

Aus dem Institut für Agrarökonomie
der Christian-Albrechts-Universität zu Kiel

**Research on food healthiness:
Supporting decisions on public health, package design, and
everyday consumption situations**

Dissertation
zur Erlangung des Doktorgrades
der Agrar- und Ernährungswissenschaftlichen Fakultät
der Christian-Albrechts-Universität zu Kiel

vorgelegt von
M.Sc. Nadine Yarar, geb. Karnal
aus Bad Saarow

Kiel, 2017

Dekan:	Prof. Dr. Joachim Krieter
1. Berichterstatter:	Prof. Dr. Ulrich R. Orth
2. Berichterstatter:	Prof. Dr. Robert Mai
Tag der mündlichen Prüfung:	08. November 2017

Gedruckt mit Genehmigung
der Agrar- und Ernährungswissenschaftlichen Fakultät
der Christian-Albrechts-Universität zu Kiel

Table of Contents

Chapter 1	Introduction	1
Chapter 2	Consumer lay theories on healthy nutrition: A Q methodology application in Germany	22
Chapter 3	What shapes consumer healthiness inferences? Investigating subtle design cues in food packages	57
Chapter 4	Healthy by design, but only when in focus: Communicating non-verbal health cues through symbolic meaning in packaging	80
Chapter 5	Shaping up: How food package and consumer body conspire to affect healthiness evaluation.	118
Chapter 6	See how tasty it is? Effects of symbolic cues on product evaluation and taste	148
Chapter 7	Conclusion	171
Chapter 8	Summary	187
Chapter 9	Zusammenfassung	197

Chapter 1

Introduction

Food consumption constitutes one of the most important health behaviors which strongly determines a population's overall health status, quality of life, and life expectation (Amarantos, Martinez, & Dwyer, 2001; Roman, Carta, & Angel, 2008; Truthmann et al., 2017). Food fundamentally influences human health as it provides energy to fulfill physiological needs and the nutrient balance a human body requires. However, the modern development of food composition and nutritional behavior has led to an increasingly poor diet quality, which in combination with declining physical activity, caused a substantial increase in obesity (Nestle & Nesheim, 2012; Swinburn et al., 2011). The occurrence of nutrition-related diseases forced public health organizations and governments to implement multiple, yet only moderately successful, interventions to promote a healthier diet (Capacci et al., 2012). Paradoxically, this development coexists with a heightened consumer awareness for healthy nutrition and a growing interest in healthy food products (Nielsen, 2015; The Consumer Goods Forum, 2016). Food marketing has been accused of being one of the leading causes of increased energy intake and, consequently, obesity (Chandon & Wansink, 2012). However, food marketing can also be used as a means to combat the obesity epidemic by increasing the healthiness of a consumer's diet. The negative *and* positive influence of marketing practices on food intake has been investigated for advertisement via traditional (media) and modern (online, in-store, events, etc.) channels, branding campaigns, or product placement (Chandon & Wansink, 2012). Another increasingly applied, yet underresearched marketing tool, which marketers use to communicate

with consumers, is product packaging (Chandon, 2013). Recently, the potential of food packaging to positively influence a healthy food choice has attracted researchers' interest, specifically overall effects (van Rompay, Deterink, & Fenko, 2016) as well as effects of its color (Mai, Symmank, & Seeberg-Elverfeldt, 2016) and shape (van Ooijen, Franssen, Verlegh, & Smit, 2017) were examined. Contributing to these developments, this cumulative dissertation empirically investigates consumers' understanding of healthy nutrition and effects of multiple package design elements on subjective food healthiness perceptions. Findings can be used to address the current public health concern by deriving implications for public health officials, marketing managers, and the informed consumer. Therefore, the following sections introduce the theoretical background for the dissertation.

Relevance of nutrition for public health

Globally, there have been dramatic changes in nutritional patterns in the last three centuries (Popkin, Adair, & Ng, 2012). Although consumption of healthy foods has risen, the intake of unhealthy foods increased substantially in both developed and developing countries (Imamura et al., 2015). According to the World Health Organization (WHO, 2015), an unhealthy diet constitutes of low fruit and vegetable intake as well as an excessive consumption of processed foods that are high in sugar, salt, saturated and trans fat. This is especially relevant since the relation between diet and health has been well established over the years (Sofi, Cesari, Abbate, Gensini, & Casini, 2008; WHO, 2015). Firstly, a suboptimal diet is related to increased body fatness, possibly leading to obesity (Mozaffarian, 2016), which was shown to lower the health-related quality of life in more than one way (Truthmann et al., 2017). Related to that, an unhealthy diet is a major risk factor for one of the main public health as well as economic burdens of our time: non-communicable diseases (NCD; Reddy, 2016; WHO, 2010a). A suboptimal diet contributes more to the prevalence of NCDs than tobacco consumption, alcohol use, and physical inactivity combined (Danaei et al., 2014). More precisely, an unhealthy diet increases the risk of developing diseases such as various cancers (Larsson, 2014; Tantamango-Bartley, Jaceldo-Siegl, Fan, & Fraser, 2013), diabetes (Micha et al., 2017), and cardiovascular diseases (Micha et al., 2017; Mozaffarian, 2016). Together, NCD's account for 63% of deaths worldwide and will globally cause an estimated economic loss of around \$17.3 trillion until 2030; this includes healthcare expenditure, lost capital, and reduced productivity (Mozaffarian, 2016). According to the findings of the Global Burden of Disease Study 2015, the reduction and prevention of nutrition-related NCD's are among the leading priorities of our time and constitute the most prevailing public health challenge within the next years (Reddy, 2016). Research has shown that changing dietary habits, such as decreasing the sugar intake and

increasing the consumption of fruits and vegetables, yields a reduction of body fat, and, ultimately, results in a decline of diet-associated NCD's (McCarthy, Skinner, Fenech, & Keating, 2016; McGuire, 2016). Therefore, primary prevention of long-term weight gain by fostering healthful eating in the population would be more effective than dealing with the fatal consequences of NCD's (Mozaffarian, 2016).

As a result of these diet-related developments, governments have made considerable efforts to foster a healthier diet by implementing a multitude of public health policies. The two major policy strategies constitute altering the market environment (i.e., taxing unhealthy food) and enabling the consumer to make a more informed choice. Examples of the second policy include raising public awareness of detrimental health effects, public information campaigns, dietary guidelines, nutrition education or nutrient profiling (Brambila-Macias et al., 2011; Capacci et al., 2012; WHO, 2010b). Specifically, nutrient profiling aims at promoting a healthier food choice by categorizing food based on its nutritional composition. These profiles are then applied on a product so that consumers can easily judge the nutritional quality of specific foods (WHO, 2010b). Product labels that are mainly utilized on the front-of-pack, such as the guideline daily amount (GDA), traffic light or choice label, vary in the amount and degree of available information and in how easily an overall product healthiness evaluation can be derived (van Kleef & Dagevos, 2013). However, the introduction of nutrient profiling showed limited effectiveness on consumers' actual behavior (Cowburn & Stockley, 2005; Foltran et al., 2010). Even though consumers find practical support in inferring healthiness information (Feunekes, Gortemaker, Willems, Lion, & van den Kommer, Marcelle, 2008; Lobstein & Davies, 2009), and the labels also enhance the perceived healthiness of the evaluated product (Barreiro-Hurlé, Gracia, & de-Magistris, 2010; Bialkova, Sasse, & Fenko, 2015; Newman, Howlett, & Burton, 2014), they have failed to influence the healthiness of food choice (Aschemann-Witzel et al., 2013; Borgmeier & Westenhoefer, 2009; van Herpen & van Trijp, 2011; Vasiljevic, Pechey, & Marteau, 2015). Generally, public health actions related to dietary improvements exhibit mixed or only limited behavioral impact (Brambila-Macias et al., 2011; Capacci et al., 2012). In other words, although consumers seem to know what is considered healthy and what official guidelines recommend, they are unable to implement these recommendations in their behavior (Lake et al., 2007). Consumers even fail to act according to recommendations if they have good intentions to do otherwise—a concept that is called intention-behavior gap (Brug, Oenema, & Ferreira, 2005; Gollwitzer, 1999).

Consumer differences and food choice

The previously mentioned negative influences of suboptimal nutrition could be prevented in the long-term by behavioral changes, such as healthy eating. Findings of a recent study in the US are supportive of this as they provided evidence that a strict adherence to official dietary guidelines significantly decreases the risk of developing major chronic diseases (McCullough & Willett, 2006). However, food preferences vary strongly between individuals and situations, indicating that behaviors such as food choices are influenced by various personal and environmental factors. Therefore, it is crucial to account for these in food-related research and the following sections introduce the most relevant consumer differences. Amongst the personal factors are psychophysiological cues (e.g., internal states such as hunger), implicit attitudes towards the product (e.g., smell, taste, liking), and motivational, cognitive and affective processes. Environmental factors include situational cues (e.g., availability), communication and information provision as well as extrinsic product attributes (e.g., branding, price, or packaging; Mai et al., 2011; Mela, 2001; Verbeke, 2008). Holistically, these cues can trigger the desire to eat a certain food and shape preferences, which might be the reason for the aforementioned intention-behavior gap in consumers' nutritional behavior. On the consumer side, individual differences regarding motivations and cognitive processes influence perception and processing of visual and informational inputs. As a result of this, these differences also determine reactions towards communication measures like those initiated by public health organizations or food companies (Mai, Hoffmann, Hoppert, Schwarz, & Rohm, 2015; Orquin, 2014; Verbeke, 2008). At the other end, companies and organizations or governments are responsible for further external factors, such as the food package design. The relevance of food package design will be introduced at a later point.

Given that individual differences impact motivations and motives for food choice, Geeroms, Verbeke, and van Kenhove (2008) identified five population subgroups that differed in their health-related motive orientation. They based them on motives such as health is about energy, emotional well-being, social responsibility, management of physical appearance, and physical aspects. These subgroups exhibited diverging fruit, vegetable and meat consumption behavior, health orientation, and reaction to advertisements. Similarly, grouping consumers based on their health-related attitudes (such as low interest in healthy eating, positive health enthusiast, or health strivers) yielded differences in consumption, attitudes, and knowledge towards specific products, and interest in product-specific informational cues (Pieniak, Verbeke, Olsen, Hansen, & Brunsø, 2010). Furthermore, nutritional knowledge constitutes a pivotal determinant of food choice (Alba & Hutchinson, 1987) as it has been shown to reduce consumption of unhealthy

foods (Tarabashkina, Quester, & Crouch, 2016), enhance the adoption of a healthier diet (Wardle, Parmenter, & Waller, 2000; Worsley, 2002), and promote label utilization (Soederberg Miller & Cassady, 2015). Similarly, a person's health consciousness describes the motivation of a consumer to engage in health-related behavior (Wood & Shukla, 2016), such as healthy eating (Hearty, McCarthy, Kearney, & Gibney, 2007; Her & Seo, 2017). In particular, it positively impacts the choice of healthy options in restaurants (Lee, Conklin, Cranage, & Lee, 2014), guides interest in organic foods (Michaelidou & Hassan, 2008), determines whether taste or nutrition facts determine food choice (Mai & Hoffmann, 2012), and increases the reliance on heuristic cues during decision making (Fernqvist & Ekelund, 2014). Interestingly, there is evidence indicating that even the physical characteristics of consumers can affect processes related to food choice and consumption behavior. For instance, obese consumers show different brain responses to visual food stimuli (Spetter et al., 2017), an implicit anti-fat bias (Schwartz, Vartanian, Nosek, & Brownell, 2006), increased food-directed attention (Janssen et al., 2017), and, consequently, unhealthy eating patterns (Maskarinec, Novotny, & Tasaki, 2000). In line with this argumentation on the importance of individual differences, the current dissertation includes various individual characteristics as boundary conditions that may boost or attenuate the investigated effects.

The limited effectiveness of public health campaigns as well as the discrepancy between positive diet-related intentions and the actual consumption of healthy foods (Brug et al., 2005) might also be attributable to differences in consumer information processing. During grocery shopping and decision making, consumers only have limited access to their cognitive abilities, which results in superficial processing of the available (nutritional) information (Mai et al., 2011; Petty, Cacioppo, & Schumann, 1983). This leads to food choices that are not consciously reflected but are instead based on intuition, heuristics, and habits (Köster, 2009). This idea is grounded in dual process theories (Strack & Deutsch, 2004) which suggest that human decision making can follow two different systems. System 1—the reflective goal-oriented system—generates decisions based on reasoning with facts and values. Therefore, operations via System 1 are slower, more effortful, cognitively controlled, and require higher cognitive capacity. Decisions via System 2—the automatic system—are based on intuition and affective response. In this case behavior results from fast and automatic processes requiring little to no cognitive effort and often occur outside of conscious awareness. Strategies for health interventions are generally educative and therefore require engagement with System 1, which might be the reason for their modest success (Capacci et al., 2012). As decisions based on System 2 such as food choices can occur as direct response to the environment (Kahneman, 2003), changes in the

environment may thus lead to subconscious behavioral change. A relatively new public health strategy that accounts for the subconscious and intuitive nature of food choices via System 2 is called nudging (Marteau, Ogilvie, Roland, Suhrcke, & Kelly, 2011). Nudges are modifications of the decision-making environment to subtly bias consumer's choice in a specific way (Selinger & Whyte, 2011; Thaler & Sunstein, 2008). Evidence from studies investigating various nudging strategies, such as placing food at different distances from consumers (Privitera & Zuraikat, 2014), increasing availability of healthy foods (Gittelsohn, Kim, He, & Pardilla, 2013), or adding an extra step in the ordering procedure for unhealthy foods (Wisdom, Downs, & Loewenstein, 2010), suggests that these interventions can be successfully used to encourage a healthier choice (Arno & Thomas, 2016; Wilson, Buckley, Buckley, & Bogomolova, 2016). Similar effects should be attainable by enhancing the perceived healthiness of a food, because health constitutes one of the main motives for food choice besides taste (Grunert, 2011; Steptoe, Pollard, & Wardle, 1995). Based on this relationship, food perceptions related to healthiness are considered strong determinants of food choice and consumption behavior (Contento, 2008). Generally, the concept of food perception describes the way consumers think about food and how they understand it. Previous works demonstrated that consumers are inclined to categorize (perceive) foods as healthy or unhealthy (Chandon, 2013; Larkin & Martin, 2016; Oakes & Slotterback, 2001). Factors influencing this categorization are the declared/expected calorie content (Carels, Harper, & Konrad, 2006), beliefs about brand names (Oakes & Slotterback, 2001), or simple external information such as adding the word "fruit" to a product (Sütterlin & Siegrist, 2015). Another possibility to nudge consumers towards healthy foods by influencing healthiness perceptions includes changing the package design of a food product (Bucher et al., 2016; Tijssen, Zandstra, Graaf, & Jager, 2017). Initial research has already started to investigate this process, yet to date it is not fully understood (Fenko, Lotterman, & Galetzka, 2016; Mai et al., 2016; van Ooijen et al., 2017). As food package design is one of the core topics of this dissertation, the following sections will introduce it more elaborately.

Package design as silent salesman for food products

A product's packaging relates to the way a food or beverage is wrapped, boxed, arranged, and presented to consumers. Besides its logistic and protective functions, package design informs the consumer and promotes its contents (Bloch, 1995; Rundh, 2009). Therefore, a product's package design functions as a silent salesman at the point of sale and acts as a prime medium in shaping consumer judgments (Orth & Malkewitz, 2008; Underwood & Klein, 2002), and choice (Creusen & Schoormans, 2005; Karjalainen, 2007). Specifically, on the consumer side a product package provides a first impression, aids recognition (Karjalainen & Snelders, 2010),

attracts attention (Rundh, 2009), influences visual attractiveness (Orth, Campana, & Malkewitz, 2010), and can be used to identify and categorize a product (Chandon, 2013). Furthermore, it enables consumers to evaluate a product regarding specific characteristics, such as quality, brand personality (Orth et al., 2010; Orth & Malkewitz, 2008) or product healthiness (i.e., van Rompay et al., 2016). From a managerial perspective, product design enables companies to differentiate their products from competitors (Ampuero & Vila, 2006), creates brand value (Rundh, 2016), and, most importantly, conveys what is desired (Silayoi & Speece, 2004; Sundar & Noseworthy, 2014), such as sustainability (Steenis, van Herpen, van der Lans, Ligthart, & van Trijp, 2017) or healthiness (Chandon, 2013; Mai et al., 2016; van Rompay et al., 2016). By default, packaging is not intrinsically linked with the product's content. However, previous research demonstrated that consumers implicitly infer product-related meaning based on visual packaging attributes that subsequently shape product expectations and impressions (Becker, van Rompay, Schifferstein, & Galetzka, 2011; Huber & McCann, 1982; Kauppinen-Räsänen & Luomala, 2010; Magnier, Schoormans, & Mugge, 2016). These works specifically focus on the holistic package design impression (Orth & Malkewitz, 2008) as well as on effects of specific elements, such as color (Aslam, 2006), shape (Becker et al., 2011), typeface (Henderson, Giese, & Cote, 2004), or product image (Madzharov & Block, 2010). Holistically, research has shown atypicality and transparency in package design to enhance the effectiveness of claims (van Ooijen, Fransen, Verlegh, & Smit, 2016), and willingness to purchase of products, respectively (Simmonds & Spence, 2017). Similarly, the perceived efforts that were put into product packaging positively influence the overall product evaluation via perceived quality judgments (Söderlund et al., 2017). This even extends to tactile or haptic characteristics of the package impacting naturalness evaluations (Peters, 2016), and tasting experiences (van Rompay, Finger, Saakes, & Fenko, 2017). Turning to effects of single design elements, the following sections introduce the role of color, shape, typeface, and product image on perceptions. To date, only scant research has investigated how those design elements on food packages are processed and interpreted regarding the healthiness of a product, which is the primary focus of this dissertation. Therefore, at the end of each section a short reference to the upcoming chapters that focus on the respective design element is given.

Color: Colors carry symbolic and associative information based on life experiences and are therefore considered a cultural artifact (Garber Jr, Hyatt, & Starr Jr, 2000; Hine, 1995). Color can cause physiological arousal based on biological meaning or it can evoke learned associations (Labrecque, Patrick, & Milne, 2013). In both ways, color transfers meaning that subsequently impacts consumers' thoughts, feelings, and behavior, such as preference or

choice. In package design, colors help consumers identify a product category or brand, it enhances brand associations (Garber Jr, Burke, & Jones, 2000), and increases brand recognition (Skorinko, Kemmer, Hebl, & Lane, 2006). Colors also play a central role in consumers' everyday food and drink experiences (Hutchings, 1977) as they alter taste perceptions (Garber Jr et al., 2000), influence consumption amounts (Genschow, Reutner, & Wänke, 2012), and impact product perceptions. For instance, product color drives flavor perception (Shankar, Levitan, Prescott, & Spence, 2009; Spence, Levitan, Shankar, & Zampini, 2010), whereas the color of containers (i.e., plate or cup) is able to trigger varying warmth evaluations of a drink (Guéguen & Jacob, 2014), influence consumption (Bruno, Martani, Corsini, & Oleari, 2013; Genschow et al., 2012), and alter flavor intensity (Piqueras-Fiszman, Alcaide, Roura, & Spence, 2012). Generally, colors in food packages yield flavor and texture expectation, such as sweetness and creaminess, consequently influencing taste evaluation, overall liking and purchase intention (Ares & Deliza, 2010; Deliza & MacFie, 2001). Relating to healthiness evaluations, a blue-colored utilitarian product was perceived healthier than a red-colored (Huang & Lu, 2015), a green label on a candy bar conveyed a healthier product than a red or a white label (Schuldt, 2013), and light colors were shown to increase healthiness ratings of foods (Mai et al., 2016; Tijssen et al., 2017). Extending these findings, Chapter 3 fundamentally investigates the link between color lightness and healthiness, while Chapter 4 introduces effects of color weight on food healthiness.

Shape: Previous research on the relationship between food package shape or container shape and consumer behavior primarily concentrated on biased volume perception. For instance, the height of an object is often utilized as visual cue to estimate a container's volume, which is why consumers often overestimate the volume of elongated as compared to wide containers (Raghubir & Krishna, 1999). Similarly, participants pour higher amounts into conical than into cylindrical containers (Chandon & Ordabayeva, 2009), and generally consume higher amounts from bigger package sizes (Chandon, 2013). This can be explained due to a calorie bias based on the package shape. Koo and Suk (2016) provided evidence that elongated packages are expected to have fewer calories than wider packages, but yield higher volume perception—a combination that subsequently increases consumption. Ultimately, package shapes following thin (vs. wide) human-like curves induce more expensive, indulgent choices (Romero & Craig, 2017), and cue product healthiness (van Ooijen et al., 2017). Turning to other shape features, differences in the roundness and angularity of shapes are related to discrepancies in liking and purchase intention, and can further cause sensory expectations based on textural characteristics (Ares & Deliza, 2010). Research on cross-modal correspondence indicates links between

roundness or angularity in shapes with taste expectations and experiences. Investigating round and angular shaped yogurt packages, Becker et al. (2011) report more intense taste in angular packages, thus indicating a more potent product. Similarly, angular shapes are generally associated with sour or bitter tasting foods, whereas rounded shapes lead to sweeter tastes (Liang, Roy, Chen, & Zhang, 2013; Ngo et al., 2013; Spence & Ngo, 2012). Consequently, Chapter 3 aims at uncovering the explicit and implicit impact of roundness and angularity in shapes on product healthiness perceptions; while Chapter 5 digs deeper into the effect mechanism of healthiness effects triggered by human-like slim vs. less slim package shapes.

Typeface: Typeface is a very feasible communication tool for companies to speak visually to the consumer when the spoken word is not enough (Childers & Jass, 2002). Previous research has indicated that the physical (visual) features of written words are subconsciously processed before its message. Thus, visual characteristics of typefaces may communicate symbolic meaning to its recipients faster and beyond the literal meaning of the written word (Childers & Jass, 2002; Doyle & Bottomley, 2004; Drucker, 1994; Henderson et al., 2004). In line with this, typefaces have been shown to enhance brand identity (Doyle & Bottomley, 2004), brand personality perception (Grohmann, Giese, & Parkman, 2012; van Rompay & Pruyn, 2011), product origin (Celhay, Boysselle, & Cohen, 2015), and even taste expectations, like sweetness and sourness (Velasco, Woods, Hyndman, & Spence, 2015). Following up on these findings, Chapter 4 focuses on explicit and implicit typeface effects on food healthiness perceptions.

