

Reducing Food Waste at a Consumer Level: Persuasive Advertising Tailored to Comprehensive Thinking Styles

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ABSTRACT

Climate change is an increasing threat, and food waste at a consumer level plays a crucial part in it. Therefore, this study examines how persuasive advertising can enhance consumers' attitudes towards food waste while also considering individual differences, such as thinking styles. Research on how to make advertisements about this topic most effective is crucial, as climate change is a topic that needs to be tackled as soon as possible. Further, there is little existing research about the role of thinking styles in this context.

To test the effectiveness of different persuasive techniques, a 2x2 factorial design was chosen with gain and loss framing as well as high and low self-referencing. Comprehensive Thinking Styles were used as an interaction variable. The study explored whether loss frames, in combination with thinking styles characterised by a low need for cognition, have a more positive effect than their counterparts. Additionally, it was tested whether or not messages with a high degree of self-referencing combined with thinking styles based on a higher need for cognition lead to more positive effects. Lastly, the interaction between framing and self-referencing was examined.

The results demonstrated a significant interaction effect of high self-referencing and Actively Open-minded Thinking as well as Preference for Effortful Thinking on attitudes towards food waste.

Further, high self-referencing in combination with loss framing also demonstrated a positive effect on attitudes towards food waste. These results offer some implications for theory and practice.

Firstly, thinking styles with a higher need for cognition led to a more positive attitude towards food waste. This indicates that consumers with a high need for cognition do not need to be targeted when the goal is to enhance attitudes towards food waste or potentially any climate change related topics. In contrast, the two thinking styles characterised by a low need for cognition did not demonstrate the expected results. That encourages further research into the individual differences in thinking styles to explore why no effect was detected and which other variables potentially influence interaction effects with thinking styles.

Secondly, the interaction between high self-referencing and loss frames significantly positively affected the participants' attitudes towards food waste. However, a more detailed comparison of means revealed that the general attitude towards food waste was relatively high. This implies that this participant group's attitudes towards food waste were already relatively high, indicating that participants with such demographics do not need to be targeted primarily.

KEYWORDS: *Food Waste, Framing, Self-Referencing, Thinking Styles, Persuasive Advertising*

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1. Introduction

One of today's biggest and most pressing concerns of today is climate change and its negative impact. Many factors drive climate change, such as coal mining or deforestation, but one of the most critical ones is food waste (Scherhauser et al., 2018). According to the World Wildlife Fund (n.d.), about one-third of the produced food worldwide is being wasted. That includes food which is lost during transportation, gets spoiled or is thrown away in grocery shops, restaurants or home kitchens. A United Nations Environment Programme (UNEP, 2021) report suggests that about 931 million tons of food were wasted in 2019 alone. The largest share of 61% can be attributed to private households, while only 26% was due to waste in food services. Reducing food waste on a global level is critical as it has far-reaching consequences, including the waste of valuable resources, environmental degradation, negative impact on food security, and increasing food prices (United Nations, n.d.). The negative impact on the environment is mainly due to the water, land, and energy resources used in food production since they all have their own environmental footprint and end up being wasted as well (Scherhauser et al., 2018). The methane that arises while the waste decomposes only adds to that (WWF, n.d.). Therefore, reducing food waste would significantly contribute to fighting climate change (Scherhauser et al., 2018).

However, there are not only negative environmental but also social consequences. That is because wasted food has the same harmful impact on the environment as if it was consumed but without fulfilling any purpose (Aschemann-Witzel et al., 2016). Given that the resources that go to waste could have been used to address the needs of people who are suffering from malnutrition, it is also a social issue since a significant proportion of the human population is affected by starvation (Aschemann-Witzel et al., 2016). According to Kummu et al. (2012), with the amount of food and thus calories wasted, around 1.9 billion additional people could be fed.

It is important to note the distinction between food waste and food loss when discussing this topic. Food waste is defined as edible items that are not consumed, such as wasted processed foods in retail or the consumer's home (Aschemann-Witzel et al., 2017). In contrast, food loss occurs at an earlier stage in the supply chain during harvest, transportation or storing (Aschemann-Witzel et al., 2017). Considering these differences, this study will only focus on food waste. This is because food waste at the consumption level is where, according to Kummu et al. (2012), the largest potential for reduction lies. This substantial potential can be based on the fact that it is easier to target food waste reduction at household levels than in earlier supply chain stages. Harvesting and transportation systems are frequently regulated by governmental rules, which makes targeting the occurrence of food loss at this level more difficult than targeting food waste at the consumer level.

According to Knezevic et al. (2019), the waste at the consumption level can be altered by addressing consumers' attitudes and behaviours. One reason for that might be that especially younger people are aware of the issues caused by food waste and just need a nudge to act differently by being reminded of the societal, environmental and financial consequences of food waste (Knezevic et al.,

2019). Further, attitudes and behaviours are aspects that social advertisers can easily target if they are aware of the characteristics of different consumer groups. This makes it an effective means for initiatives trying to decrease food waste.

One way of supporting sustainability and decreasing food waste is persuasive advertising campaigns that aim to prompt individuals to reduce their food waste. To make such advertisements most effective, advertisers can use persuasive techniques such as framing and self-referencing, which have proven to positively affect people's attitudes and behavioural intentions towards food waste reduction (Burnkrant & Unnava, 1989; Chang & Lee, 2009; Debevec & Romeo, 1992; Tversky & Kahneman, 1981; Zhang & Buda, 1999).

However, it is crucial to tailor the message of the persuasive content to the intended consumer segments as much as possible by considering their unique characteristics. For many years, this focused on demographic variables such as age or gender since those insights are easily obtainable (Smith, 1996). To go beyond that, other factors with an influence on the effects of framing and self-referencing have to be considered. One of those factors are people's thinking styles as they determine how individuals process information (Stanovich & West, 1998; Zhang & Sternberg, 2005). That is why this study focuses on targeting the reduction of food waste at a consumer level with persuasive advertising that considers individual differences such as thinking styles. In regards to these aspects, this paper strives to answer the research question: *To what extent do comprehensive thinking styles and advertisements with persuasive techniques addressing the reduction of food waste interact with each other and influence people's attitudes about food waste?*

This particular research is of great societal and scientific relevance. It is relevant for society because food waste is one of the global drivers of climate change, and addressing this issue instantly is crucial. Additionally, food waste not only greatly contributes to climate change but also has social consequences, such as enhancing malnutrition worldwide (Aschemann-Witzel et al., 2016). Therefore, determining how to make advertisements addressing this issue most effective is highly important.

Further, multiple aspects highlight the scientific relevance of this topic. To enhance the effectiveness of advertisements, it is crucial to analyse which thinking styles can improve persuasive communication. Furthermore, there are contradicting research findings regarding the effectiveness and influence of persuasive techniques, such as framing, which need to be addressed. Compared to the extensive research about the impact of other individual differences, like personality traits, on persuasive appeals (Hirsh et al., 2012), the influence of comprehensive thinking styles has received relatively little attention. Therefore, the research on this topic holds scientific significance and needs further exploration.

To address this question, the first part of the paper will introduce a theoretical framework discussing all the relevant theories, such as comprehensive thinking styles, framing, self-referencing and attitudes towards food waste reduction. Then follows a detailed explanation of the conducted experiment and survey before the results are presented. The discussion afterwards will serve as an

interpretation of the gained results, linking them back to the demonstrated theories. In the last step, the limitations and further research opportunities will be presented before the conclusion.

2. Theoretical framework

2.1. Comprehensive thinking styles

2.1.1 Thinking style frameworks

Many different characteristics set individual consumers apart from each other and need to be considered when wanting to make persuasive communication more personal. One of them is people's thinking styles. In general, thinking styles are an individual's favoured method of handling tasks and processing information (Zhang & Sternberg, 2005). Thus, thinking styles influence people's judgement and decision-making (Stanovich & West, 1998). The specific thinking style a person tends to have depends on their individual differences and characteristics (Zhang & Sternberg, 2005). Because thinking styles are a complex matter, some of the most recognised studies that established frameworks for thinking styles are presented here.

One of the earliest efforts to put individual differences and thinking styles into a concrete concept is by Cacioppo and Petty (1982). They established that individuals vary in their need for cognition. The need for cognition is the extent to which people are willing to participate in cognitive actions that can be described as effortful. Their research demonstrated that individual differences in thinking and information processing can be related to people's need for cognition. According to them, people with a higher need for cognition are more likely to enjoy complex tasks, while those with a lower need for cognition favour simple rules and instructions.

A more precise model is Curry's (1983) three-layered onion-like model. The central layer of her model is titled Cognitive Personality Style and includes the foundational aspects of one's personality. The middle layer Information Processing Style encompasses someone's cognitive approach to processing information. The outmost layer is called Instructional Preferences, which she defines as an individual's preference towards a specific learning environment or context. According to Curry (1983), these three layers represent the fundamental elements that control thinking and learning. In this model, the influence of the layers decreases from the centre to the outside.

Another critical approach is the dual model of Riding and Cheema (1991). They suggest the existence of two fundamental dimensions of cognitive styles. The wholistic-analytic style refers to someone's inclination to process information in either the whole or parts. The other dimension is titled the verbal imagery style. It pertains to an individual's tendency to represent information verbally or through mental imagery. Riding and Cheema (1991) define both dimensions as independent of each other, meaning that a person's position on one of the two dimensions does not influence their position on the other. Thus, it is possible to be a wholistic verbaliser or a verbaliser and more analytic.

These presented conceptualisations are widely recognised and highly esteemed frameworks for understanding thinking styles. Nonetheless, there are many different ways of differentiating

thinking styles and even more attempts to put them in theoretical frameworks (Newton et al., 2023). A widespread approach, however, is a single-dimension differentiation between analytical and intuitive thinking, where people either lean towards one or the other (Newton et al., 2023). However, Newton et al. (2023) challenged the notion that the primary distinction among individuals lies in their inclination towards either intuitive or analytic thinking. They suggest that there are indeed diverse types of thinking styles going beyond only those two characteristics.

Therefore, one of the most recent conceptualisations is the one by Newton et al. (2023), who defined four different thinking styles. While their framework is similar to the previous models in trying to provide a concrete structure for people's information processing, it differs in a crucial point. In contrast to the concepts of Curry (1983) and Riding and Cheema (1991), these newly defined thinking styles are based on people's need for cognition, as defined by Cacioppo and Petty (1982). Moreover, this new model is more detailed as it defines four distinct thinking styles that are all based on the same foundation, unlike the two entirely different foundations of Riding and Cheema's (1991) framework.

Newton et al. (2023) name their newly developed thinking styles *Preference for Effortful Thinking*, *Preference for Intuitive Thinking*, *Actively Open-minded Thinking* and *Close-Minded Thinking*. They discovered that the four have a different share in predicting people's behaviours and attitudes towards different topics.

The Preference for Effortful Thinking is defined as a person's inclination to participate in cognitive tasks that demand significant effort and derive satisfaction from doing so. Thus, people with a Preference for Effortful Thinking can be characterised as analytical and with a high need for cognition as they enjoy putting cognitive effort into processing information. Preference for Effortful Thinking was further discovered to correlate positively with both self-reported happiness and the ability to empathise with others. Newton et al. (2023) based their Preference for Effortful Thinking mainly on the 'Need for Cognition Scale' by Cacioppo and Petty (1982).

A Preference for Intuitive Thinking can be described as contrary to that. Individuals with a Preference for Intuitive Thinking are more prone to rely on their intuitive judgments and gut feelings when making decisions (Newton et al., 2023). Further, a Preference for Intuitive Thinking has been found to correlate positively with paranormal and conspiratorial beliefs and is related to a lower need for cognition (Newton et al., 2023). This scale was mainly developed based on the 'Faith in Intuition' scale by Epstein et al. (1996).

