

# CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management



## **Diploma Thesis Title:**

Consumer Perception of Product Healthiness

This Diploma Thesis has been written and defended at the Wageningen University in the Netherlands under the Double Degree Agreement between the Czech University of Life Sciences Prague, and the Wageningen University. In accordance with the Double Degree Agreement, this Diploma Thesis is fully recognized as part of the MSc study programme at the Czech University of Life Sciences Prague.

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## **MSc Thesis**

### **Consumer perception of product healthiness**

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Name of the thesis: Consumer perception of product  
healthiness  
Course name: Thesis Marketing and Consumer Behaviour  
Thesis code: MCB - 80433  
Credits: 33

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Date: July 2011

## **Abstract**

Perception of products' healthiness using an integrative methodology, which assesses attention to front of pack information cues, is investigated. Eye-tracking measures and choice paradigm are implemented in the methodology and thus hypotheses are tested in two tasks: (A) participants choose a product among an assortment of 8 products, then (B) product healthiness is evaluated on 5 point Likert scale. Respondents' eye-movement in terms of dwell time and their actual choice from assortment is recorded. Each product is manipulated with different GDA chromaticity (monochrome vs. color-coded), enrichment (present vs. absent), healthy choice logo (present vs. absent), and brand (weak vs. strong).

**Key words:** *consumers, perception, eye-tracking, choice, nutrition information, product healthiness, attention,*

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# 1 Introduction

Although food companies increase the launch of health products, consumers cannot typically verify products' healthiness from personal experience. They rather infer the healthiness value from information for which they have two belief formations, inferential and/or informational (e.g., Fishbein and Ajzen, 1975). In the inferential belief formation, based on consumers' (subjective) knowledge, the personal rules of thumb (e.g., light colored soups are healthy; milk is more healthy when in glass than in plastic pack) may be used to infer healthiness. Alternatively, nutritional information on pack (e.g. a label or health logo) play a role in the process of informational belief formation. Whether consumers use nutrition information on pack depends on certain extent to whether this information was attended, and thus attention seems a prerequisite for consumers' perception.

The relative balance, however, between informational and inferential belief formation is still poorly understood. This lack of insight is mainly due to poor methodology to quantify attention and perception processes in details. Previous consumer research based on self-reports and think-aloud protocols measures (e.g., Cowburn & Stokley, 2005; Higginson et al., 2002; Kelly et al., 2009) requires a considerable level of introspection on the part of the consumer and thus cannot validly report the true nature of his/her perception processing. Thus, there is a need for elaborating a more sophisticated research methodology to quantify the true health perception process.

Based on experimental designs, psychology and psychophysics provide more accurate methodologies, which allow for a detailed insight into attention and perception processes. These methods also help to explain how attention mediates perceptual selectivity for further action (Allport, 1987, Yantis, 2000).

The aim of the present thesis is to extend previous efforts in this domain into two directions: (1) to explore the potential of these methods for understanding healthiness perception processes, and (2) to expand these methods to more realistic situations of food healthiness perception (which combines informational and inferential belief formation) beyond the manipulation on single tasks as typically applied in psychophysical research (e.g., Schneider 1980; Maloney and Yang 2003). The focus of the research will be on the complexity of product packaging design in terms of color, shape, location of nutrition information on pack, and the assortment context in which the product occurs, to understand how this determines (variation in) healthiness perception.

The approach we suggest is experimental and will be measured by different techniques. Response time, accuracy, consumer choice will be recorded. Eye-tracking methodology will be also implemented. The combination of different methods and techniques will give opportunity to investigate the way consumers perceive healthiness of products as a function of GDA, healthy choice logo, brand and enrichment presented FOP.

In the following the theoretical background and methodological approach are presented.

## **2 Theoretical Background**

### **2.1 Attention**

Attention is a cognitive process, characterizing the capability to select part of the stimuli that are further processed (Levitin, 2002). It is a component of perceptual processing and has the ability to selectively focus on chosen stimulus (Solomon, Bamossy, & Askegaard, 2002). Nowadays, consumers are exposed to many stimuli and therefore the marketers must be creative in their attempts to increase attention for their products. A creation of a superior package may be one of the ways to increase the consumers' attention. As the main focus of the current project is on the visual characteristics of product packaging, in the following section we concentrate on visual attention.

#### **2.1.1 Visual attention**

What people see is defined by what they attend to (Styles, 2006). The environment around us is continually offering more visual stimuli than we can effectively process (Levitin, 2002). Thanks to visual attention, people select only such information, which is relevant to the actual performance. We therefore assume that attention plays a crucial role towards consumers' product decision making. For instance, right choice on healthy product depends on consumers' ability to detect and monitor nutritional information or healthy claims of packaging, product assortment and other attracting features; different color of the packaging, price of the product or difference between brand with strong healthy image and weak healthy image. (Grunert et al., 2007).



When we move our eyes to a specific object, we attempt to fixate what we are attending to. In the second half of nineteenth century, a German physicist Hermann von Helmholtz (1866) point out the fact about the coincidence between attention and fixation. Attention and fixation is not necessarily in conjunction (Juola et al. 1991). For instance, if you fixate on one letter in the text, you can read nearby letters or even words without shifting the fixation. Juola et al. (1991) measured the speed and accuracy of identification of letter within a display divided into center, inner ring, middle ring and outer ring. The targets were presented in different parts of the ring. The goal was to confirm whether performance speed and accuracy was best for targets presented in inner ring (subjects fixated the center of the display). The results showed up that the identification of targets was fastest in a cued ring. It was concluded that the objects within the visual environment of middle and outer ring may be the major focus of visual attention. This fact could help to better locate the nutritional information and /or healthy claims on front-of-pack so that the consumers' attention capture would be better.

### **2.1.2 Selective attention**

Human's perceptual system is not able to process all of the available information and thus the subset of the input has to be selected for further processing (Styles, 2006). Broadbent (1956) assumed that if the message reaches the senses, the information is processed in parallel, but must converge on a perceptual channel of limited capacity. In other words, he believed that there is a filter in our nervous system, which controls the consciousness level of the knowledge.