Images: Product imagery depicts a comfortable way to communicate effectively with the consumer at the point of sales as it attracts attention (Simmonds & Spence, 2017), enables product comparison (Venter, van der Merwe, Beer, Kempen, & Bosman, 2011), enhances brand beliefs (Underwood & Klein, 2002), and positively affects product evaluations, such as taste freshness, palatability, and aroma (Mizutani et al., 2010). Findings further indicate that consumers use product imagery as a crucial heuristic to infer specific product-related characteristics. For instances, varying potato crisp images affect expected saltiness and crunchiness of the crisps (Rebollar et al., 2017), while images of pouring a fruit juice (vs. not pouring) increase freshness evaluation of the juice (Gvili et al., 2015). Furthermore, the amount of product units featured on a food package impacts product quantity perception and consumption amount with higher numbers leading to a higher expected quantity and higher amount consumed (Madzharov & Block, 2010). Ultimately, product images have stronger influences on behavioral intention than package material (Rebollar et al., 2017) or verbal information on packages (Piqueras-Fiszman, Velasco, Salgado-Montejo, & Spence, 2013).

Therefore, Chapter 6 examines the influence of symbolic cues in product packaging images on various product characteristics and actual taste.

The need for implicit measurement methods in food research

Consumer psychology mainly utilizes classic explicit measures based on self-report as a fundamental research tool. Having participants evaluate their own feelings, thoughts, and behaviors offers a very straightforward way of measuring these. However, people are often unable to precisely evaluate their own psychological values and these evaluations are susceptible to social desirability (Steenkamp, Jong, & Baumgartner, 2010) or self-enhancement bias (Sedikides & Gregg, 2008). Additionally, measured attributes need to lay within conscious awareness and have to be introspectively accessible for the participant to yield valid self-reports (Wilson, 2009). In light of dual process theories and since food choice has been shown to be subject of subconscious decision making (Mai et al., 2011), it is necessary to measure aspects of, and influences on, food choice via explicit *and* implicit measures to fully predict or explain consumer behavior. The need of uncovering subconscious mental processes can be fulfilled by a variety of measurement tools. Measures of implicit cognition summarize a subclass of measures which can be used to capture psychological attitudes without requiring participants to explicitly assess these attitudes (Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009). According to Houwer and Bruycker (2007), the term implicit is equivalent to the term automatic, as both characterize a process where individuals lack available cognitive resources, substantial time or awareness of the process, stimulus or outcome. Hence, an implicit measure assesses outcomes on which the effect of the to-be-measured attribute is unintentional, unconscious, resource-independent, or uncontrollable. Explicit measures, on the other hand, investigate an effect of the to-be-measured attribute on responses that is intentional, conscious, resource-dependent, or controllable (Houwer et al., 2009). Therefore, explicit measures encourage consumers to analyze their attitudes by consciously reflecting on them (Köster, 2009). Complementing explicit methods with implicit measures has been shown to strengthen the explanatory power of consumer attitudes on food choice or consumption behavior (Raghunathan, Naylor, & Hoyer, 2006; Richetin, Perugini, Prestwich, & O'Gorman, 2007).

One of the leading implicit measures used in psychology is the Implicit Associations Test (IAT) developed by Greenwald and Banaji (1995). The IAT assesses the relative strength of automatic associations between two pairs of contrasted concepts (i.e., female-male, family-career). It is a measure that is based on the performance speed during categorization tasks where the strength of associations impacts performance. That is because it ought to be easier to give the same

behavioral response (such as pressing a key) to strongly associated concepts than when concepts are only weakly associated (Greenwald & Banaji, 1995). The IAT surpasses other reaction-time based implicit measures, as it yields adequately reliable and reproducible results (Houwer & Bruycker, 2007). Hence, the IAT seems a suitable implicit measure for a food context as it fulfills two crucial functions: It not only confirms (or not) self-report measures (in case of social desirability bias), but is also able to extend findings from self-report measures (in case of self-deception or self-ignorance bias; Gregg & Klymowsky, 2013). To answer the call of accounting for implicit attitudes in relation to healthy and unhealthy food choices (Mai et al., 2011), this dissertation combines explicit and implicit measures to fully examine effects.

Article overview

Contributing to the aforementioned developments, this cumulative dissertation consists of five research articles reporting on eleven studies that use implicit and explicit measures to empirically investigate food healthiness and the impact of package design elements. The first article (Chapter 2) provides an exploration of fundamental lay theories regarding healthy nutrition among German consumers by using Q methodology—a method that combines qualitative and quantitative research techniques—to extrapolate implications for improvements of public campaigns promoting healthy eating. Relating to package design effects, Chapter 3 implicitly and explicitly establishes basic and food-related design-healthiness association for color lightness (vs. darkness) and shape roundness (vs. angularity). Chapter 4 examines how the design factor weight—as expressed by light-weighted vs. heavy-weighted color and typeface applied on a package design—influences the respective food healthiness perception. It also reveals boundary conditions of the effect for individuals' health regulatory focus. Following up on this, Chapter 5 investigates the overall shape of a package design, i.e., its slimness (vs. thickness) and how it subsequently shapes food healthiness perceptions depending on participants' gender and body mass index (BMI). It also introduces the social construct self-referencing as an explanatory mechanism. The last chapter (Chapter 6) extends design-related findings by utilizing symbolic meaning in product images on packages that are shown to not only impact a food's healthiness, but perceptions of its level of processing, quality, and, ultimately, its actual taste. Chapter 6, additionally, demonstrates a person's health consciousness as boundary condition for the effect. Chapter 7 constitutes the concluding statement followed by an English (Chapter 8) and German summary (Chapter 9) of the work.

References

- Alba, J. W., & Hutchinson, J. W. (1987). Dimensions of consumer expertise. *Journal of Consumer Research*, 13(4), 411. doi:10.1086/209080
- Amarantos, E., Martinez, A., & Dwyer, J. (2001). Nutrition and quality of life in older adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 56(Supplement 2), 54–64. doi:10.1093/gerona/56.suppl_2.54
- Ampuero, O., & Vila, N. (2006). Consumer perceptions of product packaging. *Journal of Consumer Marketing*, 23(2), 100–112. doi:10.1108/07363760610655032
- Ares, G., & Deliza, R. (2010). Studying the influence of package shape and colour on consumer expectations of milk desserts using word association and conjoint analysis. *Food Quality and Preference*, 21(8), 930–937. doi:10.1016/j.foodqual.2010.03.006
- Arno, A., & Thomas, S. (2016). The efficacy of nudge theory strategies in influencing adult dietary behaviour: a systematic review and meta-analysis. *BMC Public Health*, 16, 676. doi:10.1186/s12889-016-3272-x
- Aschemann-Witzel, J., Grunert, K. G., van Trijp, H. C., Bialkova, S., Raats, M. M., Hodgkins, C., . . . Koenigstorfer, J. (2013). Effects of nutrition label format and product assortment on the healthfulness of food choice. *Appetite*, 71, 63–74. doi:10.1016/j.appet.2013.07.004
- Aslam, M. M. (2006). Are you selling the right colour?: A cross-cultural review of colour as a marketing cue. *Journal of Marketing Communications*, 12(1), 15–30. doi:10.1080/13527260500247827
- Barreiro-Hurlé, J., Gracia, A., & de-Magistris, T. (2010). Does nutrition information on food products lead to healthier food choices? *Food Policy*, 35(3), 221–229. doi:10.1016/j.foodpol.2009.12.006
- Becker, L., van Rompay, T., Schifferstein, H. N., & Galetzka, M. (2011). Tough package, strong taste: The influence of packaging design on taste impressions and product evaluations. *Food Quality and Preference*, 22(1), 17–23. doi:10.1016/j.foodqual.2010.06.007
- Bialkova, S., Sasse, L., & Fenko, A. (2015). The role of nutrition labels and advertising claims in altering consumers' evaluation and choice. *Appetite*, 96, 38–46. doi:10.1016/j.appet.2015.08.030
- Bloch, P. H. (1995). Seeking the ideal form: Product design and consumer response. *Journal of Marketing*, 59(3), 16. doi:10.2307/1252116
- Borgmeier, I., & Westenhoefer, J. (2009). Impact of different food label formats on healthiness evaluation and food choice of consumers: A randomized-controlled study. *BMC Public Health*, 9(1), 184. doi:10.1186/1471-2458-9-184
- Brambila-Macias, J., Shankar, B., Capacci, S., Mazzocchi, M., Perez-Cueto, F. J. A., Verbeke, W., & Traill, W. B. (2011). Policy interventions to promote healthy eating: a review of what works, what does not, and what is promising. *Food and nutrition bulletin*, 32(4), 365–375. doi:10.1177/156482651103200408
- Brug, J., Oenema, A., & Ferreira, I. (2005). Theory, evidence and Intervention Mapping to improve behavior nutrition and physical activity interventions. *The international journal of behavioral nutrition and physical activity*, 2(1), 2. doi:10.1186/1479-5868-2-2
- Bruno, N., Martani, M., Corsini, C., & Oleari, C. (2013). The effect of the color red on consuming food does not depend on achromatic (Michelson) contrast and extends to rubbing cream on the skin. *Appetite*, 71, 307–313. doi:10.1016/j.appet.2013.08.012
- Bucher, T., Collins, C., Rollo, M. E., McCaffrey, T. A., Vlieger, N. de, van der Bend, D., . . . Perez-Cueto, F. J. A. (2016). Nudging consumers towards healthier choices: A systematic

- review of positional influences on food choice. *The British journal of nutrition*, 115(12), 2252–2263. doi:10.1017/S0007114516001653
- Capacci, S., Mazzocchi, M., Shankar, B., Macias, J. B., Verbeke, W., Perez-Cueto, F. J. A., . . . Traill, W. B. (2012). Policies to promote healthy eating in Europe: A structured review of policies and their effectiveness. *Nutrition reviews*, 70(3), 188–200. doi:10.1111/j.1753-4887.2011.00442.x
- Carels, R. A., Harper, J., & Konrad, K. (2006). Qualitative perceptions and caloric estimations of healthy and unhealthy foods by behavioral weight loss participants. *Appetite*, 46(2), 199–206. doi:10.1016/j.appet.2005.12.002
- Celhay, F., Boysselle, J., & Cohen, J. (2015). Food packages and communication through typeface design: The exoticism of exotypes. *Food Quality and Preference*, 39, 167–175. doi:10.1016/j.foodqual.2014.07.009
- Chandon, P. (2013). How package design and packaged-based marketing claims lead to overeating. *Applied Economic Perspectives and Policy*, 35(1), 7–31. doi:10.1093/aep/ppp028
- Chandon, P., & Ordabayeva, N. (2009). Supersize in one dimension, downsize in three dimensions: Effects of spatial dimensionality on size perceptions and preferences. *Journal of Marketing Research*, 46(6), 739–753. doi:10.1509/jmkr.46.6.739
- Chandon, P., & Wansink, B. (2012). Does food marketing need to make us fat? A review and solutions. *Nutrition reviews*, 70(10), 571–593. doi:10.1111/j.1753-4887.2012.00518.x
- Childers, T. L., & Jass, J. (2002). All dressed up with something to say: Effects of typeface semantic associations on brand perceptions and consumer memory. *Journal of Consumer Psychology*, 12(2), 93–106. doi:10.1207/S15327663JCP1202_03
- The Consumer Goods Forum. (2016). *Health & Wellness Progress Report 2016*. Retrieved from <http://www.theconsumergoodsforum.com/files/Publications/201601-CGF-Health-and-Wellness-Progress-Report-Final.pdf>
- Contento, I. R. (2008). Nutrition education: Linking research, theory, and practice. *Asia Pacific Journal of Clinical Nutrition*, 17(1), 176–179.
- Cowburn, G., & Stockley, L. (2005). Consumer understanding and use of nutrition labelling: A systematic review. *Public Health Nutrition*, 8(01), 210. doi:10.1079/PHN2004666
- Creusen, M. E. H., & Schoormans, J. P. L. (2005). The different roles of product appearance in consumer choice. *Journal of Product Innovation Management*, 22(1), 63–81. doi:10.1111/j.0737-6782.2005.00103.x
- Danaei, G., Lu, Y., Singh, G. M., Carnahan, E., Stevens, G. A., & Cowan, M.J., Farzadfar, F., Lin, J.K. (2014). Cardiovascular disease, chronic kidney disease, and diabetes mortality burden of cardiometabolic risk factors from 1980 to 2010: A comparative risk assessment. *The Lancet Diabetes & Endocrinology*, 2(8), 634–647. doi:10.1016/S2213-8587(14)70102-0
- Deliza, R., & MacFie, H. (2001). Product packaging and branding. In L. J. Frewer, E. Risvik, & H. Schifferstein (Eds.), *Food, People and Society* (pp. 55–72). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Doyle, J. R., & Bottomley, P. A. (2004). Font appropriateness and brand choice. *Journal of Business Research*, 57(8), 873–880. doi:10.1016/S0148-2963(02)00487-3
- Drucker, J. (1994). *The visible word : Experimental typography and modern art, 1909-1923*. Chicago, IL: University Of Chicago Press.
- Fenko, A., Lotterman, H., & Galetzka, M. (2016). What's in a name? The effects of sound symbolism and package shape on consumer responses to food products. *Food Quality and Preference*, 51, 100–108. doi:10.1016/j.foodqual.2016.02.021

- Fernqvist, F., & Ekelund, L. (2014). Credence and the effect on consumer liking of food – A review. *Food Quality and Preference*, 32, 340–353. doi:10.1016/j.foodqual.2013.10.005
- Feunekes, G. I. J., Gortemaker, I. A., Willems, A. A., Lion, R., & van den Kommer, Marcelle. (2008). Front-of-pack nutrition labelling: Testing effectiveness of different nutrition labelling formats front-of-pack in four European countries. *Appetite*, 50(1), 57–70. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0195666307003066>
- Foltran, F., Verduci, E., Ghidina, M., Campoy, C., Jany, K.-D., Widhalm, K., . . . Gregori, D. (2010). Nutritional profiles in a public health perspective: A critical review. *The Journal of international medical research*, 38(2), 318–385. doi:10.1177/147323001003800202
- Garber Jr, L. L., Burke, R. R., & Jones, J. M. (2000). *The role of package color in consumer purchase consideration and choice*. Report No. 00-104. Boston: Marketing Science Institute, pp. 1–46.
- Garber Jr, L. L., Hyatt, E. M., & Starr Jr, R. G. (2000). The effects of food color on perceived flavor. *Journal of Marketing Theory and Practice*, 8(4), 59–72. doi:10.2307/40470017
- Geeroms, N., Verbeke, W., & van Kenhove, P. (2008). Consumers' health-related motive orientations and ready meal consumption behaviour. *Appetite*, 51(3), 704–712. doi:10.1016/j.appet.2008.06.011
- Genschow, O., Reutner, L., & Wänke, M. (2012). The color red reduces snack food and soft drink intake. *Appetite*, 58(2), 699–702. doi:10.1016/j.appet.2011.12.023
- Gittelsohn, J., Kim, E. M., He, S., & Pardia, M. (2013). A food store-based environmental intervention is associated with reduced BMI and improved psychosocial factors and food-related behaviors on the Navajo nation. *The Journal of nutrition*, 143(9), 1494–1500. doi:10.3945/jn.112.165266
- Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist*, 54(7), 493–503. doi:10.1037/0003-066X.54.7.493
- Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review*, 102(1), 4. Retrieved from <http://psycnet.apa.org/psycinfo/1998-02892-004>
- Gregg, A. P., & Klymowsky, J. (2013). The Implicit Association Test in market research: Potentials and pitfalls. *Psychology & Marketing*, 30(7), 588–601. doi:10.1002/mar.20630
- Grohmann, B., Giese, J. L., & Parkman, I. D. (2012). Using type font characteristics to communicate brand personality of new brands. *Journal of Brand Management*, 20(5), 389–403. doi:10.1057/bm.2012.23
- Grunert, K. G. (2011). How changes in consumer behaviour and retailing affect competence requirements for food producers and processors. *Economía Agraria y Recursos Naturales*, 6(11), 3. doi:10.7201/earn.2006.11.01
- Guéguen, N., & Jacob, C. (2014). Coffee cup color and evaluation of a beverage's “warmth quality”. *Color Research & Application*, 39(1), 79–81. doi:10.1002/col.21757
- Gvili, Y., Tal, A., Amar, M., Hallak, Y., Wansink, B., Giblin, M., & Bommelaer, C. (2015). Fresh from the tree: Implied motion improves food evaluation. *Food Quality and Preference*, 46, 160–165. doi:10.1016/j.foodqual.2015.07.015
- Hearty, A. P., McCarthy, S. N., Kearney, J. M., & Gibney, M. J. (2007). Relationship between attitudes towards healthy eating and dietary behaviour, lifestyle and demographic factors in a representative sample of Irish adults. *Appetite*, 48(1), 1–11. doi:10.1016/j.appet.2006.03.329
- Henderson, P. W., Giese, J. L., & Cote, J. A. (2004). Impression management using typeface design. *Journal of Marketing*, 68(4), 60–72.

- Her, E., & Seo, S. (2017). Health halo effects in sequential food consumption: The moderating roles of health-consciousness and attribute framing. *International Journal of Hospitality Management*, 62, 1–10. doi:10.1016/j.ijhm.2016.11.009
- Hine, T. (1995). *The total package: The secret history and hidden meanings of boxes, bottles, cans and other persuasive containers*. New York: Little Brown.
- Houwer, J. de, & Bruycker, E. de. (2007). The identification-EAST as a valid measure of implicit attitudes toward alcohol-related stimuli. *Journal of Behavior Therapy and Experimental Psychiatry*, 38(2), 133–143. doi:10.1016/j.jbtep.2006.10.004
- Houwer, J. de, Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures: A normative analysis and review. *Psychological Bulletin*, 135(3), 347. Retrieved from <http://psycnet.apa.org/journals/bul/135/3/347/>
- Huang, L., & Lu, J. (2015). The impact of package color and the nutrition content labels on the perception of food healthiness and purchase intention. *Journal of Food Products Marketing*, 22(2), 191–218. doi:10.1080/10454446.2014.1000434
- Huber, J., & McCann, J. (1982). The impact of inferential beliefs on product evaluations. *Journal of Marketing Research*, 19(3), 324. doi:10.2307/3151566
- Hutchings, J. B. (1977). The importance of visual appearance of food to the food processor and the consumer. *Journal of Food Quality*, 1(3), 267–278. doi:10.1111/j.1745-4557.1977.tb00945.x
- Imamura, F., Micha, R., Khatibzadeh, S., Fahimi, S., Shi, P., Powles, J., & Mozaffarian, D. (2015). Dietary quality among men and women in 187 countries in 1990 and 2010: A systematic assessment. *The Lancet Global Health*, 3(3), e132-e142. doi:10.1016/S2214-109X(14)70381-X
- Janssen, L. K., Duif, I., van Loon, I., Wegman, J., Vries, J. H. M. de, Cools, R., & Aarts, E. (2017). Loss of lateral prefrontal cortex control in food-directed attention and goal-directed food choice in obesity. *NeuroImage*, 146, 148–156. doi:10.1016/j.neuroimage.2016.11.015
- Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *The American psychologist*, 58(9), 697–720. doi:10.1037/0003-066X.58.9.697
- Karjalainen, T.-M. (2007). It looks like a Toyota: Educational approaches to designing for visual brand recognition. *International Journal of Design*, 1(1), 67–81.
- Karjalainen, T.-M., & Snelders, D. (2010). Designing visual recognition for the brand. *Journal of Product Innovation Management*, 27(1), 6–22. doi:10.1111/j.1540-5885.2009.00696.x
- Kauppinen-Räsänen, H., & Luomala, H. T. (2010). Exploring consumers' product-specific colour meanings. *Qualitative Market Research: An International Journal*, 13(3), 287–308. doi:10.1108/13522751011053644
- Koo, J., & Suk, K. (2016). The effect of package shape on calorie estimation. *International Journal of Research in Marketing*. doi:10.1016/j.ijresmar.2016.03.002
- Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference*, 20(2), 70–82. doi:10.1016/j.foodqual.2007.11.002
- Labrecque, L. I., Patrick, V. M., & Milne, G. R. (2013). The marketers' prismatic palette: A review of color research and future directions. *Psychology & Marketing*, 30(2), 187–202. doi:10.1002/mar.20597
- Lake, A. A., Hyland, R. M., Rugg-Gunn, A. J., Wood, C. E., Mathers, J. C., & Adamson, A. J. (2007). Healthy eating: Perceptions and practice (the ASH30 study). *Appetite*, 48(2), 176–182. doi:10.1016/j.appet.2006.08.065
- Larkin, D., & Martin, C. R. (2016). Caloric estimation of healthy and unhealthy foods in normal-weight, overweight and obese participants. *Eating Behaviors*, 23, 91–96. doi:10.1016/j.eatbeh.2016.08.004

- Larsson, S. C. (2014). Plasma alkylresorcinols as a biomarker for whole-grain intake and association with colorectal cancer. *Journal of the National Cancer Institute*, *106*(1), djt362. doi:10.1093/jnci/djt362
- Lee, K., Conklin, M., Cranage, D. A., & Lee, S. (2014). The role of perceived corporate social responsibility on providing healthful foods and nutrition information with health-consciousness as a moderator. *International Journal of Hospitality Management*, *37*, 29–37. doi:10.1016/j.ijhm.2013.10.005
- Liang, P., Roy, S., Chen, M.-L., & Zhang, G.-H. (2013). Visual influence of shapes and semantic familiarity on human sweet sensitivity. *Behavioural brain research*, *253*, 42–47. doi:10.1016/j.bbr.2013.07.001
- Lobstein, T., & Davies, S. (2009). Defining and labelling 'healthy' and 'unhealthy' food. *Public Health Nutrition*, *12*(3), 331–340. doi:10.1017/S1368980008002541
- Madzharov, A. V., & Block, L. G. (2010). Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology*, *20*(4), 398–409. doi:10.1016/j.jcps.2010.06.007
- Magnier, L., Schoormans, J., & Mugge, R. (2016). Judging a product by its cover: Packaging sustainability and perceptions of quality in food products. *Food Quality and Preference*, *53*, 132–142. doi:10.1016/j.foodqual.2016.06.006
- Mai, R., Hoffmann, S., Helmert, J. R., Velichkovsky, B. M., Zahn, S., Jaros, D., . . . Rohm, H. (2011). Implicit food associations as obstacles to healthy nutrition: The need for further research. *The British Journal of Diabetes & Vascular Disease*, *11*(4), 182–186. doi:10.1177/1474651411410725
- Mai, R., & Hoffmann, S. (2012). Taste lovers versus nutrition fact seekers: How health consciousness and self-efficacy determine the way consumers choose food products. *Journal of Consumer Behaviour*, *11*(4), 316–328. doi:10.1002/cb.1390
- Mai, R., Hoffmann, S., Hoppert, K., Schwarz, P., & Rohm, H. (2015). The spirit is willing, but the flesh is weak: The moderating effect of implicit associations on healthy eating behaviors. *Food Quality and Preference*, *39*, 62–72. doi:10.1016/j.foodqual.2014.06.014
- Mai, R., Symmank, C., & Seeberg-Elverfeldt, B. (2016). Light and pale colors in food packaging: When does this package cue signal superior healthiness or inferior tastiness? *Journal of Retailing*. doi:10.1016/j.jretai.2016.08.002
- Marteau, T. M., Ogilvie, D., Roland, M., Suhrcke, M., & Kelly, M. P. (2011). Judging nudging: Can nudging improve population health? *BMJ (Clinical research ed.)*, *342*, d228. doi:10.1136/bmj.d228
- Maskarinec, G., Novotny, R., & Tasaki, K. (2000). Dietary patterns are associated with body mass index in multiethnic women. *The Journal of nutrition*, *130*(12), 3068–3072.
- McCarthy, A., Skinner, T., Fenech, M., & Keating, S. (2016). Prevention of chronic conditions and cancer. In *Cancer and Chronic Conditions. Addressing the Problem of Multimorbidity in Cancer Patients and Survivors* (1st ed., pp. 203–240). Singapore: Springer Singapore.
- McCullough, M. L., & Willett, W. C. (2006). Evaluating adherence to recommended diets in adults: The Alternate Healthy Eating Index. *Public Health Nutrition*, *9*(1a), 1261. doi:10.1079/PHN2005938
- McGuire, S. (2016). World Cancer Report 2014. Geneva, Switzerland: World Health Organization, International Agency for Research on Cancer, WHO Press, 2015. *Advances in nutrition (Bethesda, Md.)*, *7*(2), 418–419. doi:10.3945/an.116.012211
- Mela, D. J. (2001). Determinants of food choice: Relationships with obesity and weight control. *Obesity research*, *9 Suppl 4*, 249S. doi:10.1038/oby.2001.127