Newton et al. (2023) define people with Actively Open-minded Thinking as individuals inclined to scrutinise their pre-existing beliefs and instincts thoroughly. This can be interpreted as the reason why people with an Actively Open-minded Thinking style were found to be more likely to recognise misinformation in combination with their ability to critically evaluate news sources (Newton et al., 2023). Therefore, this thinking style is also characterised by a higher need for cognition. However, Actively Open-Minded Thinking differentiates from the Preference for Effortful Thinking

as one style has thinking with an open mind at its core and the other the mere enjoyment some derive from cognitive efforts. This is in accordance with one of the earliest developed Actively Open-minded Thinking scales by Stanovich and West (1998), who put the inclination to consider evidence that contradicts one's current beliefs and the ability to embrace ambiguity combined with the willingness to delay final conclusions at the forefront.

The final thinking style of Close-Minded Thinking is defined by the degree to which individuals perceive truth in absolute terms, so as either black or white and something that is not changeable once it is set. Thus, Newton et al. (2023) detected a negative correlation between Close-Minded Thinking and the willingness to change one's beliefs and found people with this thinking style to be more receptive to conspiracy theories. Further, Close-Minded Thinking can be characterised by a low need for cognition. This style was not based on one other scale but is instead derived from a mix of scales.

Newton et al. (2023) highlight that these four newly developed scales should not be regarded as scales operating on a linear spectrum. Therefore, Actively Open-minded Thinking cannot be solely characterised as the opposite of Close-Minded Thinking and likewise for the other two styles. Instead, the scales were designed to present distinct and specific types of thinking styles. While there are multiple approaches to measuring thinking styles, the one from Newton et al. (2023) will be at the centre of this study for the following reasons.

The framework by Cacioppo and Petty (1982) provides the foundation for other concepts but does not distinguish between any more individual characteristics than the need for cognition. Curry's (1983) onion model presents factors influencing how people process information but does not illustrate any specific thinking styles. The dual model of Riding and Cheema (1991) does demonstrate two concrete dimensions of thinking styles. However, those are based on different foundations, making it difficult to compare them against each other. Therefore, Newton et al.'s (2023) approach was chosen because it offers four specific thinking styles that are all distinctly characterised by different attributes. Yet they can all be traced back to the same centre point, which is someone's need for cognition, making them comparable. Moreover, their scales are a continuation and combination of already established scales that were extensively tested and combined to provide a complete and extensive thinking style framework.

2.1.2. Thinking style characteristics

Regardless of the specific framework defining thinking styles, they all have distinct characteristics. According to Zhang and Sternberg (2005), people's thinking styles are not isolated but influenced by many cognitive and sociological factors. The cognitive aspect is present as one needs to engage in some form of mental activity to process information. The sociological factor refers to the influence of societal norms and preferences on the adoption of a particular thinking style.

There are, however, a few controversies around thinking styles. Zhang and Sternberg (2005) highlight the controversial debate on whether such styles are permanent traits that cannot be changed

or relatively flexible states that can be modified. According to their summary of previous research, thinking styles primarily represent malleable states as they can change according to people's life experiences. To support this, they accentuate a survey by Zhang (1999) conducted among students in Hong Kong. The students were asked to answer statements concerning their thinking styles and demographic information. By analysing the data, Zhang (1999) demonstrated that the participants' thinking styles were significantly different depending on someone's age and work experience. This result confirms Zhang and Sternberg's (2005) assumptions that while individuals may have preferences for particular thinking styles, they are not fixed traits. Instead, they can be altered as a result of life experiences. Nevertheless, thinking styles are generally stable as they do not constantly change (Zhang & Sternberg, 2005).

Fan et al. (2021) confirmed this changeability of thinking styles through a longitudinal study with Chinese university students. The students had to complete a questionnaire addressing their thinking style characteristics and demographic information. After one year, the same survey was repeated. The researchers analysed the gathered data and validated that thinking styles are mainly consistent and stable but not entirely fixed.

This strengthens the possibility of using thinking styles as a factor that can be targeted through advertisements. Since they are relatively stable, aiming certain advertisement aspects at specific thinking styles is possible. However, the fact that people's thinking styles are subject to change is crucial to consider when designing advertisements, as they must be tailored to align with people's current thinking styles. To achieve this, it is imperative to conduct ongoing research to identify the predominant thinking styles of the target audience.

Another crucial issue regarding thinking styles is whether they are strongly related to or even part of people's personality traits. A distinction from personality traits would further validate the importance of thinking styles as a unique construct (Fan et al., 2018). Scholars' opinions on this matter differ, but Fan et al. (2018) demonstrated that thinking styles are separate from personality traits rather than being a subset of them. They established this by analysing the correlations between participants' thinking styles and personality traits from three distinct angles. First, the extent to which personality styles account for variations in thinking styles was measured. They then tested the ability of thinking styles to explain an outcome variable, such as career choices, beyond what can be accounted for by personality alone. Lastly, Fan et al. (2018) conducted a direct comparison between the alterations in participants' personalities and their thinking styles over the course of one year. This led to the result that thinking styles are not equal to or interchangeable with personality traits. Thus in research, thinking styles have to be considered as their own conclusive construct.

2.2. Persuasive techniques

Persuasive techniques, such as framing and self-referencing, are frequently used to influence and shape consumers' attitudes (Chang & Lee, 2011; Zhang & Buda, 1999). Therefore, these two techniques are utilised for this study and will be discussed each.

2.2.1. Framing

Tversky and Kahneman (1981) originally introduced the concept of framing in the context of dealing with so-called decision problem scenarios where individuals must choose from various options. These decision problem scenarios are defined as decision frames since the same problem can be presented in different ways. Small changes in how a decision problem is presented can already significantly influence a person's choice.

The base of this is their so-called 'Asian disease' experiment conducted with university students who were asked to imagine the outbreak of a deadly epidemic killing 600 people. They then had to choose between various alternatives for preventing the disease. In a first-choice scenario, option one would mean that 200 lives would definitely be saved, and option two had a one-third probability of saving all 600 lives. In this scenario, 72% of participants chose to definitely save 200 lives, and only 28% opted for the other choice. Based on these choices, Tversky and Kahneman (1981) demonstrated that people tend to be cautious and avoid risks when one outcome is an apparent gain, such as the 200 lives that could be definitely saved.

In the second choice scenario, option one would mean the inevitable death of 400 people. Option two would entail a one-third chance of saving all 600 people. In this second scenario, 22% chose the sure death of 400 people, and 78% chose the second option. With this second scenario, the researchers demonstrated that people are more likely to choose the option involving a risk when there is an obvious potential to lose something in all portrayed message frames. This is likely because, in this case, they want to avoid the sure loss and hope for a good outcome with the other option.

However, Tversky and Kahneman (1981) highlight that option one is essentially identical in both scenarios. Both guarantee an outcome of 200 saved lives. The only distinction is in the framing of the presented options, which influences the participants' choices. While scenario one describes the amount of lives saved, scenario two focuses on the number of lives lost. Nevertheless, both scenarios lead to 200 people living and 400 people dying. Thus, framing comes into play as the specific way a particular problem is presented influences how the decision-maker views the choices and outcomes (Tversky & Kahneman, 1981).

To summarize, Chang and Lee (2009) define framing as presenting two or more equivalent outcomes in different ways. While one emphasizes the positive consequences, the other focuses on the negative outcomes. An illustrative example of framing, based on the original Asian disease experiment, is how the risk of contracting a disease is framed (Kühberger, 1998). The chances of contracting it can be described as a 10% risk of getting the disease as a negative frame or a 90% chance of remaining healthy as a positive frame (Kühberger, 1998). Frames like this, which include some sort of risk notion, are extremely common (Kühberger, 1998).

In an attempt to put this into a concrete framework with a specific name, the concept of goal framing was implemented (Levin et al., 1998). Goal framing can be divided into gain and loss framing (Levin et al., 1998). If a message is framed using the goal framing method, it either highlights the

positive consequences of performing an action (goal frame) or the negative consequences of not performing that action (loss frame). However, both messages endorse the same end result (Levin et al., 1998). Thus, goal framing is equivalent to the earlier mentioned framing examples by Tversky and Kahneman (1981) and Kühberger (1998) and serves as a more concrete framework.

In their analysis of previous studies, Levin et al. (1998) suggested that loss frames are generally more persuasive than gain frames. This can be related to the fact that preventing a negative outcome is usually more desirable than gaining something good. This phenomenon is known as *loss aversion* (Levin et al., 1998).

Tversky and Kahneman (1981) came to a similar conclusion, pointing out that people's reaction to potential losses is far greater than to potential wins. Losing a certain amount of money, for example, arouses more negative feelings than gaining the same amount would cause positive feelings. Thus, loss frames are expected to be more effective in influencing people than gain frames (Levin et al., 1998; Tversky & Kahneman, 1981).

More recent studies, such as the one by Change and Lee (2009), support this assumption. They researched the effectiveness of message frames within social advertisements encouraging donations to fight child poverty. Their research confirmed greater effectiveness for negatively framed messages than positively framed ones.

2.2.2. Framing in advertising and interactions with individual differences

Due to its effectiveness, the incorporation of framing effects into advertisements has a long history. However, advertisers have to identify which consumer segments are most likely to react positively to their message frames. That is because framing effects can interact with various other aspects (Zhang & Buda, 1999). One factor that influences framing efforts are consumers' cognitive abilities and thinking styles, which were examined in multiple studies.

Smith (1996) tested the influence of gain and loss frames in product advertisements on the participants' attitudes towards video cameras. He demonstrated a main effect of framing, showing that the messages with a gain frame lead to a more positive attitude towards the advertisements. Thus, they were more effective than the ones with a loss frame. Further, he identified an interaction effect between framing and education levels. Participants with a lower education level were affected more by loss frames, while gain frames had a bigger influence on those with higher education levels. He explained this with the tendency of individuals with lower education to adopt a less analytical cognitive approach and to make relatively simple judgments. Therefore, this is also an indication of the participants' thinking styles. Because of this interaction effect, Smith (1996) concluded that the influence of framing effects on consumers' purchase decision-making hinges on people's cognitive abilities. Thus cognitive abilities and, thereby, thinking styles interact with framing efforts.

In a similar study, Zhang and Buda (1999) explored the influence of individual variations in the propensity to engage in cognitively demanding thinking styles on message framing. They confirmed that advertisements with positive frames led to considerably more favourable reactions than

those with negative frames. In addition, they demonstrated that the participants' need for cognition and, thereby, also their thinking styles played a role in shaping the reactions to advertisements with a message frame. More precisely, the message frames were more effective among individuals with a lower need for cognition. Thus, they had less of an effect on the participants with a high need for cognition. On top of that, participants with a low need for cognition were found to be more responsive to messages with a negative frame rather than positively framed ones.

Zhang and Buda (1999) explain this with the fact that consumers with a low need for cognition tend to depend on simple peripheral cues, such as the optimistic or pessimistic tone of the communication, to form an attitude towards an object. Compared to that, people with a higher need for cognition are more prone to analyse advertisements extensively. Hence, negatively framed messages are more likely to be effective for consumers with a low need for cognition.

When applying these insights to Newton et al.'s (2023) four comprehensive thinking styles, it can be assumed that thinking styles such as Preference for Intuitive Thinking and Close-Minded Thinking, which usually require a lower need for cognition, are more effective in combination with loss than with gain frames. This assumption will be incorporated into the hypotheses for this study.

What has to be noted, however, are the different results regarding the effectiveness of loss and gain frames. According to scholars such as Levin et al. (1998), Tversky and Kahneman (1981) and Change and Lee (2009), loss frames are expected to be more effective. Nonetheless, studies by Smith (1996) and Zhang and Buda (1999) demonstrated higher effectiveness for gain frames in influencing people's attitudes and reactions. These results contradict each other and highlight the need for further research into the effectiveness of framing efforts. A particular focus should be laid on factors that interact with framing efforts, such as people's thinking styles. This is because thinking styles and people's need for cognition influence the impact of gain and loss frames (Zhang & Buda, 1999). Thus, research should focus on analysing framing effects and their interaction with thinking styles with different characteristics.