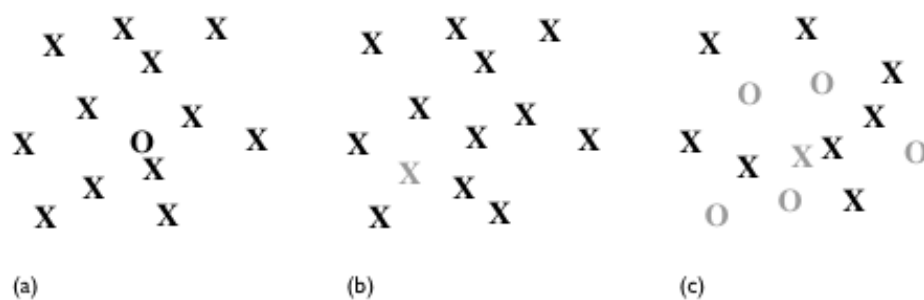


Figure 1 – Parallel and serial processing (Treisman & Gelade, 1980)

Selective attention was tested by experiments allowing measuring participants' reaction time while they were presented with different displays (e.g., Treisman and Gelade, 1980). There were three types of displays: In one case (Figure 1 A) the target and distractors are different in terms of letter shape (letter X vs. O); in other (Figure 1 B) in terms of color (grey vs. black X); and in third case (Figure 1 C) in both dimensions, shape and color. Thus, while in cases A and B one dimension has to be processed in case C two dimensions have to be processed. The results showed that in displays (A) and (B), the detection of unique, distinctive feature size had no influence on search time. In this case, the attention is processed in parallel. Contrariwise, in the display (C), attention moves serially through the display until a target connection is found. Every extra distractor in display adds 60 ms to the reaction time. This experiment proves a difference between parallel and serial processing. Based on this study, we assume that designing a packaging that contains multi-dimensional items (e.g., multicolored GDA nutritional information) and increased number of items (Grunert and Wills, 2007) could cause an increase of consumer's

reaction time in spotting particular information FOP (Bialkova and Trijp, 2010; submitted).

### ***Late vs. early selection***

People cannot do everything at once and must choose what is most important. The term of early selection is based on attention of rough physical characteristics of the stimuli (such shape, color, size, brightness, form). The meaning is determined afterwards, by the deeper processing and thus early selection is meaning-independent (Zimbardo et al., 1995). On the other hand, late selection operates at stage where the information has a meaning. For example you would not have problem to point to the different colored words in a paragraph very quickly. However, you would have to think when you were asked to point to nouns in the paragraph and this process would take longer time. This is a proof that in visual selection, the early selection does occur and it is concerned rather with seeing than knowing. The location is also a very important mediator (Van der Heijden, 1992) and therefore not only color or size of GDA nutritional information is important, but also its location on packaging (FOP) and location of product in the supermarket shelf.

### **2.1.3 Congruent vs. incongruent information**

Another experiment in exploring selective attention was introduced by Eriksen and Eriksen (1974). In their flanker compatibility task the participants were expected to respond to a centered item (e.g., letter) flanked by another distracting item (either congruent or incongruent in color and type to the target). The results showed that reaction time was higher with incongruent than congruent flankers. This experiment was further elaborated by Shaffer and Laberge (1979), who replaced letter items by word items belonging to different categories (e.g., furniture or clothing).

Participant had to determine the category of the word displayed on the screen and to press a relevant button as a response. Above and below every target word, flanker word appeared – either congruent or incongruent with the target word category. There was a significant slowdown in performance with incongruent than congruent flankers, presumably due to parallel processing of the information.

The standard Stroop (1935) task is also an example for the influence of incongruent distractors on reaction time. Participants are asked to call out aloud the color of the ink in which the colored words are written. In the case of a different color from the meaning of the word (e.g., word “green” colored in red), the participants slowed-down the response time and they were even unable to answer correctly in comparison when the word and color were congruent (word “green” colored in green). This also proves the fact that the incongruent stimuli distracts the attention and slow down the performance.

All the studies mentioned above (illustrating feature integration, flanker effect, stroop effect) show that congruency of information is a crucial factor in attention. In the context of consumer behavior, we essentially assume that congruency of (nutrition) information would enhance consumers’ attention as well as perception of product healthiness. Therefore, congruency will be applied as a systematic variation in the empirical part of the thesis.

## 2.1.4 Local vs. Global processing

Every human being has already experienced a situation when wanted to look at a small part of the object or at a whole object. Figure 2 shows the Navon's (1977) test, where items are presented as large letters, made up of small ones.

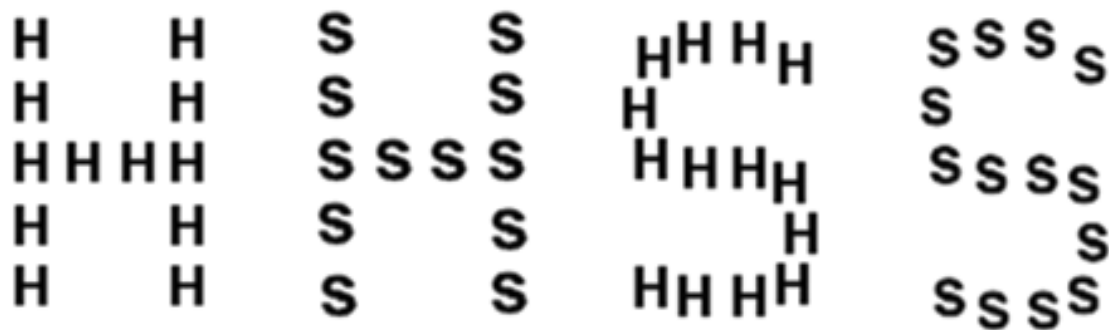


Figure 2 – Global shape vs. local shape (Navon, 1977)

Global shape represents the large letter and local shape represents small letters. The congruent shape is represented by large letter “H” composed of small “H”, and incongruency is represented by large letter “S” composed of small “H”. Response in the incongruent condition to small letters is interfered by the global letter identity. On the other hand, local letter identity does not obstruct the global letter identification (Navon, 1977). Martin (1979) also pointed out the difficulties in dividing a visual attention between the local and global attributes of the object. Another study argues that attention may be focused either on global or local dimension and time is required for switching between dimensions (Shiffrin, 1988).

### *Attentional shift*

The theory proposes that attention switches between representational levels (Shiffrin, 1988). Put differently, if attention alters from global shape to a local element, there should be a zooming in or zooming out of attentional focus (Stoffer, 1993). Two conditions (involuntary vs. voluntary) were compared and the subjects paid attention to local or global property. In first condition involuntary changes are cued by unexpected onset specifying the spatial extent to be attended and in the second condition, voluntary shifts are indicated by symbolic instruction. The results showed that there were no functional differences between attention shifts and attentional zooming at a functional level. On the other hand, it was proven that zooming to the local level lasted twice longer than zooming to the global level. According to Stoffer's suggestion, the global level is attended to first and the additional time is reflecting an additional step that requires the reorientation to the local level of representation. This study helps us to focus on importance of product assortment, which allows consumers a faster and easier orientation for searching a desired product.

#### **2.1.5 Bottom-up processing vs. Top-down processing**

Attention may be driven by bottom-up (stimulus-driven) processing, which has a very fast and short-term course (Connor et al., 2004). This process is automatic and independent on task demands (Desimone and Duncan, 1995). Stimulus-driven processes work with bits of information, which are transformed from concrete, physical features of stimuli into physiological codes and after all into abstract representations (Zimbardo et al., 1995). An example of bottom-up attention was given in study of Theeuwes (1992). The subjects had to search for a singleton element in color distractor condition and in a condition without any distraction. Singleton feature

was a stimulus consisted of squares and a green ring on an imaginary circle. In the color distractor condition, one item was red. This distraction caused the slowing down of the reaction time. The study concludes that the most salient item captures attention automatically. Recently, Geyer et al. (2009) showed that attentional capture by salient distractor does not have to be always automatic.