- Micha, R., Peñalvo, J. L., Cudhea, F., Imamura, F., Rehm, C. D., & Mozaffarian, D. (2017). Association between dietary factors and mortality from heart disease, stroke, and type 2 diabetes in the United States. *JAMA*, *317*(9), 912–924. doi:10.1001/jama.2017.0947
- Michaelidou, N., & Hassan, L. M. (2008). The role of health consciousness, food safety concern and ethical identity on attitudes and intentions towards organic food. *International Journal of Consumer Studies*, *32*(2), 163–170. doi:10.1111/j.1470-6431.2007.00619.x
- Mizutani, N., Okamoto, M., Yamaguchi, Y., Kusakabe, Y., Dan, I., & Yamanaka, T. (2010). Package images modulate flavor perception for orange juice. *Food Quality and Preference*, *21*(7), 867–872. doi:10.1016/j.foodqual.2010.05.010
- Mozaffarian, D. (2016). Dietary and policy priorities for cardiovascular disease, diabetes, and obesity: A comprehensive review. *Circulation*, *133*(2), 187–225. doi:10.1161/CIRCULATIONAHA.115.018585
- Nestle, M., & Nesheim, M. (2012). *Why calories count: From science to politics*. Berkeley, Los Angeles, London: University of California Press.
- Newman, C. L., Howlett, E., & Burton, S. (2014). Shopper response to front-of-package nutrition labeling programs: Potential consumer and retail store benefits. *Journal of Retailing*, *90*(1), 13–26. doi:10.1016/j.jretai.2013.11.001
- Ngo, M. K., Velasco, C., Salgado, A., Boehm, E., O’Neill, D., & Spence, C. (2013). Assessing crossmodal correspondences in exotic fruit juices: The case of shape and sound symbolism. *Food Quality and Preference*, *28*(1), 361–369. doi:10.1016/j.foodqual.2012.10.004
- Nielsen. (2015). *Nielsen Global Health and Wellness Report*. Retrieved from <https://www.nielsen.com/content/dam/niensenglobal/eu/nielseninsights/pdfs/Nielsen%20Global%20Health%20and%20Wellness%20Report%20-%20January%202015.pdf>
- Oakes, M. E., & Slotterback, C. S. (2001). Judgements of food healthfulness: Food name stereotypes in adults over age 25. *Appetite*, *37*(1), 1–8. doi:10.1006/appe.2001.0405
- Orquin, J. L. (2014). A Brunswik lens model of consumer health judgments of packaged foods. *Journal of Consumer Behaviour*, *270–281*. doi:10.1002/cb.1465
- Orth, U. R., Campana, D., & Malkewitz, K. (2010). Formation of consumer price expectation based on package design: Attractive and quality routes. *The Journal of Marketing Theory and Practice*, *18*(1), 23–40. doi:10.2753/MTP1069-6679180102
- Orth, U. R., & Malkewitz, K. (2008). Holistic package design and consumer brand impressions. *Journal of Marketing*, *72*(3), 64–81. doi:10.1509/jmkg.72.3.64
- Peters, M.-L. (2016). *Feeling natural: The influence of tactile characteristics and sensory presentation of food packaging on consumers' perceived naturalness*. Master Thesis, University of Twente.
- Petty, R. E., Cacioppo, J. T., & Schumann, D. (1983). Central and peripheral routes to advertising effectiveness: The moderating role of involvement. *Journal of Consumer Research*, *10*(2), 135. doi:10.1086/208954
- Pieniak, Z., Verbeke, W., Olsen, S. O., Hansen, K. B., & Brunsø, K. (2010). Health-related attitudes as a basis for segmenting European fish consumers. *Food Policy*, *35*(5), 448–455. doi:10.1016/j.foodpol.2010.05.002
- Piqueras-Fiszman, B., Alcaide, J., Roura, E., & Spence, C. (2012). Is it the plate or is it the food? Assessing the influence of the color (black or white) and shape of the plate on the perception of the food placed on it. *Food Quality and Preference*, *24*(1), 205–208. doi:10.1016/j.foodqual.2011.08.011
- Piqueras-Fiszman, B., Velasco, C., Salgado-Montejo, A., & Spence, C. (2013). Using combined eye tracking and word association in order to assess novel packaging solutions: A case study

- involving jam jars. *Food Quality and Preference*, 28(1), 328–338. doi:10.1016/j.foodqual.2012.10.006
- Popkin, B. M., Adair, L. S., & Ng, S. W. (2012). Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition reviews*, 70(1), 3–21. doi:10.1111/j.1753-4887.2011.00456.x
- Privitera, G. J., & Zuraikat, F. M. (2014). Proximity of foods in a competitive food environment influences consumption of a low calorie and a high calorie food. *Appetite*, 76, 175–179. doi:10.1016/j.appet.2014.02.004
- Raghubir, P., & Krishna, A. (1999). Vital dimensions in volume perception: Can the eye fool the stomach? *Journal of Marketing Research*, 36(3), 313. doi:10.2307/3152079
- Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy= tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing*, 70(4), 170–184.
- Rebollar, R., Gil, I., Lidón, I., Martín, J., Fernández, M. J., & Rivera, S. (2017). How material, visual and verbal cues on packaging influence consumer expectations and willingness to buy: The case of crisps (potato chips) in Spain. *Food research international (Ottawa, Ont.)*, 99(Pt 1), 239–246. doi:10.1016/j.foodres.2017.05.024
- Reddy, K. S. (2016). Global Burden of Disease Study 2015 provides GPS for global health 2030. *The Lancet*, 388(10053), 1448–1449. doi:10.1016/S0140-6736(16)31743-3
- Richetin, J., Perugini, M., Prestwich, A., & O'Gorman, R. (2007). The IAT as a predictor of food choice: The case of fruits versus snacks. *International Journal of Psychology*, 42(3), 166–173.
- Roman, B., Carta, L., & Angel, M. (2008). Effectiveness of the Mediterranean diet in the elderly. *Clinical Interventions in Aging, Volume 3*, 97–109. doi:10.2147/CIA.S1349
- Romero, M., & Craig, A. (2017). Costly curves: How human-like shapes can increase spending. *Journal of Consumer Research*, ucw080. doi:10.1093/jcr/ucw080
- Rundh, B. (2009). Packaging design: Creating competitive advantage with product packaging. *British Food Journal*, 111(9), 988–1002. doi:10.1108/00070700910992880
- Rundh, B. (2016). The role of packaging within marketing and value creation. *British Food Journal*, 118(10), 2491–2511. doi:10.1108/BFJ-10-2015-0390
- Schuldt, J. P. (2013). Does green mean healthy? Nutrition label color affects perceptions of healthfulness. *Health Communication*, 28(8), 814–821. doi:10.1080/10410236.2012.725270
- Schwartz, M. B., Vartanian, L. R., Nosek, B. A., & Brownell, K. D. (2006). The influence of one's own body weight on implicit and explicit anti-fat bias. *Obesity (Silver Spring, Md.)*, 14(3), 440–447. doi:10.1038/oby.2006.58
- Sedikides, C., & Gregg, A. P. (2008). Self-Enhancement: Food for Thought. *Perspectives on psychological science : a journal of the Association for Psychological Science*, 3(2), 102–116. doi:10.1111/j.1745-6916.2008.00068.x
- Selinger, E., & Whyte, K. (2011). Is there a right way to nudge?: The practice and ethics of choice architecture. *Sociology Compass*, 5(10), 923–935. doi:10.1111/j.1751-9020.2011.00413.x
- Shankar, M. U., Levitan, C. A., Prescott, J., & Spence, C. (2009). The influence of color and label information on flavor perception. *Chemosensory Perception*, 2(2), 53–58. doi:10.1007/s12078-009-9046-4
- Silayoi, P., & Speece, M. (2004). Packaging and purchase decisions. *British Food Journal*, 106(8), 607–628. doi:10.1108/00070700410553602

- Simmonds, G., & Spence, C. (2017). Thinking inside the box: How seeing products on, or through, the packaging influences consumer perceptions and purchase behaviour. *Food Quality and Preference*, *62*, 340–351. doi:10.1016/j.foodqual.2016.11.010
- Skorinko, J. L., Kemmer, S., Hebl, M. R., & Lane, D. M. (2006). A rose by any other name . . . : Color-naming influences on decision making. *Psychology and Marketing*, *23*(12), 975–993. doi:10.1002/mar.20142
- Söderlund, M., Colliander, J., Karsberg, J., Liljedal, K. T., Modig, E., Rosengren, S., . . . Åkestam, N. (2017). The allure of the bottle as a package: An assessment of perceived effort in a packaging context. *Journal of Product & Brand Management*, *26*(1), 91–100. doi:10.1108/JPBM-12-2015-1065
- Soederberg Miller, L. M., & Cassady, D. L. (2015). The effects of nutrition knowledge on food label use. A review of the literature. *Appetite*, *92*, 207–216. doi:10.1016/j.appet.2015.05.029
- Sofi, F., Cesari, F., Abbate, R., Gensini, G. F., & Casini, A. (2008). Adherence to Mediterranean diet and health status: meta-analysis. *BMJ (Clinical research ed.)*, *337*, a1344.
- Spence, C., Levitan, C. A., Shankar, M. U., & Zampini, M. (2010). Does food color influence taste and flavor perception in humans? *Chemosensory Perception*, *3*(1), 68–84. doi:10.1007/s12078-010-9067-z
- Spence, C., & Ngo, M. (2012). Assessing the shape symbolism of the taste, flavour, and texture of foods and beverages. *Flavour*, *1*(1), 12. doi:10.1186/2044-7248-1-12
- Spetter, M. S., Malekshahi, R., Birbaumer, N., Lührs, M., van der Veer, A. H., Scheffler, K., . . . Hallschmid, M. (2017). Volitional regulation of brain responses to food stimuli in overweight and obese subjects: A real-time fMRI feedback study. *Appetite*, *112*, 188–195. doi:10.1016/j.appet.2017.01.032
- Steenis, N. D., van Herpen, E., van der Lans, I. A., Ligthart, T. N., & van Trijp, H. C. (2017). Consumer response to packaging design: The role of packaging materials and graphics in sustainability perceptions and product evaluations. *Journal of Cleaner Production*, *162*, 286–298. doi:10.1016/j.jclepro.2017.06.036
- Steenkamp, J.-B. E., Jong, M. G. de, & Baumgartner, H. (2010). Socially desirable response tendencies in survey research. *Journal of Marketing Research*, *47*(2), 199–214. doi:10.1509/jmkr.47.2.199
- Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The food choice questionnaire. *Appetite*, *25*(3), 267–284. doi:10.1006/appe.1995.0061
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and social psychology review : an official journal of the Society for Personality and Social Psychology, Inc*, *8*(3), 220–247. doi:10.1207/s15327957pspr0803_1
- Sundar, A., & Noseworthy, T. J. (2014). Place the logo high or low? Using conceptual metaphors of power in packaging design. *Journal of Marketing*, *78*(5), 138–151. doi:10.1509/jm.13.0253
- Sütterlin, B., & Siegrist, M. (2015). Simply adding the word "fruit" makes sugar healthier: The misleading effect of symbolic information on the perceived healthiness of food. *Appetite*, *95*, 252–261. doi:10.1016/j.appet.2015.07.011
- Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: Shaped by global drivers and local environments. *The Lancet*, *378*(9793), 804–814. doi:10.1016/S0140-6736(11)60813-1
- Tantamango-Bartley, Y., Jaceldo-Siegl, K., Fan, J., & Fraser, G. (2013). Vegetarian diets and the incidence of cancer in a low-risk population. *Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored*

- by the American Society of Preventive Oncology, 22(2), 286–294. doi:10.1158/1055-9965.EPI-12-1060
- Tarabashkina, L., Quester, P., & Crouch, R. (2016). Exploring the moderating effect of children's nutritional knowledge on the relationship between product evaluations and food choice. *Social science & medicine (1982)*, 149, 145–152. doi:10.1016/j.socscimed.2015.11.046
- Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. *Constitutional Political Economy*, 19(4), 356–360. doi:10.1007/s10602-008-9056-2
- Tijssen, I., Zandstra, E. H., Graaf, C. de, & Jager, G. (2017). Why a 'light' product package should not be light blue: Effects of package colour on perceived healthiness and attractiveness of sugar- and fat- reduced products. *Food Quality and Preference*, (59), 46–58. doi:10.1016/j.foodqual.2017.01.019
- Truthmann, J., Mensink, G. B. M., Bosy-Westphal, A., Hapke, U., Scheidt-Nave, C., & Schienkiewitz, A. (2017). Physical health-related quality of life in relation to metabolic health and obesity among men and women in Germany. *Health and quality of life outcomes*, 15(1), 122. doi:10.1186/s12955-017-0688-7
- Underwood, R. L., & Klein, N. M. (2002). Packaging as brand communication: Effects of product pictures on consumer responses to the package and brand. *Journal of Marketing Theory and Practice*, 10(4), 58–68. doi:10.2307/41304282
- van Herpen, E., & van Trijp, H. C. (2011). Front-of-pack nutrition labels. Their effect on attention and choices when consumers have varying goals and time constraints. *Appetite*, 57(1), 148–160. doi:10.1016/j.appet.2011.04.011
- van Kleef, E., & Dagevos, H. (2013). The growing role of front-of-pack nutrition profile labelling: A consumer perspective on key issues and controversies. *Critical Reviews in Food Science and Nutrition*, 130702135804008. doi:10.1080/10408398.2011.653018
- van Ooijen, I., Fransen, M. L., Verlegh, P. W. J., & Smit, E. G. (2017). Signalling product healthiness through symbolic package cues: Effects of package shape and goal congruence on consumer behaviour. *Appetite*, 109, 73–82. doi:10.1016/j.appet.2016.11.021
- van Ooijen, I., Fransen, M. L., Verlegh, P. W., & Smit, E. G. (2016). Atypical food packaging affects the persuasive impact of product claims. *Food Quality and Preference*, 48, 33–40. doi:10.1016/j.foodqual.2015.08.002
- van Rompay, T. J., Deterink, F., & Fenko, A. (2016). Healthy package, healthy product? Effects of packaging design as a function of purchase setting. *Food Quality and Preference*, 53, 84–89. doi:10.1016/j.foodqual.2016.06.001
- van Rompay, T. J., Finger, F., Saakes, D., & Fenko, A. (2017). “See me, feel me”: Effects of 3D-printed surface patterns on beverage evaluation. *Food Quality and Preference*, 62, 332–339. doi:10.1016/j.foodqual.2016.12.002
- van Rompay, T. J., & Pruyn, A. T. H. (2011). When visual product features speak the same language: Effects of shape-typeface congruence on brand perception and price expectations. *Journal of Product Innovation Management*, 28(4), 599–610. doi:10.1111/j.1540-5885.2011.00828.x
- Vasiljevic, M., Pechey, R., & Marteau, T. M. (2015). Making food labels social: The impact of colour of nutritional labels and injunctive norms on perceptions and choice of snack foods. *Appetite*, 91, 56–63. doi:10.1016/j.appet.2015.03.034
- Velasco, C., Woods, A. T., Hyndman, S., & Spence, C. (2015). The taste of typeface. *i-Perception*, 6(4). doi:10.1177/2041669515593040

- Venter, K., van der Merwe, D., Beer, H. de, Kempen, E., & Bosman, M. (2011). Consumers' perceptions of food packaging: An exploratory investigation in Potchefstroom, South Africa. *International Journal of Consumer Studies*, 35(3), 273–281. doi:10.1111/j.1470-6431.2010.00936.x
- Verbeke, W. (2008). Impact of communication on consumers' food choices. *The Proceedings of the Nutrition Society*, 67(3), 281–288. doi:10.1017/S0029665108007179
- Wardle, J., Parmenter, K., & Waller, J. (2000). Nutrition knowledge and food intake. *Appetite*, 34(3), 269–275. doi:10.1006/appe.1999.0311
- WHO. (2010a). *Global status report on noncommunicable diseases*. Retrieved from http://apps.who.int/iris/bitstream/10665/44579/1/9789240686458_eng.pdf
- WHO. (2010b). *Nutrient profiling*. Retrieved from <http://www.who.int/nutrition/topics/profiling/en/>
- WHO. (2015). *Healthy Diet*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs394/en/>
- Wilson, A. L., Buckley, E., Buckley, J. D., & Bogomolova, S. (2016). Nudging healthier food and beverage choices through salience and priming. Evidence from a systematic review. *Food Quality and Preference*, 51, 47–64. doi:10.1016/j.foodqual.2016.02.009
- Wilson, T. D. (2009). Know Thyself. *Perspectives on psychological science : a journal of the Association for Psychological Science*, 4(4), 384–389. doi:10.1111/j.1745-6924.2009.01143.x
- Wisdom, J., Downs, J. S., & Loewenstein, G. (2010). Promoting healthy choices: Information versus convenience. *American Economic Journal: Applied Economics*, 2(2), 164–178. doi:10.1257/app.2.2.164
- Wood, M., & Shukla, P. (2016). Weight bias, health consciousness and behavioral actions (activities). *Eating Behaviors*, 23, 200–205. doi:10.1016/j.eatbeh.2016.10.005
- Worsley, A. (2002). Nutrition knowledge and food consumption: Can nutrition knowledge change food behaviour? *Asia Pacific Journal of Clinical Nutrition*, 11(s3), S579-S585. doi:10.1046/j.1440-6047.11.supp3.7.x

Chapter 2

Consumer lay theories on healthy nutrition:

A Q methodology application

Nadine Yarar

Ulrich R. Orth

This contribution is published in *Appetite*, Volume 120, pages 145-157.

<https://doi.org/10.1016/j.appet.2017.08.026>

Abstract

Food is an important driver of individual health, and an important subject in public policy and health intervention research. Viewpoints on what constitutes healthy nutrition, however, are manifold and highly subjective in nature, suggesting there is no one-size-fits-all behavioral change intervention. This research explores fundamental lay theories regarding healthy nutrition with consumers in Germany. The study aimed at identifying and characterizing distinct groups of consumers based on similarities and differences in the lay theories individuals hold by means of Q methodology. Thirty German consumers ranked a Q set of 63 statements representing a vast spectrum of individual opinions and beliefs on healthy nutrition into a quasi-normal distribution. Factor analysis identified four major lay theories on healthy nutrition: (1) “Healthy is what tastes good, in moderation”, (2) “Healthy nutrition is expensive and inconvenient”, (3) “Healthy is everything that makes me slim and pretty”, and (4) “Only home-made, organic, and vegetarian food is healthy”. Consensus existed among the theories about the question of whom to trust regarding nutritional information and the low relevance of information from official sources. Disagreement existed concerning the overall importance of healthy nutrition in day-to-day lives and whether food healthiness is related to organic or conventional production methods. The findings underscore that specific consumer groups should be engaged separately when intervening in healthy nutrition issues. Implications for public policies and intervention strategies are discussed.

Keywords: healthy nutrition, Q methodology, lay theories

1. Introduction

Worldwide numbers of overweight and obese people have doubled in the last thirty years (WHO, 2016), resulting in 1.9 billion adults vulnerable to non-communicable chronic diseases such as hypertension and type-2 diabetes, cardiovascular diseases, and various cancers (Swinburn et al., 2011; WHO, 2016). Accompanied by tremendous medical costs (Popkin, Kim, Rusev, Du, & Zizza, 2006) those diseases account for approximately 38 million preventable deaths yearly (WHO, 2015b). Given that an unhealthy diet is thought to be one of the major risk factors of non-communicable diseases (WHO, 2015b), policy makers and health professionals are keen on aiding consumers in following a healthy diet, for example by developing dietary guidelines, implementing public health campaigns, and adding nutrition profiles on food packages (Capacci et al., 2012; Lobstein & Davies, 2009; van Kleef, van Trijp, Paeps, & Fernández-Celemín, 2008).

However, many of the recommendations provided are complex, difficult to understand, and even more difficult to implement (Brown et al., 2011), resulting in a low compliance with dietary guidelines across all age-groups (Abreu et al., 2013; Croll, Neumark-Sztainer, & Story, 2001; Gille et al., 2016; Mötteli, Keller, Siegrist, Barbey, & Bucher, 2016). Moreover, never before were opinions on healthy nutrition so widespread and easily accessible as today, exposing consumers to an abundance of often conflicting perspectives by the media, health professionals, and sources on the Internet (Buttriss, 2003; Jung, Walsh-Childers, & Kim, 2016). Not surprisingly, consumer beliefs on healthy nutrition are thought to vary greatly among individuals (Challem, 2011; Velardo, 2017).

Understanding nutrition and healthy foods has considerably shifted over the last century. While food intake once only served the functional purpose of survival and satiation, it has now emerged into a complex and multidimensional construct, including additional aspects such as taste, physical and psychological well-being, as well as ethical and environmental concerns (Bisogni, Jastran, Seligson, & Thompson, 2012; Paquette, 2005; Sørensen & Holm, 2016). Nowadays, two main motives for food choice are taste and healthiness (Grunert, 2011; Steptoe, Pollard, & Wardle, 1995). As such, taste and healthiness reflect the current conundrum of a continuous increase in obesity in the presence of a heightened awareness for healthful living. In Germany, for example, approximately 70% of consumers feel that they comply with the standards of a healthy diet; an even larger percentage considers themselves well-informed about healthy nutrition (BMEL, 2016). These self-evaluations stand in stark contrast to a national rate of overweight people which hovers around 60% (Robert Koch Institute, 2016). This

discrepancy raises the question of what opinions and beliefs German consumers actually hold when it comes to healthy nutrition.

