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Abstract

Health and sustainability labels often do not get the attention they need to change buying behaviour of healthier and more sustainable products. The present study explores the effect of incongruency (i.e. two or more pieces of information that conflict with each other) between Nutri-Score and Eco-Score labels on the level of attention (i.e. recall) to these labels and how this affects subsequent information comprehension, healthy and sustainable product inferences and buying probability of healthier and more sustainable products. Through a questionnaire and an eye-tracking study, 275 Dutch students filled in questions about two types of pizzas with (or without) Nutri-Score and Eco-Score labels on them.

Findings reveal a spill-over effect in attention, indicating that attention to the labels on the newly developed pizza extends to increased attention to the labels on the assortment pizzas. However, no significant differences between groups in recall of the labels were found, suggesting potential unconscious attention to labels that may not translate into conscious recall. This finding was supported by the eye-tracking study by showing that all participants at some point gazed over the labels. Information incongruency was shown to increase the level of information comprehension of the Nutri-Score, but not Eco-Score label, when comparing between the incongruent and congruent treatment groups for the newly developed pizza. While comprehension itself did not directly influence product inferences, less accurate healthy and sustainable product inferences were found to significantly increase the buying probability of an unhealthy and unsustainable product. Future research is advised to further examine how information incongruency can actually lead to increased attention and how innovative technology like artificial intelligence might play a role here to further enhance research on this subject.

Keywords: Information incongruency, Nutri-Score, Eco-Score, Health, Sustainability, Attention, Information comprehension, Product inferences, Buying probability

Table of contents

1. Introduction

Sustainability problems caused by the (over)consumption of food have increased a lot over the past decades (Nemecek et al., 2016; Reisch et al., 2013). According to estimations, household consumption contributes to more than 60% of the global greenhouse gas emissions (Ivanova et al., 2016). The (over)consumption of food is seen as one of the major contributors to these emissions, accounting for between 48% and 70% globally (Ivanova et al., 2016; Tukker et al., 2010). Other health problems, such as obesity, have also increased a lot due to the overconsumption of food. It is estimated that obesity has nearly tripled since 1975 (Jaacks et al., 2019). Furthermore, overweight and obesity in Europe affects nearly 60% of adults and one in three children (World Health Organisation, 2022). These problems have caused researchers to call for methods that educate consumers about health and sustainability instead of just providing information, enable them to clearly assess product ingredients and increase their motivation to make healthier and more sustainable food choices (Magnusson, 2010; Siegrist et al., 2015).

Willett et al. (2019) presented an integrated framework for a global healthy and sustainable diet that showed it is possible to feed ten billion people by 2050. However, the authors state that governments must educate consumers to make them choose healthier and select more sustainable products to reach this goal. To reach this goal, literature mentions better health and sustainability food labelling as one of the most promising methods (Guthrie et al., 2015; Magnusson, 2010). Labelling could potentially influence consumers to make better food choices by giving health and sustainability information and increasing their ability to assess product ingredients in a simple and clear way (Guthrie et al., 2015; Magnusson, 2010; Siegrist et al., 2015). Consequently, several different health and sustainability labels were developed to give health and sustainability information and aid consumers into making better food choices (Temple, 2020).

Health and sustainability labelling, particularly Front-Of-Packaging (FOP) labels, are pivotal in aiding consumer choices, but current criticisms highlight the need for clarity and simplicity (Temple & Fraser, 2014). Labels like Multiple Traffic Light (MTL), Guideline Daily Amount (GDA), and newer ones like Nutri-Score and Eco-Score aim to simplify information processing for healthier and more sustainable choices (Grunert et al., 2010; De Temmerman et al., 2021). While labels act as cues for influencing choices, biases may arise when this information is unconsciously processed, impacting perceptions and decision making (Guthrie et al., 2015; Grabenhorst et al., 2013; Raghunathan et al., 2006). Depending on the type of information, label information potentially biases people to either choose based on concrete (e.g. taste inferences) or abstract (e.g. health and sustainability) perceptions of attributes of the product (Grabenhorst et al., 2013).

Consumers can consciously process label information, but this requires Motivation, Opportunity, and Ability (MOA) on the part of the consumer (MacInnis & Jaworski, 1989; Rothschild, 1999). This is summarised in the MOA framework that is used to describe, understand and predict when information is processed (Grunert, 2011; MacInnis & Jaworski, 1989; Rothschild, 1999; Schruff-Lim et al., 2023) and when consumers act on this (Thøgersen, 1994). Turning information into action can be seen as a two-step process (see Figure 1 in paragraph 2.2): (1) information is transformed into knowledge when consumers notice the information and understand it and (2) knowledge is transformed into action, giving consumers reason for action (Hornik, 1989; Schruff-Lim et al., 2023). Health and sustainability labels

enhance consumers' opportunity and ability to process information, with combined health and sustainability labels potentially improving comprehension of this information (Potter et al., 2023; Sonntag et al., 2023; De Bauw et al., 2022). This combined labelling approach enables quick access to product ingredients and increases knowledge in a simple and clear way (Dubois et al., 2020; Hagmann & Siegrist, 2020). However, labels must remain simple to prevent overload and maintain effectiveness (De Bauw et al., 2021; Spiller et al., 2016). Ability of correctly comprehending (i.e. decoding) the information is a necessary, yet insufficient condition for consumers to act upon it (Schruff-Lim et al., 2023). Labels cause a more 'concrete' perception of health and sustainability information at the point of purchase, since consumers can access such information easier and more directly via labels than normally (Schruff-Lim et al., 2023), making them more decisive in product choice (Van Dam & Van Trijp, 2013).

So, the question remains why health and environmental information is normally seen as more 'abstract' rather than 'concrete' information and is consequently often not decisive in consumers' final choice (Van Dam & Van Trijp, 2013). Construal Level Theory (CLT) explains how health and sustainability information are perceived as psychologically distant and abstract (i.e. at higher construal level) compared to other product features like taste inferences (Jäger & Weber, 2020; Ronteltap et al., 2012). Concrete features are psychologically closer and consequently more decisive in consumers' actual "here and now" choice which reflect lower levels of construal (Reczek et al., 2018; Van Dam & Van Trijp, 2013). Health and sustainability are difficult attributes to assess directly at the point of purchase and have to be verified in some way (Reczek et al., 2018). Health and sustainability are called credence attributes, as the healthiness and sustainability level of a product have to be verified by some other type of information (Moser et al., 2011). Alternatively, taste inferences is called an experience attribute (i.e. lower psychological distance), since it can be directly experienced after consumption quite easily (Moser et al., 2011). This makes experience attributes way more decisive in consumer choice than credence attributes (Van Dam & Van Trijp, 2013).

Labels, especially colour-scale labels, make health and sustainability more concrete, and consequently more competitive with experience attributes at the point of purchase, assisting easier information processing and reducing psychological distance (Chattaraman et al., 2023; Reczek et al., 2018). Drawing attention to these labels is essential as health and sustainability information otherwise goes unnoticed and results in no changes in purchasing behaviour at all (Sonntag et al., 2023). So, how can attention be drawn to these labels and motivate consumers to process and comprehend this information? Attention can be drawn by changing something in the visual environment of consumers that disrupts with the expected status quo and breaks with their information processing routines (Schwarz et al., 2021). Several ways of drawing attention to label information are mentioned in literature, with one of the most promising ones being information incongruency (Schwarz et al., 2021; Sonntag et al., 2023).

Incongruency between label information occurs when there are two or more pieces of information available on a food product that conflict with each other (Sonntag et al., 2023). This incongruency disrupts consumers attention, requiring more effortful information processing for comprehension (Schwarz et al., 2021). When two incongruent labels are presented, higher attention and subsequent information processing are triggered compared to easily processed information, resulting in increased comprehension (Schwarz et al., 2021; Sonntag et al., 2023). Incongruency can take place at the benefit level (e.g. health and sustainability) as well as the feature level of a product (e.g. colours) (De Bauw et al., 2021). Nevertheless, incongruency of health and sustainability (i.e. benefits) can occur at the feature

level when two colour-scale labels corresponding with health and sustainability are used, displaying conflicting 'green' and 'red' labels on a food product (De Bauw et al., 2021).

So, (incongruent) labels may ironically promote healthier and more sustainable product choices as explained by MOA and CLT. Although information congruency or incongruency is quite heavily researched (e.g. Schwarz et al., 2021), the effect of incongruent product information on attention, comprehension, product inferences, and decision making still needs more exploration (Potter et al., 2023; Sonntag et al., 2023). Moreover, the research on using health and sustainability labels together on a food product is limited (e.g. De Bauw et al., 2021; Potter et al., 2023; Sonntag et al., 2023). So, while there are studies about these subjects, there is a gap in understanding the two-step process from information to action; how incongruency in features has an effect on attention and comprehension and, consequently, product inferences and consumer buying decisions.

Therefore, the present study aims to fill this knowledge gap by looking specifically at situations with incongruent health and sustainability labels on a food product to gain further insights into its effect on attention, comprehension, product inferences and decision making with MOA and CLT as underlying processes. Different combinations (congruent or incongruent) of the health and sustainability labels are researched for a specific food product. This study investigates whether incongruent labels will trigger more attention compared to congruent labels and consequently see what the effect will be on the level of label comprehension, healthy and sustainable product inferences and consumer buying probability for healthier and more sustainable products. The relating main research question (MRQ) and two sub research questions (SQ1 and SQ2) are stated as follows:

MRQ: *How and to what extent do incongruent health and sustainability labels on food products affect consumers' label attention and comprehension and subsequently influence their product inferences and buying probability, as compared to congruent labels?*

SQ1: *How do incongruent health and sustainability labels on food products affect consumers' label attention and comprehension, as compared to congruent labels?*

SQ2: *To what extent do incongruent health and sustainability labels influence consumer buying decisions via label attention, comprehension and product inferences?*

This study contributes to the current literature by extending the research on using (incongruent) health and sustainability labels together on a food product and use MOA and CLT as underlying theories to develop expectations. Furthermore, this study builds on the research of Sonntag et al. (2023) of using two incongruent labels to increase attention, label comprehension, healthy and sustainable product inferences and the buying probability for healthier and more sustainable food choices (Sirieix et al., 2013). Potentially, this research can offer relevant insights of using health and sustainability labels together as standard food labelling methods across Europe.

2. Theoretical background

2.1 Products as bundles of benefits

Why do consumers prefer certain food products over other food products? This a question that has gained a lot of interest from researchers over the years (e.g. Lancaster, 1966; Steptoe et al., 1995; Fotopoulos et al., 2009; Verain et al., 2019). In the early years of the twentieth century, researchers thought that consumers bought products because of their utility; consumers can rationally think of just as many aspects of an apple as of a diamond and consider them in their decision making (Lancaster, 1966).

However, this line of thinking changed from the 1960s onwards (Lancaster, 1966). In short, it was proposed that a product on itself does not provide utility to a consumer, but that a combination of several characteristics of a product give rise to utility and that many characteristics are shared by more than one product (Lancaster, 1966). Moreover, products in combination with each other may have different perceived characteristics than when these goods are seen separately. So, it is these characteristics and not the product itself that gives rise to consumer preference (Lancaster, 1966; Steptoe et al., 1995). This line of research has been expanded a lot over the years and researchers started describing these characteristics as benefits (Steptoe et al., 1995). Benefits in this research are described as the advantages consumers get from buying a particular product that improves their current state of well-being (Steptoe et al., 1995). So, in line with Lancaster (1966), consumers buy products because of the bundles of benefits (i.e. the combination of several characteristics) they offer (Steptoe et al., 1995).

There are many different types of benefits mentioned in literature that motivate consumers to buy certain food products or not (Onwezen et al., 2019). The Food Choice Questionnaire (FCQ) originally developed by Steptoe et al. (1995) found nine factors that influence consumers' food choices: healthfulness, affect, convenience, sensory appeal or taste, natural content (i.e. use of additives), price, weight control, familiarity, and ethical concern. The authors state that sensory appeal, health, convenience, and price were the most important determinants of food choice. More recent research also found sensory appeal, health, convenience, and price to be the most important motivators for food choice (Fotopoulos et al., 2009). The ethical concern factor was later extended to a factor aimed at animal welfare and environmental protection next to political concern as well (Onwezen et al., 2019). For this research, this means that these are the most important determinants of the buying probability of a food product, acknowledging the importance of health and sustainability in food choice as well.

As environmental protection became a more important topic for consumers, a Sustainable FCQ was developed to gain insight into the most important sustainable motives consumers have for selecting food (Verain et al., 2021). The authors found two dimensions of sustainability benefits. The first dimension found was called general sustainability and contained environmental, ethical and animal welfare aspects. The second dimension was called seasonal and local production. Seasonal and local production were found as sustainable benefits by consumers since such production requires shorter transportation distances and unheated greenhouses (Siegrist et al., 2015). Local and seasonal production are often seen as closer to the self than general sustainability as it affects consumers more directly (Jäger & Weber, 2020; Verain et al., 2021). As such, local and seasonal consumption have higher feasibility levels for consumers

than general consumption, which has higher desirability levels (Reczek et al., 2018; Van Dam & Van Trijp, 2013).

Desirability is about benefits of buying a product in the future; it is about longer-term desirable goals (Trope et al., 2007). Feasibility is about how to make these longer-term desirable goals happen and with wat short term costs or trade-offs (Trope et al., 2007). In terms of psychological distance, feasibility is more important in psychologically close situations and about concrete benefits compared to desirability which is more important in psychologically distant situations and about abstract benefits (Trope et al., 2007). So, this is also why local and seasonal consumption are more feasible as this behaviour is actionable in the present and is perceived as psychologically close, while general sustainability is more about benefits in the future (i.e. perceived as psychologically distant) and thus more desirable (Verain et al., 2021). The most important benefits of food choices from the FCQ (i.e. sensory appeal, health, convenience and price) are also benefits consumers can act upon in the present and are thus more related to feasibility in consumer choice (Van Dam & Van Trijp, 2013).

Consequently, health is regularly a more feasible, and thus, decisive factor for buying food products than sustainability (Fotopoulos et al., 2009; Steptoe et al., 1995). This is because health is more about the self and sustainability about the collective; acting healthily will provide benefits for yourself while acting sustainably will provide benefits for others as well (Jäger & Weber, 2020; Ronteltap et al., 2012). However, health is both feasible and desirable as a person can act healthily in the present, but the consequences of this behaviour lie more in the future (Ronteltap et al., 2012). Thus, health and also sustainability are both desirable benefits and more often lead to intended behaviour in the future rather than in the present (Jäger & Weber, 2020). Next to the temporal (i.e. time) dimension defining psychological distance, a division can be made on a social, spatial, and hypothetical dimension as well (Trope et al., 2007).