Attention may also be driven by persons' goals (intentions) and these goals can influence processing of the sensory input via goal-directed, top-down mechanisms (Yantis, 2000). Top-down processes originate in the brain and are important for selection, interpretation or organization of sensory data (Zimbardo et al., 1995). Top-down processes recognize and identify the objects through the stored knowledge. Importance of conceptually driven processes can be described on Doodle drawings (Price, 1953). Figure 3 shows the object, which needs to be decoded and provided meaning to. Once the meaning to that object is provided (object is Giraffe), the knowledge is stored and available in memory.

Top-down attention enhances bottom-up signals in a way we need to look for something specific (Connor et al., 2004). In the context of nutrition information, goal-directed attention plays a crucial role (Bialkova and Trijp, 2010; submitted), e.g., consumers suffering diabetes are searching for sugar free products, and consumers suffering cardio-vascular diseases search for low fat. In other words, consumers will more attend to information, which they are looking for. Therefore it is essential to find the most effective way how to boost up consumer's attention on choosing the right product by proper balancing between the top-down and bottom-up components.

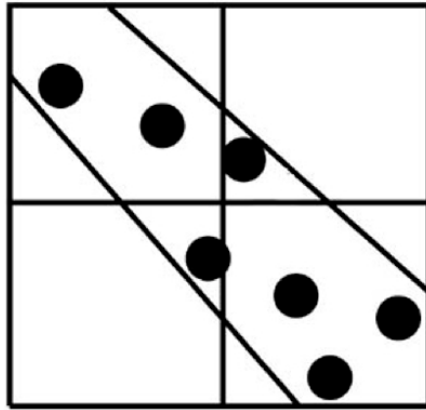


Figure 3 – Doodle drawings (Price, 1953)

## 2.2 Perception

Perception is a process involving the analysis of sensory information, e.g., selecting, organizing and interpreting stimuli (Levitin, 2002). This chapter discusses visual perception (rather than any other modalities), as we focus on consumers perception of product healthiness based on info front-of pack, e.g., info perceived via visual modality.

The perceptual process organizes the chaotic and continuously changing sensory input into an organized percept (Braisby and Gellatly, 2005). A percept is the outcome of process of perception and during the process of selecting, the physical sensations such as sight, is converted into neural codes and further processed in the brain (Levitin, 2002). Perceptual organization forms the internal representation of an object. It estimates the object's attributes (size, shape, movement, distance and orientation). Sensory features (color, lines) are integrated and combined into the percept of the object recognized later (Levitin, 2002).



In the identification and recognition stage, the meanings to percepts are created. For instance, objects with circular shape are identified as coins, balls, and sun. The perceptual question “What does the object look like?” transforms into the identification question -“What is this object?” - and further to the question of recognition - What is the object’s function?” This identification involves higher level of cognitive processes. (Levitin, 2002).

In further part we would like to highlight the conjunction of consumers perception of product healthiness based on info provided FOP.

### **2.2.1 Consumer Perception of food healthiness**

Consumers’ perception deals with understanding of how a consumers’ perception of product influences the behavior – what decisions they do and how they are influenced by these decisions. Product healthiness is the factor that influences the consumers’ perception and it is becoming most significant trend in the global food market (Meziane, 2007).

Due to increase of chronic diseases such as stroke, heart attacks, obesity and diabetes, it is necessary to help consumers to reduce the energy intake or motivate them to make healthier choices (Astrup, 2001).

The perception of food healthiness is influenced by information for origin, production, conservation method, use of additives, packaging, etc. (Bech-Larsen and Grunert, 2003). Consumers view on food healthiness is generally divided into two main dimensions – eating healthy and avoiding unhealthy food (Brunso et al., 2002). Healthy diet, sugar-free or low-fat food is related to the eating healthy dimension, whereas avoiding unhealthy food concerns food safety (GMO food, pesticides utilization, etc.).

First confrontation with food products is usually happening visually and therefore the visual sensation is the most important perceptual tool and thus visual sensation should not be underestimated because human perception of quality is dependent on the visual image (Hetherington and MacDougall, 1992). Products in the supermarket can be affected only by visual cues and therefore the appearance is becoming important before purchase (Hutchings, 1994). Clydesdale (1975) studied the consumers' product preference with different appearances and concluded that those products with the most appealing appearance will be chosen first.

### ***Factors determining (health) product perception***

This section is focused on describing the most effective way of health food products differentiation. To differentiate health food products from those of a competitor it is crucial to decide which product attributes it is necessary to focus on.

Chrysochou (2010) shows the importance of health value as a necessary product characteristic due to the current trend, which is to launch products with health-related claims. He claims that the brand health image is created first by the health stimuli such as colors, symbols, healthy claims, nutritional information etc. This stimulus is picked up through our sensory receptors and initiates the consumer perception in relation to health. The focus should be on choosing the right combination of marketing mix elements such as brand credibility, brand history, advertising and packaging (Chrysochou, 2010). We have to point out here, that different importance is given to the variety of marketing elements; high to brand elements, middle to communication elements and low to specific health communication elements (Chrysochou, 2010). On the other hand, research from van Trijp and van Lans (2007) argues that consumer perception of health claims increases perceived healthiness of products.

The factors hypothesized as key determinants in consumer perception of product healthiness are summarized in a conceptual model and are described in details below (see appendix 2).

**Color** is the most important sensory attribute in taste recognition, in flavor detection and in food preference (Braisby and Gellatly, 2005). Perception of color acceptability is also associated with other quality attributes such as flavor, nutrition or level of satisfaction (Christensen, 1983). Color with other appearance attributes makes the first impression within consumers' product choice. Gifford and Clydesdale (1986) argued that color is a primary factor influencing the acceptance (or rejection) of food. Another research of Rolls et al. (1982) proves that color manipulation can enhance the intake and increase the sales. In the concept of healthiness perception, we assume that with blue monochrome GDA labels presented on labels will enhance the consumers' perception of products healthiness.

**Nutrition labels** appear on package in form of back-of-pack information alone or in form of recently popular front-of-pack information (Feunekes et al, 2008). Feunekes studied the conjunction of different formats of nutritional labels on front-of-pack. It was reported that healthy decisions are simpler and faster with health claims than with more detailed nutritional information like GDA. GDA stands for Guideline Daily Amount and this nutrition facts label informs consumers about approximate amount of carbohydrate, fat, calories, saturated fat, total sugars, salt, fibre and sodium required for a healthy diet (Tesco, 2006). Although according to Feunekes studies the healthy claims are preferred before GDA labels in consumers' perception of healthiness, testing of GDA on front-of-pack in different forms will be assessed in this study.