Structured beliefs of laypeople—so-called lay theories—are clearly different from scientific theories (Furnham & Cheng, 2000). While scientific theories are based on conceptual and empirical research, lay theories consist of individual and non-scientific beliefs often based on common sense, personal observations, and experience (Furnham, 1988). Due to the use of a wide variety of informational sources (Davison, Smith, & Frankel, 1991), lay theories often include inconsistent and ambiguous views (Furnham, 1988). With diet- and health-related lay theories, the use of heuristics, personal experience, and bodily feelings is especially applicable (Kristensen, Askegaard, & Jeppesen, 2013; Lupton & Chapman, 1995). Lay theories on healthy nutrition capture the complex and holistic understanding of what a person believes constitutes a healthy diet, its impact on one's personal life, and behavioral consequences (Furnham, 1988; Furnham & Cheng, 2000).

What the general public understands contributes to a healthy nutrition ranges from eating specific foods such as fruits and vegetables to attending to product characteristics such as a low sugar and fat or high vitamin and mineral content (e.g., Bisogni et al., 2012; Margetts et al., 1997; Paquette, 2005). Other perceived determinants of healthy nutrition include consuming from environmental friendly production (Lazzarini, Zimmermann, Visschers, & Siegrist, 2016), home-cooking (Lavelle et al., 2016), eating concepts such as moderation, balance, and variety (Paquette, 2005) as well as a low weight (Spiteri Cornish & Moraes, 2015). Anticipated consequences of a healthy nutrition include physical (e.g., fitness, weight loss, prolonged life) and psychosocial (e.g., feeling good) elements (Bisogni et al., 2012; Blake, Bisogni, Sobal, Devine, & Jastran, 2007; Falk, Sobal, Bisogni, Connors, & Devine, 2001). In laypeople's minds the concept of healthy nutrition even extends to topics such as personal goals, moral aspects of consumption and production, and eating restrictions (Bisogni et al., 2012; Croll et al., 2001; Paquette, 2005; Povey, Conner, Sparks, James, & Shepherd, 1998). This diversity in beliefs could be due to the fact that lay people base their interpretations on their understanding of official nutrition guidelines (Paquette, 2005), but augment academic definitions through their personal experiences, common sense, feelings, personal knowledge, and other parts of individual life (Bisogni et al., 2012; Kristensen et al., 2013; Maubach, Hoek, & McCreanor, 2009). In addition, lay people use friends and family as major sources to gain nutrition information (Hiddink, Hautvast, van Woerkum, Fieren, & vant Hof, 1997; Pedersen, Gronhoj, & Thogersen, 2015). Lay theories have also been shown to be influenced by public discourse on social norms and may thus be guided by government strategies as well as contemporary

trends in society (Chrysochou, Askegaard, Grunert, & Kristensen, 2010; Kristensen et al., 2013; Ristovski-Slijepcevic, Chapman, & Beagan, 2008). Using an exploratory approach, Ronteltap, Sijtsma, Dagevos, and de Winter (2012) explored how consumers actually interpret the concept of healthy food. Through qualitative and quantitative research, their findings indicate that individuals use a multitude of concepts, and associations to identify food healthiness, thereby interpreting the concept on very different levels of abstraction. Taken together, previous research indicates diverse and multi-faceted lay interpretations of healthy eating embedded in the complex environment of a person's life.

Especially where individuals' health is concerned, lay theories are key drivers of consumer behavior (Shaw Hughner & Schultz Kleine, 2008). This finding is further reflected in the fact that misconceptions about healthy nutrition strongly influence food consumption (Dickson-Spillmann & Siegrist, 2011). Similarly, being interested in health issues, light, or natural products and seeking nutrition knowledge determines consumption of unhealthy snacks, fruits and vegetable intake as well as general dietary behavior (Roininen et al., 2001; Spronk, Kullen, Burdon, & O'Connor, 2014; Zandstra, Graaf, & van Staveren, 2001). To aid policy makers in more successfully intervening with specific consumer segments, it is crucial that they become aware of the different beliefs, experiences, values, or needs consumers hold (Andreasen, 2002; Bos, van der Lans, van Rijnsoever, & van Trijp, 2013). Yet, only limited research has investigated consumer segments that share an underlying belief system concerning healthy nutrition. For example, using open-end interviews, Falk and colleagues (2001) identified seven prominent themes that guide beliefs on healthy nutrition in a U.S. sample. Those beliefs include healthy as being low in fat and home-cooked, unprocessed/natural, balanced, disease management and prevention, weight control, and achieving a balance in nutrients. Similarly, Chrysochou et al. (2010) utilized a latent class analysis to identify health-related segments including their attitudes towards healthy eating and perceptions of food healthiness. According to this study the majority of the consumers belong to the "Common" segment that only exhibits moderate interest in health and healthy foods. "Idealists", on the other hand, are highly interested in and involved with healthy foods, whereas the "Pragmatics", overstrained by the abundance of available health information, show low interest in healthy foods and do not adhere to guidelines. Similarly, by analyzing healthy eating discourses between various ethnocultural groups in Canada, Ristovski-Slijepcevic et al. (2008) uncovered three discourses people draw upon for an interpretation of healthy eating: A cultural/traditional, a mainstream, and a complementary/ethical discourse. Geeroms, Verbeke, and van Kenhove (2008) identified five consumer segments based on health-related motives in Belgium (the health motives being

energy, emotional well-being, social responsibility, management/outward appearance, and physical well-being/functional) and tested the effectiveness of different health advertisement for each segment. They found target-group tailored advertisements consistently to evoke more positive responses than generic advertisements aimed at the whole population. Given their conclusion that a one-size-fits-all approach to public health interventions appears to not reach all intended audiences, it may be necessary to differentiate between consumer groups varying in their understanding of healthy nutrition. Therefore, whether the task is developing nutrition guidelines or designing public health interventions, professionals need to account for the perspective of their target audience. Understanding lay theories is, therefore, crucial in improving health nutrition interventions (Popay & Williams, 1996).

Hence, the purpose of the current research is to identify, explore, and classify major lay theories regarding healthy nutrition. For illustrative purposes, it focuses on German consumers and the similarities and differences in the lay theories they hold. Results will allow stakeholders and decision-makers in the realm of public health to sneak a peek into laypeople's minds with the ultimate goal to create more effective health interventions. In doing so, the present study adopts a novel perspective on this important topic, by employing Q methodology, an approach to study population subjectivity. This mixed-method research approach is well-suited to systematically identify underlying intra-individual differences and permits a holistic insight into the complex, multi-layered, and unique nature of those theories (Brown, 1993; Ramlo, 2015; Watts & Stenner, 2005).

2. Empirical Study

2.1 Methodological background

Acclaimed as a method for studying human subjectivity (McKeown & Thomas, 2013), Q methodology was introduced by William Stephenson in 1935 as a means for identifying subjective viewpoints by conducting an inverted factor analysis (Stephenson, 1935). While typical factor analysis focuses on uncovering correlations and patterns across variables, Q methodology aims at revealing inter-correlations across persons (Watts & Stenner, 2012). Specifically, a limited number of participants is sufficient to rank-order pre-selected statements about a given domain from their subjective point of view into a quasi-normal distribution (Brown, 1980). Important to note, participants sort statements according to *their own* understanding and preferences without any intervention of the researcher, making the sorting

inherently subjective (Brown, 1980; McKeown & Thomas, 2013). Quantitative factor analysis is then used to identify correlations within individual responses, followed by a qualitative interpretation to uncover personal beliefs, perspectives, and meanings about a certain topic (Previte, Pini, & Haslam-McKenzie, 2007). Q methodology, therefore, enables researchers to compare similarities and differences among subjective viewpoints, and, ultimately, to construct consumer segments that share an underlying lay theory (Brown, 1993). Hence, Q methodology aims at assigning meaning a posteriori through researcher interpretation of the sorting distribution (Brown, 1980). Because data analysis uses quantitative as well as qualitative techniques, it is considered superior to standard surveys in identifying population viewpoints (Brown, 1993; Kraak, Swinburn, Lawrence, & Harrison, 2014), arguably reducing researcher bias more than typical qualitative research (Brown, 1980; Brown, Danielson, & van Exel, 2015).

Originally utilized in psychology and medical sciences (McKeown & Thomas, 1988), Q methodology is now applied more widely in social sciences. In a health and nutrition context, Q methodology has been applied to study lay theories of health (Shaw Hughner & Schultz Kleine, 2008), health care resources (van Exel, Baker, Mason, Donaldson, & Brouwer, 2015), food security (Pelletier, Kraak, McCullum, & Uusitalo, 2000), promotion of healthy food environments (Kraak et al., 2014), and food trust (Eden, Bear, & Walker, 2008).

2.2 Procedure

Q methodology follows a five-step-procedure (McKeown & Thomas, 2013): (1) Construction of the *concourse*, (2) development of the Q set, (3) selection of the P set, (4) Q sorting, and (5) Q factor analysis and interpretation.

*2.2.1 Development of *concourse* and Q set:* The basis to apply Q methodology is the so-called “*concourse*”, a comprehensive collection of statements encompassing all possibly relevant aspects of the subject at hand (Brown, 1980). These statements represent a wide array of opinions that respondents might possess on the topic; they do not necessarily represent facts (Brown, 1993). The *concourse* was developed jointly by the authors and one research assistant, a trained dietician holding a M.Sc. in nutritional science and with substantial experience in qualitative research methods. *Concourse* development integrated previous research on lay understanding of healthy food and healthy nutrition (e.g., Brunso & Grunert, 1995; Bucher, Muller, & Siegrist, 2015; Eden et al., 2008; Roininen et al., 2001; Shaw Hughner & Schultz Kleine, 2008; Steptoe et al., 1995) with content analyses of websites, magazines, and online forums dealing with food and nutrition topics. This approach of combining scientific literature

with public sources closely follows previous applications of Q methodology (Eden et al., 2008; Kraak et al., 2014; Mandolesi, Nicholas, Naspetti, & Zanolli, 2015). Following the so called structured Q set-approach for concourse development (Watts & Stenner, 2012), a list of 16 key themes of healthy nutrition was assembled for use as theoretical structure to develop a representative set of statements for each theme. Drawing from the literature and public opinion review, the researchers then drafted a more expanded list of statements for subsequent discussion with a team of experts comprised of seven dietitians and nutritionists. During this discussion, the list was augmented through statements reflecting opinions the dietitians and nutritionists encountered in their work with patients. This approach resulted in a final concourse of 171 statements. Assisted by the expert team the next step reduced the concourse to a manageable number of statements for the sorting task: Highly similar statements and statements reflecting identical standpoints from a positive and a negative perspective were merged; identical statements were dropped. Merging themes of marginal relevance further reduced the list of themes to eleven. To achieve a balanced sample each theme was now represented by at least two statements, with the more complex and more ambiguous themes being represented by larger numbers of statements (see van Exel et al., 2015 for a similar procedure; Watts & Stenner, 2012). This approach yielded a final set of 63 statements utilized for the Q sort (see Table 2). Generally, key criteria for reducing the number of statements were to ascertain that the Q set is broadly representative of the complexity of healthy nutrition and provides participants with the opportunity to properly express their individual opinion (Watts & Stenner, 2012). Further care was taken to keep the language non-academic, to include equal numbers of positive and negative statements, and to avoid antonyms or statements of high similarity (Stephenson, 1953). All statements were printed separately on small cards, each identifiable through a three digit number on the back which were non-informative to participants (Brown, 1993). Participants were not privy to the thematical classification at any time during the interview procedure. The Q sorting procedure was pilot-tested with two naïve family members and one coworker of the research assistant.

2.2.2 Participants (P Set): Selecting the participant set (the so-called P Set) in Q methodology aims at assembling a group of participants theoretically relevant to the research question (Brown, 1980; van Exel & Graaf, 2005). We followed Watts and Stenner's (2012) suggestion of recruiting a minimum of one participant for every two Q set items, thus using half as many participants as there are statements in the Q set. Therefore, 30 individuals were recruited at diverse locations to ascertain heterogeneity in their opinions. Locations included health food stores, fast-food restaurants, discount stores, 'delicatessen' stores, fitness clubs, and the

farmers’ market in a German city, under the assumption that these locations attract people with diverse health views (Schifferstein & Oude Ophuis, 1998). Recruitment and interviewing were conducted by the research assistant, an experienced qualitative researcher thoroughly briefed about the specific methodology, recruitment, and interview procedures. Specific instructions included recruiting from all age groups, balancing gender, and using a variety of markers to identify diverse health groups (such as having a very muscular body, finishing a burger in front of a fast food restaurant, carrying a shopping basket full of organic foods). Each participant received a 10€ coupon for participation. Only a very small fraction of the consumers approached refused, thereby minimizing possible participation bias. See Table 3, first and second column for characteristics of the P Set.

← Most disagree					Most agree →					
-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
(3)										(3)
	(4)								(4)	
		(5)						(5)		
			(6)				(6)			
				(8)		(8)				
					(11)					

Figure 1: Score sheet with fixed 11-point distribution for the Q sort procedure. Numbers in brackets below each column indicate the number of statements assigned to each rank.

2.2.3 Administering the Q sort (Procedure): All participants received detailed instructions (in writing) for conducting the Q sort (adapted from van Exel et al., 2015) along with the stack of statements cards. Participants were instructed to carefully read all statements and then to roughly sort them into three stacks reflecting agreement, disagreement or neutrality. Next, participants conducted a more fine-grained sorting by rank ordering the statements from each stack into the slots of a 11-point forced-choice quasi-normal distribution printed on a score sheet (see Figure 1), ranging from “completely disagree” (-5) through “neutral” (0) to

“completely agree” (+5) (Brown, 1980). A forced-choice prearranged distribution following a normal distribution facilitates standardizing the sorting procedure and has become the standard approach in Q methodology (Watts & Stenner, 2012). As can be seen in Figure 1, the distribution dictates the number of statements to be sorted within each rank with all participants following instructions to sort all 63 statements into the preprinted slots (Watts & Stenner, 2012). Starting with extreme agreement and disagreement (-5/+5) participants placed three statement cards each on the score sheet, working their way to the neutral middle of the score sheet so that finally *all* statement cards were placed in slots that reflected their subjective viewpoint best. Watts and Stenner (2012) point out the importance of collecting additional post-sort information to grasp each participant’s individual understanding of the topic and their sorting pattern. Hence, after completion of the Q sort, a post-sort interview was conducted with each participant, offering them the opportunity to elaborate on their sorting, point out difficulties or even add missing viewpoints which they considered important. These additional data aided in subsequent interpretation of lay theories. Finally, participants submitted information on personal data (age, sex, education level, family status, number of children, and income), preferred shopping location, diet, and a subjective evaluation of their nutrition quality (which was rated on a scale from 1 [very good] to 6 [very poor]).

3. Results

3.1 Data analysis

A total 30 Q sorts, each containing one individual sorting pattern of 63 statements for a specific participant, were logged and analyzed using the PQMethod Software (Schmolck, 2002), specifically designed for carrying out Q methodological data analysis. Following Watts and Stenner (2012), a by-person factor analysis via centroid factor analysis was conducted to identify respondent groups whose Q sorts were highly correlated. Such highly correlated Q sorts indicate respondents share meaning on healthy nutrition with each shared meaning group being represented by one factor. Thus, each factor corresponds with one lay health theory. Following Watts and Stenner (2012) and Brown (1980) all factor solutions applicable to the data (ranging from three to seven factor solutions) were extracted and inspected. The best solution was identified based on the Kaiser-Guttman criterion, an objective statistical criterion which demands an Eigenvalue of greater than 1 as cut-off point for factor inclusion, and a minimum of two Q sorts to load significantly on each factor (Brown, 1980). To identify Q sorts that loaded significantly on each factor, a significant ($p < .01$) factor loading was calculated

using the Brown rule (Brown, 1980; $2.58 \times (1 \div \sqrt{63} [= \text{no. of items in the } Q \text{ set}])$). Accordingly, Q sorts with factor loadings greater than $\pm.33$ were considered significant. Applying these criteria, the four factor solution emerged as the best, explaining 62% of the variance in the data. For the four factor solution varimax-rotation was followed by a minor by-hand rotation (Brown, 1980; Watts & Stenner, 2012). Q sorts with factor loadings greater than .33 (see Table 1) are considered to correlate strongly with the meaning of the factor and therefore are factor or—in our case lay theory—defining Q sorts. Therefore, from here on the term “factor” will be used synonymously with “lay theory” (LT). Confounding Q sorts (i.e. those that load significantly on more than one LT) were attributed to the LT with the highest loading (Mandolesi et al., 2015). This procedure applied to Q sorts no. 04, 17, 18, and 19. Q sorts 17, 18, and 19 were unequivocally assigned to LT4. Because Q sort no. 04 loaded comparatively on both LT1 (0.44) and LT2 (0.39), Q sort no. 04 could not unambiguously be assigned to one of the two lay theories and was therefore considered not factor/LT defining. In contrast twenty-nine of the thirty Q sorts can be considered LT defining for the four extracted LTs. Table 1 displays the four LTs and indicates (in bold) the 29 Q Sorts including their respective factor loadings. Q sorts loading significantly on a lay theory indicate that these participants created very similar sorting patterns in their Q sort and, thus, constitute one distinct lay theory. For purposes of interpretation all theory-defining Q sorts were merged by weight-averaging to generate one prototypical Q sort per lay theory (Brown, 1980). As such, the prototypical Q sorts illustrate how a prototypical member of each LT would have sorted the statements (Watts & Stenner, 2012; see Table 3, last columns). These prototypical Q sorts constitute the basis for an elaborate and holistic interpretation of each LT.

Table 1: Rotated factor loadings of the four factor solution, bold writing indicates which Q sorts that are significantly associated with each of the factors (= lay theories, LT)

No. Q Sort	Age/Gender	Factor Loadings			
		LT 1	LT 2	LT 3	LT 4
01	28 / M	0.55	0.22	0.28	0.09
02	60 / F	0.68	-0.15	0.01	0.19
03	29 / F	0.69	-0.27	-0.02	0.35
04	61 / M	0.44	0.39	-0.21	-0.11
05	63 / F	0.62	0.23	-0.22	-0.03
06	61 / F	0.65	-0.24	0.14	0.51
07	30 / F	0.69	0.07	0.06	0.32
08	30 / M	0.71	-0.06	-0.23	0.22
09	59 / M	0.68	-0.19	-0.05	0.45
10	27 / F	0.54	-0.00	-0.07	0.10
11	31 / M	0.65	0.12	0.29	-0.33
12	38 / M	-0.08	-0.12	0.83	0.05
13	48 / M	-0.06	-0.07	0.76	-0.20
14	32 / F	-0.07	-0.02	0.81	-0.13
15	33 / F	0.20	-0.19	0.60	0.23
16	33 / M	0.13	0.53	0.16	-0.08
17	59 / F	0.26	-0.48	-0.02	0.74
18	42 / M	0.17	-0.41	-0.02	0.80
19	48 / F	0.21	-0.36	-0.04	0.84
20	29 / M	0.23	-0.26	-0.05	0.79
21	54 / F	0.77	-0.10	0.11	0.34
22	43 / F	0.23	-0.32	-0.05	0.61
23	50 / F	0.29	-0.30	-0.00	0.64
24	26 / F	-0.06	0.17	0.57	0.06
25	22 / F	0.05	0.22	0.50	-0.02
26	35 / F	0.77	-0.07	-0.00	0.21
27	24 / M	-0.11	0.73	-0.09	-0.50
28	18 / M	-0.06	0.81	0.03	-0.43
29	66 / M	-0.02	0.79	0.01	-0.45
30	20 / M	-0.01	0.78	-0.10	-0.37
	Eigenvalue	5.99	4.10	3.24	5.25
	% variance explained	20	14	11	18

Table 2: The full set of 63 statements used in the Q sort (translated to English language). Each of the lay theories (columns) shows the prototypical Q sorts for this specific theory (=this shows how the prototypical member of each lay theory would have sorted the statements) based on the data analysis.

