingen:

30. (Waarde) 'Ik scheid mijn afval in het dagelijks leven' *(D5sorteer)*
    1 (Zeer oneens) – 7 (helemaal eens)

31. (Waarde) 'Ik vind het belangrijk om afval te scheiden' *(D5belangrijk)*
    1 (Zeer oneens) – 7 (helemaal eens)

32. (Kennis) 'Ik weet welke producten in de plastic afvalbak horen' *(D5weetP)*
    1 (Zeer oneens) – 7 (helemaal eens)

33. (Kennis) 'Ik weet welke producten in de restafval bak horen' *(D5weetR)*
    1 (Zeer oneens) – 7 (helemaal eens)

Deel 6. Opmerkingen

34. Heb je nog opmerkingen of dingen die je kwijt wilt? *(D6opmerking)*
(Open vraag)

Deel 7. Beloning

35. Wil je kans maken op één van de drie Tony Chocolonely repen? Laat dan hier je e-mailadres achter: *(D7beloning)*
(Open vraag)

Heel erg bedankt voor het invullen van deze enquête! Als je benieuwd bent naar de uitkomsten van het onderzoek of andere vragen hebt, dan kan je die naar mij mailen via janne.mertens@wur.nl

Appendix C. Tables

Table 1

Example of a package per experimental condition

	Icon	**No icon**
Text		
No text		

Table 2

Table of products used in the sorting task

Products plastic waste		
		
Can of coke	Fruit juice pack	Soup can
		
Squeeze bottle mayonnaise	Liquid detergent packaging	Tube of toothpaste
Products residual waste		
		
Chips bag	Deodorant spray	Spice mix packaging
		
Blister	Plastic packaging engine oi	Bag of soup

Table 3

Adjusted Means and Standard Deviations four the four conditions

	Control condition	Text	Icon	Text and Icon
Correct amount	7.93[a] (.38)	8.37[a] (.38)	8.78[a] (.39)	9.47[a] (.37)
Time needed	71.71[a] (5.16)	89.97[a] (5.16)	69.09[a] (5.29)	81.79[a] (4.98)
Attention	2.09[a] (.37)	3.56[a] (.37)	4.44[a] (.38)	3.76[a] (.36)
Liking	4.41[a] (.25)	4.98[a] (.25)	4.44[a] (.25)	4.91[a] (.24)
Understanding	4.52[a] (.23)	4.98[a] (.23)	5.10[a] (.23)	4.80[a] (.22)
Use instructions	2.54[a] (.34)	3.59[a] (.34)	4.57[a] (.35)	3.95[a] (.33)
Use material	6.24[a] (.25)	5.66[a] (.25)	5.58[a] (.25)	5.37[a] (.24)

a. Covariates appearing in the model are evaluated at the following values: Value = 5.9367, Knowledge = 5.0767.

Table 4

F-value, P-value and the effect sizes for the two-way ANOVA

	Text			Icon			Interaction		
	F	*P*	η_p^2	*F*	*P*	η_p^2	*F*	*P*	η_p^2
Sorting behaviour	1.00	.318	<.01	7.08	.009	.05	<.01	.972	<.01
Time needed	6.55	.012	0.04	.73	.394	.01	.80	.373	<.01
Attention	1.00	.319	<.01	11.89	.001	.08	8.30	.005	.05
Liking	.20	.654	<.01	2.32	.130	.02	3.70	.056	.03
Understanding	.12	.728	<.01	.99	.321	<.01	3.56	.061	.02
Use instructions	.35	.557	<.01	13.09	<.001	.08	6.93	.009	.05
Use material	3.02	.084	.02	3.58	.061	.02	.46	.499	<.01

Table 5

F-value and P-value for the pairwise comparison of the interaction effect

	Text			Icon		
	F	*P*	η_p^2	*F*	*P*	η_p^2
Attention	.148	.701	< .01	1.67	.198	.01
Use	.587	.445	< .01	1.66	.200	.01