2.2.3. Self-referencing

Another persuasive approach that emerged from psychology research is self-referencing. Self-referencing focuses on the degree to which messages address the intended audience directly (Burnkrant & Unnava, 1995).

Burnkrant and Unnava (1989) were some of the first researchers to analyse this technique. They conducted an experiment in which they manipulated the self-referencing degree within razor advertisements. The high self-referencing condition included a direct appeal to the participants with the word 'you' and a prompt to recall personal experiences with the product. In contrast, the low self-referencing condition used the third person and did not include a request to remember past experiences. After randomly exposing the participants to either of the conditions, the researchers demonstrated that the messages with high self-referencing were generally more effective in

influencing the participants. They further identified that a high degree of self-referencing leads to improved recall of the seen advertisements.

The researchers explain these effects of self-referencing with the assumption that directly addressing individuals in a message or even prompting them to recall their past experiences stimulates a self-structure. This self-structure enables access to relevant experiences stored in someone's memory and thus aids in processing message content and arguments. Therefore, a high degree of self-referencing leads to the activation of a self-structure which in return increases people's capabilities to process message arguments effectively. Contrary to that, a lower degree of self-referencing does not lead to such a self-structure activation and is thus less effective. Additionally, Burnkrant and Unnava (1989) suggested that individuals exposed to high self-referencing messages must devote more cognitive capacities to processing the messages due to the activation of said self-structure.

Burnkrant and Unnava conducted a similar experiment in 1995 that featured advertisements with self-referencing manipulations identical to the previous experiment. The high self-referencing condition again included the personal pronoun 'you', while the low self-referencing condition was written in the third person. By analysing the collected data, it became evident that the higher self-referencing condition resulted in an enhanced attitude towards the portrayed product and, thus, increased persuasion. Therefore, self-referencing was established as a suitable persuasive technique for influencing attitudes.

Debevec and Romeo (1992) already confirmed the effectiveness of high self-referencing. Similar to the other studies, they conducted an experiment with soft drink advertisements that varied in their degree of self-referencing. After the random exposure to one of the advertisements, the participants had to complete a survey examining their attitudes and behavioural intentions. By analysing the data, the researchers established that when individuals self-reference an advertisement to a greater extent, their attitudes and behavioural intentions are more favourable.

Since self-referencing has become a common practice in advertising, scholars seem to agree that if advertising information is relatable to consumers, it can increase their information processing and improve an advertisement's effectiveness (Chang & Lee, 2011). Chang and Lee (2011) demonstrated the effectiveness of high self-referencing messages by examining their influence on charity appeal advertisements. They experimented with posters that included messages with either a high or low degree of self-referencing. Out of the almost 200 participants, the ones exposed to the high self-referencing condition depicted a stronger intention to perform the advertised behaviour.

Based on the presented studies, self-referencing can be considered an effective persuasive technique that advertisers should include in their work. Despite, or even because of, the effectiveness of self-referencing as a persuasive technique, it is crucial to understand which variables could influence self-referencing effects. Only then can their influence be maximised. One factor that assumedly interacts with self-referencing is thinking styles. It can be expected that the way people

process information influences the impact of self-referencing messages. However, there is little actual research on the interaction between thinking styles and self-referencing appeals.

What can be taken as a first baseline is the above-mentioned suggestion by Burnkrant and Unnava (1989). According to them, a high degree of self-referencing increases people's capabilities to process message arguments effectively and forces them to devote more cognitive capacities to the message processing. Due to the idea that more cognitive capacities are needed to process high self-referencing messages, it can be assumed that people with a higher need for cognition are better at doing so. Thus high self-referencing appeals should be more effective when interacting with thinking styles based on a high need for cognition. In terms of the already presented literature, such thinking styles are Newton et al.'s (2023) Preference for Effortful Thinking and Actively Open-minded Thinking. These assumptions will be included in the hypotheses later on.

However, Burnkrant and Unnava (1995) demonstrated that higher self-referencing levels only led to greater persuasion when the participants did not have to spend additional cognitive resources on processing other elements of the advertisements. They established this by adding pictures to the self-referencing messages that were either relevant or irrelevant to the participants. Only the inclusion of a picture irrelevant to the participants' enhanced the self-referencing effect and, thus, their attitudes. According to the researchers, this is because being exposed to a picture that is irrelevant to oneself does not additionally increase the elaboration of the entire advertisement even more than it already has.

In this context, elaboration refers to the cognitive efforts that people invest in evaluating the content. In other words, the participants do not have to use additional cognitive resources to process the advertisements when the message includes a picture that is irrelevant to them. Burnkrant and Unnava (1995) highlight that when additionally increasing the elaboration of arguments through exposure to a relevant picture or any elaboration-enhancing variable, no higher persuasion effect could be observed. Thus, high self-referencing effects themselves are effective as they increase people's elaboration and lead to a more positive attitude. However, if this enhanced elaboration effect of the self-referencing condition is increased even further by adding another elaboration-enhancing variable, the positive effect gets reversed (Burnkrant & Unnava, 1995).

2.3. Food waste

2.3.1. Attitudes towards food waste

Because attitude towards food waste is a broad term, this section explores some of the underlying concepts that compile people's attitudes towards food waste. For this, previous studies are explored.

In their research, Stefan et al. (2013) aimed to examine consumer behaviour related to food waste and the potential factors that contribute to it. Therefore, they collected data on people's attitudes towards food waste. More precisely, the concrete variables explored were the participants' lack of concern, their moral attitudes towards food waste and their intentions not to waste food, amongst

others. They examined the lack of concern to get a broad understanding of the overall attitude towards food waste. Stefan et al. (2013) argued that due to the common ideal of not wasting food, directly assessing individuals' perceptions of whether wasting food is acceptable or not provides a broad estimation of their general attitude towards the topic. The other factor of moral attitudes was aimed at exploring the underlying moral influences that impact people's attitudes towards food waste. Regarding this, they focused on the participants' guilt about throwing away food. Lastly, Stefan et al. (2013) collected the intentions not to waste food. They did this to gain insights about the intention not to throw away food in the present week, the next week and in general. The researchers reported that the evaluation of the mentioned variables was successful and helped them gain the intended knowledge.

Stancu et al. (2016) conducted another study that collected data on people's attitudes towards food waste. They aimed to identify successful measures that influence people's food waste behaviours. To achieve this, they measured various concepts, such as moral norms and the intention not to waste food. The measurements of moral norms were similar to the moral attitudes by Stefan et al. (2013), as they also addressed the participants' guilt about wasting food. Further, Stancu et al. (2016) investigated the intention not to waste food as well in order to get a deeper understanding of people's intention to avoid food waste in the near future. The analysis of the gathered data allowed the researchers to understand the participants' attitudes towards food waste sufficiently.

The last study on this topic presented here is the one by Mondéjar-Jiménez et al. (2016). They created a survey to analyse behaviours related to food waste among the youth in Spain and Italy. With this, they wanted to gain insights into the intricacies of food waste within a Mediterranean diet. Among the variables the survey consisted of were the participants' intentions, moral attitudes and concern about food waste. With the variable intention, the researchers measured the intentions to reduce food waste in the near future and the motivation to look up information about the general impact of food waste. The measurement of moral attitudes differed from the ones used in the previous two studies. Mondéjar-Jiménez et al. (2016) aimed to gather insights into potential incentives that could encourage people to decrease their food waste. Lastly, the researchers collected data about people's concerns about food waste to understand the severity of their concerns better. While this addresses the same area of interest as the lack of concern variable of Stefan et al. (2013), it measures exactly the opposite. While one measures how concerned the questioned individuals are, the other determines how little the concern is. However, by reversing one of the two concepts, they would end up measuring almost identical features.

Based on the three presented studies, three main categories emerge that can be combined into an overall attitude towards food waste. Those three categories are 'moral attitudes towards food waste', 'lack of concern' and 'intention not to waste food', which will be the main focus of this study. Together they will present the participants' attitudes towards food waste.

2.3.2. Food waste and its prevention

A common approach to reducing food waste or addressing other climate change-related topics is the use of persuasive techniques (Cozzio et al., 2021). Such persuasive techniques include the earlier described framing and self-referencing. Therefore, this section describes previous studies concerning food waste that implemented those concepts.

Zhang et al. (2020) examined the influence of self-referencing appeals on attitudes regarding food waste reduction. For this, they conducted an experiment with advertisements which included different self-referencing degrees. Their goal was to analyse the participants' intentions to comply with food waste reduction measures suggested by a company. They found that participants who were exposed to advertisements which included self-referencing had a more positive attitude towards the intention to reduce food waste than people who saw a message without the self-referencing effort.

However, according to Cheng et al. (2011), only a few studies have concentrated on utilizing self-referencing to promote changes in environmental behaviour, such as food waste. That gives room for more extensive research on the topic, especially concerning potential interaction effects with other variables.

Next to self-referencing, framing is another persuasive technique used to address issues such as food waste and change people's attitudes towards them. Bilandzic et al. (2017) highlight that for framing regarding any topic that is related to climate change, loss frames are the most effective ones. Since the most desirable result of fighting climate change is sustaining the present status quo, this is the only positive outcome gain frames can highlight (Bilandzic et al., 2017). This interpretation of gain framing is very distinct, as preserving the current state does not offer any improvement and is therefore considered a weak argument (Bilandzic et al., 2017). That is why Bilandzic et al. (2017) argue that gain frames provide less effective means than loss frames regarding communication about climate change factors such as food waste.

In general, when designing advertisements that aim to reduce food waste, such as in this study, it is crucial to keep the variety of potential consequences attached to wasting food in mind. To influence consumers, it is imperative to know which consequences matter most to them. Those negative consequences include social, environmental and economic ones (Stancu et al., 2016). Stancu et al. (2016) identified economic consequences to have the strongest correlation with food waste behaviour. This is because people seem to be driven mainly by financial self-interest instead of societal or environmental concerns.

Lazell (2016) and his study on food waste behaviour among students and staff of an English university support these insights. His research consisted of a mixed methods approach, including a survey to identify potential incentives to reduce waste, ethnographic observations to determine actual food waste behaviours and semi-structured interviews about catering practices. In line with previous research, Lazell's (2016) main discovery was that the participants were primarily motivated by

financial factors to decrease their food waste. The desire to personally save money by wasting less food was more important to them than considering the matter as a measure to battle climate change.

Knezevic et al. (2019) presented similar insights. They conducted research among Croatian university students by administering a survey. The survey examined their awareness of food waste and concerns about the health, economic and environmental consequences of wasting food. They found that participants in that age group showed greater concern for economic losses than environmental or health issues.

The findings of these studies suggest that efforts to reduce food waste should incorporate a message that emphasizes the potential economic consequences of food waste to increase effectiveness, especially when targeting a younger demographic group.

2.4. Reduction of food waste through persuasive techniques and thinking styles

Based on the presented literature, one way of encouraging the reduction of food waste is through advertisements, including persuasive techniques such as framing and self-referencing, while considering different thinking styles that influence how these advertisements are processed. All those presented variables have the potential to influence people's attitudes and interact with each other. Therefore, this chapter will explore potential interactions between the above-presented factors.

One of the biggest impacts of thinking styles can be observed when researching their interaction with framing approaches. Smith and Levin (1996) conducted an experiment examining this interaction. They randomly presented the participants with a scenario framed in one of two ways. The scenario used was a so-called 'mortality frame' where the participants had to choose between cancer treatments. One treatment option was described with a 22% success rate (survival frame), and the other with a 78% mortality rate (mortality frame). However, both treatments had identical outcomes. In an additional step, the researchers evaluated the participants' need for cognition. As expected, the participants with a lower need for cognition were more receptive to the framing efforts. Of those participants, around 70% chose the mortality frame option, and the rest opted for the survival frame.