No	Statement	Lay theory			
		1 (n=12)	2 (n=5)	3 (n=6)	4 (n=6)
01	A healthy nutrition is the only way to be fit and fully productive.	+5	+1	+3	+3
02	You can strive for the correct diet as much as you want, but you still do not live longer because of that.	-1	+2	-2	-3
03	The mind, body, and mood are all connected; all of them need to be in sync for a healthy nutritional status.	+3	-1	0	+3
04	I eat a lot of fruits and vegetables every day, because this makes me feel fit and healthy.	+4	0	+2	+3
05	Many ailments of age could be prevented if people followed a healthier nutrition.	+5	+1	+1	+1
06	Talking about the correct diet is very fashionable at the moment. However, the entire problem is basically overrated.	0	+3	-5	-2
07	These days, people are spending too much time on thinking about their nutritional status, although there are more important things in life.	-1	+5	-5	-3
08	A lot of people are fat and overweight due to their own bad eating habits.	+5	+3	+4	+1
09	My diet today will have a major influence on my nutritional status in the future.	+3	-1	+3	+1
10	I need to be familiar with the groceries I buy and consume. Only then, I can be sure that these groceries are healthy.	0	-2	0	+2
11	Not only is the good taste of meat relevant to me as a characteristic for the quality of meat, but also environmentally friendly produced pasture and adequate animal housing.	+4	-1	-2	0
12	When buying food like eggs and meat, I make sure they come from high welfare farming systems.	+4	-3	-1	0
13	Intensive animal farming produces meat with the same quality as organic farming does.	-4	+2	0	-2
14	A healthy diet is characterized by reduced meat consumption and high amounts of vegetable protein.	+1	-1	-2	+2
15	High consumption of meat or sausage products causes diet-related diseases.	+2	-2	0	+2
16	When following a vegetarian or vegan diet, it is hardly possible to reach a sufficient supply of all essential nutrients and can therefore lead to deficiencies.	0	+1	0	-5
17	Vegetarians and vegans are neither healthier nor do they live longer.	0	+1	+2	-5
18	Flexitarians (occasional consumption of meat) consciously follow a healthier diet and at the same time make a positive contribution to animal welfare and environmental protection.	+2	0	-1	0
19	As I am too busy to deal with complex questions relating to food I have to rely on the things scientists and doctors say.	-1	+2	-3	-1
20	I rely on information from advertisements when choosing which food to buy.	-3	+3	+3	-1
21	Scientists, who work for non-governmental organizations or universities, are a more credible source of information and better nutritional advisors than scientists who work for the government or the industry.	+1	0	0	0
22	It is difficult to trust anyone, because when it comes to a healthy diet one hears many contradictory opinions. In the end one can only rely on their own feeling when planning meals.	+1	0	-1	+1
23	If one would always pay attention to the nutritional advice from experts, one would get completely confused.	0	+2	-4	-2

24	I can trust the information given in TV or radio commercials for groceries, because the statements have to be controlled before being broadcasted.	-5	+2	+2	-1
25	The scope of nutritional information is often confusing and unnecessary.	+1	+1	-2	0
26	Nutrition fact labels and/or specific labels with information about calorie, sugar and fat content on packaged food immediately show the consumer which groceries offered in the supermarket are healthy.	-1	0	+3	+2
27	One quick and easy way for me to follow a healthier and more environmentally friendly diet is to look for specific seals such as ecological, organic or fair-trade labels.	+2	0	-3	+2
28	Modern dietary supplements play an important role for a healthy nutrition.	0	+1	+5	0
29	When following a healthy diet it takes too long until the effect hoped for eventually shows, which makes a medical intervention such as stomach stapling or a gastric band totally legitimate.	-3	0	+1	-2
30	Taking appetite suppressants or fat burning pills is a lot easier and more effective than changing to an entirely new diet.	-4	0	+4	-1
31	Doing a lot of sport and being very active, one needs additional nutrients (amino acids, creatine, L-carnitine,...) which cannot all be supplied with food. In this case, the intake of complementary supplements is very important.	-2	-2	+4	0
32	Because a good portion of the industrial produced products contain hidden sugars and fats, the food industry is responsible for the ubiquitous overweight in our society.	+4	-1	+1	+2
33	Nutrition would be healthy and optimal if one would avoid industrial produced food entirely.	+1	-4	-1	+4
34	In the last decades, the food industry has assured good food quality to the consumer.	0	+5	0	-3
35	It is impossible for food businesses to add unhealthy or environmentally harmful substances to food during production, because German standards (such as governmental food control) are so high.	-2	+1	0	-2
36	I use food that stems from controlled organic cultivation whenever possible.	+3	-3	-2	+4
37	“Naturalness” is an important aspect to me when it comes to preparing food. Food is only healthy when planted in one’s own yard.	0	-5	-3	+5
38	It is important to me, that the food I eat does not contain any artificial ingredients, additives or preservatives.	+3	-2	-1	+4
39	I prefer buying fresh meat and vegetables instead of packaged ones, because they contain more vitamins and mineral nutrients compared to their packaged counterparts.	+2	-1	+1	0
40	Organically produced foods are not healthier than conventional produced ones.	-1	+4	+1	-4
41	The additives in industrial produced foods have a negative impact on our health.	+2	-5	+1	+3
42	The food I buy needs to be packaged in an ecologically friendly way since food which is packaged in plastic or welded is often harmful to health.	+1	-3	-3	+5
43	I tend to buy food in specialized stores in which I receive competent guidance. Compared to normal supermarkets, I have the opportunity to buy more healthy food in these stores.	0	-4	-4	+5
44	Truly healthy food is only available in health shops or natural food stores.	-3	-4	-2	+4
45	The food offered in discount stores or supermarkets these days is just as healthy as the food offered on farmer’s markets.	+2	+4	+2	-4
46	Healthy groceries are a lot more expensive than unhealthy ones.	-3	+3	+1	0
47	I am willing to pay more for ecological products since these are usually also healthier.	+3	-3	-3	+3
48	Food tastes less the healthier it is.	-5	+3	-4	-3
49	The taste and a convenient preparation of a meal are certainly more important to me than calories and vitamins.	0	+2	-5	-3
50	The food at fast food restaurants is not much healthier than the food I would have cooked myself.	-3	+4	-1	-4

51	Nowadays I think it is possible to prepare healthy meals using convenience products.	-1	+4	0	-5
52	Due to the short preparation time, convenience food is a lot healthier compared to food that one would cook for hours.	-2	+1	-1	-4
53	Frozen and convenience products are just as healthy as fresh food.	-2	+5	0	-2
54	To live on mainly carbohydrates (50% daily) is very unhealthy, because by doing so one takes up a lot of sugars and fattening ingredients. A nutrition that is rich in proteins and low in fats is a lot healthier and more effective, because only then muscles can be built up and fat reduced.	+1	0	+5	-1
55	Diets and nutritional suggestions out of magazines are healthy, lead to a better nutritional status and improve the physical well-being.	-2	-2	+3	0
56	It is important to me that my nutrition is low in calories and fats and helps me control my weight.	+1	0	+5	+1
57	Specific foods such as sugar, grain, dairy products or legumes can be made responsible for feeling lethargic, having inexplicable troubles and not losing any weight during a diet.	-1	-1	+2	-1
58	The food I eat on a typical day needs to be good for my skin/teeth/hair/nails.	0	-5	+4	+1
59	In order to control my weight, I use regulating measures like certain diets and the intake of diuretic, laxative or appetite suppressing drugs whereby my nutritional status is a lot healthier.	-5	-4	+2	0
60	Once one has successfully lost weight, one can go back to the normal and usual nutrition.	-4	-1	-4	-1
61	The natural detoxification process is stimulated by the "Detox-regimen" or rather "Clean-Eating" and the nutritional status is considerably improved.	-1	-3	0	+1
62	"Light"-drinks containing sugar substitutes (for example sweeteners such as stevia or sorbitol) are generally just as healthy as water. They merely contain additional but uncritical flavors.	-4	0	+1	-1
63	I prefer diets like fasting cure, ayurveda, basic nutrition or nutrition in the traditional Chinese medicine, since these alternatives tend to be healthier and more balanced.	-2	-2	-1	+1

Table 3: Socio-demographic profile for the overall P set and of participants who loaded significantly on each lay theory

Characteristics	Overall (n = 30)	LT1 (n=12)	LT2 (n=5)	LT3 (n=6)	LT4 (n=6)
<i>Age (years)</i>					
Age range	18 – 66	27 – 63	18 – 66	22 – 48	29 – 59
Age mean	39.97	43.27	32.2	33.2	45.2
<i>Sex</i>					
Male	14 (47%)	3 (25%)	5 (100%)	2 (33%)	2 (33%)
Female	16 (53%)	8 (75%)	-	4 (67%)	4 (67%)
<i>Family status</i>					
Single	16	6	4	3	2
Married	14	5	1	3	4
<i>Children</i>					
None	14	5	3	5	1
1 or more	16	6	2	1	5
No. of participants with children still living at home	7	1	1	1	3
<i>Education</i>					
High school or lower	18	4	4	5	5
University degree	12	7	1	1	1
<i>Income (monthly gross)</i>					
€ <1,000	7	2	2	2	-
€ 1,000 ≤ 2,000	10	3	2	4	1
€ 2,000 ≤ 3,000	6	3	1	-	2
€ 3,000 ≤ 4,000	4	1	-	-	3
€ ≥ 4,000	1	1	-	-	-
Not disclosed	2	1	-	-	-
<i>Nutrition quality*</i>	2.5	2.6	3.4	2.33	1.5
<i>Preferred shopping location</i>					
Discount store	9	2	4	3	-
Supermarket	12	6	1	3	-
Health food store	4	1	-	-	3
Weekly market	5	2	-	-	3
<i>Diet</i>					
Omnivorian	10	3	3	3	-
Vegetarian	9	5	-	1	2
Vegan	5	1	-	-	4
Others (e.g. flexitarian diet)	6	2	2	2	-
<i>Interview duration</i>					
Mean (minutes)	67	65	60	64	92

Note: * Individual nutrition quality was judged on a scale from 1 (very good) to 6 (very poor).

3.2 Interpretation of the four lay theories

Aiming for a “sound and holistic factor [=lay theory] interpretation” (Watts & Stenner, 2012, page 150), we closely followed the crib sheet procedure introduced by Watts and Stenner (2012), which forces the engagement with each single item of the prototypical Q sorts for the LTs. Therefore, to capture the substance of each LT and to examine how this LT polarized compared to the other LTs, the prototypical Q sort scores were compared across the four LTs, hereby (1) highlighting all items ranked +5 and -5 for each LT, and (2) identifying all items within one LT that showed ratings higher (or lower) than the other LTs (Watts & Stenner, 2012).¹ In addition to these ratings, statements that were further informative for the lay viewpoints were also included into interpretation. Post-sort comments and demographic information of participants were utilized to aid correct interpretation of the LTs (Watts & Stenner, 2012). Below, we provide a summarized interpretation of LTs complemented with post-sort interview comments of participants who were significantly associated with the LT. Table 3 summarizes socio-demographic data of all participants and of those who significantly associate with each LT. At the end of each theory interpretation, we summarize the socio-demographic profile for each LT as represented in the current German sample. Notably, the profiles serve illustrative purpose and provided a mere first glimpse at socio-demographic characteristics for our sample. Therefore, care must be taken, not to overextend results based on these profiling data.

Lay Theory 1: “Healthy is what tastes good, in moderation”

Lay theory 1 (LT1) members view healthy nutrition as a rather important, holistic concept to achieve life-long physical and mental well-being (1: +5; 2: -1; 3: +3; 5: +5, 9: +3). For example, Participant 11 states: “[...] nutrition does have a large impact on well-being and the quality of life as well as on health. Therefore one should take time to think about nutrition. If one is already suffering from overweight, one should at least do some sports or find a different exercise regime in order to get to a healthier weight. You don’t necessarily need to strive for perfect measurements, but there is for sure a certain weight range that allows to achieve healthy blood values and a healthy lifestyle.” For a healthy diet, they deem it important to eat in moderation and follow a well-balanced diet, with special regard to vitamins in the form of fruits

¹ These characterizing statements are used to interpret each lay theory. For instance, ranking of statement 01 (i.e., *A healthy nutrition is the only way to be fit and fully productive.*) was lowest for LT2 with +1 and highest for LT1 with +5, whereas LT3 and 4 ranked it with +3. Hence, statement 01 was included in interpretation of LT1 and LT2. Statement number and ranking will be included in brackets behind the corresponding message (e.g., 01: +5 for LT1) in the running text.

and vegetables (4: +4) and moderate amounts of meat (14: +1; 15: +2; 18: +2; 39: +2). Hence, short-term diets, the consumption of regulating aids such as dietary supplements, and surgical procedures are rejected (28: 0; 29: -3; 30: -4; 31: -2; 59: -5; 60: -4). In general, these consumers avoid any extreme attitudes and behaviors with respect to their nutrition. Valuing health and taste in foods as equally important (49: 0), they oppose the idea that healthy foods are untasty (48: -5) or expensive (46: -3). Healthy nutrition is worth thinking about, yet it is not the most important thing in their lives (6: 0; 7: -1). However, they do believe that it is each one's own responsibility to adhere to a healthy diet and to have a healthy body weight (8: +5), yet they see the current overweight prevalence as a social problem that concerns society as a whole, as expressed in the post-sort interviews. Participant 21 states: *“Overweight represents a substantial social problem. When comparing [Germany] to the USA, it is obvious that an unhealthy nutrition—as it is prevalent in the States—causes obesity, which in turn increases health costs tremendously. Hence, overweight and a correct nutrition not only concern the individual—all of us are affected and equally involved.”*

The post-sort interviews reveal a general and lively discussed mistrust in the food industry. LT1 consumers deem industrially produced foods to contain excessive sugar and fat (32: +4), possible contaminations (35: -2), conservatives (38: +3), additives (62: -4), and to be packaged in possibly health-impairing materials (39: +2; 42: +1). Therefore, convenience products are considered less healthy than freshly prepared meals (52: -2; 53: -2) and are to be avoided (33: +1). Yet, a positive sentiment for frozen products emerged during the post-sort interviews, as frozen foods are thought to be carefully prepared, still containing many vitamins and minerals and therefore fitting a healthy lifestyle. Additionally, there is an overall preference for organic foods with a pronounced focus on animal welfare and environmental friendly production methods (11: +4; 12: +4), which are considered of higher quality than conventional products (13: -4). These consumers attend to organic labels (27: +2) and have an increased willingness to pay for such products (47: +3). Nevertheless, they see no health differences between products bought from discount stores or supermarket and health food stores or farmer's markets (44: -3; 45: +2), and their grocery shopping habits are not restricted to one of these outlets as detailed in the demographic information.

In this LT consumers in the post-sort interviews mentioned many different information sources (such as fitness trainers, online blogs, friends, books, journals, and specific search terms in online search engines) for knowledge acquisition. However, provision of nutrition information is perceived as slightly confusing and as not satisfying (22: +1; 25: +1). These consumers do not put a lot of trust in information from advertisements, magazines or product labels (20: -3; 26: -

1; 55: -2) and especially mistrust food advertised on radio or TV (24: -5). Participant 9 stated: *“Agreeing with this statement [Statement 24] and thus trusting advertising blindly, would mean that you lose your own will, because advertising is basically obscuring. I consider adverts to be a nice film that deceives the consumer, which is why I have no trust in TV or radio advertisements using healthy food-slogans.”*

Finally, within our German sample LT1 represents the largest group (n=12, 75% female, M_{age}=43.3 years) of participants. As can be seen in Table 3, members of LT1 are highly educated and report a good to satisfactory nutrition quality. This group follows a mixed diet and shops at different locations.

Lay Theory 2: “Healthy nutrition is expensive and inconvenient”

Lay theory 2 (LT2) consumers disagree with the current enthusiasm about the importance of healthy nutrition in their lives (6: +3; 7: +5). They also disregard positive effects of a healthy nutrition on their overall health status (1:+1; 2: +2; 3: -1; 5: +1; 9: -1) or appearance (58: -5). Participant 27 illustrates: *“[t]here are more important things in life than nutrition, with which one never really knows, what is right or wrong. It is, for example, a lot more important to be healthy and free of illness. Thinking about nutrition should only be the second or third most relevant thing. If I am terminally ill, eating lettuce or cucumbers won't make me healthy again.”* As meat has been mentioned as an integral part from LT2 members in the interviews, meat consumption constitutes a fundamental part of a healthy nutrition for this group, whereas a vegetarian or vegan diet is considered unhealthy (16: +1; 17: +1). Consumers in this group dissent from the view that high meat consumption is correlated with nutrition related-diseases (15: -2). They value good taste and convenience over possibly detrimental health effects of foods (49: +2) and generally view healthy foods as expensive and not tasty (46: +3; 48: +3). Dieting, weight control, nutritional supplements, or any alternative diet forms (31: -2; 55: -2; 56: 0; 59: -4; 60: -1; 61: -3; 63: -2) have little to no relevance for the holders of this theory.

Generally, this group agrees that the food industry provides high quality (34: +5, 35: +1) and healthy foods (33: -4), thereby improving the population's nutrition quality (33: -4; 34: +5) without being responsible for the current overweight problem (32: -1). Given that taste and convenience are the main drivers of their food choice rather than healthiness (49: +2), health-impairing ingredients in industrial foods are of no concern to them (38: -2; 41: -5; 42: -3), while fast food and ready-to-eat industrial foods are highly appreciated and perceived as healthy on par with fresh, home-made meals (37: -5; 50: +4; 51: +4; 52: +1; 53: +5). In line with this, foods offered in supermarkets and discount stores are not thought to be inferior with respect to their

health value compared to foods from health food stores, farmer's market, or specialty stores (40: +4; 43: -4; 44: -4; 45: +4). Organic foods are neither part of a healthy nutrition nor purchased, as LT2 holders do not see any benefits in consumption of such foods (12: -3; 13: +2; 36: -3; 40: +4; 42: -3) and are thus not willing to pay more for them (47: -3) These beliefs are underlined by Participant 30: *“Labeling a food as organic does not automatically imply that it is healthier. For example, a roll from the discounter with many grains and seeds is healthy and does by far not have to be organic. A kebab can also be healthy, even if the lettuce is not organic or “organic” is not written on the kebab. I think that organic food is only a strategy of supermarkets and companies offering no real health benefits to us customers.”*

Regarding nutrition information, LT2 consumers are only interested in information from advertisements (20: +3; 24: +2), and consider any other information as confusing and unnecessary (23: +2; 25: +1); at most they would take a physician's advice into consideration (19: +2).

Within our German, LT2 is comprised exclusively of young men (n=6, M_{age}=32.2 years) who mainly follow a heavy meat diet, shop groceries in discount stores, and indicate a less than satisfying diet quality.

Lay Theory 3: “Healthy is all the food that makes me slim and pretty”

The lives of lay theory 3 (LT3) consumers revolve around nutrition and healthy nutrition in particular (6: -5; 7: -5). Foods that are low in fat, calories, and carbohydrates and high in proteins are considered healthy (54: +5; 56: +5). These consumers appear to adopt a healthy nutrition primarily to control their weight (56: +5) and increase their physical attractiveness (58: +4). It should be noted that the post-sort interviews revealed two divergent views within LT 3 on what constitutes an attractive appearance – one indicating a slim body and the other a muscular body. However, views on healthy nutrition and outcomes are very similar. Consumers appreciate the health value and calorie content of food more than its taste or convenience (49: -5) as stated by Participant 24: *“Calorie and fat content in food are actually more important than its taste, which is why I pay a lot of attention to that. Nowadays there are a lot of “light”-products available, which are tasty and healthy at the same time since the calorie content is considerably reduced. I find it very important to pay attention to the right and optimal calorie content of my diet. [...] if I do not look after that and eat foods inconsiderately, I automatically gain weight and follow an unhealthy eating pattern. Therefore I believe that fat and calorie content of a meal should be considered first in order to be able to maintain a healthy diet.”* Continuously restricting eating as well as following multiple diets (59: +2; 60: -4) constitute

their understanding of healthy nutrition (55: +3). During the post-sort interviews, LT3 members mentioned a range of diets (e.g., Atkins diet, low carb diet, cabbage soup diet) as well as a variety of nutrition rules (e.g., eating no carbs past 5 p.m. or drinking a minimum of 2 liters water per day). To counterbalance nutrient loss, they view nutritional supplements as an integral part of a healthy nutrition (28: +5; 31: +4). Additionally, LT3 consumers accept fat burner or appetite suppressants (30: +4) as well as medical surgeries as a quick means to an end, namely, losing weight (29: +1). Their approach is future oriented (9: +3), not mainly because they value a long and healthy life (1: +3; 4: +2; 5: +1) but because they put their physical appearance before everything else (56: +5; 58: +4).

Consequently, this group's high involvement with the topic translates into a large desire for knowledge (19: -3). To support a healthy food choice, extensive information is gathered from multiple sources, such as diet advice from magazines (55: +3), product labels and advertising (20: +3; 24: +2; 26: +3), or experts (23: -4), still without leading to confusion (25: -2). However, opposed to LT1 members, LT3 consumers do not base their knowledge on scientific literature, instead opting for advice from popular magazines, a characteristic mentioned multiple times during the interviews.

This group sees no health differences between foods purchased from supermarkets, discount stores, health food stores, or home-grown foods (33: -1; 37: -3; 40: +1; 43: -4; 44: -2; 45: +2) nor would this group be willing to pay a higher price for organic products (47: -3).

In our sample, six young consumers (4 women, $M_{age}=33.2$ years) were significantly associated with LT3. They evaluate their nutrition as satisfying to good, and shop for groceries in discount stores or supermarkets.

Lay Theory 4: "Only home-made, organic and vegetarian food is healthy"

Lay theory 4 (LT4) members feel that healthy nutrition increases the life span (2: -3) and is therefore an important topic (6: -2; 7: -3). Since meat-based diets lead to nutrition-related diseases (15: +2), a healthy nutrition is defined as being low in meat, high in vegetable proteins (4: +3; 14: +2) and to consist of familiar foods (10: +2). LT4 consumers vehemently object to the opinion that a vegan or vegetarian diet comes with health disadvantages or a shorter life expectancy (16: -5; 17: -5). Even though healthy food tastes good (48: -3), it is its health value that determines food choice for these consumers (49: -3). Short-term measures, such as dieting or the intake of nutritional supplements are not considered (28: 0; 31: 0; 55: 0; 59: 0; 60: -1). Alternative or traditional diet forms, however, might be considered as part of a healthy diet (63:

+1). During the post-sort interviews a few group members mentioned following nutrition rules based on Traditional Chinese Medicine (TCM): “[...] *following the elements “Yang” and “Yin during nutrition is the only possibility to live healthy, only in this way health complaints can be diminished or even be prevented.*” (Participant 23).

For this consumer group, healthy nutrition is strongly determined by ecological and environmental aspects of their diet (40: -4; 47: +3). Only natural and organic products, either home-grown or purchased from specialized health food stores or farmer’s markets, are considered healthy (36: +4; 37: +5; 40: -4; 43: +5; 44: +4; 45: -4). As a consequence, LT4 consumers pay attention to organic labeling to track down highly valued products (27: +2; 47: +3). Industrial food, on the other hand, raises concerns regarding insufficient quality controls (34: -3; 35: -2). In line with this, LT4’ers are wary of food conservatives, artificial additives, and the packaging of industrial foods (38: +4; 42: +5), because they feel those measures harm the environment and human health in general (41: +3; 42: +5). They thus feel that only strict avoidance of industrial foods leads to an optimum and healthy nutrition (33: +4). Food from supermarkets, discount stores or fast food restaurants as well as frozen or other ready-to-eat meals can never be as healthy as organic food freshly prepared at home (50: -4; 51: -5; 52: -4; 53: -2).

Apart from expert advice provided by health food stores (43: +5) and the use of organic and nutrition labels (26: +2; 27: +2), LT4 consumers do not actively search for advice on healthy nutrition. Instead they trust organic production methods, the vegetarian or vegan lifestyle, and their own intuition on healthy eating (22: +1). Participant 18 explains: *“If one gets proper counseling on healthy nutrition, like for example in a health food store, one realizes very quickly and it is very obvious that these food products are clearly healthier, produced in an honest way and that unhealthy foods cannot be bought in these shops in the first place. [...] One would never receive such counseling in the supermarket, because in these places only industrial products are sold and, in addition, offered goods are questionable and are not produced in a honest way and the sellers have no idea, where the products come from [...].”*

Finally, within our sample LT4 comprised six consumers (four of them women) who exclusively followed a vegetarian or vegan diet and shopped in health food stores or farmers’ markets. Compared to other lay theories, LT4 consumers have the highest mean age (45.2 years), highest income, and best self-awarded nutrition quality (very good to good). As an aside, interview duration was the longest for this group (see Table 3) and during the post-sort

interviews almost all members referred to having their own garden in which they mainly grow their own fruits and vegetables.