These different dimensions of psychological distance and why health and sustainability are desirability benefits can be explained by Construal Level Theory (CLT) (Trope et al., 2007). CLT has already been stated as a suitable theoretical basis for researching healthy and sustainable consumption (Chang et al., 2015; Chattaraman et al., 2023; Ramirez et al., 2015; Reczek et al., 2018; Schmeichel & Vohs, 2009). According to CLT, people can perceive events, objects or information as psychologically close or distant (Trope et al., 2007). Psychological distance can be about spatial (e.g. close or distant location), temporal (e.g. near or distant future), social (e.g. similar or dissimilar person to the self) and hypothetical (e.g. low or high probability of happening) distance. For example, within social distance, consumers thinking about healthy eating for their children leads to more abstract thoughts and a higher level construal, but thinking about healthy food for themselves leads to more concrete thoughts and a lower level construal (Chattaraman et al., 2023). The higher the psychological distance, the more distant and abstract this event, object or information appears. Psychological distance has an effect on the way mental structures are formed: a detailed, concrete and psychologically close interpretation (low-level construal, e.g. “buying a product for direct benefits”), or an abstract and psychologically distant interpretation (high-level construal, e.g. “buying a product for benefits in the future”) (Trope et al., 2007). Health and sustainability are often seen as psychologically distant attributes and consequently cause a higher level construal (Chattaraman et al., 2023).

As psychological distance increases, desirability concerns (e.g. how interesting health and sustainability are) receive greater weight than feasibility concerns (e.g. how tasty a product is). So, a higher-level construal emphasizes desirability concerns, and a lower-level construal emphasizes feasibility concerns (Trope et al., 2007). Therefore, the construal level of an object, event or piece of information can explain trade-offs (e.g. feasibility versus desirability) people make when given a choice. Health and sustainability also have higher desirability levels for consumers because they are difficult to ascertain at the point of purchase and have to be verified by other information (Chattaraman et al., 2023; Jäger & Weber, 2020; Moser et al., 2011).

Attributes like health and sustainability that are difficult to ascertain at the point of purchase and have to be verified in some other way than experiencing it directly are also called credence attributes (Moser et al., 2011; Sonntag et al., 2023). Additionally, attributes like price and colour are search attributes; these attributes can be evaluated before purchase (Fagerstrøm et al., 2019). Health and sustainability can also be search attributes, but consumers need to actively evaluate them before purchase. Attributes like convenience and flavour are experience attributes; these attributes can be evaluated directly after purchase (Moser et al., 2011). For food products, search and experience attributes are mostly used at the point of purchase as consumers can directly experience them before or after purchase without too much effort or processing motivation and use this direct experience as their verification (Fagerstrøm et al., 2019; Van Dam & Van Trijp, 2013). Consequently, experience and search attributes get more attention than credence attributes (Moser et al., 2011).

This means that health and sustainability information generally gets less attention from consumers than experience attributes as it is more difficult information to process (Moser et al., 2011; Sanjari et al., 2017). So, making health and sustainability information easier to process at the point of purchase will decrease the perceived psychological distance and consequently activate a lower level construal (i.e. higher feasibility) (Chattaraman et al., 2023; Reczek et al., 2018; Schruff-Lim et al., 2023). Literature mentions that labels can make assessing health and sustainability information easier in the present and increase consumers' comprehension of the provided information (Chattaraman et al., 2023; Reczek et al., 2018). Consequently, the feasibility of the normally more desirable health and sustainability attributes increases.

However, consumers may not even process product information like health and sustainability at all if the product does not receive enough attention (Schwarz et al., 2021). Products and their labels are not always consciously processed by consumers or even noticed by consumers (Sanjari et al., 2017; Sonntag et al., 2023). Products contain various cues from which consumers can make inferences, like colours or taste inferences. These cues can be aligned with each other (e.g. green coloured health label and green coloured sustainability label) resulting in lower levels of attention and information processing, but sometimes these cues are not aligned with each other (e.g. red coloured health label and green coloured sustainability label) (Schwarz et al., 2021). When these cues are not aligned with each other, this could lead to higher levels of attention and different inferences compared to products with aligned cues (Schwarz et al., 2021; Sonntag et al., 2023). This phenomenon is called information incongruency in literature and is explored in the next paragraph (Loebnitz et al., 2015).

2.2 Information incongruency and level of attention

Information incongruency in literature is also referred to as discrepancy (De Bauw et al., 2021), disfluency (e.g. Schwarz et al., 2021) or conflicting (labels) (e.g. Sonntag et al., 2023). For this research, incongruency is used as a term since it is also used in literature for the same phenomenon (Loebnitz et al., 2015). Furthermore, incongruency in this research is related to labels and is described as when there are two or more pieces of information available on a food product that conflict with each other (Sonntag et al., 2023). Attention is about if consumers notice certain label information or not (Schwarz et al., 2021). So, even a slight level of attention is considered as attention.

Incongruency is about product features (e.g. colours, De Bauw et al., 2021); specifically how abstract subjects like health and sustainability can be made more concrete by using incongruent colours (i.e. feature of the product) on food labels that correspond to a certain level of health and sustainability (Jäger & Weber, 2020; Moser et al., 2011; Sonntag et al., 2023). For example, Loebnitz et al. (2015) state that moderately incongruent shaped food (a feature) leads to a bit more attention and cognitive (i.e. more effortful) information processing compared to normal shaped food, but to the same purchase intention. So, moderately incongruent information in this case leads to higher levels of attention and higher levels of cognitive processing of this information (Schwarz et al., 2021). When consumers are motivated, information that is moderately incongruent like the shape of food is preferred over congruent or extremely incongruent information (Loebnitz et al., 2015) if accommodated to- and assimilated by-consumers successfully as well (more about motivation in paragraph 2.4) (Lee & Schumann 2004).

Alternatively, other literature suggests that congruent nutrition information generates a more positive effect and result in enhanced liking, while incongruent information results in the opposite (Gomez et al., 2017). These authors suggest that incongruency has a negative impact because of the difficulty to process this information. However, other research suggests that slight incongruency results in more cognitive information processing, which prevents negative outcomes correlated with intuitive information processing such as biases (Alter et al., 2007). Experienced incongruency can lead to more attention and subsequent cognitive information processing, because consumers can see this as a cue that the problem in question requires more elaborate thought (Alter et al., 2007). When the colour of a piece of information differs from what consumers expect, this may influence processing motivation and strategy (Schwarz et al., 2021). Furthermore, incongruency is most interesting when motivation and ability are high (see paragraph 2.4) **(**Alter et al. 2007)**.**

Marette (2021) found that the ‘red’ colour of a negative health or sustainability label on a product had a significantly bigger effect on consumers’ attention to these labels than the ‘green’ colour of a positive health or sustainability label. These results can be explained by prospect theory (Kahneman & Tversky, 1979). According to prospect theory, the impact of information (i.e. via labels) implying losses are higher than the impact of information implying gains; people are more averse to losing than they are attracted to winning (Kahneman & Tversky, 1979). For health and sustainability labels this means that consumers are more inclined to notice ‘red’ scores than ‘green’ scores, since these ‘red’ scores signal losing (Marette, 2021). Thus, it is expected that incongruent health and sustainability label combinations will lead to higher levels of attention than congruent health and sustainability label combinations. This leads to the following hypotheses:

H1: *The presence of an incongruent (congruent) health and sustainability label combination leads to higher (lower) levels of attention compared to congruent (incongruent) or no health and sustainability label combinations.*

However, research suggests that attention to health and sustainability labels is not enough to positively change behaviour, since health and sustainability are difficult subjects to think about and need to be properly understood (Sanjari et al., 2017). This means that comprehension (= understanding) mediates the effect between label attention and a healthy and sustainable consumer choice. The model of Schruff-Lim et al. (2023) visually shows this process from information to action with comprehension (in their model: understanding) as the mediator and is used as a guiding framework throughout this chapter (see Figure 1).

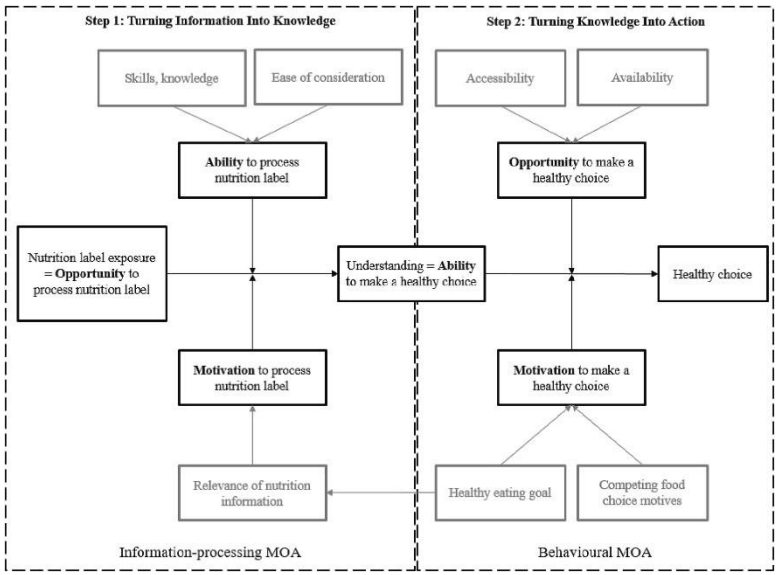

Figure 1: Two-step process from information to action (Schruff-Lim et al., 2023)

Label comprehension is described as to what extent consumers understand the health and sustainability information provided by the product via a label. Research suggests that comprehension of label information is a necessary condition for consumers to make a healthy and sustainable choice (Kolber & Meixner, 2023; Sonntag et al., 2023). Without health and sustainability label comprehension, consumers tend to rely more on habits (i.e. buying the same products as previously bought again without too much thought) and on taste perception for their purchase decisions and less on health and sustainability since these require a higher level of comprehension to act upon (Sanjari et al., 2017). If people do not understand the newly provided information, they are not going to change their habits (Grunert et al., 2010). Therefore, the effect of label attention on label information comprehension is further explored.

2.3 Level of label attention and label comprehension

The effect of nutrition and sustainability label attention on label information comprehension has been studied quite extensively in the past (Onwezen et al., 2021). Studies have also referred to this effect as the level of label information processing that has taken place (e.g. Kolber & Meixner, 2023; Sonntag et al., 2023). The level of label information processing is basically the relationship between attention and comprehension; if consumers notice a label, how much they will understand the information provided by this label about the product may depend on how

much information is processed. Therefore, the effect of label attention on label information comprehension is also referred to in this section as the level of information processing that has taken place.

The level of label information comprehension of consumers depends on if consumers pay any attention to the information on the label at all, since information needs to be processed in some conscious or unconscious way to lead to a certain level of label comprehension (Kolber & Meixner, 2023). This also means that if consumers do not pay any attention to the information at all, they will also not comprehend any of the information.

When consumers pay little attention to product labels, little effort will generally be taken to comprehend the information on them and consumers will base their decisions on other heuristics such as taste inferences or previous experiences (Vlaeminck et al., 2014). Heuristics are described as empirical rules of thumb used to process information with minimum effort (Scheibehenne et al., 2007). Consumers often rely on simple heuristics for information processing as most information can be processed easily (Schwarz et al., 2021; Vlaeminck et al., 2014). This means that consumers use heuristics to easily process information and can result in habits (Grunert et al., 2010) (see paragraph 2.6). However, habits are helpful if consumers are already knowledgeable about health and sustainability from previous experiences, thus requiring lower levels of comprehension to perform the desired behaviour (Hung et al., 2017). Moreover, if consumers are already familiar with the stimuli, small amounts of attention can also result in more cognitive information processing (Schwarz et al., 2021).

Consumers normally tend to have higher levels of label information comprehension when information is somewhat harder to process, as discussed in paragraph 2.2 (Loebnitz et al., 2015). For example, when the colour of the information slightly deviates from what consumers expect, this information might receive higher levels of attention and result in higher levels of label information comprehension (Schwarz et al., 2021). So, when consumers think a product is healthy but then find out via the health label that the product actually scores ‘red’ (i.e. unhealthy), it causes higher levels of attention and a deeper level of information processing (Marette, 2021).

This incongruency between what consumers may think and what is actually true can be explained by Cognitive Dissonance Theory (Festinger, 1957). This theory states that when people experience incongruent cognitions (e.g. consumers thinking a product is healthy while they notice that a product is actually unhealthy) they experience a psychological state of discomfort. Consumers will then try to remove this state of discomfort by altering one of the cognitions; in this case probably their own previous cognition (Festinger, 1957). Edenbrandt et al. (2021) found that consumers comprehended more sustainability information with higher levels of cognitive dissonance. So, consumers are more likely to process health and sustainability information with incongruent cognitions. As health and sustainability are credence attributes, deeper information processing of product information is quite necessary to reach a higher level of label information comprehension (Jäger & Weber, 2020; Moser et al., 2011).

Studies that combined eco and nutrition labels on a food product found that a five-Colour Nutrition Label ranging from A to E led to higher levels of label information comprehension than other singular or binary (i.e. black and white) labels (Kolber & Meixner, 2023; Potter et al., 2023; Sonntag et al., 2023; Spiller et al., 2016). Additionally, it was found that a five-Colour

Nutrition Label, like the Nutri-Score and Eco-Score, on a food product enabled consumers to comprehend product information easily without needing too much background information. Sonntag et al. (2023) state that food products containing both a health and sustainability label had a greater impact on the level of information comprehension than, for example, an organic label since their nutrition and sustainability labels were more attractive and colourful. Therefore, the hypothesis is as follows:

H2: *Higher levels of attention to health and sustainability labels as a consequence of label incongruency result in higher levels of label information comprehension, while lower levels or no attention result in lower or no label information comprehension.*

Incongruency can lead to higher levels of attention and comprehension if motivation and ability of consumers to process this information are high (Alter et al., 2007; Schwarz et al., 2021). Research has found that motivation and ability are quite hard to trigger, but important factors for attention and subsequent comprehension to happen or not (Grunert et al., 2010; Hung et al., 2017; Verain et al., 2017). Therefore, motivation and ability are further explored.

2.4 Motivation and ability to process health and sustainability information

How healthy and sustainable food products are, is difficult information to process as consumers cannot directly experience it but have to verify the health and sustainability level from the information provided by the product (Moser et al., 2011). Literature points towards the important role of motivation and ability in reaching comprehension of health and sustainability information (Grunert et al., 2010). Motivation emerges as the primary driver of processing information, also enhancing ability (i.e. increased knowledge) when motivation increases (Hung et al., 2017; Verain et al., 2017).

The factors mentioned by Grunert et al. (2010) are summarised in the Motivation, Opportunity and Ability (MOA)-framework which is used to describe, understand and predict when information is processed (Grunert, 2011; MacInnis & Jaworski, 1989; Rothschild, 1999; Schruff-Lim et al., 2023) and when consumers act on this (see paragraph 2.6) (Thøgersen, 1994). As providing the opportunity to read and comprehend the information is a necessary, yet insufficient condition for processing information, only a deeper dive will be taken into motivation and ability (Schruff-Lim et al., 2023).

Information to action is a two-step process: information is transformed into knowledge when consumers notice the information and understand it (i.e. have the ability) (1) and knowledge is transformed into action, giving consumers reason for action (2) (see Figure 1) (Hornik, 1989). This first step is called information-processing MOA and can be constrained by a lack of ability and motivation to process information (see Figure 1) (Schruff-Lim et al., 2023). So, for the model developed in this research, a lack of ability and motivation may constrain information processing even if consumers notice information provided by labels and if they are able to comprehend the information that has been brought to their attention (for comprehension see paragraph 2.3).