Another recent research also confirms that 80% of population would prefer a food product labeled with *health claims* from those without health claims (Pospechova, 2010). Roe et al. (1999) proved that nutritional information reduces the extent of the informational belief formation. The study of Kozup et al. (2003) shows that in the absence of nutrition information, health claims can have positive effect on purchase intentions. These claims are processed through inferential belief. This benefits marketers of packaged food products to place such claims on the front of the package. With the combination of nutrition information, the purchase intention has even stronger effect. However, this research highlights that consumers may have lack of knowledge about the nutritional information. The research by Lähtenmäki (2010) studies the different forms of healthy claims and how they influence consumers' perception. It was concluded that consumers' perception towards product's attributes was mostly negative, but the perceived naturalness is dependent on type of claim ingredient and product; products that contain functional components together with omega 3 ingredient were perceived less negatively than non-processed products (pork chops) with added ingredients. Therefore in our study we will focus on similar-processed products.

Using a *brand* name significantly increases perceived quality and willingness to buy as compared to using no brand (Dodds & Monroe, 1985). This evokes us to test whether the strong and weak healthy image brands influence the consumers' product healthiness perception.

*Product assortment* is also assumed to play a role in consumers' perception. Kahn & Lehman (1991) showed that larger assortments lead to stronger preferences because consumers are more flexible during their choices. Contrariwise, recent study suggested that large assortments could lead to the decrease of choice

likelihood (Iyengar & Lepper, 2000). Furthermore, every individual varies in the readiness of established attribute preferences. For instance, if two consumers are choosing from same category – spread cheese and the first one is aware of key healthy attributes (e.g., prefers combination of low-fat content with parsley flavor ingredient), but the second is aware only of the attributes describing the cheese (e.g., flavored, dietary), the first consumer’s expression of attribute combination is ideal, whereas second one’s is not (Iyengar & Lepper, 2000). Chernev (2002) argued that for those consumers who do not have articulated preferences, decision making from large assortments is more difficult.

There were several researchers which elaborated on how healthy claims and /or nutrition claims influence consumers perception but there was never taken into account the whole visual environment; either of the product package information (within micro-context) or the macro-context of other products within the whole product assortment. From the theory of attention (Global vs. Local processing section) we know that subjects’ zooming RT to the local level lasted twice longer than to a global level and therefore the interaction of the product assortment with **healthy choice logos** and **enrichment** claims will be tested in our study.

## 2.3 Hypotheses

### 2.3.1 Congruency effect:

Researches have analyzed the impact of nutrition information on food packages on costumers' assessment of food regarding to their healthiness. The results generally showed that the products labeled with specific nutrition information were perceived healthier (Ford et al. 1996; Mitra et al. 1999; Garretson and Burton 2000; van Trijp and van der Lans 2007) than products without nutrition information. Furthermore it was reported that in the absence of nutrition information, health claims may have positive effect on purchase intentions (John C. Kozup, Elizabeth H. Creyer, & Scot Burton, 2003).

Therefore we hypothesize:

**H1:** Healthy choice logos on packaging enhance perceiving a product as healthier than products with no choice logo

However it is not clear how nutrition information interplays with health claims and other design elements front-of pack concerning consumer perception of product healthiness. Following the findings from psychology (Eriksen and Eriksen 1974; Shaffer and Laberge 1979; Stroop 1935; MacLeod, 1991) that congruent information facilitates performance, we assume that an appropriate combination of package design elements could be beneficial for perceiving a product as more healthy. Pospeschova (2010) also argues, that 80% of population would prefer products labeled with health claims. More precisely we predict:

**H2:** Enrichment healthy claims enhance perceiving a product as healthier than products with no enrichment.

### **2.3.2 GDA color effect**

The color of GDA labels determines the way attention is captured (Bialkova & van Trijp, 2010). In their study, visual search task confirmed that attention was captured better with monochromatic than polychromatic coloring. However in the other study (Kelly et al., 2009), participants were more likely to identify traffic light color-coding rather than monochrome system. We predict:

**H3:** Consumers pay more attention to Color-coded GDA than to monochrome GDA.

**H4:** Color-coded GDA enhance perceiving product as healthier than monochrome GDA.

### **2.3.3 Brand effect**

The study of Dodds & Monroe (1985) concludes, that using a brand name increases significantly the perceived quality and willingness to buy a product as compared to products without brand. From other literature, we know that most consumers consider health to be very important food quality aspect (Brunso et al., 2002) and thus we expect:

**H5:** Product of a strong brand is supporting consumers' attention to GDA label more than product of a weak brand

### **2.3.4 Goal effect**

Bialkova & van Trijp (2011) reported that shopping goal determines attention and thus a goal-directed attention plays a crucial role in consumers' choice. In our study, we want to find out how the factors determining healthiness on FOP (e.g.: enrichment, GDA, healthy choice logo) interact with the activated goal (health vs. preference). The assumption is that more time will be spent (e.g.: higher number

of fixations) on FOP elements when choosing product for healthy purposes than choosing product according to consumers' preference. Therefore, we expect:

**H6:** Consumers pay more attention to enrichment claims when choosing product for healthy purposes than for preference.

**H7:** Consumers pay more attention to GDA when choosing product for healthy purposes than for preference

**H8:** Consumers pay more attention to healthy claim logos when choosing product for healthy purposes than for preference.

### **3 Methodology**

The respondents are presented with products in assortment where 8 products are manipulated with different label design, choice logo, enrichment and brand name. Visual search and choice paradigm are combined in way that respondents gaze is recorded (by using an eye-tracking device) as well as the choice made.

#### **3.1 Eye-tracking measures**

In this study, visual attention to displayed stimulus will be measured. Eye-tracking equipment will be used to execute this research since the eye-tracking measures are benefiting from providing direct measures of eye movements without require of verbalized pre-store memory-based consideration (Wedel, 2008). Eye-tracking studies are fast growing segment of the POP market research industry and Young (2000) argues that they are suitable for commercial studies of package design.



Recent studies also confirmed the reliability of this new technique (Hoffman, 1998; Lohse and Johnson, 1996; Rayner, 1998).

When using gaze or eye movement for research, we must distinguish between fixations and saccades. A fixation occurs when the eye is still in one position and saccade occurs when the eye moves to another position (Rayner, 1998). For our study, we are further interested only in the fixation and its time. The areas of interests have to be defined (e.g.: brand name, GDA label) in order to analyze number of fixation within these areas. The time from the first fixation to the area of interest until the time of last fixation from the area of interest is called a dwell time.

### **3.1.1 Subjects**

Forty-one academics, aged between 18 – 35 years, were recruited at Wageningen University in the Netherlands. All participants had a full color vision and a normal (corrected-to-normal) vision. Subjects were paid 2 euro each by completing this experiment.