4. Discussion

The aim of this work was to holistically explore major lay theories consumers hold about the concept of healthy nutrition in Germany, as assessed through Q methodology. To date, only few studies have employed this method in food or nutrition research and, to the best of our knowledge, ours is the first study to apply it to the concept of healthy nutrition. In doing so, the present study demonstrates that the complex myriad of views on healthy nutrition of the population as a whole (e.g., Bisogni et al., 2012; Paquette, 2005) do not apply entirely to everyone, but that different and distinct viewpoints/lay theories emerge among German consumers.

Using Q methodology, a method that combines qualitative and quantitative elements (Davis & Michelle, 2011), four main lay theories were identified, each demonstrating how, in general, persons from this specific lay theory think about healthy nutrition in Germany. LT1 *“Healthy is what tastes good, in moderation”* demonstrates the moderate viewpoint some consumers hold on the topic by considering an informed, moderate, and balanced diet, without restrictions or pharmaceutical help, as the optimal way to achieve a long life of physical and mental well-being. Focusing on the culinary and convenience qualities of foods provided by the industry, supporters of LT2 *“Healthy nutrition is expensive and inconvenient”* do not care much about the health aspect of their diet. They mostly aim at short-termed hedonic satisfaction. The LT3 *“Healthy is everything that makes me slim and pretty”* opts for calorie-reduced nutrition combined with frequent diet restrictions in order to achieve weight-loss and sustain an attractive body. Here, the use of dietary pharmaceuticals as supplementation is not frowned upon. Lastly, LT4 *“Only home-made, organic, and vegetarian food is healthy”* advocates the moral aspect of a healthy nutrition. Consumers supporting this theory exclusively consume home-cooked (vegetarian and vegan) foods that are organically produced.

4.1 Theoretical contribution

The findings extend previous research aimed at uncovering consumer segments based on their understanding of food healthiness. Chrysochou et al. (2010) identified health-related segments including attitude towards healthy eating and perceptions of food healthiness in Denmark. Their results yielded three segments: The “Common”, with moderate interest in food healthiness; the

“Idealists”, showcasing high interest and involvement in healthy foods; and the “Pragmatics”, who are overstrained by the abundance of available health information, have low interest in food healthiness, and do not adhere to guidelines. In a U.S. sample, Falk and colleagues (2001) found seven prominent themes that guide beliefs on healthy nutrition. These themes include healthy foods as being low in fat, unprocessed, balanced, to prevent and manage diseases, control weight, and achieve a nutrient balance. The four main lay theories we explored among German consumers combine and condense those findings into a more fine-grained and holistic understandings of the complex theories consumers hold on healthy nutrition. Consumer segments established in Denmark and prominent themes on healthy nutrition exhibited by Americans are echoed by a German sample. As such, our LT1 is comparable with the Common segment and contains achieving a nutrient balance and prevention of disease as overarching topics. LT2 members reflect the Pragmatics without prominent guiding beliefs due to the lack of interest in healthy nutrition. LT3 and LT4 could both be assigned to the Idealist segment, but they exhibit diverging overarching topics. While the understanding of healthy nutrition for LT3 is guided by the themes low in fat and control weight, the main theme of LT4 is unprocessed. What sets our study apart is that the core of Q methodology relates to a holistically understanding population subjectivity (Brown, 1993). Thereby, our identification of the four German consumer lay theories offer a deep and fine-grained understanding of these laypeople’s thinking, and reasoning related to the concept of healthy nutrition.

Linking the views on healthy nutrition embedded in the lay theories to official science-based definitions yields divergent results depending on the lay theories. According to the World Health Organization (WHO, 2015a) and the Dietary Guidelines for Americans (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015) a healthy nutrition is “an adequate, well balanced diet” that includes consumption of fruits, vegetables, legumes, nuts, whole grains and oils, and limits the intake of salt, added sugar, saturated fats and trans fatty acids. The German Society of Nutrition (DGE) additionally recommends diversity in food choice, gentle processing and usage of fresh ingredients while cooking as well as taking time for eating (Deutsche Gesellschaft für Ernährung, 2013). These definitions are only partially reflected in the lay theories we found. LT1 and LT4 appear to closely correspond with the scientific definition. LT1 reflects a balanced diet with mainly unprocessed products as well as a high fruit and vegetable consumption, whereas LT4 reflects gentle and low processing as well as the use of fresh ingredients. In contrast, LT2 and LT3 diverge from scientific guidelines with LT2 viewing highly processed convenience food as healthy and LT3 focusing on caloric over vitamin content of a food favoring pharmaceutical aids to control weight.

Recent trends regarding healthy nutrition pop up periodically in popular media, highlighting superfoods, spiritual foods, clean eating, paleo diet, gluten-free diet, or consumption of specific foods (i.e., matcha tea or turmeric). Yet, such trends appear to play only a minor role in our lay theories. Because those (and other) trends did not emerge during the concourse development or interviews with the nutritionists, the Q set does not reflect them. Additionally, trends are usually short-lived and excluding them from major lay theories in Germany may ensure greater temporal stability. Only LT4 revealed some interest in alternative nutrition forms, such as traditional Chinese medicine or clean eating, but no participant mentioned any of these trends during the post-sort interviews. This finding may hint at fleeting trends not playing a role in shaping consumer lay theories on healthy nutrition.

4.2 Public policy implications derived from consensus and dissent across lay theories

Consensus and dissent between the identified lay theories also offers important insights for public policy makers. Surprisingly little consensus surfaced across the four lay theories. The only statement that was shared within all lay theories relates to the (lack of) trustworthiness of scientists from different organizations as informational source (No. 21). Investigating the LTs evaluation of informational sources, it is only members of LT1 and LT3 who are actively searching for information on healthy nutrition. While LT1 members consult multiple, specialist sources, LT3 members focus mainly on non-scientific information from popular sources. LT2 and LT4 are little interested in information at all, either because of a lack of interest in healthy nutrition (LT2) or because they consider organic production a universal remedy for achieving a healthy nutrition (LT4). Thus, scientific nutritional information is of low relevance overall and there seems to be uncertainty as to whom to trust regarding nutritional information (No. 22). This finding is in line with reports by Eden et al. (2008) that consumers are generally sceptic about food information and food assurance claims. The authors argue that consumers are inclined to only trust their own judgment, a tendency that is also implied by our LT1 and LT4.

As there is little consensus across the theories, areas of dissent may yield additional insights for policy makers. We identified two major topics of dissent across the four lay theories: (1) The overall importance of healthy nutrition and (2) the dependence of food healthiness on production methods (i.e., organic vs. industrial).

Regarding the first topic, two of the four lay theories (LT2 and LT3) represent extreme attitudes. While LT2 rejects health aspects of nutrition in favor of flavor, convenience, and low price, LT3 prioritizes a healthy nutrition over everything else in life, solely for the purpose of an

attractive outer appearance. LT1's attitude regarding the importance of a healthy nutrition constitutes the middle ground. Consumers following LT1 evaluate the importance of a healthy nutrition as rather neutral, because they see it as an integral part of everyday life. However, they are the only ones acknowledging the relevance of healthy nutrition in disease prevention. Finally, LT4 considers a healthy nutrition almost as important in their lives as LT3. However, LT4 consumers put abiding trust in the relevance and healthiness of organic foods. These distinctions on the relevance of healthy nutrition clearly indicate the need to group consumers into segments and develop public health campaigns specifically tailored to preferred target groups. As public health nutrition interventions provide universal, science-based nutritional information to the entire lay audience (Coveney, 2005), the corollary of our results recommends to adjust presented themes, motives, and goals in nutrition health communication as well as selecting communication outlets such that they specifically address each lay theory. For example, during the years 2012 through 2014 the 5-a-day initiative ran a national billboard campaign *'Freshness in Life'* in Germany. Campaign billboards shown in the vicinity of supermarkets, consumers markets, and self-service stores tried to stimulate enthusiasm for a healthy nutrition. Building upon our four lay theories, billboards and additional informational material could be modified in at least four different ways. For LT1 consumers the billboards should focus on good taste and the positive impact of fruits and vegetables on well-being and physical health (e.g., *'Be healthy, eat tasty'*) placed best in front of supermarkets. As these consumers are already aware of fruits and vegetables being part of a healthy diet, they merely need to be reminded of a natural way of eating healthy and distribution of recipes that promote the use of fresh products could complement the campaign. To address LT2 consumers, billboards should emphasize the topic *'Eat tasty and quick'* showing how fruits and vegetables can be enjoyed in a quick and convenient way, placed in front of discounters. Recipes could be distributed showing how to easily and quickly prepare meals with healthy ingredients along with informational materials on what convenience foods are advisable for a healthy nutrition. To reach LT3 consumers, it would be advisable to stress the topic *'Be beautiful and fit'* with fruits and vegetables, and to promote recipes with low fat-, sugar-, and calorie-content. Placements of these billboards could be close to supermarkets or discount stores, perhaps even in beauty and fashion magazines. LT4 consumers, finally, could be reached best in health food stores where the campaign should promote the transparency or naturalness of fruits and vegetables. For this group, it is important that store staff is included in the campaign to explain details. Additionally, recipes in line with a healthy vegan and vegetarian way of life could be promoted and free seeds for garden vegetables or fruits could be distributed to further enhance

home-gardening in this group. In other words, it would be advisable for policy makers to develop singular interventions for each lay theory, optimized for individual beliefs, values, and viewpoints to ultimately reach out via their preferred shopping location or informational outlet. Taking this together with the low relevance of official nutrition information, this finding also highlights the need to work on the clarity and the successful dissemination of evidence-based educational information.

Regarding the second divergent topic—the dependence of food healthiness on production methods—LT2 and LT4 stand for diametrically opposing viewpoints. LT2 puts absolute trust in the healthiness of industrial food products, which may be grounded in their pronounced desire for convenient meals. In the post-sort interviews, these consumers revealed their unwillingness to put effort, thought, time or money into their nutrition. They prefer quick, convenient, cheap, and, therefore, simple ways of eating, indicating that constraints of will, time, and money may drive nutrition beliefs for these consumers. Albeit less extreme, LT3 also reflects lower skepticism regarding the healthiness of industrial food products. In contrast, consumers from LT4 spare neither effort nor money to consume the most unprocessed, organically produced foods with which they aim for a healthy nutrition. These results support previous findings showing consumers to link environmental friendly production and home-cooking with food healthiness (Lavelle et al., 2016; Lazzarini et al., 2016). However, our findings indicate that these heuristics do not apply uniformly to all consumer groups, but specifically for consumers who base healthy nutrition on the idea of natural and organic production. One reason could lie with differences in income level and price (in)sensitivity, given that LT2 and LT3 consumers had lower income than consumers holding LT4 and that healthy nutrition is in fact more expensive than unhealthy nutrition (Darmon & Drewnowski, 2015). This speculation may be further substantiated by the fact that combining educational interventions with price reductions was more effective in improving healthiness of food choice than educational interventions alone (Le et al., 2016; Waterlander, de Boer, Schuit, Seidell, & Steenhuis, 2013). According to our results such an approach would be especially successful with consumers in LT2 as those would most likely not be convinced by nutritional information, but would need additional incentives, such as low prices, fast preparation times etc. to turn to healthy foods.

4.3 Strengths and Limitations

Results yielded with Q methodology relate to identification of major viewpoints – or in our case lay theories – on a certain topic in society. This property and the fact that our empirical study

included a small amount of consumers from one German city over a short period of time, may limit the generalizability of findings. Even though our study strictly adhered to the prescribed ratio between sample size and number of items (Watts & Stenner, 2012) and provides a nuanced insight into the main viewpoints about healthy nutrition among German consumers, it remains unknown how common these viewpoints are in the population and how robust theories may be across cultures or time. Therefore, a more elaborate study based on quantitative data with a bigger sample could be conducted in future research to validate the presented theories that emerged from a small German sample. Even though, the current sample represents a wide range of age, income, and education groups as well as diet forms, differences in culture, religion, local food supply, governmental regulations, or economic situations across countries might lead to different and more lay theories about healthy nutrition. As lay theories on healthy nutrition can be influenced by social discourse as well as by official and public informational sources, we expect our theories to be relatively stable over the years as social discourse changes slowly over time and trends gain hold rather slowly. However, our results should be interpreted as a snapshot of a small group of German consumers. Our approach does, however, offer the basis for longitudinal monitoring to study how lay theories emerge and change over time.

Exploring complex issues such as consumers' concepts of healthy nutrition always involves making multiple decisions during the research process. Despite the utmost care being taken during development of the Q set statements and multiple feedback loops with nutritionists, it cannot be ruled out that relevant topics have been missed. Although no participant pointed out missing viewpoints during post-sort interviews, a different composition of the Q set might have yielded different results. Therefore, the presented lay theories should be carefully viewed in the context of the German society at the present time.

5. Conclusion

Employing Q methodology this study explored the main lay theories on healthy nutrition among German consumers. Four lay theories emerged: (1) *Healthy is what tastes good, in moderation*, (2) *Healthy nutrition is expensive and inconvenient*, (3) *Healthy is everything that makes me slim and pretty*, and (4) *Only home-made, organic, and vegetarian food is healthy*. While consensus existed among the low relevance of official nutritional information, dissent was expressed about overall importance of healthy nutrition in the consumers' lives and food healthiness related to its production methods (organic vs. industrial). To conclude, our findings clearly indicate the need to engage specific consumer groups separately on the basis of their perspective on healthy nutrition. Acknowledging our findings, policy makers should address these consumer groups in more specific and more individual ways or find better ways to communicate through their information sources, like peers, or in-groups. If our findings show anything, it is that food healthiness beliefs—whether correct or not—come about through an abundance of information channels, and that consumers are well aware of which channel they tune into.

Acknowledgements

Special thanks go to Antonia Gölz for her excellent research assistance and to Casparus J. A. Machiels for his helpful comments on previous versions of this manuscript. The authors also thank the editor and three anonymous reviewers for their helpful suggestions on earlier versions of the manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sector.

References

- Abreu, D. de, Guessous, I., Vaucher, J., Preisig, M., Waeber, G., Vollenweider, P., & Marques-Vidal, P. (2013). Low compliance with dietary recommendations for food intake among adults. *Clinical Nutrition, 32*(5), 783–788. doi:10.1016/j.clnu.2012.11.022
- Andreasen, A. R. (2002). Marketing social marketing in the social change marketplace. *Journal of Public Policy & Marketing, 21*(1), 3–13. doi:10.1509/jppm.21.1.3.17602
- Bisogni, C. A., Jastran, M., Seligson, M., & Thompson, A. (2012). How people interpret healthy eating: Contributions of qualitative research. *Journal of Nutrition Education and Behavior, 44*(4), 282–301. doi:10.1016/j.jneb.2011.11.009
- Blake, C. E., Bisogni, C. A., Sobal, J., Devine, C. M., & Jastran, M. (2007). Classifying foods in contexts: How adults categorize foods for different eating settings. *Appetite, 49*(2), 500–510. doi:10.1016/j.appet.2007.03.009
- BMEL. (2016). BMEL-Ernährungsreport 2016: Deutschland, wie es isst.
- Bos, C., van der Lans, I. A., van Rijnsoever, F. J., & van Trijp, H. C. M. (2013). Understanding consumer acceptance of intervention strategies for healthy food choices: a qualitative study. *BMC Public Health, 13*, 1073. doi:10.1186/1471-2458-13-1073
- Brown, K. A., Timotijevic, L., Barnett, J., Shepherd, R., Lahteenmaki, L., & Raats, M. M. (2011). A review of consumer awareness, understanding and use of food-based dietary guidelines. *The British Journal of Nutrition, 106*(1), 15–26. doi:10.1017/S0007114511000250
- Brown, S. R. (1980). *Political subjectivity: Applications of Q methodology in political science*. New Haven: Yale University Press.
- Brown, S. R. (1993). A primer on Q methodology. *Operant Subjectivity, 19*, 91–138.
- Brown, S. R., Danielson, S., & van Exel, J. (2015). Overly ambitious critics and the Medici Effect: A reply to Kampen and Tamás. *Quality & Quantity, 49*(2), 523–537. doi:10.1007/s11135-014-0007-x
- Brunso, K., & Grunert, K. G. (1995). Development and testing of a cross-culturally valid instrument: Food-related life style. *Advances in Consumer Research, 22*(1), 475–480.
- Bucher, T., Muller, B., & Siegrist, M. (2015). What is healthy food? Objective nutrient profile scores and subjective lay evaluations in comparison. *Appetite, 95*, 408–414. doi:10.1016/j.appet.2015.08.005
- Buttriss, J. (2003). Scene setting: who is the voice of nutrition in Britain? *The Proceedings of the Nutrition Society, 62*(3), 573–575. doi:10.1079/PNS2003270
- Capacci, S., Mazzocchi, M., Shankar, B., Macias, J. B., Verbeke, W., Perez-Cueto, F. J. A., . . . Traill, W. B. (2012). Policies to promote healthy eating in Europe: a structured review of policies and their effectiveness. *Nutrition Reviews, 70*(3), 188–200. doi:10.1111/j.1753-4887.2011.00442.x
- Challem, J. (2011). *The religion of nutrition: Has nutrition become a "good 'ol time religion?"*. Retrieved from <https://www.psychologytoday.com/blog/the-nutrition-reporter/201102/the-religion-nutrition>
- Chrysochou, P., Askegaard, S., Grunert, K. G., & Kristensen, D. B. (2010). Social discourses of healthy eating. A market segmentation approach. *Appetite, 55*(2), 288–297. doi:10.1016/j.appet.2010.06.015
- Coveney, J. (2005). A qualitative study exploring socio-economic differences in parental lay knowledge of food and health: Implications for public health nutrition. *Public Health Nutrition, 8*(03), 58. doi:10.1079/PHN2004682

- Croll, J. K., Neumark-Sztainer, D., & Story, M. (2001). Healthy eating: What does it mean to adolescents? *Journal of Nutrition Education*, 33(4), 193–198. doi:10.1016/S1499-4046(06)60031-6
- Darmon, N., & Drewnowski, A. (2015). Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: A systematic review and analysis. *Nutrition Reviews*, 73(10), 643–660. doi:10.1093/nutrit/nuv027
- Davis, C. H., & Michelle, C. (2011). Q methodology in audience research: Bridging the qualitative/quantitative 'divide'? *Participations: Journal of Audience & reception Studies*, 8(2), 559–593.
- Davison, C., Smith, G. D., & Frankel, S. (1991). Lay epidemiology and the prevention paradox: The implications of coronary candidacy for health education. *Sociology of Health & Illness*, 13(1), 1–19. doi:10.1111/j.1467-9566.1991.tb00085.x
- Deutsche Gesellschaft für Ernährung. (2013). *10 guidelines of the German Nutrition Society (DGE) for a wholesome diet*. Retrieved from <https://www.dge.de/index.php?id=322>
- Dickson-Spillmann, M., & Siegrist, M. (2011). Consumers' knowledge of healthy diets and its correlation with dietary behaviour. *Journal of Human Nutrition and Dietetics : The official Journal of the British Dietetic Association*, 24(1), 54–60. doi:10.1111/j.1365-277X.2010.01124.x
- Eden, S., Bear, C., & Walker, G. (2008). The sceptical consumer?: Exploring views about food assurance. *Food Policy*, 33(6), 624–630. doi:10.1016/j.foodpol.2008.02.003
- Falk, L. W., Sobal, J., Bisogni, C. A., Connors, M., & Devine, C. M. (2001). Managing healthy eating: Definitions, classifications, and strategies. *Health Education & Behavior*, 28(4), 425–439. doi:10.1177/109019810102800405
- Furnham, A. (1988). *Lay Theories: Everyday understanding of problems in social sciences*. New York: Pergamon Press.
- Furnham, A., & Cheng, H. (2000). Lay theories of happiness. *Journal of Happiness Studies*, 1(2), 227–246. doi:10.1023/A:1010027611587
- Geeroms, N., Verbeke, W., & van Kenhove, P. (2008). Health advertising to promote fruit and vegetable intake: Application of health-related motive segmentation. *Food Quality and Preference*, 19(5), 481–497. doi:10.1016/j.foodqual.2008.02.004
- Gille, D., Bütikofer, U., Chollet, M., Schmid, A., Altintzoglou, T., Honkanen, P., . . . Piccinali, P. (2016). Nutrition behavior of the middle-aged and elderly: Compliance with dietary recommendations of the food pyramid. *Clinical Nutrition*, 35(3), 638–644. doi:10.1016/j.clnu.2015.04.002
- Grunert, K. G. (2011). How changes in consumer behaviour and retailing affect competence requirements for food producers and processors. *Economía Agraria y Recursos Naturales*, 6(11), 3. doi:10.7201/earn.2006.11.01
- Hiddink, G. J., Hautvast, J. G., van Woerkum, C. M., Fieren, C. J., & vant Hof, M. A. (1997). Consumers' expectation about nutrition guidance: The importance of primary care physicians. *American Journal of Clinical Nutrition*, (65), 1974S-1979S.
- Jung, E. H., Walsh-Childers, K., & Kim, H.-S. (2016). Factors influencing the perceived credibility of diet-nutrition information web sites. *Computers in Human Behavior*, 58, 37–47. doi:10.1016/j.chb.2015.11.044
- Kraak, V. I., Swinburn, B., Lawrence, M., & Harrison, P. (2014). A Q methodology study of stakeholders' views about accountability for promoting healthy food environments in England through the Responsibility Deal Food Network. *Food Policy*, 49, 207–218. doi:10.1016/j.foodpol.2014.07.006