Consumers lack ability for processing nutrition and sustainability information when the required skills or knowledge to do so are not present (MacInnis et al., 1991), or when there is information overload caused by the environment, like in supermarkets (Schruff-Lim et al., 2023). Consumers lack motivation when they have a low interest in healthy eating (Hung et al.,

2017), and when it is not in their personal interest (De Bauw et al., 2022; Rothschild, 1999). A lack of personal interest is especially apparent for sustainability, since sustainability is more of a collective problem but health an individual problem (Jäger & Weber, 2020). The second step, behavioural MOA, gives individuals cause for action (see paragraph 2.6). For now, the focus lies on the first step. There are several ways mentioned in literature to improve the motivation and ability of consumers to process information.

Motivation can be improved by personalising information to consumers (Schruff-Lim et al., 2023). This is because motivation is driven by an intrinsic interest in healthy and sustainable eating, meaning that consumers would only process the information if it is in their own interest (Hung et al., 2017; Rothschild et al., 1999; Verain et al., 2017). Consumers' motivation can also be increased by highlighting the link between sustainability and more personal motives such as health (Verain et al., 2017).

Ability can be improved by enhancing skills and knowledge of consumers (Rothschild, 1999). Educating consumers can help them understand health and sustainability information (Schruff-Lim et al., 2023). Moreover, the complexity of processing information should be reduced to prevent information overload (De Bauw et al., 2022). This led researchers to point out that consumers' ability to assess nutritional quality of a product can be improved via labels (Dubois et al., 2020; Hagmann & Siegrist, 2020). Labels can facilitate nutritional and sustainability information in a simple and clear way (De Temmerman et al., 2021; Santé publique France, 2022).

Achieving an optimal combination of motivation and ability is suggested in research to positively impact the effect of (in)congruent labels on information processing, leading to higher levels of attention and comprehension (De Bauw et al., 2022; Schruff-Lim et al., 2023). Moreover, incongruent information results in higher levels of attention than congruent information (H3a), and consumers are more willing to process this information when motivation and ability are higher, resulting in higher levels of comprehension (H3b) (Alter et al., 2007; Schwarz et al., 2021). Therefore, the hypotheses are as follows:

H3a: *An increased motivation and ability combination positively moderates the effect of incongruent (congruent) health and sustainability label combinations on the level of attention.*

H3b: *An increased motivation and ability combination positively moderates the effect of the level of attention paid to labels on the comprehension level of the provided information.*

So, as attention to information on labels and comprehension of the information have been discovered already, how do these incongruent health and sustainability labels lead to healthy and sustainable product inferences via a certain level of information comprehension? The next section will dive deeper into this effect.

2.5 Healthy and sustainable product inferences based on information comprehension

Before leading to actual behaviour (change), consumers need to make proper health and sustainability inferences from the comprehended information. Health and sustainability inferences are described as a correct conclusion about the healthiness and sustainability level of a product reached based on a certain level of health and sustainability information

comprehension from a label. Product inferences, especially when little information is comprehended from the product, are prone to biases and consequently do not lead to the desired behaviour (Alter et al., 2007).

Moreover, consumers can rely more on heuristics such as taste inferences, visual representation or previous experiences when only low levels of label attention and comprehension have taken place and ignore health and sustainability (Ares et al., 2014; Raghunathan et al., 2006; Sanjari et al., 2017; Van Dam & Van Trijp, 2013), especially when motivation is low (see paragraph 2.4) (Grunert et al., 2010). This means that health and sustainability need to be salient in the consumers' mind to get from information comprehension to proper inferences. Salience is described as the conscious presence of health and sustainability in the consumer's mind.

When consumers have higher levels of label information comprehension, they tend to also make inferences based on the healthiness and sustainability of the product as this enables them to comprehend such difficult subjects (Onwezen et al., 2019). In this way, consumers could break with potentially unhealthy and unsustainable habits. Therefore, it is expected that higher levels of label information comprehension lead to improved health and sustainability product inferences, while lower levels of label information comprehension do not or to biased inferences. The hypothesis is as follows:

H4: *Higher levels of label information comprehension lead to different health and sustainability product inferences compared to lower levels of label information comprehension in which health and sustainability inferences are often not made or biased.*

As product inferences have been covered, how do these inferences lead to a higher probability of buying a healthy and sustainable product and can certain inferences break with unhealthy and unsustainable habits caused by, for example, previous experiences? The final section of the theoretical background dives deeper into this.

2.6 Consumer buying probability based on level of health and sustainability product inferences

In the context of labels, increasing the probability of consumers to buy healthy and sustainable products may depend on the health and sustainability inferences made by consumers (see Figure 2) (Thøgersen, 2021). So, a certain level of product inferences caused by higher levels of information comprehension can be necessary to break with habits and increase the probability of consumers to buy healthier and more sustainable products. Consumer buying probability is described as the chance that consumers buy healthy and sustainable products based on the amount of correctly made inferences. Therefore, when health and sustainability labels are highly noticed and the containing information is comprehended, this can influence subsequent product inferences and thus behaviour (Thøgersen, 2021).

Potentially unhealthy and unsustainable habits of buying behaviour are usually a result of previous experiences and are hard to break with (Sanjari et al., 2017). If consumers do not reach higher levels of information comprehension and make proper health and sustainability product inferences, they are not going to change their habits and potentially keep ignoring

difficult subjects like health and sustainability (Grunert et al., 2010; Sanjari et al., 2017). Salience of proper health and sustainability inferences is necessary for increasing the buying probability of healthy and sustainable products (see paragraph 2.5).

However, making health and sustainability salient for consumers and stimulating healthy and sustainable behaviour is not easy (Thøgersen, 2021). The best way of stimulating consumers into sustainable behaviour is by making sustainable behaviour easy (i.e. increase the opportunity), but most importantly by providing comprehensible and clear sustainability information, making climate friendly inferences and choices easier. Consumers who are already more invested in healthy and sustainable behaviour are more likely to make proper health and sustainability product inferences and subsequently buy the product (Grunert et al., 2010; Rondoni & Grasso. 2021). Therefore, the hypothesis is as follows:

H5: *Salient health and sustainability product inferences result in a higher buying probability of a healthy and sustainable product by breaking with potentially unhealthy and unsustainable habits.*

Labels can provide consumers the opportunity to comprehend the information, make proper health and sustainability product inferences and change their behaviour easily (Thøgersen, 2021). Besides having the opportunity, consumers also need to be motivated enough to turn the product inferences (i.e. ability) into action (Grunert et al., 2010). Therefore, it is necessary to investigate the effect of motivation, opportunity and ability on the relationship between product inferences and the buying probability as well (see Figure 2).

Consumers may lack buying motivation for healthy or sustainable products because health and sustainability are often not decisive in their final choice (Van Dam & Van Trijp, 2013). Behavioural motivation is driven by an intrinsic interest in healthy and sustainable eating, meaning that consumers would only act if it is in their own interest (Hung et al., 2017; Rothschild et al., 1999; Verain et al., 2017). This intrinsic motivation can be improved by increasing the personal relevance of health and sustainability information, so by highlighting the consequences of unhealthy behaviour or by giving shopping feedback (Schruff-Lim et al., 2023).

Consumers may lack opportunity to buy healthier and more sustainable products when these products are not accessible (Schruff-Lim et al., 2023). Moreover, opportunity to buy these products may be constrained by the availability of healthy and sustainable products (Schruff-Lim et al., 2023). For instance, when there are a lot more unhealthy than healthy products available, consumers are constrained in their opportunity to buy healthy products compared to unhealthy products (De Temmerman et al., 2021). Furthermore, consumers often do not have the opportunity to assess a product's overall environmental impact and make a choice based on that (Vlaeminck et al., 2014).

Ability to make a healthy choice is a necessary condition, since it is the main connection between processing the information and actually acting on the information; consumers need to comprehend the processed information and make proper inferences to act on it (see Figure 1) (Schruff-Lim et al., 2023). Proper inferences must be sufficed for consumers to act healthy and sustainable and to break with habits (Onwezen et al., 2021). If consumers do not make the right product inferences from the label, they are not going to act based on this label (Rothschild, 1999). Therefore, increasing consumers' ability of making the right product inferences in a

simple and clear way via labels potentially increases the buying probability for healthy and sustainable products (De Temmerman et al., 2021; Guthrie et al., 2015; Vlaeminck et al., 2014). Therefore, the hypothesis is as follows:

H6: *An increased MOA positively moderates the effect of healthy and sustainable product inferences on the consumer buying probability for healthy and sustainable products.*

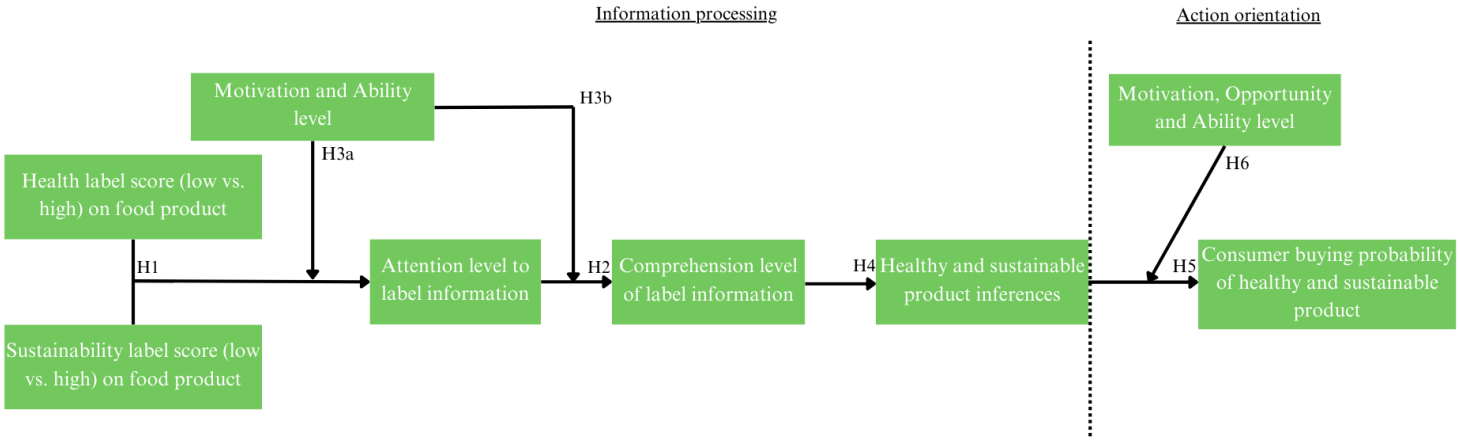

Figure 2: Conceptual framework

3. Methodology

3.1 Design

This study used a 2 (high versus low health score) x 2 (high versus low sustainability score) factorial- between subjects- with control design (De Bauw et al., 2021) to investigate whether incongruent (i.e. low-high or high-low) health and sustainability scores lead to different levels of attention, comprehension and buying probability compared to congruent (i.e. low-low or high-high) health and sustainability scores (see Table 1). A control group was used to test if labels had any effect at all on attention, comprehension, product inferences and buying probability of healthy and sustainable products. The Nutri-Score and Eco-Score were used as combined health and sustainability labels since these labels are quite similar in their presentation, preventing information overload caused by labels that are too dissimilar (Van Loo et al., 2014) (see Figure 1 and Figure 2 in Appendix I) (Colruyt Group, n.d.; Webermarking, 2022).

To investigate the differences between groups, an online Dutch questionnaire in Qualtrics was created with five different stimuli combinations (low-low, high-high, low-high, high-low and no label) to which the participants were randomly assigned to (see Table 1). Besides the questionnaire, an eye tracking study within lab setting using NoldusHub was performed as well in which participants had to fill in the same questionnaire (see Appendix II for the full questionnaire and paragraph 3.4 for the measures). This allowed for comparability between claimed behaviour (i.e. answered in the questionnaire) and actual behaviour (i.e. actual fixation behaviour). In the questionnaire, pizza was used as the central product. Pizza was chosen since the Nutri-Scores and Eco-Scores can really differ within the pizza assortment (Marette, 2021).

Table 1: Participant groups with % of participants per group

Health score / Sustainability score	Low health (E)	High health (A)
Low sustainability (E)	Congruent health/sustainability labels (20.7%)	Incongruent health/sustainability labels (20%)
High sustainability (A)	Incongruent health/sustainability labels (20.7%)	Congruent health/sustainability labels (17.8%)

Incongruency

Control group (no label) (20.7%)

Labels

3.2 Procedure

As the eye tracking study used the same questionnaire, the procedure was almost the same as well. The only thing that differed was that the eye tracking study used a specific computer with NoldusHub, while people who just filled in the questionnaire could do that on their own computer or smartphone.

Participants were selected only if they were considered pizza buyers. Participants were considered pizza buyers if they had bought pizza at least once in the past year. Before starting with the questionnaire, the participants got presented a short explanation of the research and

confidentiality about the participants' data was given. By clicking on the 'continue' button, participants agreed to participate in the study and gave informed consent.

"Newly developed" pizza product

Next, the participants were presented with a "newly developed" pizza and asked questions about what they thought of the product and had to rank a list of attributes from the FCQ on importance for buying this pizza (Onwezen et al., 2019; Steptoe et al., 1995). Moreover, participants were asked to assess (= opportunity) the healthiness and sustainability of the product based on the packaging.

Choice task from assortment

Then, the participants got a choice task and had to pick one pizza they wanted to buy from an assortment of pizza products and had to rank a list of attributes from the FCQ on importance for buying this chosen pizza (Onwezen et al., 2019; Steptoe et al., 1995).

Comparing "newly developed" pizza with choice task pizza

Furthermore, the participants were asked to compare the "newly developed pizza" with the chosen pizza from the assortment based on a list of options from the FCQ (Onwezen et al., 2019; Steptoe et al., 1995).

Rest of the questions

Continuing, participants were asked about their knowledge of health and sustainability (= ability). Furthermore, the participants were asked in hindsight about the ease of assessing how healthy and sustainable the products were (= ability), if they remembered seeing a label in the questionnaire and if they had ever seen the Nutri-Score and Eco-Score before the questionnaire. Moreover, the participants were asked if they understood the information provided by the labels and got a short explanation about the Nutri-Score and Eco-Score label. For the final questions, participants were asked about their gender and age and about how motivated they were in general to buy healthy and sustainable food products.

At the end of the questionnaire, there was some space left to leave comments and an e-mail address for the give-away. Moreover, participants were debriefed that the singular pizza product was made up with a fake Nutri-Score and Eco-Score used for the study. Finally, they were thanked for their participation.

3.3 Stimuli

"Newly developed" pizza

In the questionnaire and eye tracking study, participants were firstly randomly exposed to either a "newly developed" pizza with incongruent (i.e. low-high or high-low), congruent (i.e. low-low or high-high) or no Nutri-Score and Eco-Score combinations (control group) (see Figure 3 for one of the combinations) So, four groups got shown a product with labels and one group did not. To minimize the influence of brand familiarity, participants got shown a pizza product from a brand that is almost unknown in The Netherlands (see Figure 3). The participants were debriefed afterwards about it being a fake product.