### **3.1.2 Stimuli & Design**

Respondents were asked to complete two tasks. In the first task, the respondents were presented with eight different products currently existing on the market in the Netherlands on each trial (Figure 4). The products were from the same category of crunchy muesli. Eight trials were presented in this task. In each trial, four products varied by flavor (Naturel, Multifruit, 4 Noten, Chocolate) were of a strong-brand healthy image (Quaker Cruesli) and other four were of a weak-brand healthy image (C1000 Krokante). First initial trial was displayed with no GDA labels and enrichments. Second trial was displayed with GDA labels. Products satisfying the

healthy profile (all products with Multifruit and Naturel flavor) were presented with healthy choice logo and on the rest of products healthy choice logo was missing. The other 6 trials were manipulated by enrichment (e.g.: rich on fiber, less amount of fat). For detailed list of trials manipulation, see the Appendix 1.

Within-subject factors were following: strong vs. weak brand healthy image (Quaker Cruesli vs. Krokante muesli C1000), flavor variation (Naturel, Multifruit, 4 Noten, Chocolate), healthy choice logo being presented or absent, text enrichment presence or absence (e.g.: rich on fiber, less amount of fat).

Shopping goal and GDA chromaticity were manipulated as between-subject factors and therefore four different instructions for Task 1 were distributed. First set of respondents was instructed to choose the product they would prefer and were displayed with color-coded GDA. Second set of respondents was also instructed to choose the product they would prefer but trials were displayed with monochrome GDA. Third set of respondents was instructed to select the healthiest option with color-coded GDA labels, and finally, fourth set of respondents selected the healthiest product with monochrome labels.

In the second task, each set of respondents was presented with the same products as they had seen in Task 1, but the products were shown one by one and the respondents had to evaluate how healthy the product is on a 5 point Likert scale. This scale uses fixed choice response format designed to measure attitudes. Respondents were offered 5 pre-coded responses with the neutral point 3 = Average (Figure 5). Respondents were presented 24 trials in total (Appendix 2).

A short computer-based survey was part of the study. The survey was developed for further implementation of overall statistics. The survey was designed in

the web-based application Qualtrics offered by Wageningen University. The questionnaire contained 13 questions (For more details, see the measures section).



Figure 4 – An example of trial in Task 1



Figure 5 - An example of trial in Task 2

### 3.1.3 Procedure

Subjects were individually taken to a room and were administered the task. A written instruction informed the subjects about the procedure of both tasks and about the calibration procedure. Prior each task, the calibration procedure was run with average error in gaze position smaller than 0.5 degrees. After the calibration, the word “START” displayed on the screen and the participant could start the first task by pressing space bar key on keyboard. Firstly, a fixation cross appeared for 500 ms and after its disappearing, the first stimulus set was presented on the screen until the respondent made decision by saying aloud the product chosen and entering the space bar. The experimenter recorded choice made whereas the computer recorded dwell time. Then, a new fixation cross appeared automatically for 600 ms followed by the next stimulus set. When Task 1 finished, calibration was repeated prior the Task 2. In Task 2 the procedure was similar to Task 1 (products’ healthiness was evaluated by saying aloud the number on 5 point scale). The RED SensoMotoric Instruments eye-tracking device was installed under the 42” LCD Sony Bravo television with 1920x1080 pixel resolution, where stimuli were displayed. The distance of 60 cm was maintained between respondent and the screen with eye-tracking device and eye positions were sampled at 50 Hz.

When both tasks were finished, the respondent filled in the computer-based questionnaire on another laptop computer.

### **3.1.4 Measures**

In the first task, choice made (Quaker Cruesli Naturel, Quaker Cruesli Multifruit, Krokante Muesli Naturel, Krokante Muesli fruitmix, Quaker Cruesli 4 noten, Quaker Cruesli Chocolate, Krokante Muesli noten, Krokante Muesli Chocolate) according to the shopping goal was recorded in each of 8 trials from product assortment. In addition, for the analysis of the eye movements data, dwell time was calculated for defined Areas of Interest in order to capture the eye fixations on following front-of-pack design elements: the brand name, nutrition labels (GDA), healthy choice logo, the flavor info, and enrichment claims. Dwell time was the crucial factor measured for each of the area of interest. In the second task, the product healthiness evaluation was measured on the five point Likert scale (Not healthy at all – Very healthy).

#### ***Survey***

Respondents were asked to execute a short survey assessing background variables divided into five categories. For complete design of the questionnaire, see Appendix 3. First category represents socio demographic description of respondents and we are interested in age, gender and the level of university degree currently studying. Second category belongs to shopping-related variables and respondents were asked where and why do they usually shop. Healthy life style category explains subjects' attitude towards sports and healthy eating habits. Next category is directly connected to the product tested in this study and we ask about passed experience with brands (e.g: Krokante and/or Quaker). Last category assesses respondents' self-reported attention and use to information on FOP in this study (Figure 6, Figure 7, Figure 8).

Answer		%
Other (specify)		5%
Healthy choice logo		15%
Brand name		21%
Enrichment info		22%
Package design		27%
GDA label		28%
Product flavor		51%

Figure 6 – Question 10: Which information attracted you most? Select max two answers

Answer		Response	%
Other (specify)		2	2%
Brand name		11	13%
Package design		14	17%
Healthy choice logo		18	22%
Enrichment info		20	24%
GDA label		33	40%
Product flavor		42	51%

Figure 7 – Question 11: Which information you bases your choice on? Select max two answers

Answer		%
Brand name		4%
Other (specify)		4%
Package design		9%
Product flavor		24%
Healthy choice logo		27%
Enrichment info		46%
GDA label		59%

Figure 8 - Question 12: Which information was the most helpful for evaluating product healthiness? Select max two answers.

### 3.1.5 Data analysis

Two-way and one-way repeated measures analyses of variances were used to execute the data. Dwell time recorded by the eye-tracker and choice made were selected as dependent measure variables. Survey was analyzed with supporting descriptive statistics.

## 4 Results

The statistical results are summarized in Table 1.

Table 1 - Summary of statistical test

Effect	DF	Task 1		Task 2	
		Eye track dwell time		Healthiness perception	
		<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
Choices logo	(1,38)			116.95	< .001
Enrichment	(1,38)			16.57	< .001
GDA chromaticity	(1,38)	.56	> .05	.07	> .05
Brand	(1,36)	3.38	< .05		
Brand x Healthy image	(1,36)	4.72	< .05		
Enrichment x Shopping goal	(1,38)	4.69	< .05		
GDA x Shopping goal	(1,38)	.053	> .05		
Logo x Shopping goal	(1,38)	.2	> .05		
Enrichment x healthy profile	(1,38)	12.31	< .01		

*Note: Goal and chromaticity are between subject factors*



## 4.1 Respondent description

In total, 41 Dutch students or researchers aged between 18 – 37 years from Wageningen University were participating in the study. All participants had a full color and a normal (corrected-to-normal) vision. The students covered all categories of gender and education (Figure 6). Almost three quarters of respondents were women and one quarter were men mostly studying BSc and MSc degree level.



Answer		%
Male		28%
Female		72%

Figure 9 – Gender

From the shopping-related point of view, the respondents usually shop in AlbertHeijn or Hoogvliet, because of its convenient location and majority (77%) cares about food healthiness (Figure 10, Figure 11).