- Kristensen, D. B., Askegaard, S., & Jeppesen, L. H. (2013). 'If it makes you feel good it must be right': Embodiment strategies for healthy eating and risk management. *Journal of Consumer Behaviour*, *12*(4), 243–252. doi:10.1002/cb.1427
- Lavelle, F., McGowan, L., Spence, M., Caraher, M., Raats, M. M., Hollywood, L., . . . Dean, M. (2016). Barriers and facilitators to cooking from 'scratch' using basic or raw ingredients: A qualitative interview study. *Appetite*, *107*, 383–391. doi:10.1016/j.appet.2016.08.115
- Lazarini, G. A., Zimmermann, J., Visschers, V. H. M., & Siegrist, M. (2016). Does environmental friendliness equal healthiness? Swiss consumers' perception of protein products. *Appetite*, *105*, 663–673. doi:10.1016/j.appet.2016.06.038
- Le, H. N. D., Gold, L., Abbott, G., Crawford, D., McNaughton, S. A., Mhurchu, C. N., . . . Ball, K. (2016). Economic evaluation of price discounts and skill-building strategies on purchase and consumption of healthy food and beverages: The SHELf randomized controlled trial. *Social science & medicine (1982)*, *159*, 83–91. doi:10.1016/j.socscimed.2016.04.015
- Lobstein, T., & Davies, S. (2009). Defining and labelling 'healthy' and 'unhealthy' food. *Public Health Nutrition*, *12*(3), 331–340. doi:10.1017/S1368980008002541
- Lupton, D., & Chapman, S. (1995). 'A healthy lifestyle might be the death of you': Discourses on diet, cholesterol control and heart disease in the press and among the lay public. *Sociology of Health and Illness*, *17*(4), 477–494. doi:10.1111/1467-9566.ep10932547
- Mandolesi, S., Nicholas, P., Naspetti, S., & Zanolli, R. (2015). Identifying viewpoints on innovation in low-input and organic dairy supply chains: A Q-methodological study. *Food Policy*, *54*, 25–34. doi:10.1016/j.foodpol.2015.04.008
- Margetts, B. M., Martinez, J. A., Saba, A., Holm, L., Kearney, M., & Moles, A. (1997). Definitions of 'healthy' eating: A pan-EU survey of consumer attitudes to food, nutrition and health. *European Journal of Clinical Nutrition*, *51 Suppl 2*, S23-9.
- Maubach, N., Hoek, J., & McCreanor, T. (2009). An exploration of parents' food purchasing behaviours. *Appetite*, *53*(3), 297–302. doi:10.1016/j.appet.2009.07.005
- McKeown, B., & Thomas, D. B. (1988). *Q methodology: Qualitative applications in the social sciences series, Vol. 66*. Newbury Park, CA: Sage.
- McKeown, B., & Thomas, D. B. (2013). *Q methodology*. London: SAGE Publications Ltd.
- Mötteli, S., Keller, C., Siegrist, M., Barbey, J., & Bucher, T. (2016). Consumers' practical understanding of healthy food choices: A fake food experiment. *The British Journal of Nutrition*, *116*(3), 559–566. doi:10.1017/S0007114516002130
- Paquette, M.-C. (2005). Perceptions of healthy eating: State of knowledge and research gaps. *Canadian Journal of Public Health = Revue canadienne de sante publique*, *96 Suppl 3*, S15-9, S16-21.
- Pedersen, S., Gronhoj, A., & Thogersen, J. (2015). Following family or friends. Social norms in adolescent healthy eating. *Appetite*, *86*, 54–60. doi:10.1016/j.appet.2014.07.030
- Pelletier, D. L., Kraak, V., McCullum, C., & Uusitalo, U. (2000). Values, public policy, and community food security. *Agriculture and Human Values*, *17*(1), 75–93. doi:10.1023/A:1007668425322
- Popay, J., & Williams, G. (1996). Public health research and lay knowledge. *Social Science & Medicine*, *42*(5), 759–768. doi:10.1016/0277-9536(95)00341-X
- Popkin, B. M., Kim, S., Rusev, E. R., Du, S., & Zizza, C. (2006). Measuring the full economic costs of diet, physical activity and obesity-related chronic diseases. *Obesity Reviews : An official Journal of the International Association for the Study of Obesity*, *7*(3), 271–293. doi:10.1111/j.1467-789X.2006.00230.x

- Povey, R., Conner, M., Sparks, P., James, R., & Shepherd, R. (1998). Interpretations of healthy and unhealthy eating, and implications for dietary change. *Health Education Research, 13*(2), 171–183. doi:10.1093/her/13.2.171
- Previte, J., Pini, B., & Haslam-McKenzie, F. (2007). Q Methodology and Rural Research. *Sociologia Ruralis, 47*(2), 135–147. doi:10.1111/j.1467-9523.2007.00433.x
- Ramlo, S. (2015). Mixed Method Lessons Learned From 80 Years of Q Methodology. *Journal of Mixed Methods Research, 10*(1), 28–45. doi:10.1177/1558689815610998
- Ristovski-Slijepcevic, S., Chapman, G. E., & Beagan, B. L. (2008). Engaging with healthy eating discourse(s): Ways of knowing about food and health in three ethnocultural groups in Canada. *Appetite, 50*(1), 167–178. doi:10.1016/j.appet.2007.07.001
- Robert Koch Institut (RKI). (2016). *Gesundheit in Deutschland - die wichtigsten Entwicklungen: Gesundheitsberichterstattung des Bundes. Gemeinsam getragen von RKI und DESTATIS*. Berlin.
- Roininen, K., Tuorila, H., Zandstra, E. H., Graaf, C. de, Vehkalahti, K., Stubenitsky, K., & Mela, D. J. (2001). Differences in health and taste attitudes and reported behaviour among Finnish, Dutch and British consumers: a cross-national validation of the Health and Taste Attitude Scales (HTAS). *Appetite, 37*(1), 33–45. doi:10.1006/appe.2001.0414
- Ronteltap, A., Sijtsema, S. J., Dagevos, H., & de Winter, M. A. (2012). Construal levels of healthy eating. Exploring consumers' interpretation of health in the food context. *Appetite, 59*(2), 333–340. doi:10.1016/j.appet.2012.05.023
- Schifferstein, H. N., & Oude Ophuis, P. A. (1998). Health-related determinants of organic food consumption in The Netherlands. *Food Quality and Preference, 9*(3), 119–133. doi:10.1016/S0950-3293(97)00044-X
- Schmolck, P. (2002). *PQMethod Manual*. Retrieved from <http://schmolck.userweb.mwn.de/qmethod/pqmanual.htm>
- Shaw Hughner, R., & Schultz Kleine, S. (2008). Variations in lay health theories: Implications for consumer health care decision making. *Qualitative Health Research, 18*(12), 1687–1703. doi:10.1177/1049732308327354
- Sørensen, M. R., & Holm, L. (2016). "I feel good and I am not overweight" - A qualitative study of considerations underlying lay people's self-assessments of unhealthy diets. *Appetite, 107*, 135–143. doi:10.1016/j.appet.2016.07.032
- Spiteri Cornish, L., & Moraes, C. (2015). The impact of consumer confusion on nutrition literacy and subsequent dietary behavior. *Psychology & Marketing, 32*(5), 558–574. doi:10.1002/mar.20800
- Spronk, I., Kullen, C., Burdon, C., & O'Connor, H. (2014). Relationship between nutrition knowledge and dietary intake. *The British Journal of Nutrition, 111*(10), 1713–1726. doi:10.1017/S0007114514000087
- Stephenson, W. (1935). Technique of Factor Analysis. *Nature, 136*(3434), 297. doi:10.1038/136297b0
- Stephenson, W. (1953). *The study of behavior; Q-technique and its methodology*. Chicago, IL, US: University of Chicago Press.
- Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The food choice questionnaire. *Appetite, 25*(3), 267–284. doi:10.1006/appe.1995.0061
- Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: Shaped by global drivers and local environments. *The Lancet, 378*(9793), 804–814. doi:10.1016/S0140-6736(11)60813-1

- U.S. Department of Health and Human Services & U.S. Department of Agriculture. (2015). *2015-2020 Dietary Guidelines for Americans*. Retrieved from <https://health.gov/dietaryguidelines/2015/guidelines/>
- van Exel, J., Baker, R., Mason, H., Donaldson, C., & Brouwer, W. (2015). Public views on principles for health care priority setting: Findings of a European cross-country study using Q methodology. *Social Science & Medicine*, *126*, 128–137. doi:10.1016/j.socscimed.2014.12.023
- van Exel, N. J. & Graaf, G. de. (2005). *Q methodology: A sneak preview*. Retrieved from www.jobvanexel.nl
- van Kleef, E., van Trijp, H., Paeps, F., & Fernández-Celemín, L. (2008). Consumer preferences for front-of-pack calories labelling. *Public Health Nutrition*, *11*(2), 203–213. doi:10.1017/S1368980007000304
- Velardo, S. (2017). Nutrition literacy for the health literate. *Journal of Nutrition Education and Behavior*, *49*(2), 183. doi:10.1016/j.jneb.2016.07.018
- Waterlander, W. E., de Boer, M. R., Schuit, A. J., Seidell, J. C., & Steenhuis, I. H. M. (2013). Price discounts significantly enhance fruit and vegetable purchases when combined with nutrition education: a randomized controlled supermarket trial. *The American Journal of Clinical Nutrition*, *97*(4), 886–895. doi:10.3945/ajcn.112.041632.
- Watts, S., & Stenner, P. (2005). Doing Q methodology: Theory, method and interpretation. *Qualitative Research in Psychology*, *2*(1), 67–91. doi:10.1191/1478088705qp022oa
- Watts, S., & Stenner, P. (2012). *Doing Q methodological research: Theory, method and interpretation*. Los Angeles: SAGE Publications Ltd.
- WHO. (2015a). *Healthy Diet*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs394/en/>
- WHO. (2015b). *Noncommunicable diseases: Fact sheet*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs355/en/>
- WHO. (2016). *Obesity and overweight: Fact sheet*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs311/en/>
- Zandstra, E., Graaf, C. de, & van Staveren, W. (2001). Influence of health and taste attitudes on consumption of low- and high-fat foods. *Food Quality and Preference*, *12*(1), 75–82. doi:10.1016/S0950-3293(00)00032-X

Chapter 3

What shapes consumer healthiness inferences?

Investigating subtle design cues in food packages

Nadine Yarar

This contribution is submitted for publication to *Journal of Public Policy & Marketing*,
Special Issue: Food and Consumer Well-Being

Abstract

Given growing concern about a possible lack of healthiness in the general population, means of encouraging healthier food choices are receiving increasing attention. This study focuses on subtle features of a food package's visual design as a means for shaping healthiness inferences. Two studies are reported investigating both implicit and explicit healthiness inferences drawn by consumers from fundamental features of design. Study 1 employs a multidimensional Implicit Association Test (md-IAT) and abstract stimuli to examine the association strength between healthiness and three design features: color lightness (IAT 1), shape roundness (IAT 2), and thickness (IAT 3). The findings indicate that consumers associate light (versus dark) colors and round (versus angular) shapes implicitly with healthiness; effects for thin (versus thick) shapes, however, are less clear. Extending the context to actual food packages, Study 2 shows that consumers relate color lightness and shape roundness also explicitly to a product's healthiness, an effect attributable to design-induced perception. Together the two studies aid consumer advocates, policy makers, and marketers in more effectively communicating healthiness through subtle means of visual design.

Keywords: healthiness, design elements, IAT, implicit, package design

1. Introduction

In spite of extensive health education measures and healthy eating campaigns, the number of overweight and obese people worldwide has been rising steadily over the last years (WHO, 2016). Further emphasizing the need for action, excessive weight is related to a range of preventable non-communicable diseases, such as diabetes, cardiovascular disease, or cancer (WHO, 2015b). Because unhealthy nutrition lies at the heart of these health threats (WHO, 2015a), public health practitioners are on the lookout for effective and affordable measures to encourage a healthy diet. Food choices are low-involvement choices and are often based on subconscious consumer processing (Köster, 2009; Silayoi & Speece, 2004). This means that these choices are largely driven by implicit attitudes (Friese, Hofmann, & Wänke, 2008; Mai, Hoffmann, Hoppert, Schwarz, & Rohm, 2015), a fact that traditional public health interventions fail to account for (Sheeran, Gollwitzer, & Bargh, 2013). Trying to overcome limitations of explicit approaches, nudging has been put forward as an alternative strategy to influence consumer decision making and behavior at the subconscious level (Wilson, Buckley, Buckley, & Bogomolova, 2016). Reflecting small and subtle rearrangements of the individual decision-making context, nudging makes the desirable (from a public health perspective) choice —the easy choice, leaving consumer's perceived freedom of choice unaffected (Selinger & Whyte, 2011), hereby avoiding backfiring effects due to psychological reactance (Dillard & Shen, 2005). Nudging has been proven effective in encouraging healthy nutrition (Arno & Thomas, 2016), and public health researchers are now seeking ways for using nudging to increase healthy food choices at the point of purchase. An important means of communicating at the POP are food packages as consumers commonly use them for deriving healthiness from their visual design (e.g., Bucher et al., 2016; Karnal, Machiels, Orth, & Mai, 2016; Tijssen, Zandstra, Graaf, & Jager, 2017).

While design elements themselves usually lack a specific intrinsic health value, there are cases where consumers associate a specific valence with specific elements, factors or types of visual design. For example, fundamental design characteristics such as lightness (Banerjee, Chatterjee, & Sinha, 2012; Meier, Robinson, & Clore, 2004; Meier, Robinson, Crawford, & Ahlvers, 2007; Sherman & Clore, 2009), size (Meier, Robinson, & Caven, 2008), shape (Westerman et al., 2012) or verticality (Meier & Robinson, 2004) can be associated with valenced judgments including positive versus negative evaluations or morality versus immorality (Crawford, 2009). Yet, research has neglected to link implicit health associations with fundamental features of design. While store shelves display numerous products explicitly designed to enhance perceived healthiness (e.g., by name: Healthy choice), it remains unclear

whether and how consumers infer implicit healthiness associations from fundamental features of design. Nonetheless, there has been a growing interest in studying visual health cues (i.e., nudges) on food package design and their impact on consumer evaluation and decision making. For instance, various studies investigate the influence of visual package design elements on product healthiness associations, such as color (Mai, Symmank, & Seeberg-Elverfeldt, 2016; Tijssen et al., 2017), shape (Fenko, Lotterman, & Galetzka, 2016; van Ooijen, Fransen, Verlegh, & Smit, 2017; Yarar, Machiels, & Orth, 2017), and typeface (Karnal et al., 2016). Notwithstanding the various effects these studies uncovered, there is a shortcoming of fundamental research investigating possible associations between (simple) design features and healthiness inferences. In addition, studies on visual health cues fail to establish the design-induced perceptions as explanatory mechanism for the found effects. The aim of the present research is, therefore, threefold. It aims to (1) determine whether and to what extent consumers associate abstract design features with the concept of healthiness, (2) how these effects transfer to food evaluation, and (3) offer a process explanation.

1.1 Effects of color

Constituting a major feature of visual design, color has received a substantial amount of researcher interest, especially regarding symbolic properties. Colors elicit personal associations with objects or experiences based on learned associations over life (Labrecque, Patrick, & Milne, 2013). However, the majority of studies has focused on effects of color hue, hereby neglecting the other two major properties, saturation (intensity of pigments) and value (lightness versus darkness; Labrecque et al., 2013). For example, linking affective associations with color lightness, Meier et al. (2004) report automatic positive attitudes towards words presented in light colors and negative attitudes with words presented in dark colors, irrespective of the literal meaning of the words. This example illustrates how fundamental visual features of a stimulus subconsciously bias viewer evaluations, even when they are irrelevant for the task at hand. While marketers and design professionals commonly use light or pale colors for low-fat and low-sugar food products, researchers have very recently begun to study these characteristics in the context of food package cues to healthiness. Extending reports that colors have different weights with lighter-weight colors signaling greater healthiness (Karnal et al., 2016), Mai et al. (2016) and Tijssen et al. (2017) showed strong implicit associations between light-colored food packages and consumer inference of healthiness. Important to note those studies focused on consumer *implicit* associations evoked by highly complex full-color food packages, with healthiness assessed at a highly disaggregate and specific level (i.e., low-fat, low-sugar, etc.). Therefore, it still remains unknown whether it is the category, the holistic

design of the package, or something intrinsically "healthy" about one or more fundamental features of color (i.e., lightness, hue, or saturation) that accounts for implicit associations with healthiness. Integrating the studies reviewed above, we expect:

H1: Light (dark) colored design elements will be associated with more (less) healthiness.

1.2 Effects of shape

Within the stream of research on shapes as visual cues with evaluative meaning, studies have mostly concentrated on round versus angular shapes. Evidence converges on the findings that people generally prefer rounded patterns and objects over sharp-angled alternatives (Bar & Neta, 2006). It is thought that sharp-angled objects are innately and subconsciously associated with danger, being perceived as physically harmful and therefore less preferred. This interpretation has been confirmed by Palumbo, Ruta, and Bertamini (2015) who employed Implicit Association Tests (IATs) to show rounded shapes to be associated with positive concepts and safety, and angular shapes with negative concepts and danger. Shaping actual product packages yields similar results, as products with rounded shapes are preferred, leading to greater purchase intention, and positive emotions (Leder & Carbon, 2005; Westerman et al., 2012). Fenko et al. (2016), however, found products in angular, slim packages to be perceived as healthier than products in rounded, thick packages. According to the authors this effects is based on consumers relating a slim, angular body to being physically healthy, whereas a round, fat body relates to being not healthy. It remains unclear, however, whether effects are based on the design's roundness/angularity or slimness/thickness. Conclusively, drawing from research on learned associations (Bar & Neta, 2006; McClelland, 1988), roundness in design should trigger feelings of safety, harmony and positive valence—all of which characteristics might be spill over to healthiness. We expect:

H2: Round (vs. angular) shaped design elements will be associated with more (less) healthiness.

Paralleling research on roundness, the valence or inherent healthiness of shape thinness/thickness has not received much research attention. Yet, some predictions can be made for shape thinness/thickness effects by drawing from research on the influence of human body shapes on perception and, more recently, from research on package shapes mimicking human body shapes. Results obtained through implicit methods indicate positive associations with and attentional bias for thin human body shapes as well as negative attitudes for not so thin shapes (Joseph et al., 2016; Roddy, Stewart, & Barnes-Holmes, 2010; Schwartz, Vartanian, Nosek, & Brownell, 2006). With respect to healthiness inferences, thin bodies—characterized by a low

waist-to-hip ratio—signal greater physical healthiness (Singh, 1993; Welborn, Dhaliwal, & Bennett, 2003). Consistent with this finding, thin models in product advertisements yield greater associations with healthiness compared to overweight models (Chrysochou & Nikolakis, 2012). Extending these effects to objects, Brunner and Siegrist (2012) demonstrate that consumption of unhealthy foods decreases after exposure to visual thin cues (sculptures) compared to a neutral condition where the visual cue was unrelated to shapes (a landscape) indicating that thin but not neutral visual cues activate healthiness associations. Additionally, recent research shows that the shape of a package can influence the perceived caloric and fat content of food products and thus product healthiness (van Ooijen et al., 2017; Yarar et al., 2017). Summarizing previous research, thin abstract shapes relate to positive attitudes, and greater healthiness is inferred from thin models and package shapes mimicking thin body shapes. Thus, we posit:

H3: Thin (vs. thick) design elements will be associated with more (less) healthiness.

1.3 Study overview

To investigate effects of fundamental design features on healthiness the present research focuses on light versus dark colors, rounded versus angular, and thin versus thick shapes. Study 1 aimed at testing automatic associations between the general concept of healthiness and abstract design elements, using a multidimensional Implicit Association Test (md-IAT, Gattol, Sääksjärvi, Carbon, & Hempel, 2011). As such, the study explores a basic connection between design elements and healthiness. Study 2 replicates and extends Study 1 to actual product packages and examines explicit food healthiness perceptions inferred from those design features. Together, the studies aim at (1) linking healthiness associations with fundamental design elements, (2) testing the robustness of associations with actual packages, and (3) testing the role of design-induced perceptions as a possible process explanation.

2. Study 1

Study 1 aims at testing healthiness associations with fundamental design features. Specifically, associations with light versus dark colors, rounded versus angular, and thin versus thick shapes are investigated.

2.1 Method

2.1.1 Participants

Thirty students (21 females, $M_{Age} = 26.33$ years, $SD = 3.20$) were recruited from a large public university to take part in the study. They received a 5€-coupon valid at a local coffee bar as compensation. All participants had normal or corrected-to-normal vision.

2.1.2 Material

As inferences activated by visual design occur spontaneously and without conscious awareness, implicit methods are well-suited to measure them (Mai et al., 2016). A frequently employed measure to assess the strength of automatic associations is the Implicit Association Test (IAT, Greenwald, McGhee, & Schwartz, 1998). Based on a computerized categorization task, an IAT measures response latencies corresponding with the relative association strength between a target concept (here: general healthiness) and an attribute category (here: a basic design feature). The underlying assumption posits that categorizing two associated concepts leads to faster responses than categorizing non-associated concepts. Since the focus lies on three different design concepts, we utilized three separate IATs based on the md-IAT approach (Gattol et al., 2011; see Makin & Wuerger, 2013 and Palumbo et al., 2015 for an application of the md-IAT in design research), one each per design feature, to investigate effects of design features on automatic healthiness associations.

The IAT was programmed and conducted using Inquisit 4.0 (Millisecond). Stimulus material was displayed on a Dell 19 inch monitor with a spatial resolution of 1280 x 1024 pixels. The experiment was carried out in a standardized consumer laboratory to avoid any disturbances during the experiments. Participants were positioned at a distance of approximately 50 cm from the monitor, which was centered on eye level. Stimulus material consisted of identical word stimuli representing the target category “healthiness” that remained the same throughout all IATs and of visual stimuli representing the different design dimensions.











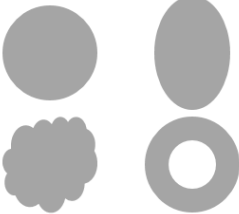


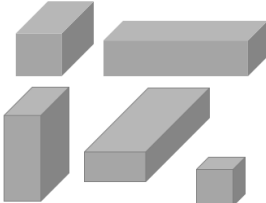
Word stimuli: The target stimuli for all IATs included six words associated with healthiness (*sporty, active, fit, happy, fresh, relaxed*) and another six words associated with unhealthiness

(*sick, pale, stressful, painful, lazy, fat*; Karnal et al., 2016). The words were presented in white typeface on black background. Note that the words “pale” and “fresh” were not included in IAT 1 (light versus dark colors) and the word “fat” was not included in IAT 3 (thin versus thick shapes) to avoid confusion during categorization. As Nosek, Greenwald, and Banaji (2005) established reliable IAT effects with a minimum of two stimuli per target category and three stimuli per attribute category, no replacement of the excluded word stimuli was necessary.

Visual stimuli: The attribute stimuli included images of eight to ten stimuli representing each design dimension in its high and low manifestation. The stimuli were deliberately kept as abstract and simple as possible. Table 1 summarizes all utilized stimuli per IAT. For IAT 1, five light and five dark colored circles were developed modifying the lightness of the unique, elementary chromatic hues red (HSL²=0/255/128), green (HSL = 85/255/128), blue (HSL = 170/255/128), and yellow (HSL = 42/255/128) as well as the achromatic color grey (HSL = 170/0/128; Hering, 1964). This was achieved by keeping the hue and the saturation level constant, while the lightness level was increased or decreased by 30% resulting in light colors (HSL = x/x/204) and dark colors (HSL = x/x/51), respectively. We used multiple hues to exclude hue-based bias during the categorization process (Tijssen et al., 2017). The colored circles were presented on black background. For IAT 2, four round (e.g., a circle) and four angular (e.g., a square) shapes were designed using an imaging program. For IAT 3, five thin and five thick shapes were designed by “thinning” down either the height or width of standard voluminous cuboid boxes. Given that verticality in an object corresponds with concepts of “good” (when up) or “bad” (when down; Meier, Sellbom, & Wygant, 2007) and because lateral positioning can influence preferences for healthy choices (Romero & Biswas, 2016), thin and thick shapes of IAT 3 included stimuli that were vertically as well as horizontally oriented to reduce possible bias due to shape orientation. All stimuli were presented on black background.