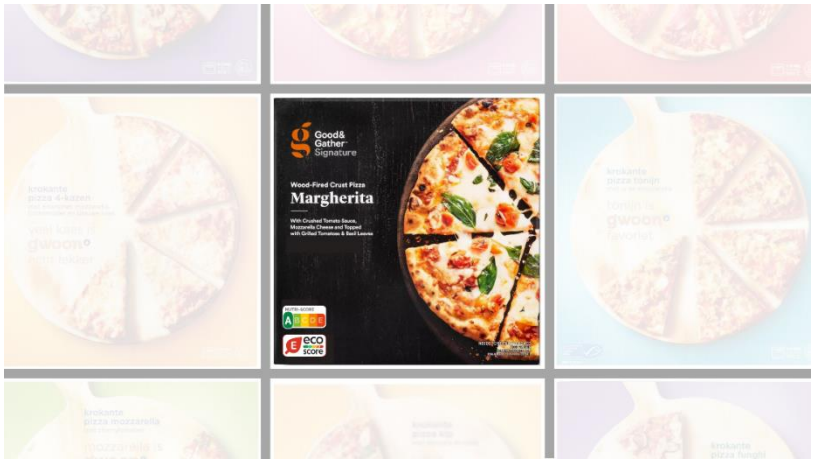

Figure 3: Example of "newly developed" pizza with incongruent combination (AE)

Low Nutri-Scores and Eco-Scores were represented by an E and high scores by an A (see Appendix I and Appendix III) (Colruyt Group, n.d.; Webermarking, 2022). The images for the Nutri-Score were retrieved from Webermarketing (Webermarketing, n.d.), and the images for the Eco-Score were retrieved from Colruyt (Colruyt Group, n.d.).

Choice task from assortment

After the participants were shown the "newly developed" pizza product, the participants were shown a whole assortment of six pizza products with Nutri-Scores and Eco-Scores from which they had to choose a product, excluding the previously shown product (See Figure 7 in Appendix III). Pizzas were from a single brand (Dr. Oetker) to maintain consistency in brand evaluation. Nutri-Scores and Eco-Scores were varied between the products, with low scores represented by a D or an E and high scores by a B or an A. The Nutri-Scores and Eco-Scores were retrieved from Open Food Facts (2023) and Colruyt Group.

Both "newly developed" pizza and choice task pizza

When the participants had chosen a pizza from the assortment, the participants got presented the "newly developed" pizza product together with the chosen pizza from the assortment for comparison.

3.4 Participants

The hypotheses were tested in a questionnaire sample of 275 (M_{age} = 22.15; 54.2% female) Dutch university students between 18 and 25 years old. Moreover, 25 Dutch university students between 18 and 25 years old completed the questionnaire in front of an eye tracker attached to NoldusHub (Pernice & Nielsen, 2009). With a sample of 275, the study can state with 95% confidence that the true level lies within +/- 5% (margin of error) of the results (Qualtrics, 2023). People were encouraged to fill in the questionnaire by giving them the chance to win one out of three Amazon vouchers of 10 euros. Participants were recruited by means of convenience sampling via the author's social network (WhatsApp, LinkedIn, Instagram and Facebook) and physically by asking students in the university to fill in the questionnaire.

Moreover, participants were asked to share the questionnaire with their network, so snowball sampling was used as well.

Besides age, nationality, being a pizza buyer and education, no other participation requirements were imposed.

3.5 Measures

Manipulation check for visual attention

A manipulation check was conducted with 5 participants whether the labels got any visual attention at all. This manipulation check measured if the manipulations shown in the study were noticeable at all. This was done by showing participants the "newly developed" pizza with the different label combinations and then afterwards asking them to answer the following question: *'Which of the following labels, if any at all, did you see?'* with the following answers: organic label, Multiple Traffic Light, Nutri-Score, Guideline Daily Amount, Eco-Score and no label.

Pre-study

After the manipulation check, the questionnaire was pre-tested with 5 participants to eliminate possible other errors and biases with the questions and stimuli in the questionnaire.

To start, the buying frequency of a specific product, pizza, was measured via a five-point scale question: *'How often do you buy pizza?'* with the following answers: very often (almost daily), often (weekly), sometimes (monthly), rarely (a couple of times every year) and once a year (scale adjusted from Bhandari & Nikolopoulou, 2023).

Attention level to label information:

Recall of the labels was measured at the end of the questionnaire by asking the following question: *'Which of the following labels, if any at all, did you see?'* with the following answers: organic label, Multiple Traffic Light, Nutri-Score, Guideline Daily Amount, Eco-Score and no label. Attention level to the labels was validated by eye-tracking via NoldusHub. Visual gaze was counted as 'fixation' when the eye-tracker showed a 'fixation dot' on the labels when the labels were shown. NoldusHub does not clearly provide a threshold in milliseconds (ms), but this should be about 100 – 150 ms for visual fixation according to literature (Negi & Mitra, 2020).

Comprehension level of label information:

Understanding of the healthiness and sustainability level of the product was measured by asking the following question: *'To what extent do you understand the information provided by the Nutri-Score (Eco-Score)?'* with the answer options ranging on a scale from 0 – 100 (0 = 'I do not understand the information provided by the Nutri-Score (Eco-Score) at all', 100 = 'I fully understand the information provided by the Nutri-Score (Eco-Score)' to also test participants' comprehension of the labels.

Buying probability of healthy and sustainable product:

Measured by asking the following question for the assortment pizza: *'If you had to pick one, which of the pizzas from the assortment would you buy?'* The participants could pick one out of six pizzas (see Figure 7 in Appendix IV).

Healthy and sustainable product inferences:

Measured by asking the following question: *'Compare the newly developed pizza with the chosen pizza on the scale shown underneath (sensory appeal, taste, health, price, convenience and sustainability): (-3 Preference newly developed pizza, -2, -1, 0 = Equal to each other, 1, 2, 3 Preference chosen pizza from assortment)' 'How healthy (sustainable) do you think the product is based on the packaging?'* to see if participants made the right inferences based on a list of important attributes from the FCQ (Onwezen et al., 2019; Steptoe et al., 1995).

Motivation, opportunity and ability (moderators):

Measured by asking the following five-point scale questions:

'How much do you know (= ability) about food healthiness (sustainability)?' with the answers ranging from 'I know a lot about food healthiness (sustainability)' to 'I know almost nothing about food healthiness (sustainability)' (adapted from Egnell et al. 2019).

'How easy was it for you to assess (= opportunity) the healthiness (sustainability) of the product displayed?' with the answers ranging from 'Very difficult' to 'Very easy' with one attention control answer option underneath that the participants should answer with 'Very easy' (scale adjusted from Bhandari & Nikolopoulou, 2023).

'How important (= motivation) is healthy food (sustainable food) for you?' with the answers ranging from 'Very important' to 'Very unimportant' (scale adjusted from Bhandari & Nikolopoulou, 2023).

3.6 Data analysis

All data was analysed with the statistical software program SPSS. Statistical tests were seen as significant with a p-value of < 0.05. Which test was used for each hypothesis is shown underneath.

Attention level to label information:

A chi-square test was performed to compare 'correct' and 'incorrect' recall of the labels between the treatment groups. These results were compared to the results of the eye-tracking study as well. Recall was called 'correct' for the treatment groups when participants remembered seeing both the Nutri-Score and Eco-Score on the newly developed pizza and/or assortment pizzas. The other answers were marked as 'false negatives'.

Recall was called 'correct' for the no label group when they answered seeing no label on the newly developed pizza. The other answers were marked as 'false positives'. Recall was called 'correct' for the assortment pizzas for the no label group when participants remembered seeing both the Nutri-Score and Eco-Score. The other answers were marked as 'false negatives'.

Comprehension level of label information:

The independent variable was the 'correct' recall of the labels and the dependent variable the mean level of comprehension of the label (i.e. Nutri-Score and Eco-Score) information on a scale from 0 - 100. A One-Way ANOVA was used to analyse these variables between the groups for both the newly developed pizza and assortment pizzas.

Motivation and ability on attention level:

The PROCESS macro for moderation analysis was used to compare attention levels between groups based on knowledge (= ability) about health and sustainability and while also taking the relative importance (= motivation) of health and sustainability for participants into account.

Motivation and ability on comprehension:

The PROCESS macro for moderation analysis was used to compare comprehension levels between groups based on knowledge (= ability) about health and sustainability and while also taking the relative importance (= motivation) of health and sustainability for participants into account.

Healthy and sustainable product inferences:

The independent variable was the mean level of comprehension of the label information and the dependent variable the mean level of healthy and sustainability product inferences (scale 1 – 7). This was analysed by means of a Pearson correlation.

Buying probability of healthy and sustainable product:

The independent variable was the mean level of healthy and sustainability product inferences (scale 1 – 7) and the dependent variable the probability of a healthy or sustainable choice (1 = yes, 0 = no) for the participants. This was analysed by means of a binary logistic regression.

Motivation, opportunity and ability on buying probability:

The PROCESS macro for moderation analysis was used to compare buying probability between groups based on a combination of knowledge (= ability) about health and sustainability, the ease of assessing the health and sustainability level of the product (= opportunity) and the relative importance (= motivation) of health and sustainability for participants.

4. Results

This chapter covers the results of the questionnaire and eye tracking study.

4.1 Sample description and randomisation check

For this research, a total of 338 participants were recruited. From the total of 338 participants, 275 participants filled in the questionnaire completely and answered the attention control question correctly with 'Zeer makkelijk'. So, the target sample size was achieved. The number of participants was 49 for the AA-combination group, 57 for EE, 55 for AE, 57 for EA and 57 for no label (control group). In Table 2, gender, age per group, Nutri-Score and Eco-Score familiarity before answering the questionnaire and buying frequency are shown for a randomisation check. The AA group is slightly biased towards females (67.3%), but not significantly different from the other groups ($\chi2(4) = 4.104$, $p = .392$). In general, there are more participants between 22-25 (64.4%) than 18-21 (35.6%), but no significant differences were found between groups for age either ($\chi2(4) = 1.010$, $p = .908$). 93.5% of the total sample is familiar with the Nutri-Score, while 20.7% of the sample is familiar with the Eco-Score. Nutri-Score and Eco-Score familiarity was compared between treatment groups on significant differences, as the control group got exposed to the labels only once (i.e. only on assortment pizzas) instead of twice (i.e. both newly developed pizza and assortment pizzas), influencing the randomisation check. No significant differences in Nutri-Score ($\chi2(3) = 1.912$, $p = .591$) and Eco-Score ($\chi2(3) = .914$, $p = .822$) familiarity between treatment groups were found. Sometimes (monthly) and rarely (a few times per year) are the options most chosen for buying frequency among the different groups, with no significant differences between groups ($\chi2(4) = 16.880$, $p = .393$) (see Figure 8 in Appendix IV).

Table 2: Gender, age groups, Nutri-Score and Eco-Score familiarity and buying frequency split out by group number (AA, AE, EA, EE and no label)

		Group numbers													
		AA		AE		EA		EE		No label		**Total**			
		Count	Colum n N %	Count	Colum n N %	Count	Colum n N %	Count	Colum n N %	Count	Colum n N %	**Count**	**Colum n N %**		Chi-square
Gender	Male	16	32.7%	27	49.1%	28	49.1%	26	45.6%	27	47.4%	**124**	**45.1%**	X^2	4.104
	Female	33	67.3%	27	49.1%	29	50.9%	30	52.6%	30	52.6%	**149**	**54.2%**	df	4
	Non-binary	0	0.0%	1	1.8%	0	0.0%	1	1.8%	0	0.0%	**2**	**0.7%**	Sig.	.392
Age groups	18-21	20	40.8%	20	36.4%	20	35.1%	18	31.6%	20	35.1%	**98**	**35.6%**	X^2	1.010
	22-25	29	59.2%	35	63.6%	37	64.9%	39	68.4%	37	64.9%	**177**	**64.4%**	df	4
														Sig.	.908
Nutri-Score	No	0	0.0%	1	1.8%	1	1.8%	0	0.0%	16	28.1%	**18**	**6.5%**	X^{2*}	1.912
familiarity	Yes	49	100.0%	54	98.2%	56	98.2%	57	100.0%	41	71.9%	**257**	**93.5%**	df	3
														Sig.	.591[a]
Eco-Score	No	39	79.6%	42	76.4%	41	71.9%	44	77.2%	52	91.2%	**218**	**79.3%**	X^{2*}	.914
familiarity	Yes	10	20.4%	13	23.6%	16	28.1%	13	22.8%	5	8.8%	**57**	**20.7%**	df	3
														Sig.	.822

Buying frequency of pizza	Very often	0	0.0%	0	0.0%	1	1.8%	1	1.8%	0	0.0%	**2**	**0.7%**	X^2	16.880
	Often	5	10.2%	9	16.4%	5	8.8%	6	10.5%	2	3.5%	**27**	**9.8%**	df	4
	Sometimes	18	36.7%	24	43.6%	26	45.6%	21	36.8%	28	49.1%	**117**	**42.5%**	Sig.	.393[a]
	Rarely	21	42.9%	18	32.7%	18	31.6%	28	49.1%	23	40.4%	**108**	**39.3%**		
	Very rarely	5	10.2%	4	7.3%	7	12.3%	1	1.8%	4	7.0%	**21**	**7.6%**		

*Between treatment groups
a. More than 20% of cells in this table have expected cell counts less than 5.

4.2 Correct recall of label information

H1: *'The presence of an incongruent (congruent) health and sustainability label combination leads to higher (lower) levels of attention compared to congruent (incongruent) or no health and sustainability label combinations'* was tested via self-report in a questionnaire (see paragraph 4.2.1) and eye gaze in an eye-tracking study (see paragraph 4.2.2).

4.2.1 Questionnaire data

Correct recall of label information for the questionnaire data was tested using a chi-square test between treatment groups for both the newly developed pizza and assortment pizzas (see paragraph 3.5 for the definition of correct recall).

Newly developed pizza

Participants in the EA-group showed slightly higher, but non-significant, levels of correct recall of the labels on the newly developed pizza (31.6%) than the other treatment groups ($\chi2(3) = 5.847$, $p = .119$) (see Table 3).

The EA and EE group showed the highest levels of correct recall of Nutri-Score and Eco-Score alone, but also non-significant compared to the other groups (Nutri-Score: $\chi2(3) = 5.132$, $p = .162$ and Eco-Score: $\chi2(3) = 6.164$, $p = .104$) (see Table 3).

As expected, more participants in the no label group correctly recalled seeing no label on the newly developed pizza (82.5%) than participants in the treatment groups could recall seeing both labels (see Table 3). 17.5% of participants in the control group falsely thought they had seen any labels on the newly developed pizza.

Assortment pizza

Participants in the EE group showed slightly higher, but non-significant, levels of correct recall of the labels on the assortment pizzas (49.1%) than the other treatment groups ($\chi2(3) = 1.829$, $p = .609$) (see Table 3).