This big difference in answer choices demonstrates the influence that message frames have on people with a low need for cognition. If the message frames had no influence, the answer percentages for both options would be more similar since they both presented identical outcomes. That becomes evident when analysing the responses from the participants with a high need for cognition. The framing did not affect them as around 50% chose the survival frame and the other 50% the mortality frame, displaying a more equal distribution. Therefore, it can be concluded that people with a low need for cognition are generally more receptive to framing efforts than those with a high need for cognition. Smith and Levin (1996) explain this with the idea that the extent of elaboration and conscious thinking mitigates or even eliminates the biasing influences of framing.

Support for this assumption by Smith and Levin (1996) can be found in an earlier study by Cacioppo et al. (1983). They argue that people with a high need for cognition are prone to evaluate messages more meticulously and thoroughly than those with a low need for cognition. Because of their

high need for cognition, they put more cognitive effort into thoroughly evaluating a message and its content, making them less susceptible to persuasive influences (Cacioppo et al., 1983).

McElroy and Seta (2003) reached similar results in their study, which aimed to identify for which people framing approaches would be most suitable. For this, they conducted an experiment and exposed participants with either an analytic or a more holistic thinking style to gain or loss frames of an identical scenario. They confirmed that individuals with a mainly holistic thinking style were more susceptible to framing efforts in decision-making. In contrast, those with a more analytical thinking style were less affected by the message frames. It can be assumed that thinking styles characterised by analytical thinking can be closely associated with a high need for cognition, as the latter can be considered a prerequisite for engaging in analytical thinking.

Both the study by Smith and Levin (1996) and the one by McElroy and Seta (2003) test the influence of thinking styles and, thus, the way people process information on framing approaches. They both come to the identical conclusion that individuals with a lower need for cognition are more receptive to framing. However, the study by Smith and Levin (1996) does not distinguish between specific thinking styles and the one by McElroy and Seta (2003) only differentiates between a holistic and an analytical approach. Therefore, neither study provides any information on the different influences of a wider variety of thinking styles, each with distinct characteristics beyond the simple focus on the need for cognition. This is where the four comprehensive thinking styles, as defined by Newton et al. (2023), come into play. While they are also characterised by the need for cognition, they each go beyond that and have their own distinct set of attributes. Thus, analysing their effects will offer more in-depth knowledge about the influence of thinking styles on framing efforts.

Because Preference for Intuitive Thinking and Close-Minded Thinking are both characterised by a low need for cognition, they can be related to the thinking styles with a low need for cognition in the studies of Smith and Levin (1996) and McElroy and Seta (2003). Therefore, it can be assumed that people with a prevalence of Preference for Intuitive Thinking and Close-Minded Thinking are more receptive to framing biases. Further, based on the reviewed literature, loss frames are expected to have a bigger effect than gain frames in this context (Bilandzic et al., 2017). Based on these assumptions, the following two hypotheses were formulated:

H1: The loss frames will have a greater positive effect on the attitude towards food waste than gain frames, especially when Preference for Intuitive Thinking increases.

H2: The loss frames will have a greater positive effect on the attitude towards food waste than gain frames, especially when Close-Minded Thinking increases.

Two other factors that interact with each other are framing and the earlier discussed method of self-referencing appeals. To examine these effects, Chang and Lee (2011) conducted an experiment analysing the impact of low and high levels of self-referencing on peoples' behavioural intentions across multiple message frames. For this, they created advertisements appealing towards charity

donations. The portrayed messages included two degrees of self-referencing and two different message frames. Chang and Lee (2011) identified an interaction effect between self-referencing and message framing. This interaction demonstrated that a low degree or the absence of self-referencing reduced the effectiveness of the message frames. So in order to increase the influence of framing efforts, they should be paired with a high degree of self-referencing.

Loroz (2007) obtained similar results in her experiment, which tested the interaction between self-referencing and message frames. She examined this in the context of influencing people's recycling behaviour by creating four advertisements, including the four conditions. The results demonstrated that the interaction between high self-referencing and loss frame showed the biggest persuasive effect and thus positively influenced the participants' behavioural intentions.

These findings can be transferred to the topic of food waste. It can be assumed that for advertisements targeted at reducing food waste, high self-referencing messages have a more positive effect when combined with loss frames. Based on this, the following hypothesis was developed:

H3: A high degree of self-referencing has a more positive effect on the attitudes towards food waste than a low degree of self-referencing when combined with the loss frame.

What has, however, been paid little attention to is the influence that people's thinking styles and the way they process information have on messages with self-referencing appeals. It can be assumed that the different ways people think and their different levels of need for cognition influence how messages with self-referencing efforts are processed. Thus, they are expected to influence the effectiveness and results of self-referencing. Nevertheless, there is little to no existing research on this topic.

What can be considered are Burnkrant and Unnava's (1989) insights indicating that messages with high self-referencing activate more cognitive resources and increase people's abilities to process message arguments. These results suggest that self-referencing efforts are more effective for people with a higher need for cognition and a thinking style involving more cognitive resources. This is because they seem more likely and able to put their cognitive resources into processing a message.

When applying this assumption to Newton et al.'s (2023) thinking styles, the two which are characterised by a high need for cognition are a Preference for Effortful Thinking and Actively Open-minded Thinking. Based on this, the two final hypotheses are as follows:

H4: A high degree of self-referencing has a more positive effect on the attitude towards food waste than a low degree of self-referencing, especially when Preference for Effortful Thinking increases.

H5: A high degree of self-referencing has a more positive effect on the attitude towards food waste than a low degree of self-referencing, especially when Actively Open-minded Thinking increases.

3. Method

3.1. Sample

The participants for the study were recruited through the snowball method. The survey was published on the 31st of March 2023 and closed for answers on the 11th of May 2023. The link to the online survey was published via social media channels like WhatsApp and LinkedIn and given to friends and family for further distribution. To get additional responses the survey was published on the platforms SurveyCircle and Survey Swap, the Facebook groups ‘Survey Exchange’, ‘SurveyCircle / Survey Panel – Post Survey, Find Participants, Get Responses’ and ‘Umfrageteilnehmer finden – Umfragegruppe für Bachelor, Master, Studium, PhD’ as well as the LinkedIn groups ‘Respondenten gezocht (onderzoek, vragenlijst, enquête, scriptie, bachelorscriptie, masterscriptie)’ and ‘Umfrageteilnehmer finden (Probanden für Bachelorarbeit, Masterarbeit, Dissertation, Marktforschung)’. This was done to enhance generalizability and representativeness, reduce the coverage error, and broaden the non-probability sample beyond the researcher’s private circle (Sarstedt et al., 2018). The recruitment process went as planned.

To be included in the population, the participants needed to be at least 18 years old and had to give their consent to the processing of their data. The desired sample size for this study was set at around 250–300 participants to measure each of the four comprehensive thinking styles adequately. Altogether 343 participants responded to the study. However, three did not consent to the processing and analysis of their data, and five people skipped the consent question without an answer. Because they did not consent to the analysis of their data, those participants were eliminated for further analysis, reducing the number of participants to 335. Of these 335 participants, 34 did not complete the entire study and were eliminated from the data analysis. In the last step, the participants’ answer times for the survey were considered. Since participants in the pre-test took around five minutes to fill out the entire survey, this time was used as a benchmark. Because the five minutes were just the results from the pre-test, all results with a duration time of three minutes or longer were accepted, while anything less was disregarded. This resulted in the elimination of 37 more answers and brought the final sample to 264 valid participants whose answers were taken into account for the data analysis.

This rectification of the data set led to a sample of 264 participants between 19 and 69 years ($M = 26.90$, $SD = 7.40$). Regarding the participants’ gender, 82 chose male and 178 selected female. Only one chose not to disclose their gender, and three others selected the non-binary/third-gender option. This reveals an unequal gender distribution. The female option was significantly more prevalent, as it had been selected over twice as often as the male option.

Further, the participants were from 38 countries overall. The vast majority was from Germany ($n = 139$) and comprised more than half of the sample, with 52.7%. The second largest participant group was Dutch ($n = 22$) and already substantially smaller, followed by British ($n = 11$) and Austrian ($n = 10$) citizens. Those four largest participant groups accounted for 68.9% of the sample population.

The participants were further spread over five continents: Africa, Asia, Europe, North America, and South America, with Europe including the largest part of the sample.

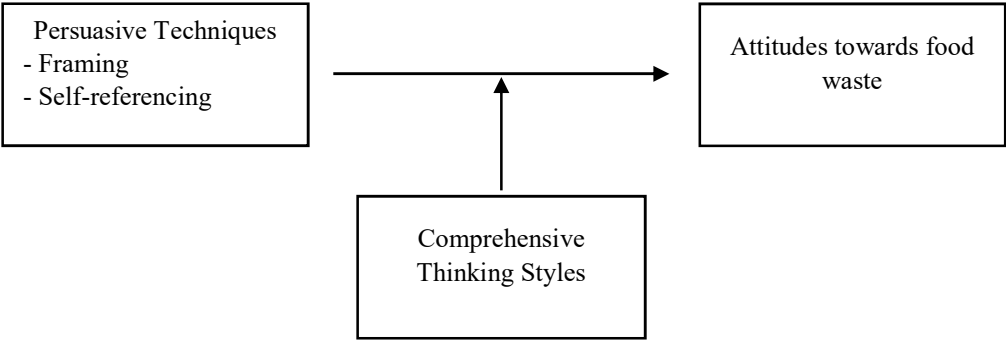
In terms of the highest education level, the majority of 160 participants (60.6%) disclosed having completed a Bachelor’s degree, followed by 49 individuals (18.6%) with a Master’s degree and 25 participants (9.5%) with a high school diploma, together making up for 88.7% of the sample.

3.2. Research design

An experiment in combination with an online survey was conducted to analyse this quantitative research. A quantitative approach was chosen to add statistically proven insights to the existing literature and research discussed above, as well as connect the different theoretical approaches (Brosius et al., 2012). The more specific approach of an experiment was selected as it is the best way of examining causal relationships between the discussed independent and dependent variables (Neuman, 2013).

In the experiment, the independent variables were the two persuasive techniques framing and self-referencing and the dependent variable the participants’ attitudes towards food waste. At the same time, comprehensive thinking styles functioned as an interaction variable, as portrayed in Figure 1. For this 2x2 factorial design, four advertisements were created. The first factor was framing which was divided into gain- and loss-framing, and the second factor, self-referencing, was divided into a high and a low degree of self-referencing. The four ads each represented one possible combination of the factors, either gain-framing and a high level of self-referencing, gain-framing with a low level of self-referencing, loss-framing with a high level of self-referencing or loss-framing with a low level of self-referencing.

Figure 1: Conceptual framework of the experiment



In the online survey, the participants were randomly assigned to one of the four advertisements to ensure an equal distribution and rule out selection bias (Neuman, 2013). They were then asked to complete the survey by answering the questions mentioned below. The gathered data was analysed using the SPSS program.

3.3. Stimulus material

The four advertisements created for this experiment can be found in Appendix A. They portrayed a message that encouraged participants to waste less food, only varying in terms of their persuasive appeals, framing and self-referencing. The message framing was operationalised by incorporating gain and loss frames in the stimulus material. In the gain frame, participants were shown an advertisement informing them they could save money. In contrast, individuals presented with the loss frame were told they would lose money by wasting food. Next to that, the self-referencing approach was operationalised with a high or low level of self-referencing. Following Burnkrant and Unnava (1995), the high-degree self-referencing message addressed the participants by using the personal pronoun "You". In contrast, the advertisements with a low degree of self-referencing were phrased in the third person (Burnkrant & Unnava, 1995). The advertisements were created to control the stimulus material as much as possible and exclude confounding variables to keep the experiment's internal validity high (Neuman, 2013). The text on the four advertisements was phrased as similarly as possible and only varied in the framing effort and self-referencing degree. That was done to relate the study results directly to the different experimental conditions and to eliminate any other confounding factors as much as possible.