Answer		%
Super de Boer		1%
Aldi		1%
Other		2%
Lidl		7%
C1000		18%
Hoogvliet		33%
AlbertHeijn		37%

Figure 10 – Question 5 - Where do you usually shop the groceries? Choose one







Answer		%
Because my friends do		2%
Because it offers the healthiest products		6%
Other reason		11%
Because it offers the cheapest products		27%
Assortment variability		38%
Because it has the most convenient location		70%

Figure 11 – Question 6 – Why do you shop in selected grocery stores? Select max two answers

## 4.2 Congruency effect

The influence of healthy choice logos, brand name and enrichments on healthiness perception was examined by one repeated measurement ANOVA. Task 2 was selected for analyzing the data where healthiness evaluation by the respondents was selected as a dependent variable. The main effect of healthy choice logo was significant, for choice made ( $F(1,38) = 116.95, p < .001$ ). According to these results, we can conclude that H1 is supported and healthy choice logos on packaging enhance perceiving a product as healthier than products with no choice logo. More precisely, the healthiness perception of products with presented healthy choice logo is significantly higher ( $M = 3.37$ ) than products without healthy choice logo ( $M = 2.173$ ).

The main effect of enrichment was also significant ( $F(1,38) = 16.57, p < 0.001$ ) and therefore the H2, that the enrichment healthy claims enhance perceiving a product as more healthy than products with no enrichment, is accepted. We can conclude that the healthy choice logos had a more positive effect on consumers healthiness evaluation ( $M = 3.37$ ) with the comparison to the enrichment claims ( $M = 2.88$ ).

The interaction between healthy choice logo and GDA chromaticity ( $F(1,38) = .62, p > .05$ ), as well as the interaction of enrichment and GDA chromaticity ( $F(1,38) = .14, p > .05$ ) is not significant, and thus the manipulation between color-coded and monochrome GDA did not have any influence on respondents' choice in relation to choice logos and enrichments.

### 4.3 GDA chromaticity effect

Next we analyze if different GDA chromaticity (color-coded vs. monochrome) had any effect on respondents' perception and attention. For dwell time we used eye-track data and a one-way ANOVA was run with a dwell time of a GDA label within-subject factor and a between-subject factor GDA format (monochrome vs. color-coded). The main effect of GDA label was not significant ( $F(1,38) = .56, p > .05$ ) for dwell time on the label, which rejects the H3 that color-coded GDA is attended longer than monochrome GDA.

The between subject effect of GDA chromaticity on perceived healthiness was not significant ( $F(1,38) = .07, p > .05$ ) and therefore H4 that color-coded GDA enhance perceiving product healthier than monochrome GDA, is not supported.

### 4.4 Brand effect

The model was tested with the methodology that analyzes the effect of a strong brand and a weak brand to influence consumers' attention to GDA label. The influence of brand (Cruesli and C1000 Krokante) and healthy image (healthier product and less healthy product) based on dependent variable of GDA's dwell time was tested. The main effect of brand is significant for dwell time ( $F(1,36) = 3.38, p < .05$ ) and the interaction effect of brand strength and healthy image (as reflects in presence/absence of health choice logos) is also significant, ( $F(1,36) = 4.72, p < .05$ ). This supports the H5, a product of a strong brand is supporting consumer attention to GDA labels more than a product of a weak brand (Figure 8).

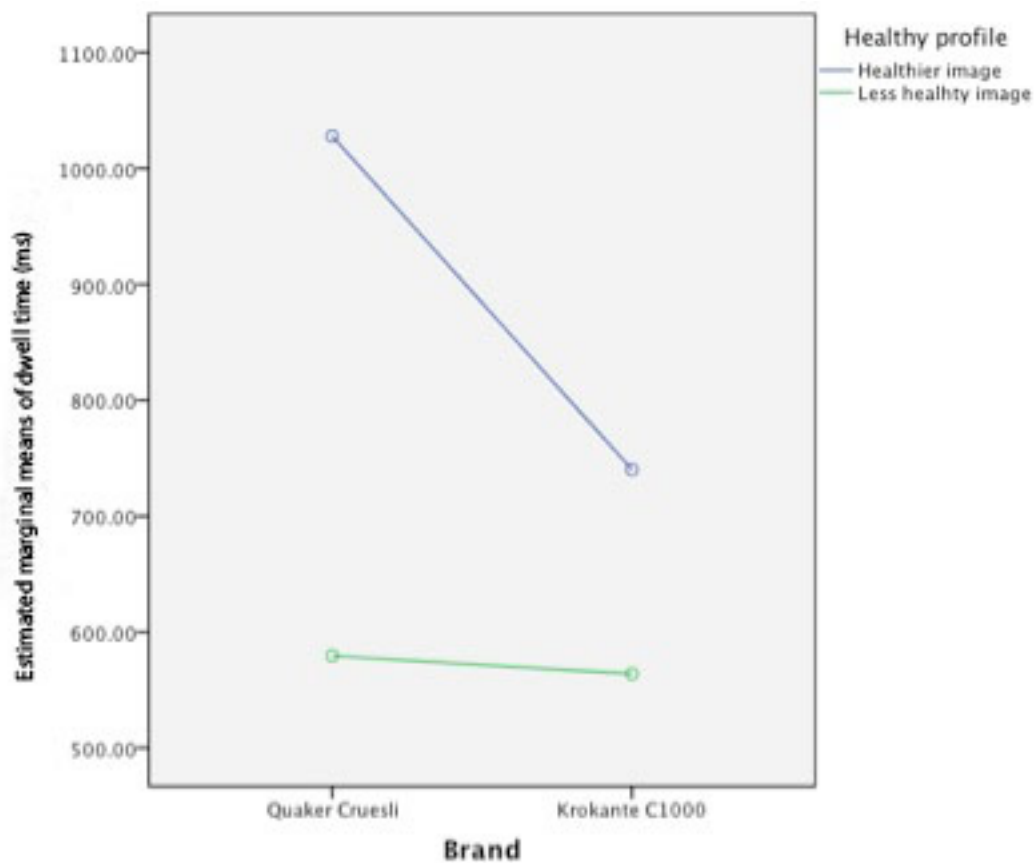


Figure 12 - Strong brand vs. weak brand manipulation effect

#### 4.5 Shopping goal effect

Next we explore to what extent the consumers pay attention to GDA logos, healthy choice logos and enrichment according to their shopping. We examined the dwell time of GDA and a shopping goal as a between-subject factor. Our analysis did not find any significant effect of shopping goal ( $F(1,38) = .053$ ,  $p > .05$ ), on dwell time, which does not support our H7, that consumers pay more attention to GDA logos when choosing product for healthy purposes than for preference. For the healthy choice logo, there was no significant effect ( $F(1,38) = .2$ ,  $p > .05$ ) of logo on dwell time on GDA label and therefore the H8 that consumers pay more attention to healthy choice logo when choosing product for healthy purposes than for preference, was also rejected.