The EE group showed the highest levels of correct recall of Nutri-Score and Eco-Score alone, but also non-significant compared to the other groups (Nutri-Score: $\chi2(3) = 4.076$, $p = .253$ and Eco-Score: $\chi2(3) = 2.649$, $p = .449$) (see Table 3).

As expected, participants in the no label group showed the lowest level of correct recall for both labels compared to the treatment groups (21.1%) (see Table 3).

Table 3: Chi-square test for correct recall of labels newly developed pizza and assortment pizzas split out by groups for Nutri-Score, Eco-Score and both labels (df = 3)

		Newly developed pizza															
		AA		AE		EA		EE		**Total**				No label (control group)*			
		N	%	N	%	N	%	N	%	**N**	**%**		Chi-square			N	%
Nutri-Score recall	False negative	14	28.6%	19	34.5%	12	21.1%	10	17.5%	**55**	**25.2%**	$\chi2$	5.132	Correct recall no label	False positive	10	17.5%
												df	3				
	Correct	35	71.4%	36	65.5%	45	78.9%	47	82.5%	**163**	**74.8%**	Sig.	.162		Correct	47	82.5%
Eco-Score recall	False negative	39	79.6%	44	80.0%	36	63.2%	38	66.7%	**157**	**72.0%**	$\chi2$	6.164				
												df	3				
	Correct	10	20.4%	11	20.0%	21	36.8%	19	33.3%	**61**	**28.0%**	Sig.	.104				
Recall both labels	False negative	42	85.7%	46	83.6%	39	68.4%	44	77.2%	**171**	**78.4%**	$\chi2$	5.847				
	Correct	7	14.3%	9	16.4%	18	31.6%	13	22.8%	**47**	**21.6%**	Sig.	.119				
		Assortment pizzas															
		AA		AE		EA		EE		**Total**				No label (control group)*			
		N	%	N	%	N	%	N	%	**N**	**%**		Chi-square			N	%
Nutri-Score recall	False negative	9	18.4%	16	29.1%	12	21.1%	8	14.0%	**45**	**20.6%**	$\chi2$	4.076	Nutri-Score recall	False negative	33	57.9%
												df	3				
	Correct	40	81.6%	39	70.9%	45	78.9%	49	86.0%	**173**	**79.4%**	Sig.	.253		Correct	24	42.1%
Eco-Score recall	False negative	30	61.2%	32	58.2%	29	50.9%	27	47.4%	**118**	**54.1%**	$\chi2$	2.649	Eco-Score recall	False negative	41	71.9%
												df	3				
	Correct	19	38.8%	23	41.8%	28	49.1%	30	52.6%	**100**	**45.9%**	Sig.	.449		Correct	16	28.1%
Recall both labels	False negative	31	63.3%	33	60.0%	33	57.9%	29	50.9%	**126**	**57.8%**	$\chi2$	1.829	Recall both labels	False negative	45	78.9%
												df	3				
	Correct	18	36.7%	22	40.0%	24	42.1%	28	49.1%	**92**	**42.2%**	Sig.	.609		Correct	12	21.1%

*Not in chi-square test

4.2.2 Eye-tracking study

A total of 25 participants completed the eye-tracking study. The four areas of interest (AoI) on the packaging of the newly developed pizza are shown in Figure 4. Almost every participant gazed over these AoI. The most common order of the participants in the treatment groups for going over the AoI was 1, 2, 3, 4 and for the participants in the control (no label) group: 1, 2, 3 (the labels, = 4, were not present).

The eye-tracking study showed a fixation on the labels for 17 out of 19 participants in the treatment groups for both the newly developed pizza and assortment pizzas at some point. 10

participants recalled both of the labels correctly (AE = 3, EA = 1, AA = 2 and EE = 4) on the newly developed pizza and 11 participants recalled both of the labels correctly (AE = 3, EA = 2, AA = 2 and EE = 4) on the assortment pizzas (see Table 4). All 6 participants in the control group recalled correctly seeing no labels on the newly developed pizza, but only 1 of the 6 participants from the control group correctly recalled the labels on the assortment pizzas (see Table 4).

Figure 4: The four focus points on the newly developed pizza

Table 4: Recall labels newly developed pizza and assortment pizzas treatment groups and control group eye tracking study

		Newly developed pizza								
		AA	AE	EA	EE	Total		No label		
		N	N	N	N	N	%		N	%
Recall both labels	False negative	2	2	3	2	9	47.4%	Correct recall no label	False positive	0	0%
	Correct	2	3	1	4	10	52.6%		Correct	6	100%
		Assortment pizzas								
		AA	AE	EA	EE	Total		No label		
		N	N	N	N	N	%		N	%
Recall both labels	False negative	2	2	2	2	8	42.1%	Recall both labels	False negative	5	83.3%
	Correct	2	3	2	4	11	57.9%		Correct	1	16.7%

Based on the questionnaire data and eye tracking study, H1 is not accepted, H0 is not rejected. The EA group showed higher levels of correct recall (especially for the newly developed pizza), but no significant differences between treatment groups were found. Across the treatment groups, participants showed higher levels of recall of the labels on the assortment pizzas compared to the newly developed pizza. According to the eye-tracking data, almost all participants did fixate on the labels, but this did not lead to correct recall for about half of the

participants. Participants in the no label group showed lower levels recall of the labels on the assortment pizza than the treatment groups.

As very few participants could recall both labels (N = 47), correct recall of the Nutri-Score (N = 163) will be used from this point onwards as 'correct recall' to have a slightly bigger sample to test on.

4.3 Comprehension level of label information

H2: '*Higher levels of attention to health and sustainability labels (as a consequence of label incongruency) result in higher levels of label information comprehension, while lower levels or no attention result in lower or no label information comprehension'* was tested using a One-Way ANOVA for a difference in mean comprehension of the Nutri-Score (and Eco-Score) between groups, for both the newly developed pizza and assortment pizzas (see Table 5). In Figure 9 and 10 in Appendix IV, a clustered bar chart of the mean comprehension per group for both the newly developed pizza and assortment pizzas is shown.

Newly developed pizza

A significant difference between group means was found for Nutri-Score comprehension on the newly developed pizza ($F = 3.564$, $df = 3$, $p = .016$, $\eta^2 = .063$) (See Table 5). Participants in the AE group had significantly higher mean levels of Nutri-Score comprehension than participants in the other groups (See Table 5). No significant difference between means was found for the comprehension of the Eco-Score ($F = .852$, $df = 3$, $p = .467$, $\eta^2 = .016$).

Assortment pizzas

For both the comprehension of the Nutri-Score and Eco-Score, no significant differences between means of the groups were found (see Table 5).

Therefore, H2 is partially supported, H0 is rejected Participants in the AE group did show significantly higher mean levels of comprehension of the Nutri-Score on the newly developed pizza than the other groups, but did not for the Eco-Score.

Table 5: One-Way ANOVA for effect correct recall newly developed pizza and assortment pizzas on mean comprehension (scale 0 – 100) of the Nutri-Score and Eco-Score, split by groups

	Group numbers											
	AA		AE		EA		EE					
	Nutri-Score comprehension	Eco-Score comprehension	*Nutri-Score comprehension*	Eco-Score comprehension	*Nutri-Score comprehension*	Eco-Score comprehension	*Nutri-Score comprehension*	Eco-Score comprehension	*Nutri-Score comprehension ANOVA*		Eco-Score comprehension ANOVA	
Correct recall	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean				
Newly developed pizza	*78*	45	*89*	53	*77*	53	*79*	50	F	3.564	F	.852
									df	3	df	3
									Sig.	**.016**	Sig.	.467
									η^2	.063	η^2	.016
Assortment pizza	*80*	45	*86*	51	*77*	52	*78*	49	F	2.163	F	.504
									df	3	df	3
									Sig.	.094	Sig.	.680
									η^2	.037	η^2	.009

Bold = Significant at the .05 level

4.3.1 Motivation and ability on attention level

H3a: *'An increased motivation and ability combination positively moderates the effect of incongruent (congruent) health and sustainability label combinations on the level of attention'* was tested using the PROCESS macro for moderation analysis.

For this analysis, the effect of exposure to one of five different label combinations on correct recall (0 = incorrect, 1 = correct) with health or sustainability knowledge and health or sustainability importance (five-point Likert scale) as moderators was tested. So, one model for the effect of different label combinations on correct recall with health importance and knowledge and one model for the effect of different label combinations on correct recall with sustainability importance and knowledge was tested (see Table 6). As the dependent variable was binary here, the PROCESS macro produced a binary logistic regression analysis.

Both models overall were found non-significant ($p > .05$) (see Table 6). None of the sole moderators or interactions were found significant either. Therefore, H3a is not accepted, H0 is not rejected.

Table 6: PROCESS macro output for effect different label combinations exposure on correct recall, with importance and knowledge as moderators

	Model summary			Model		Interactions	
	McFadden	df	Columns p	Importance (W) *B* + p	Knowledge (Z) *B* + p	Int X*W *χ2* + p	Int X*Z *χ2* + p
Label combination (X) on correct recall (Y) with health moderators	.0422	5	.1413	*-.6493* .4812	*-.2080* .7946	*.0327* .8565	*.9334* .3340
Label combination (X) on correct recall (Y) with sustainability moderators	.0199	5	.5632	*.3749* .5428	*-.9855* .1188	*.3558* .5509	*2.2622* .1326

Bold = Significant at the .05 level

4.3.2 Motivation and ability on comprehension level

H3b: '*An increased motivation and ability combination positively moderates the effect of the level of attention paid to labels on the comprehension level of the provided information'* was tested using the PROCESS macro for moderation analysis.

For this analysis, the effect of correct recall (0 = incorrect, 1 = correct) on comprehension of the Nutri-Score and Eco-Score (scale 0 – 100) with health or sustainability knowledge and health or sustainability importance (five-point Likert scale) as moderators was tested. The different groups (AA, AE, EA and EE) served as covariates. So, one model for the effect of correct recall on comprehension of the Nutri-Score and one model for the effect of correct recall on comprehension of the Eco-Score was tested (see Table 7). As the dependent variable was a scale variable here, the PROCESS macro produced a normal regression analysis.

Both models overall were found non-significant (p > .05) (see Table 7). None of the sole moderators or interactions were found significant either. Therefore, H3b is not accepted, H0 is not rejected.

Table 7: PROCESS macro output for effect correct recall on comprehension, with importance and knowledge as moderators and group number as covariate

	Model summary			Model			Interactions	
	R^2	Columns F	p	Group number *b* + p	Importance (W) *b* + p	Knowledge (Z) *b* + p	Int X*W R^2 *change* + p	Int X*Z R^2 *change* + p
Correct recall (X) on comprehension Nutri-Score (Y)	.0436	1.6030	.1476	*-1.2193* .2895	*-3.8858* .4045	*-3.4331* .3255	*.0035* .3830	*.0003* .8038
Correct recall (X) on comprehension Eco-Score (Y)	.0369	1.3481	.2372	*2.5213* .1211	*2.0597* .6322	*.3523* .9371	*.0058* .2598	*.0018* .5273

Bold = Significant at the .05 level

4.4 Healthy and sustainable product inferences

H4: '*Higher levels of label information comprehension lead to more accurate health and sustainability product inferences compared to lower levels of label information comprehension in which health and sustainability inferences are often not made or biased'* was tested using Pearson's correlation coefficient.

Figure 5 shows the distribution of the mean health (red/right) and sustainability (blue/left) inference score (1 = newly developed pizza healthier/more sustainable, 4 = equally healthy/sustainable, 7 = assortment pizza healthier/more sustainable) based on the mean comprehension of the Nutri-Score and Eco-Score information (0 - 100) for the different groups. The assortment pizzas chosen per group are shown in Table 8, with the accompanying mean health and sustainability inferences (scale 1 – 7).

When testing the correlation between information comprehension and product inferences on significance, Pearson correlation shows no significant correlation between mean Nutri-Score comprehension and mean health inference ($r = .110$, $p = .160$) or between mean Eco-Score comprehension and mean sustainability inference ($r = -.031$, $p = .697$).

Therefore, H4 is not accepted, H0 is not rejected. No significant evidence was found that increased information comprehension leads to more accurate health and sustainability inferences.

Table 8: Chosen assortment pizza with mean health (left column) and sustainability (right column) inference level (scale 1 – 7), split by groups*

N total = 163	AA group (N = 35) (mean left: health inferences, mean right: sustainability inferences)				AE group (N = 36)				EA group (N = 45)				EE group (N = 47)				No label group (N = 57)**	
Nutri-Score/Eco-Score chosen assortment pizza			Mean total 2.71	Mean total 2.83			Mean total 3.53	Mean total 4.19			Mean total 4.40	Mean total 2.69			Mean total 5.02	Mean total 4.74		
	Count	%	Mean	Mean	Count	%	Mean	Mean	Count	%	Mean	Mean	Count	%	Mean	Mean	Count	%
DB	16	*45.7%*	1.7	2	10	*27.8%*	3.3	2.15	14	*31.1%*	2.4	2.5	16	*34.0%*	4.5	5	19	*33.3%*
DE	5	*14.3%*	3	1.5	6	*16.7%*	1.9	3.5	6	*13.3%*	3.5	2	9	*19.1%*	4	4.25	8	*14.0%*
BD	4	*11.4%*	2.75	2.5	7	*19.4%*	2	3.4	7	*15.6%*	2.5	1.15	4	*8.5%*	4.6	4	7	*12.3%*
DD	4	*11.4%*	1.3	2	5	*13.9%*	3	4	10	*22.2%*	4.5	2	5	*10.6%*	5	4.5	8	*14.0%*
BA	1	*2.9%*	3	7	1	*2.8%*	6	7	4	*8.9%*	7	6	5	*10.6%*	5	5	9	*15.8%*
AB	5	*14.3%*	4.5	2	7	*19.4%*	5	5.1	4	*8.9%*	6.5	2.5	8	*17.0%*	7	5.7	6	*10.5%*

*****1 = newly developed pizza is healthier/more sustainable, 4 = equally healthy/sustainable, 7 = assortment pizza healthier/more sustainable

******Not in analysis

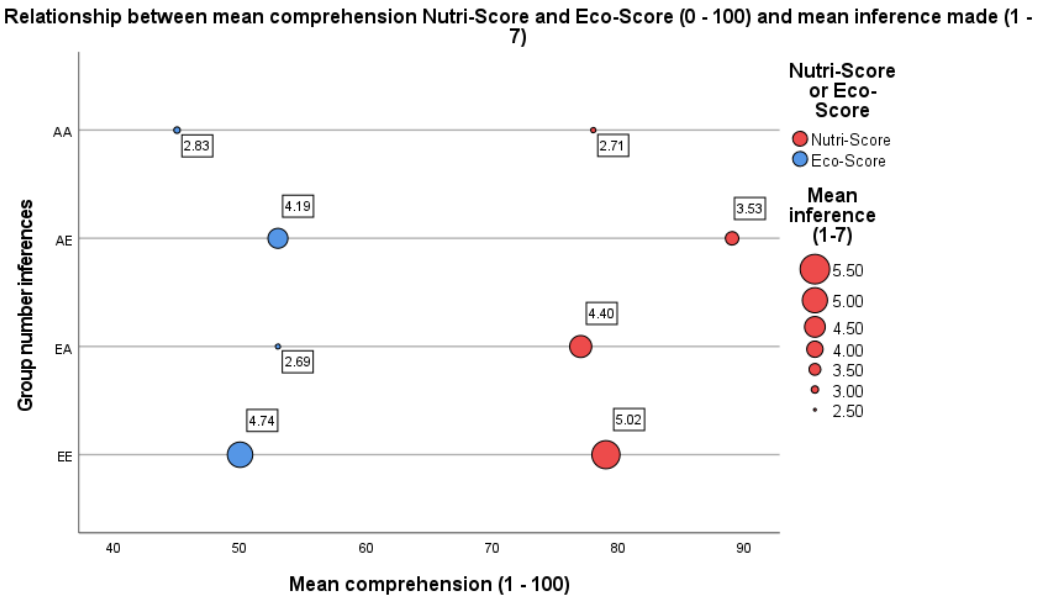

Figure 5: Scatter plot distribution of the mean health and sustainability inference score (1 – 7) for the different groups based on the mean comprehension (0 – 100) of Nutri-Score (health) and Eco-Score (sustainability) information

4.5 Buying probability of healthy and sustainable product

H5: '*More accurate health and sustainability product inferences result in a higher buying probability of a healthy and sustainable product by breaking with potentially unhealthy and unsustainable habits'* was tested using binary logistic regression.