3.4. Procedure

The survey, which can be found in Appendix B, started with a short introduction and welcome message to inform the participants about the research and assure them of their anonymity, followed by a question asking for their informed consent. This assurance of anonymous data handling should decrease the participants' social desirability and reactivity, as their answers cannot be traced back to them (Neuman, 2013). Participants who agreed to the anonymous processing of their data were able to continue with the survey. In contrast, those who did not consent were automatically redirected to the end of the survey. Afterwards, participants' attitudes towards food waste were measured using the items described below, followed by questions addressing their comprehensive thinking styles. Then the manipulation check questions about framing and self-referencing were presented to confirm that the manipulations were successful in order to increase the research's internal validity (Neuman, 2013). Lastly, the participants were asked to state their demographic information, including age, gender, nationality, and the highest degree of education. The survey ended with a debrief about the experiment and the stimulus material.

3.5. Operationalisation

Various concepts were measured throughout the survey. For the measurements of all the concepts discussed below, pre-existing scales validated by various researchers were used. This, combined with the complexity and multidimensionality of the presented scales, ensures the high validity of this study.

First, the attitudes towards food waste were operationalised and evaluated through the measurement of the three underlying concepts ‘moral attitudes towards food waste’, lack of concern’ and ‘intention not to waste food’. For the measurement of the ‘moral attitudes towards food waste’, the respective two-item scale by Stefan et al. (2013) was used. To extend this existing scale, two more items were self-developed, following Haidt and Graham’s (2007) five fundamental psychological systems of morality. The newly created items addressed the topics of harm and fairness and were as follows ‘When I throw away food I feel like I harm the environment’ and ‘When I throw away food I feel like I act unfairly towards people with less access to food’. Just as the two items from Stefan et al. (2013), the self-developed items were measured on a 7-point Likert scale with 1 = “strongly disagree” and 7 = “strongly agree”.

The participants’ lack of concern about food waste was measured with the existing four-item scale of Stefan et al. (2013). It was scored on a 7-point Likert scale with 1 = “strongly disagree” and 7 = “strongly agree”.

To measure the intention not to waste food, the respective three-item scale created by Stancu et al. (2016) was used. This scale was supplemented by the item ‘In general, I try very hard not to throw away food’ by Stefan et al. (2013), which was also answered on a 7-point Likert scale with 1 = “strongly disagree” and 7 = “strongly agree”. Thus, the scale measuring the intention not to waste food included four items overall.

For the measurement of the four comprehensive thinking styles, Actively Open-minded Thinking, Close-Minded Thinking, Preference for Intuitive Thinking and Preference for Effortful Thinking, the existing scales of Newton et al. (2023) with a total of 24 items divided into six items per thinking style were adopted. The items were scored on a 7-point Likert scale with 1 = “strongly disagree” and 7 = “strongly agree”. While Newton et al. (2023) only implemented a 6-point scale within their research, a 7-point Likert scale was used for this study to give the participants a neutral option.

Altogether, the survey included four manipulation checks that were self-developed. Two assessed the degree of self-referencing that was noticed, and two were regarding the loss and gain frame. The manipulation checks concerning the degree of self-referencing were ‘I felt I was personally addressed in the advertisement that I was shown in the beginning’ and ‘I felt the advertisement in the beginning was relevant to me’ while the two framing manipulation checks were the following, ‘I felt that the ad in the beginning informed me about a potential way to save money’ and ‘I felt that the ad in the beginning informed me that I would lose something’.

To confirm the scales and factors for the analysis, a confirmative factor analysis was conducted for the dependent variable attitude towards food waste and the independent variable comprehensive thinking styles. Concerning the attitude towards food waste, the scales of moral attitudes towards food waste, lack of concern and intention not to waste food were used for the factor analysis. The moral attitude item ‘Throwing away food does not bother me’ as well as the four lack of

concern items were scored reversed and therefore recoded for the analysis. The a priori prerequisites for a factor analysis were met, and the confirmative factor analysis was carried out with the recoded items. The 12 items, which were Likert-scale based, were entered into factor analysis using Principal Components extraction with direct oblique rotation and a fixed number of factors to extract, which were three, $KMO = .87$, $\chi^2 (N = 264, 66) = 1473.56$, $p < .001$. A direct oblique rotation was used, as a correlation among the factors was expected. The resultant model explained 66.6 % of the variance in attitudes towards food waste reduction. The factor loadings of individual items onto the three identified factors are presented in Table 1. However, the item ‘Throwing away food does not bother me’ was deleted for further analysis as its factor loading was below .45, and its elimination elevated the factor’s reliability and Cronbach’s α to .83. Therefore, the final three factors were:

Intention not to waste food. This first factor included the four original items, all related to the intention not to waste food. The item ‘In general, I try very hard not to throw away food’ loaded onto two factors but was assigned to this factor as it loads substantially higher on this factor than the other. The item ‘Throwing away food does not bother me’, which was assigned to this factor, was deleted from further analysis as mentioned above. Therefore the factor intention not to waste food consisted of four items.

Lack of concern. The second factor included all four items related to the lack of concern about food waste, just like the original scale. The items ‘I do not really worry about the impact of my food waste on the distribution of resources in the world’ and ‘I do not really worry about the environmental impact of the food that I throw away’ both loaded onto multiple factors but were assigned to this one as they loaded higher on this factor than any other.

Moral attitudes towards food waste. The third factor found included three of the expected items related to the participants’ moral attitudes towards food waste. In the original scale, the item ‘Throwing away food does not bother me’ was assigned to this factor as well, but, as mentioned, it was deleted from this analysis. Therefore this factor consists of three items.

Thus, the confirmative factor analysis validated the three factors that were expected. As presented in Table 1, the scales for the intention not to waste food (Cronbach’s $\alpha = .82$) and lack of concern (Cronbach’s $\alpha = .81$) have high reliability, while the scale of moral attitudes towards food waste (Cronbach’s $\alpha = .78$) shows moderate reliability. Thus, the scales appear to measure what is intended. When evaluating the scales and because some reversed items were recoded, it has to be noted that a high score in any of these scales is an indication of a positive attitude towards food waste reduction. Thus, participants scoring high on any of these scales are in favour of food waste reduction.

Table 1: Factor and reliability analysis for scales for attitude towards food waste ($N = 264$)

Item	Intention not to waste food	Lack of concern	Moral attitudes towards food waste
I will try not to throw food away	.88		

I intend not to throw food away	.83		
My goal is not to throw food away	.80		
In general, I try very hard not to throw away food	.56	.30	
Throwing away food does not bother me	.42		
I do not really worry about the cost of the food that I throw away		.87	
I do not really worry about the amount of food that I throw away		.76	
I do not really worry about the impact of my food waste on the distribution of resources in the world		.67	.32
I do not really worry about the environmental impact of the food that I throw away		.55	.46
When I throw away food I feel like I harm the environment			.90
When I throw away food I feel like I act unfairly towards people with less access to food			.73
When I throw away food I feel guilty	.41		.48
Cronbach's α	.82	.81	.78
Eigenvalue	5.37	1.57	1.05

A second confirmative factor analysis was conducted for the comprehensive thinking styles with the scales of Actively Open-Minded Thinking, Close-Minded Thinking, Preference for Intuitive Thinking, and Preference for Effortful Thinking. Each item of the scales Actively Open-Minded Thinking and Preference for Effortful Thinking was recoded to fit with the other items. The a priori prerequisites for a factor analysis were met, and the confirmative factor analysis was carried out with the recoded items. The 24 items which were Likert-scale based were entered into factor analysis using Principal Components extraction with direct oblique rotation and a fixed number of factors to extract, which were four, $KMO = .83$, $\chi^2 (N = 264, 276) = 3232.69$, $p < .001$. A direct oblique rotation was used as a correlation among the factors was expected. The resultant model explained 61.4 % of the variance in comprehensive thinking styles. The factor loadings of the individual items onto the four identified factors are presented in Table 2 and are in accordance with the expected results and factors. The factors found were:

Actively Open-minded Thinking. The first factor included the six items related to Actively Open-minded Thinking that were expected and are the same as in the original scale.

Preference for Effortful Thinking. The second factor included the six items related to the inclination towards effortful thinking that were expected and are the same as in the original scale.

Close-Minded Thinking. The third factor included the six items related to Close-Minded Thinking that were expected and are the same as in the original scale.

Preference for Intuitive Thinking. The fourth factor included the six items related to intuitive thinking that were expected and are the same as in the original scale.

As presented in Table 2, the scales for Actively Open-minded Thinking (Cronbach's $\alpha = .88$), Preference for Effortful Thinking (Cronbach's $\alpha = .82$), Close-Minded Thinking (Cronbach's $\alpha = .85$), and Preference for Intuitive Thinking (Cronbach's $\alpha = .89$) have a high reliability. Thus, the scales appear to measure what they were intended to.

Table 2: Factor and reliability analysis for scales for comprehensive thinking styles ($N = 264$)

Item	Actively Open-minded Thinking	Preference for Effortful Thinking	Close-Minded Thinking	Preference for Intuitive Thinking
Just because evidence conflicts with my current beliefs does not mean my beliefs are wrong	-.88			
Even if there is concrete evidence against what you believe to be true, it is OK to maintain cherished beliefs	-.85			
There may be evidence that goes against what you believe but that does not mean you have to change your beliefs	-.82			
Regardless of the topic, what you believe to be true is more important than evidence against your beliefs	-.82			
Whether something feels true is more important than evidence	-.76			
It is important to be loyal to your beliefs even when evidence is brought to bear against them	-.60			
Thinking is not my idea of an enjoyable activity		.79		
I am not a very analytical thinker		.77		
I try to avoid situations that require thinking in depth about something		.76		
Reasoning things out carefully is not one of my strong points		.74		
I'm not that good at figuring out complicated problems		.74		
Thinking hard and for a long time about something gives me little satisfaction		.56		
There is no middle ground between what is true and what is false			.88	
Either something is true or it is false; there is nothing in-between			.86	
The truth does not change			.73	
In my experience, the truth is often black and white			.72	
Truth is never relative			.69	
I think there are many wrong ways, but only one right way, to almost anything			.68	
I often go by my instincts when deciding on a course of action				.84
Using my "gut-feelings" usually works well for me in figuring out problems in my life				.84

When I make decisions, I tend to rely on my intuition				.82
I believe in trusting my hunches				.82
I like to rely on my intuitive impressions				.80
Intuition is the best guide in making decisions				.72
Cronbach's α	.88	.82	.85	.89
Eigenvalue	5.88	3.65	2.81	2.39

4. Results

4.1. Manipulation checks

In the first step, the manipulation checks were analysed with the use of independent sample t-tests. To examine the self-referencing manipulation, the two stimulus variables with a high self-referencing level were computed in SPSS. The independent sample t-test was conducted and showed that individuals exposed to the high self-referencing message did not feel more addressed by the advertisements ($M = 3.29$, $SD = 1.42$) than people who were exposed to the low self-referencing message ($M = 3.45$, $SD = 1.48$), $t(262) = -0.92$, $p = .179$. That is because the result is not significant. Moreover, the t-test revealed that individuals exposed to a high self-referencing message did not feel like the advertisements they saw were more relevant to them ($M = 4.27$, $SD = 1.41$) than participants who were exposed to the low self-referencing messages ($M = 4.60$, $SD = 1.45$), $t(262) = -1.89$, $p = .060$. These results demonstrate that the manipulation of the degree of self-referencing was not successful. Potential explanations for this will be reviewed in the discussion section.