Appendix D. Figures

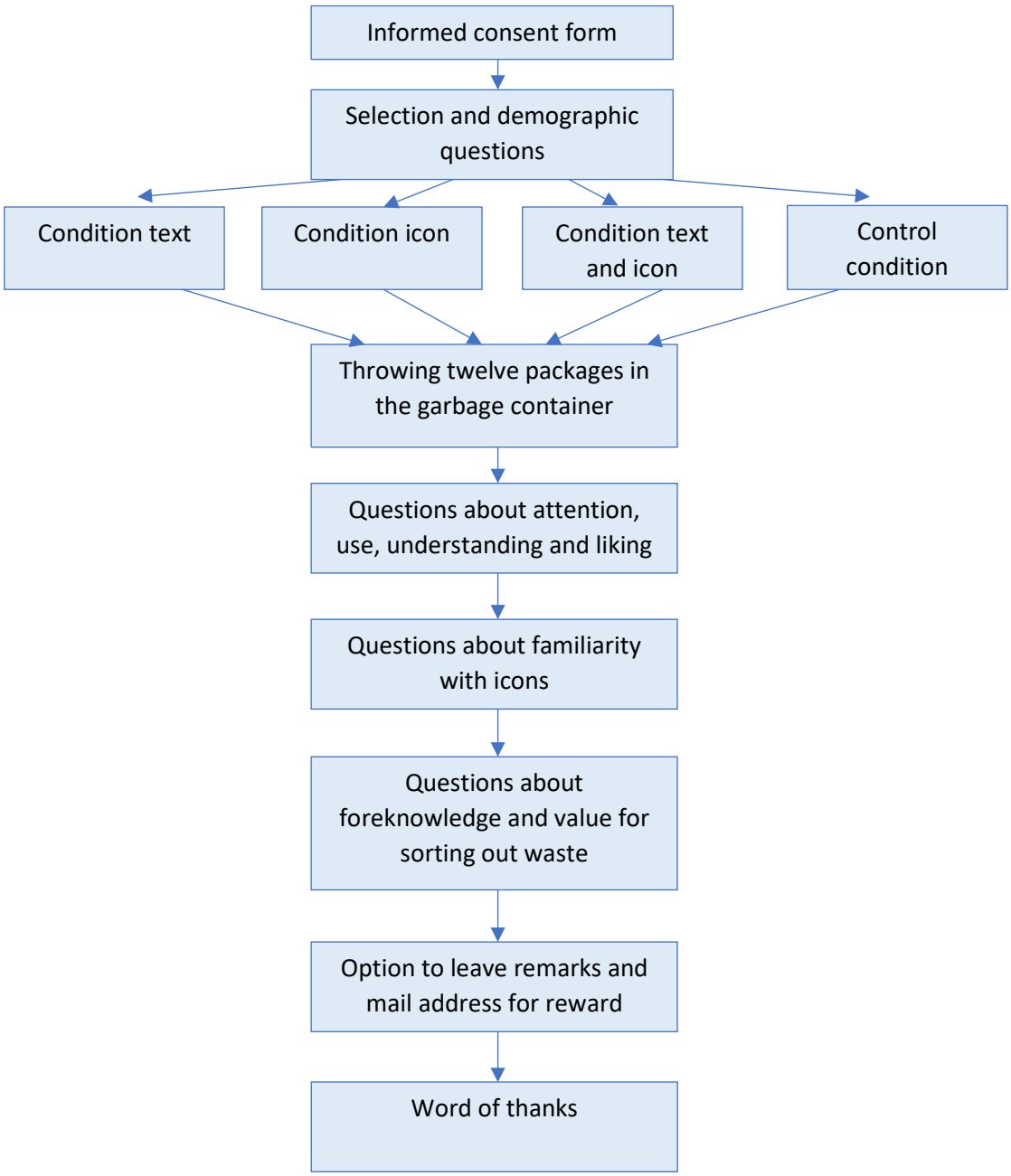


Figure 1. Flow chart questionnaire