In Table 7, all the choices from the assortment made by participants were shown with accompanying mean health and sustainability inferences. The participants who made a healthier and/or more sustainable choice (i.e. picked the BA or AB pizza) are shown in Table 8. In Table 10 in Appendix IV, the binary logistic regression output is shown.

As most people did not make a healthy or sustainable choice (128 out of 163), the prediction accuracy of the model is mainly about whether the model can predict a non-healthy/sustainable choice.

The logistic regression model was statistically significant ($\chi 2(2) = 62.211$, $p < .001$) (see Table 10 in Appendix IV). The model explained 48.9% (Nagelkerke R^2) of the variance in a healthy and sustainable choice and correctly classified 87.2% of cases (see Table 10 in Appendix IV).

Less accurate health and sustainability inferences were associated with a lower likelihood of a healthy and sustainable choice (health: ($B = .739$, Wald = 21.001, $p = <.001$) and sustainability: ($B = .468$, Wald = 9.925, $p = .002$)) (see Table 10 in Appendix IV).

Therefore, H5 is partially supported, H0 is rejected. Less accurate health and sustainability inferences were found to significantly increase the buying probability of an unhealthy and unsustainable product. As the distribution was skewed towards unhealthy and unsustainable choices, no such effect could be tested for the hypothesized effect of more accurate inferences on increased buying probability of a healthy and sustainable product.

Table 8: Healthier/more sustainable pizzas chosen by participants, split by groups

N total = 163	AA group (N = 35)		AE group (N = 36)		EA group (N = 45)		EE group (N = 47)		No label group (N = 57)*	
	Count	%	Count	%	Count	%	Count	%	Count	%
Healthier/more sustainable choice	6	17.1%	8	22.2%	8	17.8%	13	27.7%	15	26.3%
Not healthier/more sustainable choice	29	82.9%	28	77.8%	37	82.2%	34	72.3%	42	73.7%

*Not in analysis

4.5.1 Motivation, opportunity and ability on buying probability

H6: '*An increased MOA positively moderates the effect of salient healthy and sustainable product inferences on the consumer buying probability for healthy and sustainable products'* was tested using the PROCESS macro for moderation analysis.

One model for the effect of health inferences on healthy choice moderated by health MOA and one model for the effect of sustainability inferences on sustainable choice moderated by sustainability MOA were tested (see Table 9). As the dependent variable was binary here, the PROCESS macro produced a binary logistic regression analysis.

Both models were found significant overall (health: McFadden = .4211, df = 3, p = <.001 and sustainability: McFadden = .2348, df = 3, p <.001). Moreover, health MOA was found a significant moderator in the health model (b = -4.1467, p = .0064). A negative beta coefficient makes sense as the highest level of MOA was represented by a 1 and the lowest by a 5.

Therefore, H6 is partially supported, H0 is rejected. Both models were found significant overall, and the health MOA was found a significant moderator as well, but no significant interactions between the independent variable and MOA were found.

Table 9: Health and sustainability inferences on healthy and sustainable choice with health and sustainability MOA

	Model summary			Model		Interactions
	McFadden	df	Columns p	Inferences *b* + p	MOA (W) *b* + p	Int X*W $\chi 2$ + p
Health inferences (X) on healthy choice (Y) (health MOA)	.4211	3	**<.001**	*.1849* .7502	*-4.1467* **.0064**	2.5638 .1093
Sustainability inferences (X) on sustainable choice (Y) (sustainability MOA)	.2348	3	**<.001**	*.0693* .9078	*-1.6832* .1079	*1.2661* .2605

Bold = Significant at the 0.05 level

5. Discussion

5.1 Main findings

The present study provides an answer to the main research question: '*How and to what extent do incongruent health and sustainability labels on food products affect consumers' label attention and comprehension and subsequently influence their product inferences and buying probability, as compared to congruent labels?'*

Recall of label information

No significant differences between groups in recall of both labels were found for both the newly developed pizza and assortment pizzas. This was true for the Nutri-Score and Eco-Score alone, but also for the recall of both labels together (see Table 3). More participants could recall either the Nutri-Score or Eco-Score alone than both labels together. The cognitive load of needing to remember two labels instead of one could have been too high. This could also explain why more participants were able to correctly recall 'no labels' in the control group than participants in the treatment groups seeing both labels. This result is in contrast with De Bauw et al. (2021), who found that the cognitive load of both the Nutri-Score and Eco-Score on one product was not too high. In hindsight, presenting either one of the labels would probably have been better for attracting attention and enhancing recall, but then incongruency between labels could not have been researched. Overall, the low recall levels show the problem with attracting attention to labels; consumers are exposed to many labels on products and get quickly overloaded as a consequence, leading to low levels of recall (Spiller et al., 2016). Moreover, familiarity with the Eco-Score was low, which could have made the cognitive load of recalling the Eco-Score even higher. Familiarity with a stimulus can lead to easier cognitive processing compared to unfamiliarity (Schwarz et al., 2021).

Familiarity can also explain why more participants were able to recall the labels on the assortment pizzas; participants already consciously or unconsciously processed the labels, which made recall for the assortment pizzas easier (Schwarz et al., 2021). Another explanation is the presence of some kind of (un)conscious spill-over effect; conscious or unconscious attention to the labels on the newly developed pizza spilled-over to the assortment pizza. Such spill-over effects have been found in a previous study for the spill-over effect of advertisement elements (Pieters & Wedel, 2004), but also partially for nutrition labelling (Van Herpen & Van Trijp, 2011). This can explain why fewer participants in the control group were able to recall both labels on the assortment pizzas after initially being exposed to no labels on the newly developed pizza.

This unconscious spill-over effect was confirmed via the eye-tracking study. The eye-tracking study showed that all participants in the treatment groups at some point gazed over the labels, but that not all of them could recall seeing these labels. This was the case for both the newly developed pizza and the assortment pizzas. A previous study of Ares et al. (2013) found similar results. In their study, almost all participants gazed over the labels provided, regardless of the type of label provided. However, the fixation time on the labels might have been too short for some participants, thus explaining why not all of them could recall seeing the labels (Negi & Mitra, 2020). Participants in the eye-tracking study showed higher levels of attention to the labels than participants in the questionnaire, especially in the treatment groups. This can be

explained by the Hawthorne effect; as participants were aware they were being observed on answering questions, they showed higher levels attention as a consequence (McCambridge et al., 2014).

Comprehension of label information

Participants in the incongruent AE group showed significantly higher mean levels of comprehension of the Nutri-Score, but not the Eco-Score, information on the newly developed pizza. This result is in line with Loebnitz et al. (2015) and Schwarz et al. (2021), who showed that information that is slightly harder to process (i.e. incongruent information) led to higher levels of information comprehension. Surprisingly, no significant differences between mean comprehension of both the Nutri-Score and Eco-Score information were found on the assortment pizza. So, no spill-over effect from the newly developed pizza on the assortment pizzas was found for the mean comprehension of Nutri-Score and Eco-Score information. An explanation could be that not all the pizzas in the assortment had incongruent labels on them, as the significant result for the newly developed pizza was found in the incongruent group. This result indicates that factors beyond mere exposure to the labels might play a role in increasing information comprehension.

Motivation and ability on recall of label information

Both models with 'group membership' as independent variable and 'correct recall' as dependent variable and with either health knowledge and importance or sustainability knowledge and importance as moderators were found non-significant by the PROCESS macro. None of the moderators solely or in interaction were found significant either. This is in contrast with Schruff-Lim et al. (2023), who found that constrained motivation (= importance) and ability (= knowledge) could lead to lower levels of recall and enhanced motivation and ability to higher levels of recall. Moreover, this result also contrasts the findings of Rothschild (1999) and De Bauw et al. (2022) who found that increased personal importance of health and sustainability enhances attention to these subjects. In hindsight, it is possible that other factors instead of motivation and ability moderated the effect of 'group membership' on 'correct recall,' such as individual differences in attention capacity or situational factors like time constraint (Vogel & Machizawa, 2004). Moreover, the experimental design used in this research was different than used by, for example, De Bauw et al. (2022) who used a mock-up E-grocery, which could also have influenced results.

Motivation and ability on comprehension level

Both models with 'correct recall' as independent variable and 'mean comprehension of Nutri-Score (Eco-Score) information' as dependent variable and with either health knowledge and importance or sustainability knowledge and importance as moderators were found non-significant by the PROCESS macro. This result was rather surprising as a partially significant main effect of label recall on information comprehension was found. Moreover, this result contrasts previous research, as literature indicated that motivation and ability actually enhance information comprehension (Rothschild, 1999; Schwarz et al., 2021). Also here, it is possible that other factors like individual differences in cognitive processing or situational factors like time constraint actually moderated the effect of 'correct recall' on 'mean comprehension of Nutri-Score (Eco-Score) information' instead of motivation and ability (Vogel & Machizawa,

2004), or that the difference in experimental design compared to other studies influenced results.

Healthy and sustainable product inferences

No significant evidence was found that increased information comprehension for both the Nutri-Score and Eco-Score leads to more accurate health and sustainability inferences. In hindsight, this result could have occurred because pizzas are naturally seen as unhealthier (and unsustainable), causing participants to make less accurate healthy (and sustainable) inferences based on the labels but rather based on the product itself.

This result complies with Gomez et al. (2017), who found that improved information provision (as a consequence of simplified labels) led to unhealthier instead of healthy product inferences. In contrast, Marette (2021) also used pizzas as stimulus products and participants in that study actually made the right inferences from the labels, resulting in increased purchase intents. Additionally, literature found that information provided by nutrition labels such as the Nutri-Score actually results in more accurate healthy product inferences (Van Herpen et al., 2014) or more accurate sustainability product inferences (Onwezen et al., 2019), so no straightforward explanation can be given for the result in the present study.

Buying probability of healthy and sustainable product

Less accurate health and sustainability inferences were found to significantly increase the buying probability of an unhealthy and unsustainable product. The logistic regression output provided a significant result for the effect of the overall model, while also showing that less accurate health and sustainability inferences significantly increase the buying probability of an unhealthy and unsustainable product.

This result complies with previous studies that suggested an effect of less accurate health and sustainability inferences on unhealthier and less sustainable product choices (e.g. De Temmerman et al., 2021; Druschba & Shakeri, 2023; Marette, 2021). Alternatively, De Bauw et al. (2021) found that a combined Nutri-Score and Eco-Score only led to an increase in healthier product choices. An explanation for the significant result for both health and sustainability could be that the same two products were classified as healthy and sustainable in this study. De Bauw et al. (2021), for example, used a bigger selection of products with different Nutri-Score and Eco-Score combinations, which could explain the difference in results.

Motivation, opportunity and ability on buying probability

Both models were found significant overall, and the health MOA was found a significant moderator as well for the health model. However, no significant interactions between the independent variable and MOA for both models were found. The significant results of the overall models are in line with previous studies. For example, Hung et al. (2017) highlighted the positive effect of personal importance (= motivation), De Temmerman et al. (2021) found that increased opportunity to assess the healthiness level of a product (i.e. provision of the Nutri-Score (and Eco-Score) labels in this study) also increased the buying probability for a healthier product and Onwezen et al. (2021) found that the positive effect of increased knowledge (= ability) increased the buying probability of healthy and sustainable products. The lack of interactional effects could have occurred because other effects that were not included in the

present study actually had a greater influence than the ones included, like personal differences in inference ability or situational effects like time constraint.

5.2 Practical implications

Results of the questionnaire and eye-tracking study showed that Nutri-Score and Eco-Score labels do actually receive attention to some extent, but that this attention is not always conscious (as validated by the eye-tracking study) and can be influenced by other factors, like information overload. Incongruency between the Nutri-Score and Eco-Score labels did not significantly increase conscious attention to these labels, but did lead to increased comprehension of the information provided by the Nutri-Score. This is in line with previous research and shows the great potential information incongruency can actually have for grabbing attention (Schwarz et al., 2021). Although the cognitive load of providing two labels at once might have been too high, policy makers are still advised to provide both labels on as many available products as possible to increase their effectiveness for grabbing attention. Increasing exposure of both labels might also increase familiarity with the labels, which in turn decreases the amount of cognitive load needed to process the label information (Schwarz et al., 2021).

The significant effect of less accurate health and sustainability inferences on increased buying probability of unhealthy and unsustainable products adds to the current literature on the effectiveness of both the Nutri-Score and Eco-Score for increasing the buying probability of healthy and sustainable products (e.g. De Temmerman et al., 2021; Druschba & Shakeri, 2023; Marette, 2021). The Eco-Score is not very familiar yet with most people, but as the number of studies on this label increases, and with the adoption of the Eco-Score by the Colruyt Group in Belgium, first steps may have been taken for a widespread implementation of the Eco-Score as well (Colruyt Group, n.d.). Moreover, as the Nutri-Score has been made the official nutritional logo of food products in The Netherlands in 2024, a path to widespread implementation of the Nutri-Score has been opened there as well (Rijksoverheid, 2024). Policy makers are advised to closely evaluate the long-term impact and effectiveness of implementing the Nutri-Score (and potentially, also the Eco-Score) on consumers' buying probability of healthier (and more sustainable) products. However, two challenges the Nutri-Score (and potentially, also the Eco-Score) currently face, is the effect of information overload caused by the increasing amount of labels and the confusion of consumers on how this label actually works (e.g. is the product "healthy" in general or compared to its category?), with consequently the resistance among experts against a widespread implementation of the Nutri-Score (NOS, 2024). This critique was acknowledged by the developers of the Nutri-Score, and as of now, changes are made to improve the Nutri-Score to help consumers even more with making healthier choices in the supermarket (Santé publique France, 2024).

5.3 Limitations and future research

There are a couple of limitations that apply to the present study, as well as some recommendations for future research.