For the framing manipulation check, the two stimulus variables with a gain frame message were computed in SPSS. The independent sample t-test was conducted and showed that individuals exposed to the gain frame messages did not feel more informed about a potential way of saving money ($M = 4.22$, $SD = 1.57$) than people who were exposed to the loss frame messages ($M = 4.18$, $SD = 1.57$), $t(262) = 0.20$, $p = .420$. That is because the result is not significant. The t-test further demonstrated that individuals exposed to the gain frames did feel significantly less like they were informed about the potential of losing something ($M = 3.43$, $SD = 1.52$) than participants who were exposed to the loss frame messages ($M = 3.82$, $SD = 1.6$), $t(261) = -2.05$, $p = .021$. Thus, the framing manipulation was partly successful, as one of the t-tests demonstrated a significant correlation.

4.2. Hypotheses

4.2.1. H1

To test hypothesis H1, linear regressions with the three underlying concepts making up the attitudes towards food waste were conducted. These three concepts are the intention not to waste food, moral attitudes towards food waste and lack of concern. Predictors were the exposure to loss framing and the thinking style of Preference for Intuitive Thinking.

The first linear regression was for the intention not to waste food. The overall model was found to be not significant, $F(2, 261) = .20$, $p = .818$, $R^2 = .002$. The loss framing was not found to be

a significant predictor ($\beta = -.04, p = .532$), and neither was the thinking style of Preference for Intuitive Thinking ($\beta = .01, p = .883$) for the measured intention not to waste food.

The second linear regression was for moral attitudes towards food waste. The overall model was found to be not significant, $F(2, 261) = .25, p = .776, R^2 = .002$. The loss framing was not found to be a significant predictor ($\beta = .02, p = .721$), and neither was the thinking style of Preference for Intuitive Thinking ($\beta = .04, p = .556$) for the moral attitudes towards food waste.

The third linear regression was for the lack of concern. The overall model was found to be not significant, $F(2, 261) = .45, p = .636, R^2 = .003$. The loss framing was not found to be a significant predictor ($\beta = -.03, p = .666$), and neither was the thinking style of Preference for Intuitive Thinking ($\beta = .05, p = .381$) for lack of concern.

Based on the results for the three underlying concepts of attitudes towards food waste, H1 is rejected.

4.2.2. H2

To test hypothesis H2, linear regressions with the three underlying concepts making up the attitudes towards food waste were conducted. These three concepts are the intention not to waste food, moral attitudes towards food waste and lack of concern. Predictors were the exposure to loss framing and the thinking style of Close-Minded Thinking.

The first linear regression was for the intention not to waste food. The overall model was found to be not significant, $F(2, 261) = 1.40, p = .249, R^2 = .01$. The loss framing was not found to be a significant predictor ($\beta = -.04, p = .573$), and neither was the thinking style of Close-Minded Thinking ($\beta = -.10, p = .122$) for the measured intention not to waste food.

The second linear regression was for moral attitudes towards food waste. The overall model was found to be not significant, $F(2, 261) = 1.96, p = .142, R^2 = .02$. The loss framing was not found to be a significant predictor ($\beta = .03, p = .637$), and neither was the thinking style of Close-Minded Thinking ($\beta = -.12, p = .053$) for the moral attitudes towards food waste.

The third linear regression was for the lack of concern. The overall model was found to be not significant, $F(2, 261) = .46, p = .633, R^2 = .003$. The loss framing was not found to be a significant predictor ($\beta = -.02, p = .735$), and neither was the thinking style of Close-Minded Thinking ($\beta = -.06, p = .378$) for lack of concern.

Based on the results for the three underlying concepts of attitudes towards food waste, H2 is rejected.

4.2.3. H3

To test H3, an ANOVA was conducted with loss framing and high self-referencing as independent variables and attitudes towards food waste, namely intention not to waste food, moral attitudes towards food waste and lack of concern, as the dependent variables.

The first ANOVA was conducted with the two mentioned independent variables and the intention not to waste food as the dependent variable. ANOVA revealed a significant main effect for high self-referencing and loss frames on the intention not to waste food, $F(1, 260) = 4.83, p = .029$. However, the detected effect size is relatively small since partial $\eta^2 = .02$. Tukey post-hoc comparisons were not possible, but the means were compared, as can be seen in Figure 2. The highest mean was found for the combination of high self-referencing and gain frame ($M = 6.18, SD = .66$).

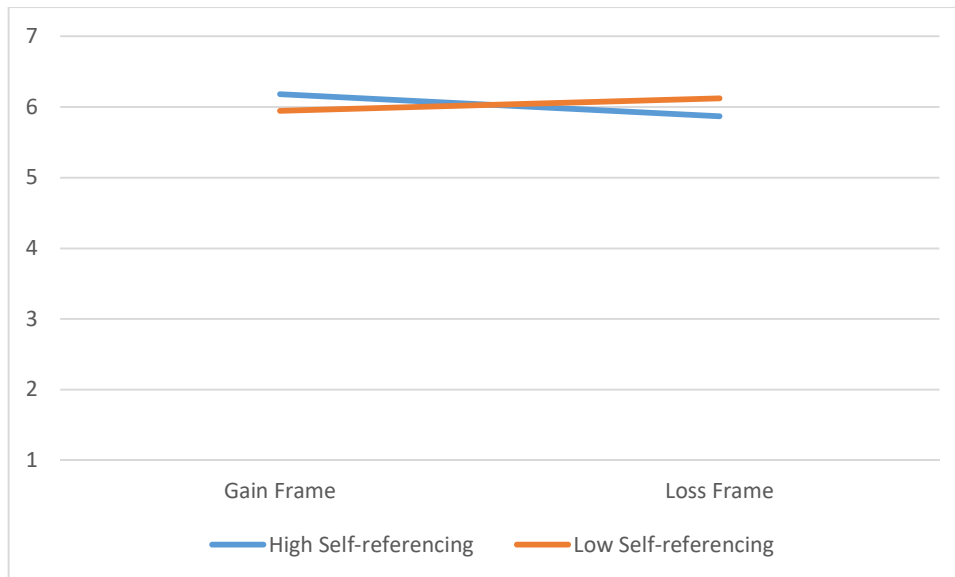


Figure 2: Comparison of means

The second ANOVA was conducted with the two mentioned independent variables and moral attitudes towards food waste as the dependent variable. ANOVA did not reveal a significant main effect for high self-referencing and loss frames on the moral attitudes towards food waste, $F(1, 260) = 3.27, p = .072$.

Lastly, the third ANOVA was conducted with the two mentioned independent variables and lack of concern as the dependent variable. ANOVA did not reveal a significant main effect for high self-referencing and loss frames on the lack of concern, $F(1, 260) = 1.60, p = .207$.

Based on the ANOVA results, H3 is accepted for the intentions not to waste food and rejected for the other two components of attitudes towards food waste.

4.2.4. H4

For the analysis of H4, linear regressions with the three underlying concepts making up the attitudes towards food waste were conducted. These three concepts are the intention not to waste food, moral attitudes towards food waste and lack of concern. Predictors were the exposure to the high self-referencing stimulus and the thinking style of Preference for Effortful Thinking.

The first linear regression was for the intention not to waste food. The overall model was found to be not significant, $F(2, 261) = .45, p = .638, R^2 = .003$. The high self-referencing was not

found to be a significant predictor ($\beta = .00, p = .949$), and neither was the thinking style of Preference for Effortful Thinking ($\beta = .06, p = .345$) for the measured intention not to waste food.

The second linear regression was for moral attitudes towards food waste. The overall model was found to be not significant, $F(2, 261) = .81, p = .447, R^2 = .01$. The high self-referencing was not found to be a significant predictor ($\beta = -.05, p = .390$), and neither was the thinking style of Preference for Effortful Thinking ($\beta = .05, p = .417$) for the measured moral attitudes towards food waste.

The third linear regression included the measured lack of concern. The overall model was found to be significant, $F(2, 261) = 3.50, p = .032, R^2 = .03$. Only the Preference for Effortful Thinking was found to be a significant predictor ($\beta = .13, p = .039$), while high self-referencing was not significant ($\beta = -.08, p = .177$) for lack of concern.

Based on the regression results, H4 is accepted for lack of concern and rejected for the other two components of attitudes towards food waste.

4.2.5. H5

To analyse H5, linear regressions with the three underlying concepts making up the attitudes towards food waste were conducted. These three concepts are the intention not to waste food, moral attitudes towards food waste and lack of concern. Predictors were the exposure to the high self-referencing stimulus and the thinking style of Actively Open-minded Thinking.

The first linear regression included the intention not to waste food. The overall model was found to be significant, $F(2, 261) = 3.10, p = .047, R^2 = .02$. Only Actively Open-minded Thinking was found to be a significant predictor ($\beta = .15, p = .013$), while high self-referencing was not significant ($\beta = .01, p = .920$) for the intention not to waste food.

The second linear regression was for moral attitudes towards food waste. The overall model was found to be not significant, $F(2, 261) = .88, p = .417, R^2 = .01$. The high self-referencing was not found to be a significant predictor ($\beta = -.06, p = .360$), and neither was the thinking style of Actively Open-minded Thinking ($\beta = .06, p = .372$) for the measured moral attitudes towards food waste.

The third linear regression was for the lack of concern. The overall model was found to be not significant, $F(2, 261) = 2.71, p = .068, R^2 = .02$. The high self-referencing was not found to be a significant predictor ($\beta = -.09, p = .129$), and neither was the thinking style of Actively Open-minded Thinking ($\beta = .10, p = .099$) for lack of concern.

Because only one of the three concepts that form the attitudes towards food waste was found to be significant, H5 is accepted for the intentions not to waste food and rejected for the other two components of attitudes towards food waste.

5. Discussion

This study aimed to examine the influence of framing and self-referencing on people's attitudes towards food waste while considering four different thinking styles. The goal was to gain insights into the interaction effects of thinking styles and advertisements with framing or self-referencing appeals. The participants' attitudes towards food waste were measured through the three underlying concepts intention not to waste food, lack of concern and moral attitudes towards food waste.

Both framing and self-referencing have proven to be effective persuasive techniques for influencing people's attitudes (Debevec & Romeo, 1992; Chang & Lee, 2011; Tversky & Kahneman, 1981; Zhang & Buda, 1999). What has, however, received little attention is the influence of individual thinking styles on the mentioned impact of framing and self-referencing. The thinking styles used for this research were the ones by Newton et al. (2023), namely Actively Open-minded Thinking, Preference for Effortful Thinking, Close-Minded Thinking and Preference for Intuitive Thinking. While a higher need for cognition characterises the first two, the latter two rely on a lower need for cognition (Newton et al., 2023). It was assumed that loss framing, in combination with the thinking styles based on a low need for cognition, would be most effective. Similarly, high self-referencing combined with the thinking styles characterised by a high need for cognition was expected to have the highest effects. Further, the interaction of self-referencing and framing was examined.

5.1. Main findings and implications for theory and practice

5.1.1. Manipulation checks

Various findings resulted from the data analysis. The results and findings from the manipulation checks will be discussed first, as they have implications for the rest of the results and the findings from the main hypotheses. Therefore, the drawn conclusions of the hypotheses' analyses will be presented after the discussion of the manipulation checks.

As the conducted t-tests demonstrated, the manipulations in the stimulus material were primarily unsuccessful. The participants randomly assigned to the high self-referencing condition felt equally addressed by the advertisements as those exposed to a message with a low degree of self-referencing. Moreover, the manipulation of high self-referencing did not influence the participants to perceive the advertisement as more relevant to themselves. Consequently, the self-referencing manipulations did not affect the participants and were unsuccessful. This lack of an effect is contrary to the effects demonstrated by researchers such as Burnkrant and Unnava (1995). The failure of the self-referencing manipulation is a potential explanation for the results of the analysed hypotheses presented below.