If we look at the enrichment effect, we can conclude that the significance of shopping goal ( $F(1,38) = 4.69$ ,  $p < .05$ ) on dwell time on enrichment was found, and therefore the H6 – Consumers pay more attention to enrichment claims when

choosing product for healthy purposes than for preference, is accepted (Figure 9). For the within-subject factor healthy profile, the effect was significant ( $F(1,38) = 12.303$ ,  $p < .01$ ) and as shown on Figure 10, for health choice task, respondents paid more attention to enrichment in both, less healthy and healthier product, than for preference goal.

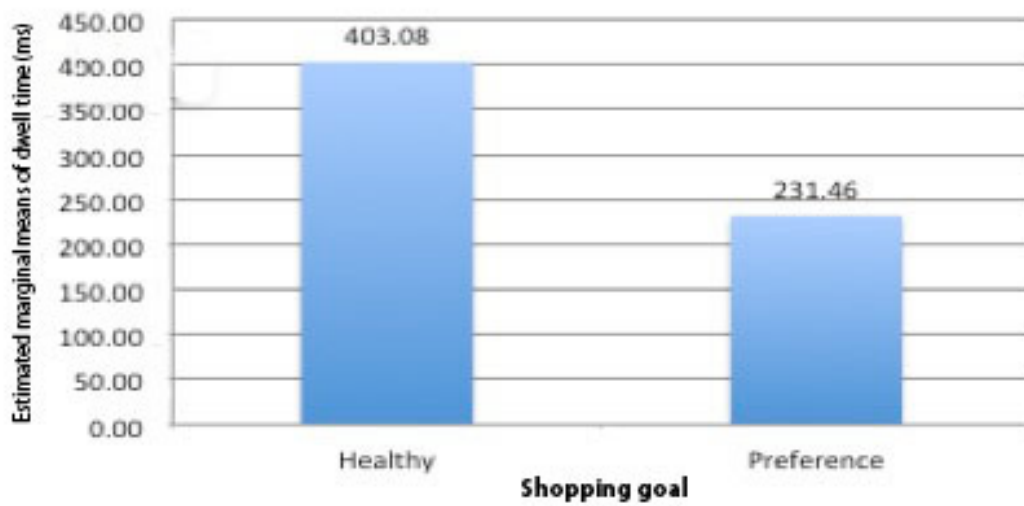


Figure 9 - Effect of shopping goal manipulation on healthiness perception influenced by enrichment

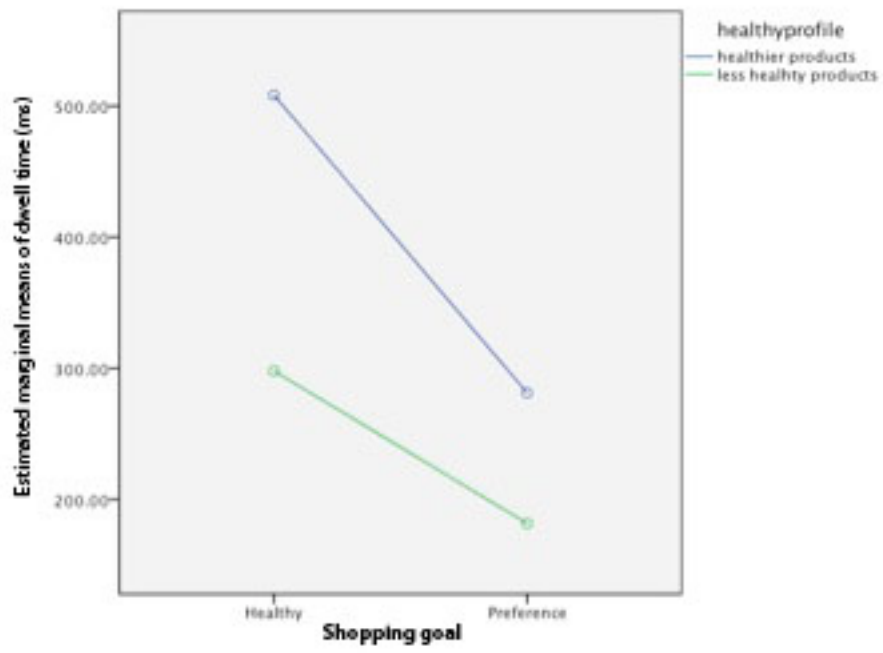


Figure 10 - Effect of shopping goal manipulation on perception

## 5 Discussion

The aim of the study was to investigate how people perceive product's healthiness by using an integrative methodology, which assesses their focus on the information cues on the front of the package. These methods were expanded to more realistic situations of food healthiness perception (which combines informational and inferential belief formation) beyond the manipulation on single tasks as typically applied in psychophysical research (e.g., Schneider 1980; Maloney and Yang 2003).

Consumer choice, as well as data from the eye track (dwell time) was recorded. The combination of different methods and techniques has brought us the opportunity to investigate the way consumers perceive healthiness of products as a function of GDA design, healthy choice logo, brand and enrichment. We tested these hypotheses in two main tasks followed by computer-base survey. In the study, the participants chose a product among an assortment of 8 products and in the second part of the study, product healthiness was evaluated on a 5 point Likert scale. Each product is manipulated with different GDA label design (monochrome vs. colorcoded), enrichment (present vs. absent), choices logo (present vs. absent), and brand (strong vs. weak). Attention can occur as top-down and bottom-up processing, thus in the present study we also manipulate the shopping goal as a between-subject factor to show important effects of stimulus driven and goal driven processes in attention. To enhance the task realism, real life product packages were used to in the study.

Whilst earlier research reported that in the absence of nutrition information, health claims may have a positive effect on purchase intentions (John C. Kozup, Elizabeth H. Creyer, & Scot Burton, 2003), we have also confirmed, that in relevance to congruency, the healthy choice logos as well as enrichments have a positive effect on product healthiness perception (H1, H2), with GDA labels presented



FOP. Further the methodology disconfirms the relevance of GDA color chromaticity. It was found (H3) that within a product assortment, the attention to the GDA labels presented either in traffic light colors or monochrome colors do not differ. The color-coded vs. monochrome GDA form has not shown any difference in healthiness perception either (H4). Although chromaticity does not play crucial role during healthiness perception, most of the respondents consider a GDA label as the most important information for product healthiness evaluation. Dodds & Monroe (1985) concluded that a strong brand name significantly increases perceived quality and willingness to buy as compared to weak brand. Our methodology confirms the investigation that a product is attended more to GDA label when associated with a strong brand than weak brand (H5).

In the context of nutrition information, goal-directed attention plays a crucial role (Bialkova and Trijp, 2010; submitted). However, in our study, we did not find any significant difference between bottom-up and top-down attention processes by GDA labels and healthy choice logo (H7, H8). On the other hand, the results show that attention to enrichment increased almost twice when respondent was instructed to choose the healthiest product (H6). Therefore we can conclude that the enrichment information may be considered an important factor in product healthiness perception.