Firstly, the channelling of participants from correct recall to increased buying probability of a healthy and sustainable product made the eventual samples per group quite small. Besides, the results could only be continued based on participants who could recall the Nutri-Score alone,

as the sample of participants who could recall both Nutri-Score and Eco-Score labels was too small for analysis. Moreover, the sample contained Dutch students between 18 and 25 only, meaning that the sample was not representative to the total Dutch population. Future research should be carried out with a bigger sample that is representative to the Dutch population to have more generalisable results.

Secondly, participants might have made less healthy and sustainable product inferences as pizza was used as the stimulus. Pizza is normally seen as a "not so healthy or sustainable" product, which could have caused participants to automatically make less healthy and sustainable product inferences, despite the product being healthier or more sustainable according to the labels. Future research could look at the effect of pizza alone on health and sustainability inferences made, with and without health and sustainability labels.

Thirdly, as the distribution of choices was skewed towards unhealthier and less sustainable choices, the model could only accurately predict unhealthy and unsustainable choices based on the level of product inferences made. Future research could look at healthier and more sustainable choices specifically to see if healthier and more sustainable choices could be predicted with the same model as well.

Fourthly, the effect of price on buying probability was not considered, as the interest of this research was the effect of incongruency in labels, and not price, on buying probability. However, previous research regarding the FCQ had found that price is an important determinant of product choice (Steptoe et al., 1995; Onwezen et al., 2019). Therefore, future research might investigate the effect of incongruency in labels on buying probability while also taking price into account.

Fifthly, not all the moderators were measured on a continuous scale but rather on an ordinal scale in the questionnaire. Continuous variables are normally more suitable for the PROCESS macro, so the usage of ordinal variables as moderators could have changed the final results from the PROCESS macro a bit. Moreover, non-significant results for the moderators could indicate that there are other factors moderating the proposed relationships in this research. Future research could look at different moderators (e.g. individual differences in visual attention and other situational factors like time constraint) and at whether all moderators measured at continuous scales would produce different results.

Finally, two labels on one product might have been too burdensome for participants, especially as only a fraction of the sample was familiar with the Eco-Score. A previous study that combined the Nutri-Score and Eco-Score did not find them to be too burdensome, but still this subject needs some further research (De Bauw et al., 2021). Moreover, a lot more participants recalled seeing the Nutri-Score alone then both Nutri-Score and Eco-Score. A main suggestion for future research is to investigate the role of familiarity on recall of such labels and if two labels on one product (despite them being very alike in presentation) is too burdensome or not (Schwarz et al., 2021). Innovative technology, like imaging decision support systems (artificial intelligence), could also help researching how burdensome two labels really are and if familiarity plays a major role here as well. This study built on previous research of Schwarz et al. (2021) and Sonntag et al. (2023) on information incongruency and serves as a stepping stone for future research on this subject for labels specifically.

6. Conclusion

The present study sought to answer the research question *'How and to what extent do incongruent health and sustainability labels on food products affect consumers' label attention and comprehension and subsequently influence their product inferences and buying probability, as compared to congruent labels?'* via the sub research questions '*How do incongruent health and sustainability labels on food products affect consumers' label attention and comprehension, as compared to congruent labels?'* and '*To what extent do incongruent health and sustainability labels influence consumer buying decisions via label attention, comprehension and product inferences?'.* For this purpose, a quantitative study through a questionnaire and an eye-tracking study were conducted.

The questionnaire findings indicate that labels do get attention from consumers when present, but that this attention is often unconscious. The eye-tracking study provided support for this claim, by showing that all participants at some point gazed over the labels, but some possibly not long enough for conscious attention. A spill-over effect for attention from the newly developed pizza onto the assortment pizzas was found in which participants in the treatment groups experienced higher amounts of recall for the labels on the assortment pizzas than on the newly developed pizza, most likely as a consequence of multiple exposures, but not significant. No significant difference was found between participants in the incongruent and congruent treatment groups for attention (recall) either. Motivation and ability were not significantly proven to moderate the effect of labels on recall.

Participants in the incongruent groups did show significantly higher amounts of information comprehension compared to the congruent groups for the Nutri-Score on the newly developed pizza, but not the Eco-Score. Information that was a bit harder to process (i.e. incongruent information) led to higher levels of information comprehension. Motivation and ability were not significantly proven to moderate the effect of attention (recall) on information comprehension.

No significant effects of information comprehension on more accurate healthy and sustainable inferences were found. However, less accurate healthy and sustainable product inferences did lead to a significant increase in the buying probability of an unhealthy and unsustainable product. The overall models of motivation, opportunity and ability were found significant for the effect of healthy and sustainable inferences on buying probability for a healthy and sustainable product.

In conclusion, this research has shown the potential impact of labels on the conscious or unconscious attention to these labels (although not significant) and the significant effect of incongruency in labels on the level of information comprehension. While no real effect of information comprehension on healthy and sustainable inferences was found, an effect of less accurate healthy and sustainable inferences on increased buying probability of an unhealthy and unsustainable product was found. Policy makers are advised to closely follow the impact of labels on attention and information comprehension in combination with the suggestions for future research, to see if there are other ways to significantly increase attention to labels, ultimately leading to an increased buying probability of healthy and sustainable products as well.

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Appendix

Appendix I: Nutri-Score and Eco-Score explained

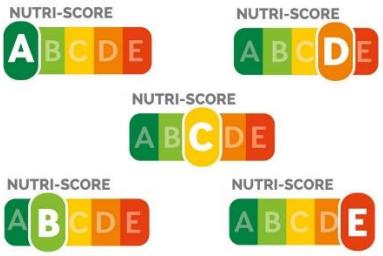


Figure 4: Nutri-Score label (Webermarking, 2022)

The Nutri-Score is a FOP label that is used to rate how healthy a product is compared to its category and communicates this to the consumer in a single summary value (c). This value is presented as a five-CNL (Colour Nutrition Label) ranging from A (healthiest) to E (unhealthiest) (see Figure 4). Components that worsen the score are energy, saturated fats, sugars and salt. Components that increase the score are fibres, proteins, fruits and vegetables. The total score is calculated by subtracting the negative score from the positive score (Santé publique France, 2024).

Figure 5: Eco-Score label (Colruyt Group, n.d.; Colruyt Group, 2021)

The Eco-Score is a FOP label that is used to calculate the entire environmental impact score of food products. The Eco-Score is calculated by using a Life Cycle Analysis that includes agriculture, processing, packaging, transport, sales and consumption (Colruyt Group, n.d.). Additionally, a product can earn bonus-malus points based on the production method (e.g. organic product), packaging (e.g. glass or metal lid), origin (e.g. Asia) and biodiversity (e.g. scarce ingredients). When the Life Cycle Analysis and bonus-malus points are added together you get the final score, as shown on the right in Figure 5 (Colruyt Group, n.d.). This final score is also presented as a five-CNL ranging from A to E.

Appendix II: Questionnaire set-up

Questionnaire text

Front page

Beste deelnemer,

Voor **mijn MSc-scriptie** doe ik **onderzoek** naar **de keuzes van consumenten voor voedsel producten in Nederlandse supermarkten**. Dit onderzoek wordt gedaan aan Wageningen Universiteit en Research (WUR) bij de leerstoelgroep Marketing en Consumentengedrag.

Het invullen van de enquête duurt ongeveer **5 tot 10 minuten** en deelname is vrijwillig en anoniem. De verzamelde gegevens worden in een beveiligde omgeving opgeslagen en niet met andere partijen gedeeld. Door deel te nemen maakt u kans op **1 van de 3 Amazon giftcards van 10 euro** en stemt u toe met deze voorwaarden.

Alvast bedankt voor uw deelname,

Bram de Leeuw

Question 1

Vanaf nu zou ik u willen vragen om u in te beelden dat u **in de supermarkt** staat en dat u pizza wil kopen voor het avondeten. Hierna krijgt u een aantal vragen over pizza.

Hoe vaak koopt u pizza in de supermarkt?

<u>Newly developed pizza</u>

Question 2

U krijgt nu **een nieuw ontwikkelde** pizza verpakking te zien (deelnemers krijgen één van de vijf verschillende verpakkingen te zien).

Wat denkt u over dit product? Ik vind dat dit product er (aantrekkelijk, smaakvol, gezond, gemakkelijk, duurzaam, anders, namelijk: (ruimte voor open antwoord)) uitziet:

Question 3

Stel dat u het product zou kopen. Rangschik op een schaal van 1 tot en met 5 welke product eigenschappen u het meest belangrijk vindt bij de aankoop van dit product (hoe het product er uitziet, smaak, gezondheid, gemak, duurzaamheid):

Question 4

Hoe gezond/duurzaam denkt u dat het product is op basis van de verpakking (0 = heel ongezond/niet-duurzaam, 100 = heel gezond/duurzaam)?

<u>Assortment pizzas</u>

Question 5

U krijgt nu een **bestaand assortiment** met pizza's te zien. Als u één van deze pizza's zou moeten kopen, welke zou u dan kopen?

Question 6

Rangschik op een schaal van 1 tot en met 5 welke product eigenschappen u het meest belangrijk vindt bij de aankoop van dit product (hoe het product er uitziet, smaak, gezondheid, gemak, duurzaamheid):

Both pizzas

Question 7

Nu krijgt u de eerste pizza en uw gekozen pizza **naast elkaar** te zien. U krijgt nu een vraag over de eerste pizza en uw gekozen pizza samen.

Vergelijk de eerste pizza met uw gekozen pizza op de onderstaande schaal wanneer u één van de twee producten zou moeten kopen (hoe het product er uitziet, smaak, gezondheid, gemak, duurzaamheid):

(-3 Voorkeur eerste pizza, -2, -1, 0 = Gelijk aan elkaar, 1, 2, 3 Voorkeur pizza uit assortiment)

Question 8

Hoe moeilijk of makkelijk vond u het om te beoordelen hoe gezond (duurzaam) de pizza's waren?

Attentiecontrole: voer 'Zeer makkelijk' in.

General questions

Question 9

Hoe zou u uw eigen kennis over gezondheid (duurzaamheid) beoordelen?

Question 10

Welke van de volgende labels, als dat al het geval is, heeft u gezien in deze enquête bij de nieuw ontwikkelde pizza/gekozen pizza uit het assortiment?

Question 11

Nu laat ik u de afbeeldingen van de Nutri-Score en Eco-Score zien. Heeft u deze labels al eens eerder voor deze enquête gezien?

Question 12

In hoeverre begrijpt u de informatie die de Nutri-Score (Eco-Score) geeft?

Ik begrijp de informatie die de Nutri-Score en Eco-Score geven (op een schaal van 0 = niet tot 100 = volledig):

Hieronder kunt u klikken voor uitleg over de Nutri-Score en Eco-Score **indien nodig**. Indien u het niet wilt lezen, kunt u op **het pijltje** klikken.

De **Nutri-Score** is een label dat wordt gebruikt om te beoordelen hoe gezond een product is in vergelijking tot de product categorie en presenteert dit aan de consument in de vorm van een letter met een kleur (A = meest gezond, B, C, D en E = meest ongezond) (Santé publique France, 2024). Componenten die de score verslechteren zijn: calorieën, verzadigde vetten, suiker en zout. Componenten die de score verbeteren zijn: vezels, eiwitten, fruit en groenten. De totale score wordt berekend door de negatieve score van de positieve score af te halen (Santé publique France, 2024).

De **Eco-Score** is een label dat wordt gebruikt om de totale milieu impact van een product visueel te laten zien in de vorm van een letter met een kleur (A= minste impact, B, C, D, E = meeste impact). De Eco-Score wordt berekend via een Life Cycle Analysis van landbouw, verwerking, verpakking, transport, verkoop en consumptie (Colruyt Group, n.d.). Hiernaast kan een product bonus-malus punten verdienen op basis van de productie methode (bijv. biologisch geproduceerd), verpakking (bijv. glas of metalen deksel) en biodiversiteit (bijv. schaarse ingrediënten). Wanneer de Life Cycle Analysis en bonus-malus punten bij elkaar zijn opgeteld krijg je de totale score.

Question 13

Als laatste volgen nog een aantal korte vragen.

Met welke gender associeert u zichzelf het meest?

Question 14

Wat is uw leeftijd?

Question 15

Hoe belangrijk is gezondheid (duurzaamheid) voor u in het dagelijks leven?

Last page

U bent aan het einde van de enquête gekomen. **Klik op het pijltje** om de enquête af te sluiten.

Bij deze moet ik u nog vertellen dat het product dat u in deze enquête gezien heeft **niet** een echt nieuw product is, maar dat ik deze zelf ontworpen heb voor het onderzoek op basis van een bestaand product. Hiernaast zijn de Nutri-Score en Eco-Score labels die u in het onderzoek (mogelijk) voorbij hebt zien komen ook **verzonnen** door mij voor dit onderzoek.

Ik wil u graag bedanken voor de bijdrage aan mijn onderzoek. Indien u nog verdere vragen of opmerkingen heeft over het onderzoek of u nog meer wil weten over de resultaten van het onderzoek, kunt u contact met mij opnemen via e-mail (bram.deleeuw@wur.nl) of uw vraag invullen in de open ruimte op deze pagina.