In contrast, the message frame manipulations were partially successful. The tests revealed that the participants exposed to the gain frames did feel less like they were informed about the potential of losing something compared to the ones that got the loss frame messages. That was the intended effect

of the manipulation and demonstrated that the message frames were partially successful in influencing the participants. However, the ones who were exposed to the gain frames did not feel more informed about a way of saving money. This is contrary to expectations since the gain frame message explicitly stated that reducing food waste is a way of saving money. As a result, the framing manipulation was only partially successful.

That only one of the two framing manipulation checks demonstrated a significant influence can be interpreted with the concept of loss aversion. Both frames were distributed to an equal amount of participants. However, the participants only remembered the messages addressing the loss of money at the end of the survey. In contrast, the messages highlighting a possible way of saving money were not remembered. Because of this, the suggestion arises that the loss frames were more memorable than the gain frames. That could be because negative experiences and consequences are generally more memorable than positive ones, which aligns precisely with the earlier described concept of loss aversion (Levin et al., 1998).

Next to that, there are various potential reasons why the manipulation checks were not statistically significant and did not have the intended influence. One of those reasons might be the wording of the message manipulations. As previously explained, the texts of the advertisements were intentionally designed to be as similar as possible. This was done to accurately compare the different advertisements and rule out any potential confounding factors. However, this approach may have led to the advertisements being too similar. Consequently, the manipulations might not have stood out enough to the participants and thus weren't remembered until the end of the survey.

This observation could be supported by the fact that the framing manipulations were more effective than the self-referencing manipulations. The framing manipulations clearly stated two opposite scenarios of either saving or losing money. At the same time, the self-referencing varied only in the use of the personal pronoun 'you' or the more general approach of referring to 'people'. It can be assumed that individuals who generally do not feel personally addressed by the topic are unlikely to experience a significant increase in personal relevance solely through the use of a personal pronoun.

Furthermore, a possibility is that there was a lack of sufficient differentiation between the two self-referencing messages. This may have prevented the establishment of a significant contrast in the self-referencing degree. As a result, some individuals may have felt personally addressed by the term 'people.' Therefore, for future studies, it is advised to enhance the extremity of low self-referencing by, for example, phrasing the message as "Reducing food waste saves money" and thus eliminating any form of directly addressing anyone to ensure a complete absence of personalisation.

However, the fact that both manipulations were mostly unsuccessful has implications for the interpretation of the hypotheses results. Any insignificant results involving framing and or self-referencing can be potentially explained by the unsuccessful manipulations. It can be argued that if participants do not realise and process the manipulations, those manipulations cannot have a noticeable effect. This will be discussed in more detail later when reviewing the hypotheses' results.

Nevertheless, the study should be repeated with improved manipulations to get more substantial results.

5.1.2. Framing

One aim of this study was to evaluate if messages with a loss frame are more effective in positively influencing people's attitudes towards food waste than gain frames when interacting with the thinking styles of Close-Minded Thinking and Preference for Intuitive Thinking. These assumptions were based on the review of multiple studies, which indicated a greater influence for loss than for gain frames (Change & Lee, 2009; Levin et al., 1998). Additional studies implied an interaction effect between loss frames and thinking styles characterised by a low need for cognition, such as Close-Minded Thinking and Preference for Intuitive Thinking (Zhang & Buda, 1999).

However, throughout all the analyses, no interaction effects between framing and either of the two thinking styles could be identified since there were no differences. Thus, these results can neither confirm nor contradict the existing literature.

There is a possible explanation for the lack of interaction effect between loss framing and both thinking styles. The assumption of an interaction effect was based on the results by Zhang and Buda (1999) that people with a low need for cognition are more responsive to framing in general and especially loss frames. Thus, Close-Minded Thinking and Preference for Intuitive Thinking were chosen as they both have a low need for cognition in common (Newton et al., 2023). However, the low need for cognition might not be such a predominant characteristic of those two thinking styles as initially presumed, and other attributes might be more dominant. That would leave room for the possibility that because of those other attributes, the thinking styles interact with framing differently than assumed. This indicates that future studies should examine Newton et al.'s (2023) defined thinking styles more closely to identify their interaction effects with various variables. It would be particularly interesting to figure out which specific attribute of each thinking style interacts with other variables.

In addition, the data analysis also did not reveal any direct influences of framing on the participants' attitudes towards food waste. This is surprising as many studies demonstrated strong effects of especially loss but also gain framing (Change & Lee, 2009; Smith, 1996; Zhang & Buda, 1999).

One potential explanation for these results and the lack of direct effects is the only partially successful framing manipulation. It can be argued that if the manipulation is ineffective, it cannot influence the participants and thus has no impact on their measured attitudes towards food waste. To accurately evaluate these results and identify the existence of significant effects, retesting the hypotheses in an experiment that includes improved framing manipulations would be necessary. Such future studies are expected to demonstrate a greater influence of loss frames on attitudes towards food waste. This is because previous research on framing main effects is substantial and mostly in favour of higher effectiveness for loss frames (Levin et al., 1998; Kühberger, 1998).

In conclusion, no main or interaction effects with Close-Minded Thinking or Intuitive Thinking could be identified for framing. Therefore, only a few theoretical implications can be derived from this study. First, it is suggested to replicate the study with improved framing manipulations to examine the existence of framing effects in this context. Second, future studies should also focus on exploring the distinct attributes of Newton et al.'s (2023) thinking styles and how they influence interactions with other variables.

5.1.3. Self-referencing

Next to framing, the study also explored the interaction between self-referencing and the thinking styles of Actively Open-minded Thinking and Preference for Effortful Thinking and the influence of that interaction on attitudes towards food waste. Actively Open-minded Thinking and Preference for Effortful Thinking were chosen as they are both characterised by a high need for cognition (Newton et al., 2023). Previous studies have indicated that especially high self-referencing is more successful for thinking styles based on a high need for cognition and a great number of cognitive resources (Burnkrant & Unnava, 1989).

Two of the overall models demonstrated significant results when testing the interaction effects of high self-referencing and the two thinking styles. The regressions revealed that a high self-referencing message and a Preference for Effortful Thinking positively affected the participants' concerns about food waste. This is because the analysis demonstrated a positive effect on lack of concern. However, because the items of lack of concern were reversed and recoded for the analysis, it can be interpreted as an increased concern about food waste. In other words, this means that both high self-referencing and a Preference for Effortful Thinking contribute to an increased concern about food waste. Further, the data analysis revealed only one other significant interaction effect. According to the regression, the high self-referencing condition interacted with Actively Open-minded Thinking and increased the participants' intentions not to waste food.

In conclusion, high self-referencing interacts with the Preference for Effortful Thinking to positively influence the participants' levels of concern. Additionally, it interacts with Actively Open-minded Thinking to positively influence the intentions not to waste food. Both of these results confirm the assumptions based on previous studies that thinking styles characterised by a high need for cognition enhance the already positive impact of self-referencing (Burnkrant & Unnava, 1989; Chang & Lee, 2011).

However, this opens up the question as to why only the intentions not to waste food and the levels of concern were influenced and not moral attitudes. Based on the demonstrated results, it seems reasonable to argue that intentions not to waste food and concern about the topic are generally easier influenced than moral attitudes. This could be because moral attitudes are based on people's underlying moral foundations (Stefan et al., 2013). It can be assumed that changing people's morals is more complicated than altering other aspects. Thus, advertisements trying to influence attitudes

towards food waste should focus on targeting the intentions not to waste food and the levels of concern instead of moral attitudes.

Whether there are genuinely no other interaction effects on attitudes towards food waste should be established in future studies. Such future studies should include larger sample sizes and improved self-referencing manipulations. Both measures should enhance the chance of detecting a significant effect if one truly exists.

Next to those two interactions, no main effects of self-referencing on any of the three concepts making up the attitudes towards food waste were demonstrated. A highly positive effect was expected as previous studies indicate that high self-referencing would have a bigger influence on someone's attitudes than low self-referencing (Burnkrant & Unnava, 1989; Debevec & Romeo, 1992). Yet, this can be neither denied nor confirmed with these results.

A potential explanation for this is the unsuccessful self-referencing manipulation. Because participants did not actively recognise the degree of self-referencing they were exposed to, the high self-referencing condition failed to have the intended influence. Thus, no significant direct effects can be attributed to the self-referencing condition. To test whether or not high levels of self-referencing indeed influence parts of the attitudes towards food waste, this experiment would have to be recreated with improved manipulations. In a future study with improved manipulations, it is expected that such a direct positive influence of self-referencing on attitudes towards food waste does exist. This is based on extensive research and the results of studies such as the ones by Burnkrant and Unnava (1995) and Debevec and Romeo (1992).

The discussed results lead to some implications for theory and future studies. First, the two demonstrated interaction effects between high self-referencing and either Actively Open-minded Thinking or Preference for Effortful Thinking confirm existing literature indicating such an interaction. This interaction between self-referencing and the way people process information is a topic with very little existing research. Thus, the finding of such interaction effects in this study paves the way for future and more thorough research on how people's thinking impacts self-referencing effects.

Second, because only the intention not to waste food and the level of concern was influenced, it is suggested to focus on those two when trying to influence attitudes towards food waste. In contrast, moral attitudes should not be explicitly targeted.

And third, despite the interaction effect, no main effects of self-referencing on the participants' attitudes towards food waste could be identified. This is contrary to the previously presented literature, and it is suggested to replicate this study with improved manipulations.

5.1.4. Interaction between framing and self-referencing

Only one effect could be identified regarding the interaction of high self-referencing and loss framing on the participants' attitudes towards food waste. The interaction of high self-referencing and loss frame significantly affected the intentions not to waste food. This demonstrates that a message

personally addressing someone and highlighting the financial losses caused by food waste increases the intention not to waste food. That confirms existing literature which highlighted an interaction effect between self-referencing and framing (Lorož, 2007). Additionally, a comparison of means demonstrated a slightly bigger effect for the combination of high self-referencing and a gain frame compared to the other combinations. Besides that, the interaction between high self-referencing and loss framing did not affect any other aspects of the participants' attitudes towards food waste.

What is very noticeable is that the conducted t-test showed only a slight difference in means within all three analyses. Further, the small Partial Eta Squared for the found interaction effect on intentions not to waste food demonstrated that the effect is very small. Since there is such little difference between the compared means and they are all relatively high, this leaves room for the interpretation that the general attitude towards food waste is already quite positive. That would imply that the particular manipulations people were exposed to were unimportant for the participants and almost did not matter since the overall attitude was already positive.

A possible explanation for this phenomenon can be related to the specific characteristics of the participants of this study. The average age of the sample is around 27 years. It is generally established that particularly younger people are more aware of and concerned about the consequences of climate change and make efforts to reduce their ecological footprint (European Union, 2022). Reducing food waste is one such way to fight climate change (Scherhauer et al., 2018). Thus it can be assumed that this segment of people already tries to keep their food waste to a minimum and has a positive attitude towards it. Therefore, the participant group used for this study might not be the one that has to be targeted when wanting to enhance people's attitudes towards food waste reduction.

In a future study, it would be advised to examine the participants' attitudes towards food waste already before the exposure to the manipulations. By doing so, the attitudes before and after the exposure to the manipulations can be compared. That could determine if they were already very positive to begin with.

5.1.5. Comprehensive Thinking Styles

The analysis of the collected data also revealed effects for some of Newton et al.'s (2023) comprehensive thinking styles. The interaction effect of Preference for Effortful Thinking and Actively Open-minded Thinking with high self-referencing has been discussed above. However, Preference for Effortful Thinking and Actively Open-minded Thinking also directly influenced one of the three underlying concepts of attitudes towards food waste. The characteristics of each thinking style are a potential explanation for this effect.