In our methodology, the chromaticity of GDA labels was tested as a between-participant factor, which could have been a reason why H3 and H4 were rejected. Therefore, in the future study we suggest to implement the GDA chromaticity variable as a within subject factor. Extension of the methodology of the other packaging design features would also promise more complex designs.

Although there was a high number of respondents participating in the study, the variability was limited to Wageningen University academics, which does

not cover overall sample of potential customers in the Netherlands (e.g.: families, households). The realism of the study was extended with the use of 42" LCD screen with products displayed in assortment at realistic size, however another eye track technology (e.g.: mobile eye tracking glasses) could be used to involve even more realistic situation in supermarket shelves. Further examination of eye-track data beyond dwell time (e.g.: reaction time, scan path) would also give us more complex information on exploring the potential of eye-tracking methods for understanding healthiness perception processes.

## **6 Conclusion**

This thesis studied how people perceive the product healthiness. Choice paradigm and eye-tracking measures were implemented as the effective tool for assessing attention to nutrition labeling information and its effects on the healthiness perception. The methodologies used in this thesis gave us the opportunity to investigate the way consumers perceive healthiness of products as a function of GDA, healthy choice logo, brand, and enrichment presented FOP.

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## 8 Appendixes

### Appendix 1 – Design of stimuli trials in Task 1

8 trials with color-coded GDA and 8 trials with monochrome GDA

1<sup>st</sup> trial

Quaker <u>Cruesi Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesi Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
Enrichment			
Quaker <u>Cruesi 4 Noten</u>	Quaker <u>Cruesi Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>

2<sup>nd</sup> trial

Quaker <u>Cruesi Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesi Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>
Quaker <u>Cruesi 4 Noten</u>	Quaker <u>Cruesi Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>
GDA	GDA	GDA	GDA

3<sup>rd</sup> trial

Enrichment		Enrichment	
Quaker <u>Cruesi Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesi Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>
Enrichment		Enrichment	
Quaker <u>Cruesi 4 Noten</u>	Quaker <u>Cruesi Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>
GDA	GDA	GDA	GDA

4<sup>th</sup> trial

Enrichment		Enrichment	
Quaker <u>Cruesi Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesi Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>
Enrichment	Enrichment	Enrichment	Enrichment
Quaker <u>Cruesi 4 Noten</u>	Quaker <u>Cruesi Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>
GDA	GDA	GDA	GDA

5<sup>th</sup> trial

	Enrichment		Enrichment
Quaker <u>Cruesli Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesli Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>
	Enrichment		Enrichment
Quaker <u>Cruesli 4 Noten</u>	Quaker <u>Cruesli Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>
GDA	GDA	GDA	GDA

6<sup>th</sup> trial

	Enrichment		Enrichment
Quaker <u>Cruesli Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesli Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>
Enrichment		Enrichment	
Quaker <u>Cruesli 4 Noten</u>	Quaker <u>Cruesli Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>
GDA	GDA	GDA	GDA

7<sup>th</sup> trial

Enrichment	Enrichment	Enrichment	Enrichment
Quaker <u>Cruesli Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesli Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>
Quaker <u>Cruesli 4 Noten</u>	Quaker <u>Cruesli Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>
GDA	GDA	GDA	GDA

8<sup>th</sup> trial

Quaker <u>Cruesli Licht &amp; Luchtig Naturel</u>	Quaker <u>Cruesli Multifruit</u>	<u>Krokante muesli naturel</u>	<u>Krokante muesli Multifruit</u>
<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>	<u>GDA+Healthy Choice Logo</u>
Enrichment	Enrichment	Enrichment	Enrichment
Quaker <u>Cruesli 4 Noten</u>	Quaker <u>Cruesli Chocolade</u>	<u>Krokante muesli 4 Noten</u>	<u>Krokante muesli choco</u>
GDA	GDA	GDA	GDA

## Appendix 2 – Design of stimuli trials in Task 2

24 trials with color-coded GDA and 24 trials with monochrome GDA

1 Quaker Cuesli Licht & Luchtig Naturel	13 Enrichment Quaker Cuesli 4 Noten GDA
2 Quaker Cuesli Multifruit	14 Quaker Cuesli Chocolade GDA
3 Krokante muesli naturel	15 Enrichment Krokante muesli 4 Noten GDA
4 Krokante muesli multifruit	16 Krokante muesli choco GDA
5 Quaker Cuesli 4 Noten	17 Quaker Cuesli 4 Noten GDA
6 Quaker Cuesli Chocolade	18 Enrichment Quaker Cuesli Chocolade GDA
7 Krokante muesli 4 Noten	19 Krokante muesli 4 Noten GDA
8 Krokante muesli choco	20 Quaker Cuesli Licht & Luchtig Naturel GDA+HC
9 Enrichment Quaker Cuesli Licht & Luchtig Naturel GDA+HC	21 Enrichment Krokante muesli multifruit GDA+HC
10 Quaker Cuesli multifruit GDA+HC	22 Enrichment Krokante muesli choco GDA
11 Enrichment Krokante muesli naturel GDA+HC	23 Enrichment Quaker Cuesli multifruit GDA+HC
12 Krokante muesli multifruit GDA+HC	24 Krokante muesli naturel GDA+HC

### Appendix 3 – Questionnaire design

Q1) Please fill in your ID number

Q2) I am

- Male
- Female

Q3) What is your age?

Q4) I am

- BSc level student
- MSc level student
- PhD level student
- Other (Specify)

Q5) Where do you usually shop the groceries? Choose one

- AlbertHeijn
- Hoogvliet
- C1000
- Aldi
- Super de Boer
- Other

Q6) Why do you shop in the selected grocery store? Select max two answers.

- Because my friends do
- Because it offers the healthiest products
- Because it has the most convenient location
- Assortment variability
- Because it offers the cheapest products
- Other reason (specify)

Q7) Which of the following statements would describe you best? Choose one

- I have to eat healthy because I have some healthy issues
- I eat healthy because I want to feel and look good
- I eat any food irrespective of how healthy it is

Q8) Do you regularly do sport?

- Yes, more than twice a week
- Yes, at least once a week
- No

Q9) How often do you eat cereals?

- Never
- Less than once a month
- Once a month
- 2-3 times a month
- Once a week
- 2-3 times a week
- Daily

Q10) Which information attracted your attention best? Select max two answers

- Product flavor
- GDA label
- Package design
- Enrichment info (e.g.: rijk aan vezels, minder verzadigt vet)
- Brand name
- Healthy choice logo
- Other (specify)



Q11) Which information you based your choice on? Select max two answers

- Product flavor
- GDA label
- Package design
- Enrichment info (e.g.: rijk aan vezels, minder verzadigt vet)
- Brand name
- Healthy choice logo
- Other (specify)

Q12) Which information was most helpful for evaluating product healthiness? Select max two answers

- Product flavor
- GDA label
- Package design
- Enrichment info (e.g.: rijk aan vezels, minder verzadigt vet)
- Brand name
- Healthy choice logo
- Other (specify)

Q13) Have you consumed any product of the brands used in the experiment? Select max two answers

- Yes, Quaker Cruesli
- Yes, Krokante Muesl