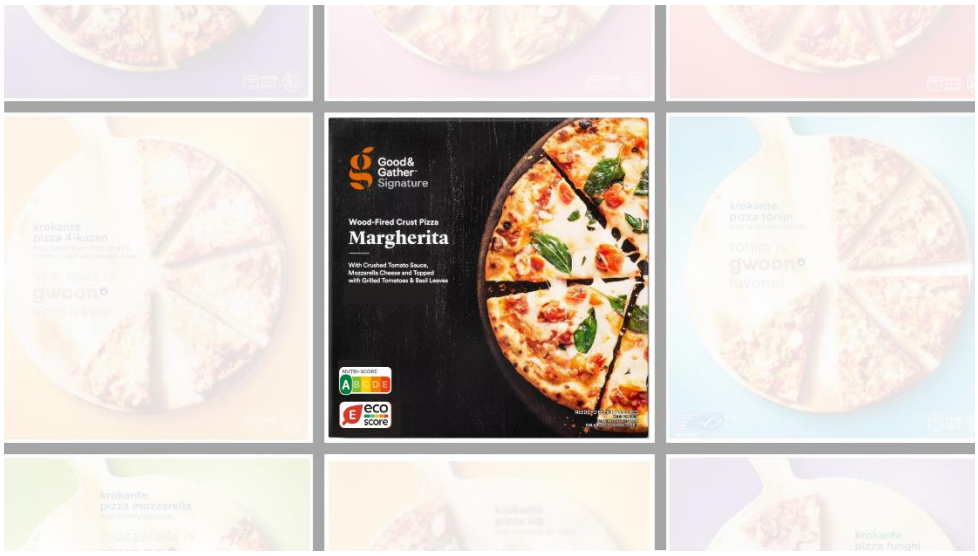
Met vriendelijke groet,

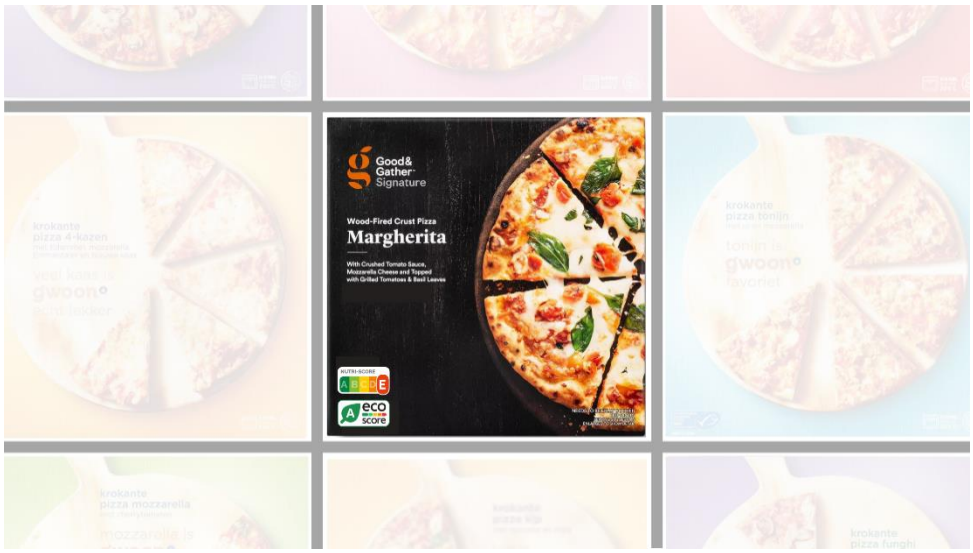
Bram de Leeuw

Wageningen Universiteit & Research (WUR)

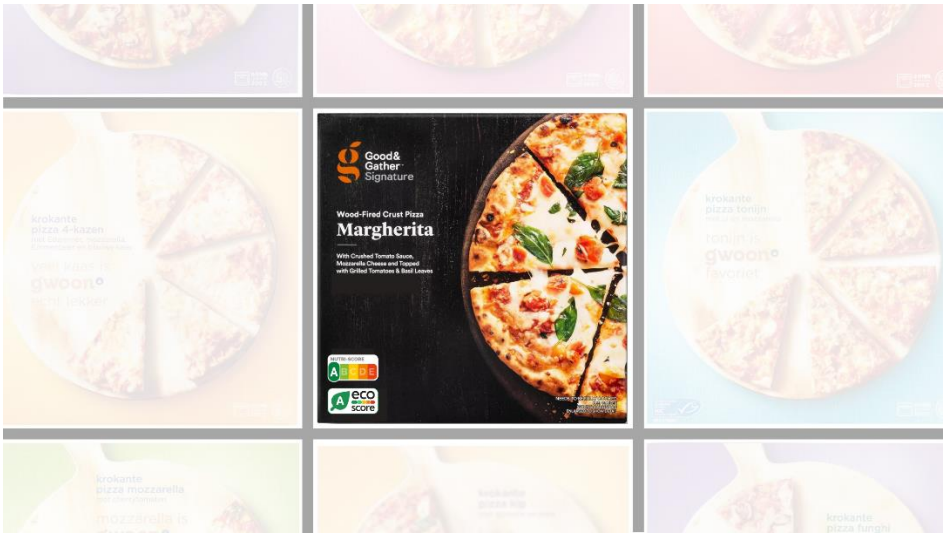
Appendix III: Products used in the questionnaire

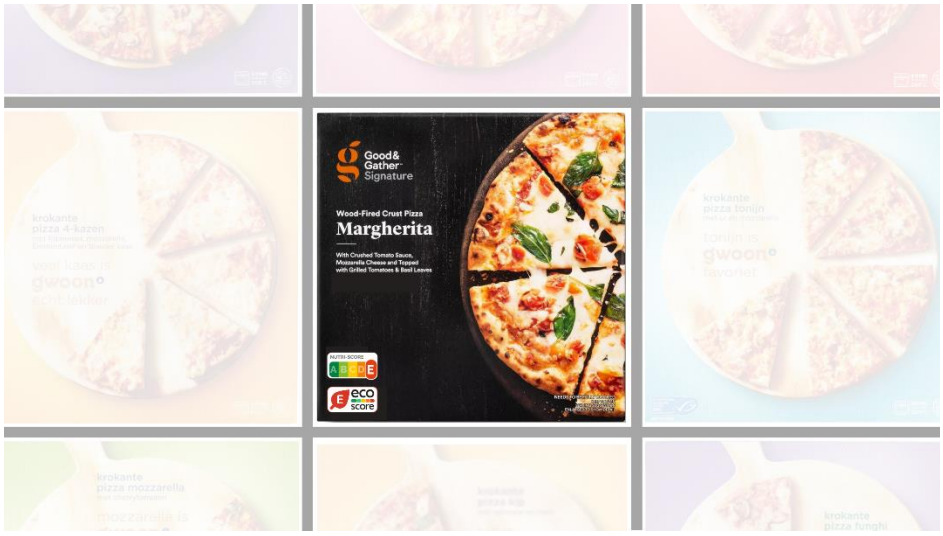
"Newly developed" pizza with different labels and no label



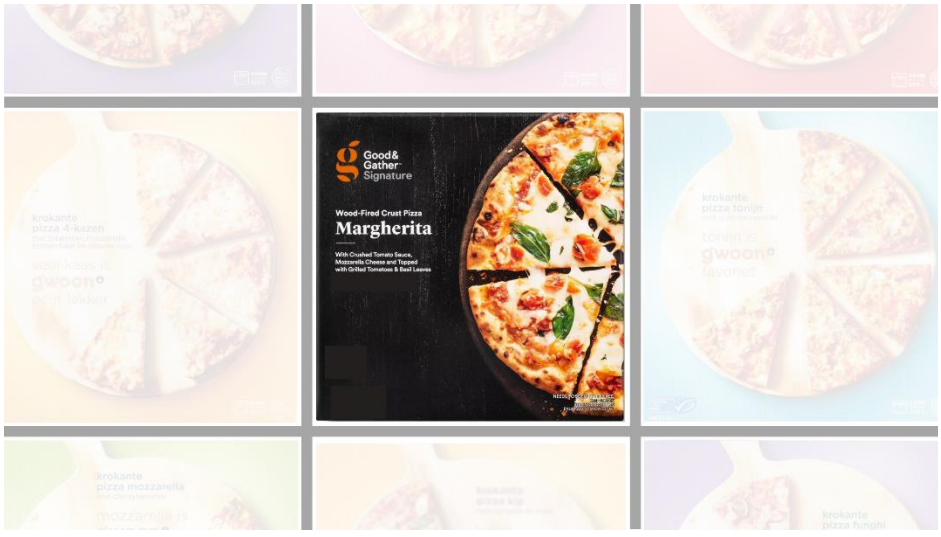


Incongruent combinations (AE and EA)





Congruent combinations (AA and EE)



No label (control group)

Figure 6: Pizza with different label combinations and no label in the questionnaire

Figure 7: Pizza assortment complete

Appendix IV: Detailed statistical data

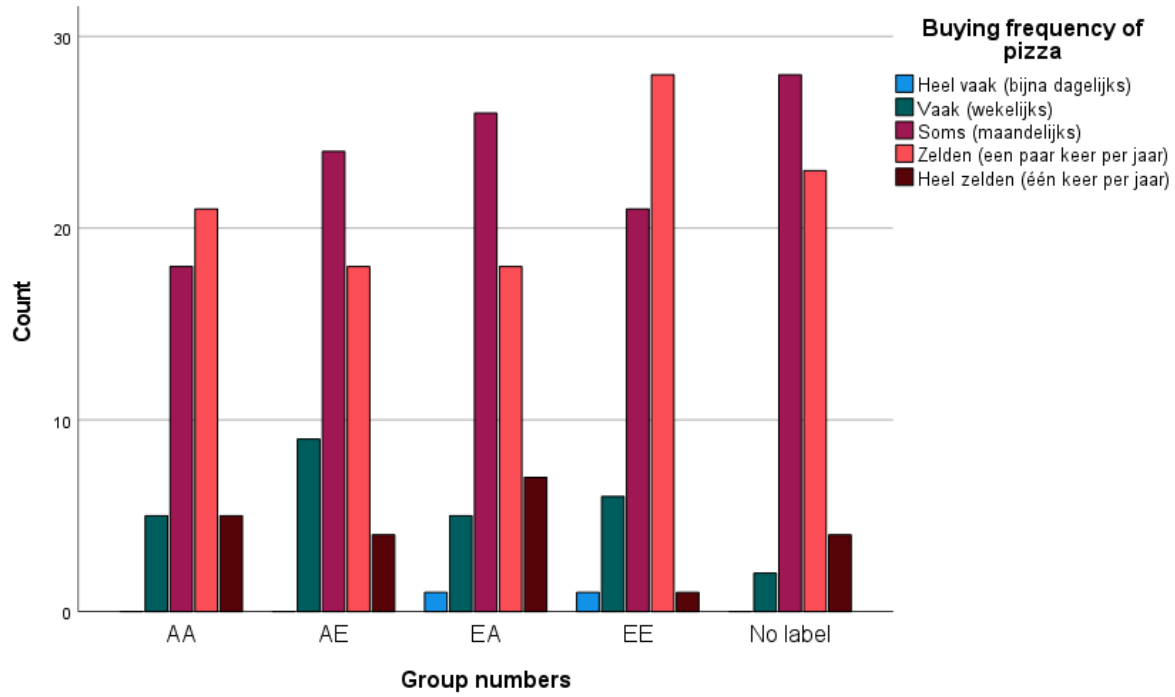


Figure 8: buying frequency of pizza per group

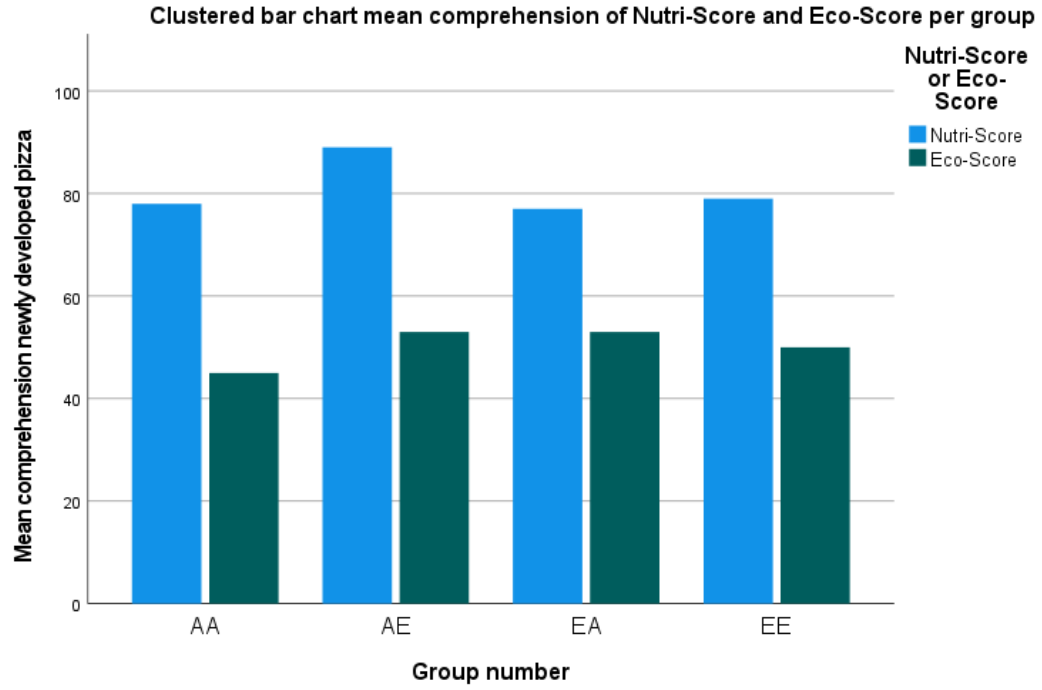


Figure 9: Mean comprehension Nutri-Score and Eco-Score per group newly developed pizza

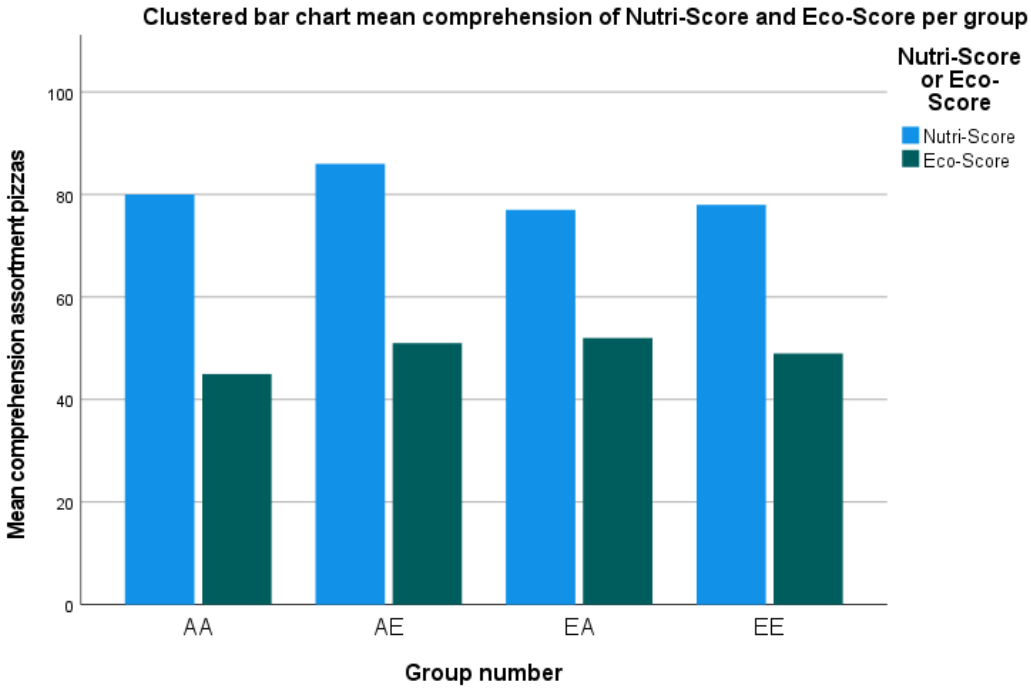


Figure 10: Mean comprehension Nutri-Score and Eco-Score per group assortment pizzas

Table 10: Logistic regression output health and sustainability inferences on healthy and sustainable choice

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	62.211	2	<.001
	Block	62.211	2	<.001
	Model	62.211	2	**<.001**

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	107.839[a]	.316	.489

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Health inferences	.739	.161	21.001	1	**<.001**	2.093
	Sustainability inferences	.468	.149	9.925	1	**.002**	1.597
	Constant	-6.763	1.012	44.688	1	**<.001**	.001

a. Variable(s) entered on step 1: Health inferences, Sustainability inferences.

Classification Table[a]

			Predicted		
			Healthy and sustainable choice yes or no		Percentage
	Observed		No	Yes	Correct
Step 1	Healthy and sustainable choice yes or no	No	123	5	96.1
		Yes	15	20	57.1
	Overall Percentage				88.4

a. The cut value is .500