Preference for Effortful Thinking led to a greater concern about food waste among the participants. This was expected as people with a Preference for Effortful Thinking tend to show an empathic understanding of others (Newton et al., 2023). Therefore, they arguably relate more easily to people negatively affected by the consequences of food waste. People with this thinking style are also characterised by thoroughly examining the information they come in contact with (Newton et al.,

2023). Because of that, it can be assumed that they critically analyse the negative consequences attached to food waste. Hence they are expected to have a more positive attitude towards the topic. However, further research is needed to examine why only the level of concern was affected and not the other components of attitudes towards food waste.

Next to that, Actively Open-minded Thinking resulted in a bigger intention not to waste food. This observation aligns with the presented literature as individuals with an Actively Open-minded Thinking style are characterised as being receptive towards new ideas and willing to put cognitive effort into the evaluation of things (Newton et al., 2023). Thus, it can be assumed that they are more likely to think critically about the potential negative consequences of food waste until it becomes clear why it makes sense to reduce food waste.

These results suggest that people with a Preference for Effortful Thinking and especially Actively Open-minded Thinking do not need to be the point of focus when trying to target people to encourage them to reduce their food waste. This is because they already consider this a necessary behaviour. Instead, resources should be allocated to targeting the other thinking style groups.

The thinking styles of Close-Minded Thinking and Preference for Intuitive Thinking did neither demonstrate interaction nor main effects on any components forming attitudes towards food waste. Thus there is no confirmation or contradiction of existing literature. Based on Newton et al.'s (2023) description of those two thinking styles, more of a negative main effect of Close-Minded Thinking and Preference for Intuitive Thinking on attitudes towards food waste was expected.

People with a Preference for Intuitive Thinking are characterised by a tendency of being prone to believe in conspiracy theories (Newton et al., 2023). Reducing food waste is frequently described as a way of fighting climate change, and many conspiracy theories portray climate change as fake and a means to manipulate people. Therefore, it could be expected that a Preference for Intuitive Thinking would lead to a more negative attitude towards decreasing food waste. That there was no such influence could be acclaimed to the fact that the advertisements did not specifically hint at reducing food waste to save the climate. Instead, they only highlighted its monetary consequences. This could have balanced out the resentment of reducing food waste to fight climate change, leading to no visible effect. However, the lack of any effect of a Preference for Intuitive Thinking calls for further studies examining the influence different thinking styles have on attitudes towards food waste.

The same applies to Close-Minded Thinking, which also did not lead to any significant effects. This thinking style is also characterised by a tendency to believe in conspiracy theories; thus, a direct negative influence on attitudes towards food waste was expected (Newton et al., 2023). Further, Close-Minded Thinking is described as black-and-white thinking, meaning something is either right or wrong (Newton et al., 2023). This rather extreme distinction of either agreeing or disagreeing with something would suggest the existence of some sort of effect. Indeed Close-Minded Thinking almost demonstrated a negative effect on moral attitudes towards food waste that is just close to being insignificant.

Therefore, the lack of any effect of a Preference for Intuitive Thinking and Close-Minded Thinking calls for further studies examining the influence different thinking styles have on attitudes towards food waste. It is suggested to conduct future studies with a bigger sample size to increase the chance of detecting significant effects.

5.2. Limitations and future research

The main limitation of this study is the partially unsuccessful manipulation of gain and loss framing and the entirely unsuccessful high and low self-referencing manipulation. Since the participants did not entirely perceive the manipulations, this probably contributed to the lack of significant results. Because the loss framing manipulation is partially successful, only a little has to be changed. A suggestion is to make the framing more evident by adding an exemplary amount of saved or lost money. On the contrary, the self-referencing manipulation should be changed entirely to be more outstanding to the participants.

Another limitation is that the participants were from 38 countries across five continents. While food waste is a worldwide issue that needs to be addressed globally, there are cultural differences in how advertisements are processed and evaluated. This is demonstrated by the difference in processing advertisements between Westerners and Asians, as established by Liang et al. (2011). Factors such as different social norms influence how individuals from different cultures process and interpret information (Liang et al. (2011)). Consequently, advertisements will likely have different effects when attempting to influence people's attitudes depending on their cultural background. This also implies potential differences in the evaluation of messages containing framing and self-referencing. Therefore, this broad range of nationalities could have led to a distortion of the evaluated effects.

It is advised for any future study to take these cultural differences in advertisement processing into account by focusing on participants with a similar cultural background. Further, more than half of the sample stated that they were from Germany. Hence, when focusing on one culture or continent, the sample should either focus on a selected country or be more diverse and spread across nationalities within a particular cultural context.

An additional limitation can be found in the images included in the stimulus material to visually support the messages. This research did not specifically account for any potential influences of those images that might have affected how the participants evaluated the advertisements. Indeed Debevec and Romeo (1992) point out that visual clues in advertisements impact how messages are processed. However, this possible influence of the depicted images is not included in the evaluation of the participants' answers. Even though the images were the same in all four created advertisements, their effects possibly vary depending on which manipulation they are paired with. As demonstrated, if a high self-referencing ad features another variable that stimulates elaboration on top of the one caused by the self-referencing, a reverse effect may be observed (Burnkrant & Unnava, 1995). Thus, in a future study, the influences of such a visual clue should be considered.

In terms of future research, there are a few possibilities. First, the study should be replicated with enhanced manipulations and stimulus material. Since the theoretical background for this study is quite extensive, it is a reasonable conclusion to test the correlations between the same selected independent and dependent variables again. The factors and items the survey contains can be retained since the factor analysis confirmed the expected factor loadings, and high reliability for all the factors was identified.

Furthermore, the results of this study suggest a more detailed analysis of the influence of comprehensive thinking styles on attitudes towards food waste. This is due to the significant positive effect of Actively Open-minded Thinking and Preference for Effortful Thinking on parts of the attitudes towards food waste. These positive influences should be confirmed in a study focusing solely on the effects of thinking styles. Further, it should be analysed whether these positive correlations only emerge for food waste reduction or other climate change-related topics as well. That would offer valuable insights for environmental organisations as to which sections of people need to be targeted to change their attitudes and which segments already have the desired attitude.

Additionally, to increase the collected data and offer more detailed insights, qualitative interviews with selected participants could accompany the quantitative experiment and survey. This would allow the participants to provide arguments and reasoning as to why they gave their respective answers. In terms of individual thinking styles, qualitative interviews would allow researchers to analyse in more depth which characteristics can be attributed to certain thinking styles. By doing so, the influence that thinking styles and, thus, the way people process information have on the individual components of attitudes towards food waste could be established in more depth.

6. Conclusion

The present study focuses on targeting food waste reduction at a consumer level with persuasive advertising that considers individual differences such as thinking styles. The persuasive techniques used were framing and self-referencing.

An interaction between high self-referencing and the two thinking styles, Actively Open-minded Thinking and Preference for Effortful Thinking, was demonstrated. The interaction positively influenced the participants' attitudes towards food waste. This confirms assumptions made based on already existing literature. Further, it provides a base for future research into the interactions between self-referencing appeals and the way people process information. As part of those interactions, Actively Open-minded Thinking and Preference for Effortful Thinking also directly positively influenced the measured attitudes towards food waste. That lead to the conclusion that people with such thinking styles already have a relatively positive attitude towards food waste and do not need to be targeted anymore. Next to that, the data analysis revealed an interaction effect of loss framing and self-referencing on parts of the examined attitudes towards food waste, confirming previous studies.

However, these were the only results that could be identified. Because no other effects in support or contrast to the presented literature could be detected, repeating the experiment with improved manipulations is highly suggested.

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Appendix A – Survey Design

Stimulus 1: Gain Frame and High Self-referencing



Stimulus 2: Gain Frame and Low Self-referencing



Stimulus 3: Loss Frame and High Self-referencing



Stimulus 4: Loss Frame and Low Self-referencing



By not reducing their food waste people will unnecessarily lose money.

Flaticon.com

Appendix B – Survey

Dear respondent,

Thank you for your interest in this research. I am a Master's student at the Erasmus University Rotterdam and I am inviting you to fill in this survey. In this survey, you will see advertisements regarding food waste. I would then like you to give your response to the questions about that topic and the way you perceive information. The questionnaire will take approximately 8 minutes to fill in.

Please answer each question carefully and honestly, I am sincerely interested in your personal opinions and there are no right or wrong answers.

Thank you for your time and willingness to participate in this survey.

All research data remain completely confidential and are collected in an anonymous form. It will not be possible to identify you and your responses will not be linked back to you. The information collected will be used solely for academic purposes and will not be shared with any third parties.

If you now decide not to participate in this research, this will not affect you. If you decide to cease your cooperation while filling in the questionnaire, this will in no way affect you either. You can cease your cooperation without giving reasons.

If you have questions about this research, in advance or afterwards, you can contact me, Hannah Emmert, personally, email: 661274he@eur.nl.

If you understand the information above and freely consent to participate in this study, click on the “I agree” button below to start the questionnaire.

I agree

I do not agree

Randomised portrayal of one of the four stimulus materials

In the following section of the survey, you will be asked to give your opinion on specific statements about food waste. Please select the most fitting answer option for each of the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Throwing away food does not bother me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I throw away food I feel guilty.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I throw away food I feel like I harm the environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I throw away food I feel like I act unfairly towards people with less access to food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Please select the most fitting answer option for each of the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I do not really worry about the environmental impact of the food that I throw away.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not really worry about the impact of my food waste on the distribution of resources in the world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not really worry about the amount of food that I throw away.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not really worry about the cost of the food that I throw away.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



In general, I try very hard not to throw away food.

- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

Please answer the following questions thinking about the near future (e.g. next one/two weeks) and your household

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I intend not to throw food away	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My goal is not to throw food away	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will try not to throw food away	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In the following sections of the survey, you will be given statements about your individual way of thinking. Please select the most fitting answer option for each of the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
It is important to be loyal to your beliefs even when evidence is brought to bear against them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Whether something feels true is more important than evidence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Just because evidence conflicts with my current beliefs does not mean my beliefs are wrong.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There may be evidence that goes against what you believe but that does not mean you have to change your beliefs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Even if there is concrete evidence against what you believe to be true, it is OK to maintain cherished beliefs.

Regardless of the topic, what you believe to be true is more important than evidence against your beliefs.



Please select the most fitting answer option for each of the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think there are many wrong ways, but only one right way, to almost anything.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my experience, the truth is often black and white.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Truth is never relative.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The truth does not change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Either something is true or it is false; there is nothing in-between.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is no middle ground between what is true and what is false.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Please select the most fitting answer option for each of the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I like to rely on my intuitive impressions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe in trusting my hunches.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I make decisions, I tend to rely on my intuition.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using my "gut-feelings" usually works well for me in figuring out problems in my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intuition is the best guide in making decisions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often go by my instincts when deciding on a course of action.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Please select the most fitting answer option for each of the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I'm not that good at figuring out complicated problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thinking is not my idea of an enjoyable activity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to avoid situations that require thinking in depth about something.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not a very analytical thinker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reasoning things out carefully is not one of my strong points.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thinking hard and for a long time about something gives me little satisfaction.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Please indicate the extent to which the following statements apply.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I felt I was personally addressed in the advertisement that I was shown in the beginning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt the advertisement in the beginning was relevant to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that the ad in the beginning informed me about a potential way to save money.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that the ad in the beginning informed me that I would lose something.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Lastly, I would like you to answer some demographic questions.

What is your gender?

- Male
 - Female
 - Non-binary / third gender
 - Prefer not to say
-

What is the highest level of education you have completed up to this point?

- Some high school
 - High school diploma or the equivalent
 - Some college but no degree
 - Associate or technical degree
 - Bachelor's degree
 - Master's degree
 - PhD or higher
 - Prefer not to say
-

How old are you? (Example: 24)

What is your nationality? (Example: Dutch)

End of Block: Demographic Information