² HSL stands for hue, which represents the degree on the color wheel from 0 to 360 – 0 is red, 120 is green, 240 is blue. Saturation as well as lightness represent a percentage value, where for saturation 0% constitutes a shade of grey and 100% goes up to full color. For lightness 0% represents black and 100% white.

Table 1: Visual stimuli for each category of the three design attributes used in the multi-dimensional Implicit Association Test.

Design attributes	Attribute category 1	Attribute category 2
IAT 1 Light versus dark colors	 Yellow: (HSL = 42/255/204)	 Yellow: (HSL = 42/255/51)
	 Green: (HSL = 85/255/204)	 Green: (HSL = 85/255/51)
	 Red: (HSL=0/255/204)	 Red: (HSL=0/255/51)
	 Blue: (HSL = 170/255/204)	 Blue: (HSL = 170/255/51)
	 Grey: (HSL=170/0/204)	 Grey: (HSL=170/0/51)
IAT 2 Round versus angular shapes		
	Size: 5.00 cm x 5.00 cm (oval shape: 4.00 cm x 6.00 cm) Color: 50% grayscale (RGB=165/165/165; HSL=170/0/165)	
IAT 3 Thin versus thick shapes		
	Color: 50% grayscale (RGB=165/165/165; HSL=170/0/165)	

2.1.3 Procedure

Following the standard 7-block procedure developed by Greenwald et al. (1998; 2003), each IAT began with 20 practice trials followed by 40 trials in critical blocks. In each trial, participants assigned a focal stimulus (i.e., either a word or a visual design stimulus) presented in the center of the computer screen as fast and as accurate as possible into a category (i.e., healthy or unhealthy; round or angular, thin or thick, light or dark), displayed either on the upper left or the upper right corner of the screen. Actual categorization was done by pressing the “E” key (for categories presented in the upper left corner) or the “I” key (for categories in the upper right corner). Response latencies were recorded as the time (in milliseconds) elapsed between the stimulus appearing on screen and the participant pressing the correct categorization key. Incorrect categorization was indicated by a red “X” flashing on the screen along with instructions for participants to try again and submit the correct answer in order to proceed. The

critical blocks required participants to (1) categorize congruent combinations of the target categories (e.g., for IAT 1: healthy word – light color or unhealthy word – dark color) and (2) categorize incongruent combinations of the categories (healthy word – dark color or unhealthy word – light color, see Table 2 for an example procedure of IAT 1).

Table 2: Order of blocks and response mappings for participants who did congruent blocks first (example from IAT 1)

Block		N trials	Left key	Right key
1	Practice 1	20	Healthy word	Unhealthy word
2	Practice 2	20	Light color	Dark color
3	Congruent 1	40	Healthy word + Light color	Unhealthy word + Dark color
4	Congruent 2	40	Healthy word + Light color	Unhealthy word + Dark color
5	Practice 3	20	Unhealthy word	Healthy word
6	Incongruent 1	40	Unhealthy word + Light color	Healthy word + Dark color
7	Incongruent 2	40	Unhealthy word + Light color	Healthy word + Dark color

After completing the IATs participants provided data on their age and gender. The order of IATs was randomized and the sequence of congruent and incongruent blocks was counterbalanced across participants (Gattol et al., 2011). Between IATs, participants were given short breaks to relax and regain focus. Overall, each experimental session lasted for approximately 15 minutes.

2.2 Results

Data analysis followed Greenwald et al.'s (2003) instructions for calculating a scoring algorithm, the D-score. Specifically, only correct responses and trials with response latencies between 300 and 10,000 ms were included. The D-score is calculated by dividing the difference in the average response times between congruent and incongruent blocks by the overall standard deviation. As such, positive D-scores indicate strong associations for congruent trials, i.e., between healthiness and light, round, and thin designs. In contrast, negative scores indicate associations between healthiness and dark, angular, and thick designs.

IAT 1: Congruent combinations of healthy (unhealthy) words and light (dark) colors yielded significantly faster response latencies ($M = 726.33$ ms, $SD = 118.98$) compared to the incongruent combinations of healthy word and dark colors ($M = 1043.63$ ms, $SD = 214.64$; $t(29) = 9.45$, $p < .001$). Consequently, the calculated D-score was strong and significant ($D = .78$, $SD = .03$; $t(29) = 14.14$, $p < .001$). Thus, results indicated that participants have strong implicit associations between light colors and healthiness as well as between dark colors and unhealthiness.

IAT 2: Mean response latencies for pairing round and angular shapes with healthiness clearly demonstrated that round shapes were more easily paired with healthiness than angular shapes, since response latencies were significantly faster for congruent trials ($M = 706.88$ ms, $SD = 119.15$) than for incongruent trials ($M = 987.36$ ms, $SD = 273.68$; $t(29) = -6.90$, $p < .001$). This is confirmed by a strong D-score ($D = .69$, $SD = .31$) that differs from zero ($t(29) = 12.36$, $p < .001$), indicating automatic round-healthy and angular-unhealthy associations.

IAT 3: For pairing thin and thick shapes with healthiness, mean response latencies were slightly faster for the congruent trials ($M = 787.21$ ms, $SD = 129.16$) than for the incongruent trials ($M = 855.39$ ms, $SD = 242.22$; $t(29) = 1.62$, $p = .117$), indicating that participants associated thin (thick) shapes faster with healthiness (unhealthiness) and vice versa. However, the D-score was small ($D = .14$, $SD = .51$), covered a relatively wide range ($-.90$ to 1.38), and did not differ from zero ($t(29) = 1.51$, $p = .142$). Accordingly, no specific healthiness associations with thin or thick shape surfaced.

2.3 Discussion

Study 1 investigated whether automatic healthiness associations exist for three fundamental design features. The results suggest a fundamental link between design features and the general concept of healthiness. More precisely, lighter colors and round shapes were more easily associated with the concept of general healthiness than with unhealthiness, whereas angular shapes and dark colors were associated with unhealthiness. This finding extends previous research on valence effects of these design features by showing that visual cues can be automatically associated with the general concept of healthiness, despite these cues being presented in an abstract manner void of context. The findings advance research showing that color lightness and shape roundness are related to positive valence associations (Bar & Neta, 2006; Meier et al., 2004), whereas darkness and angularity yield negative associations.

Notably, a shape's thinness or thickness seems not implicitly linked with healthiness. This indicates that previous research showing positive bias towards thinness or healthiness inferences based on slim models or slim packages (Chrysochou & Nikolakis, 2012; Roddy et al., 2010; Schwartz et al., 2006; van Ooijen et al., 2017) may indeed depend on (food) context effects, and thus are not caused by abstract shapes in general. However, a reason for failing to find effects might be the abstract nature of the stimuli. Admittedly, these were very far off from being visually associated with actual human body shapes. Due to this, we will not follow up on the design feature shape thinness/thickness. We will, however, look into whether the two other design elements (i.e., shape and color) still are able to communicate healthiness when applied

to actual product packaging, Study 2, therefore, will examine effects of color lightness and shape roundness/angularity in food package design on product healthiness perception.

3. Study 2

The aim of Study 2 is to test whether the fundamental associations established in Study 1 can be replicated when design features are put into context, such as a food package's design. While previous research hints at that possibility, Study 2 additionally investigates whether effects can be explained through design-induced perception, that is, the question whether food in a round package is perceived to be healthier due to the fact that the package *itself* is perceived to be rounder. As Fenko et al. (2016) found that congruency between product type (healthy vs. unhealthy) and design elements affects product healthiness, the current study aims at investigating effects for a healthy and an unhealthy product.

3.1 Method

3.1.1 Participants







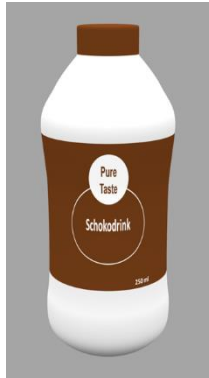

A total of two hundred and seventy-seven German consumers (170 females, $M_{Age} = 29.62$, $SD = 8.84$) were recruited via social media and from an online consumer panel. All participants reported normal or corrected-to-normal vision and no color blindness.

3.1.2 Design and Stimuli

Study 2 employed a 2 (package color: light vs. dark) x 2 (package shape: round vs. angular) x 2 (product: healthy versus unhealthy) between-subjects experimental design. As consumers generally perceive fruits to be healthier than chocolate (Ronteltap, Sijtsema, Dagevos, & Winter, 2012), a strawberry drink was chosen to represent the healthy product and a chocolate drink to represent the unhealthy product. This approach enables comparing a healthy with an unhealthy product from the same category: Dairy drinks. Using the open source 3D creation software BlenderTM, eight visuals of the fictitious brand “Pure Taste” were designed (see Table 3 for stimulus overview). For that matter, two plain drink packages were created to differ in their roundness and angularity, but to be identical in volume, and size. These packages were used as basis to apply a label and a cap in a light and dark color. To reinforce the shape manipulation, the round (angular) bottle additionally carried round (angular) label elements. A color hue similar to a strawberry red (HSL: 1/208/128) was chosen for the strawberry drink and a chocolate brown (HSL: 17/170/128) for the chocolate drink. The lightness value for both colors was kept at 50%. Similar to Study 1, a light color was achieved by increasing the

lightness value by 25% and decreased by 25% to result in a dark color. All packages were labeled to contain an identical volume of 250 ml. All stimuli were displayed on 50% grayscale background (HSL 170/0/165).

Table 3: Stimulus overview for Study 2.

		Color lightness			
		light		Dark	
Product category		Package design shape			
		round	angular	round	angular
Healthy (strawberry drink)					
	HSL: 1/208/191		HSL: 1/208/64		
Unhealthy (chocolate drink)					
	HSL: 17/170/191		HSL: 17/170/64		

3.1.3 Procedure and measures

Participants were randomly assigned to one of the eight treatments. After viewing the visual, participants submitted information on the manipulation check, the control variables, the dependent measures, and personal information regarding age and gender.

To measure perceived color lightness and shape roundness/angularity, participants indicated how they perceived the package color and shape on the semantic differentials *light (1)—dark (7)*, and *round (1)—angular (7)*, respectively. As previous research has used generic (Fenko et al., 2016; Mai et al., 2016; van Ooijen et al., 2017) as well as ingredient-related product-specific healthiness measures (Karnal et al., 2016, Yarar et al., 2017, 2017), we will apply both measures to establish whether effects relate to both or only one of these measures. To assess product-specific healthiness, participants rated the presented drink related to ingredient-content that is relevant for the utilized product category: *healthy, low in calories, low in sugar, low in fat, natural, high in vitamins*, and *light* ($\alpha = .78$). Following and extending Provencher, Polivy, and Herman (2009) and Fenko et al. (2016), generic product healthiness was measured through the items: *I consider this drink appropriate in a healthy menu, I would consider this drink healthy for me, This drink looks healthier than similar drinks, and I have an impression that this drink is healthy* ($\alpha = .87$). Unless stated otherwise, measures were rated on 7-point Likert scales, ranging from 1 (strongly disagree) to 7 (strongly agree).

3.2 Results

3.2.1 Influence of package color and shape

To test the influence of package color, shape and product category on consumer perception of the package color and shape as well as on product specific and generic healthiness, a 3-way multivariate analysis of variance (MANOVA) was conducted. Table 4 summarizes the results. The results show a significant main effect of package color on color lightness perception with the light colored package being perceived as lighter ($M = 2.60$, $SD = 1.23$) than the dark colored package ($M = 4.50$, $SD = 1.56$). Package color also exhibited a main effect on roundness perception, where the light colored package yielded slightly rounder perceptions ($M = 3.54$, $SD = 1.84$) as the dark package ($M = 4.05$, $SD = 1.90$). Package shape exhibited a significant main effect on roundness perception. The package with rounded design elements was perceived as rounder ($M = 2.51$, $SD = 1.21$), whereas the angular package was perceived as more angular ($M = 5.06$, $SD = 1.55$). As intended the product category yielded a significant main effect on product-specific healthiness with the healthy product leading to higher healthiness perceptions

($M = 3.19$, $SD = 1.02$) than the unhealthy product ($M = 2.79$, $SD = 1.00$). However, no main effect on generic product healthiness was found. There was only one significant interaction effect between package color and package shape on the shape perception. The light, round package was perceived as the roundest ($M = 2.41$, $SD = 1.20$), followed by the dark, round package ($M = 2.60$, $SD = 1.22$), while the dark, angular package was judged as the one most angular ($M = 5.52$, $SD = 1.21$), closely followed by the light, angular package ($M = 4.63$, $SD = 1.70$). The three-way interaction effect package color x package shape x product category on generic product healthiness was significant. Within the healthy product category the round, light package was perceived as least healthy ($M = 2.04$, $SD = 1.37$), whereas the light, angular package was judged the healthiest ($M = 2.75$, $SD = 1.20$). Regarding the unhealthy product, the dark, round package yielded the lowest ($M = 2.36$, $SD = 0.93$) and the light, round package the highest healthiness evaluations ($M = 3.01$, $SD = 1.53$). No other differences were significant.

Table 4: Statistics of MANOVA with package color lightness, package shape roundness and product category as independent factors.

	Color perception		Shape perception		Generic product healthiness perception		Product-specific healthiness perception	
	F	η_p^2	F	η_p^2	F	η_p^2	F	η_p^2
Color lightness (CL)	127.41***	.32	11.10***	.04	.38	.00	.84	.00
Shape roundness (SR)	.34	.00	245.67***	.48	.71	.00	.02	.00
Product category (PC)	.93	.00	.38	.00	1.30	.00	10.92***	.04
CL * SR	.35	.00	4.56*	.02	.05	.00	.29	.00
CL * PC	.02	.00	.01	.00	2.63	.01	2.72	.01
SR * PC	1.04	.00	.72	.00	1.78	.01	2.29	.01
CL * SR * PC	1.26	.01	.71	.00	5.14*	.02	2.45	.01

3.2.2 Investigating conditional effects of perceived color lightness and shape roundness

To test whether package color and package shape manipulations effects on perceived color lightness and shape roundness spill over to product healthiness, four simple mediation analyses were conducted, two for specific healthiness and two for generic product healthiness (Hayes, 2015). All models controlled for product category and the respective other manipulation. Regarding package color, results of the bias-corrected bootstrapping procedure (10,000 samples) yielded significant indirect effects of package color manipulation via color lightness perception on generic ($B = -.39$, $CI_{95} = -.638$ to $-.183$) and product specific healthiness perception ($B = -.30$, $CI_{95} = -.494$ to $-.127$). For both models the light color manipulation (coded: 0 = light, 1 = dark) yielded a significantly lighter color perception ($B = 1.91$, $t = 11.31$, $p < .001$), which subsequently lead to healthier product perceptions (specific: $B = -.15$, $t = -3.63$, $p < .001$; generic: $B = -.20$, $t = -3.74$, $p < .001$). Regarding the mediating role of package

shape, bias-corrected bootstrapping procedure (10,000 samples) showed that the effect of package shape manipulation (coded: 0 = round, 1 = angular) can be explained through perceived package roundness for generic product healthiness ($B = -.32$, $CI_{95} = -.597$ to $-.017$). The package with rounded elements was perceived as significantly rounder ($B = 2.56$, $t = 15.59$, $p < .001$), which in turn resulted in higher healthiness perceptions of the product ($B = -.12$, $t = -2.19$, $p = .029$). The 95 % CI of the indirect effect through the mediator did include zero for product specific healthiness ($CI_{95} = -.412$ to $.037$).

3.3 Discussion

Study 2 findings provide further support for the importance of design elements as cues to healthiness in food package design. The results clarify that both color and shape on food packages do not influence perceived product healthiness directly, but exert their influence by impacting the perception of packages. Similar to Study 1, a product in a package perceived to be of lighter color was perceived as healthier, whereas a darker colored package perception reduced perceived healthiness. These findings are in line with research showing color lightness to serve as a food health cue (Mai et al., 2016; Tijssen et al., 2017). Along the same lines, the rounder a package is perceived, the higher the healthiness evaluations of its content, but only regarding the perceived generic product healthiness.

The three-way interaction of package color, package shape, and product type reveals an unexpected effect. The packages that yielded the highest and the lowest healthiness perceptions for the healthy product, respectively, were both light in color, but round (healthiest) and angular (unhealthiest) in shape, thus indicating that package shape might drive healthiness perceptions for the healthy product type, but in opposite directions compared to the main effect. For the unhealthy product, the healthiest and unhealthiest combination were both round, but light (healthiest) and dark (unhealthiest) colored, thus here package color seems to drive the effect.

4. General discussion

Extending recent investigations on the role of visual health cues in food package design, the current research explored design effects of color lightness, shape roundness/angularity, and shape thinness/thickness on general healthiness associations and food healthiness perception. In Study 1, during a series of three IAT experiments participants associated general healthiness with light colors and round shapes, whereas unhealthiness was linked with dark colors and angular shapes. No clear effects emerged between healthiness and thin versus thick shapes. Building forth on these findings, Study 2 utilized light and dark colors as well as rounded and

angular shapes on food package design for a healthy and an unhealthy product to show that explicitly light colors and round shapes also yield increased product healthiness perceptions.

4.1 Theoretical and practical implications

The current findings add to and extend previous findings in several ways. First, literature on general valence associations with different design features did not include health effects. Using a variety of implicit measures, past research implicitly linked stimuli that were big in size, light in color, up in space, had high-pitched tones, and had round shapes with positivity or morality (Banerjee et al., 2012; Crawford, 2009, Meier & Robinson, 2004, 2004; Meier et al., 2008; Meier et al., 2004; Sherman & Clore, 2009). This work extends this literature by showing that abstract shapes differing in their color lightness vs. darkness, and shape roundness vs. angularity also evoke associations towards the concept of general healthiness and unhealthiness, respectively. Specifically, a design's color lightness and shape roundness yield associations with healthiness which directly extends findings on positive valence associated with these two design features (Meier et al., 2004; Meier et al., 2007; Palumbo et al., 2015). However, Study 1 could not transfer findings from research on valence of human body effects to healthiness associations with abstract designs representing thin and thick shapes. This might be attributable to the current choice of shapes that did not resemble a human body shape as they consisted of simple and abstract cuboid boxes. This is in line with results from Joseph et al. (2016) who demonstrated an attentional bias towards thin human body shapes, but failed to replicate the same bias for thin (vs. thick) objects, such as buildings. In addition, the methodological choice of using vertically and horizontally oriented shapes might have biased the current results as they further reduced resemblance to human body shapes.

Second, the results supplement and validate studies examining visual health cues in package design. Previous research has investigated effects of typefaces (Karnal et al., 2016), color hue (Genschow, Reutner, & Wänke, 2012), color lightness (Mai et al., 2016; Tijssen et al., 2017), location of product visual (Deng & Kahn, 2009), and package shape (Fenko et al., 2016; van Ooijen et al., 2017; Yarar et al., 2017) on the perceived product healthiness. To date, only two studies examined the effects of light-colored food packages on food healthiness evaluation and consistently found light colors to be preferred for healthy product communication (Mai et al., 2016; Tijssen et al., 2017). Findings from Study 1 and 2 support healthiness associations with light colors, implicitly and explicitly as well as for generic and product-specific healthiness. To date, the one study investigating rounded versus angular package design found angularity causing increased healthiness perceptions (Fenko et al., 2016). Implicitly and explicitly, our

results could not corroborate this effect direction. However, Fenko et al. (2016) investigated an angular slim shape versus a round thick shape, disabling them to disentangle design effects. Our results indicate that their findings might be explained through shape thinness/thickness. Furthermore, we find the effects of shape roundness via roundness perception on healthiness to depend on the utilized healthiness measure. Only the generic product healthiness measure that is more subject to subjective perceptions—as it is assessed based on questions such as *I would consider this drink healthy for me*—is influenced by the perceived package shape. Product-specific healthiness which is based on the actual ingredient evaluation is not affected. This alerts researcher to effects of measurement issues and the relevance of including multiple measures. More importantly, our results extend previous works by showing how design-induced perceptions are antecedents of health inferences. In sum, the results from the current work bridge the gap between design-induced valence associations and product design research that applies these features to food packages in order to alter health inferences.

Third, our results offer further insights into possible congruence effects of multiple visual cues in the context of different product types. The three-way interaction of Study 2 revealed that congruence effects seem to depend on whether these design characteristics are applied on a healthy or on an unhealthy product, albeit this effect being rather small. When a healthy product is packaged in a light colored bottle, the use of additional rounded or angular elements yields differences in health perceptions. Unexpectedly and contrasting the overall findings, angular designs increased healthiness perceptions, whereas rounded design decreased healthiness perceptions for the healthy product. In a dark colored package these design features make no difference. For the unhealthy product a round package design leads to the highest and lowest healthiness evaluations depending on color lightness. In line with lightness being a health cue, the light package relates to the healthiest evaluation. Within the angular package design no differences depending on color lightness surfaced. Although we acknowledge that three-way interactions are notoriously susceptible for false-positive results (Forstmeier, Wagenmakers, & Parker, 2016) and the small effect size of our findings, future research might investigate this matter more extensively.

From a managerial or public health perspective findings are highly relevant as they further emphasize the potential of utilizing visual cues to nudge consumers towards the desired choice. Generally, the use of light colors and rounded design elements triggers healthiness associations for food products, which are known to subsequently increase purchase intention (Karnal et al., 2016). Conclusively, our findings have two strong practical implications. On the one hand, they

enable practitioners to make better choices in designing effective health communications, either regarding packaging healthy foods or designing successful health campaigns. On the other hand, they also empower consumers by alerting them of their susceptibility to subtle visual cues impacting their judgments, and thus urging them into considering more direct health cues to make an informed and healthy choice in the supermarket.

4.2 Limitations and avenues for future research

The design of our stimuli limits the representativeness of our findings as we used fictional and non-realistic stimuli representing only two product categories. Similarly, since findings from Tijssen et al. (2017) point out that a combination of all three color factors (hue, saturation and lightness) might play a role in product evaluation, our findings are limited to effects of color lightness. Additionally, colors are known to differ in more aspects than their lightness. For instance they vary regarding their warmth (Sharpe, 1974), arousal (Küller, Mikellides, & Janssens, 2009), and perceived weight (Karnal et al., 2016; Pinkerton & Humphrey, 1974). Especially color warmth and arousal are mainly influenced by color hue which was kept constant within one product category, therefore bias should be minimal. Nonetheless, as the current study does not account for these characteristics, a possible bias in our results cannot be excluded. Therefore, findings should be interpreted with care and conclusions should not be overextended. Future studies are advised to include these variables to control for their influence and validate the investigated effect in a more controlled setting.

Previous investigations have shown that effects of visual health cues in package design strongly depend on individual characteristics, such as general food interest (Fenko et al., 2016), health regulatory focus (Karnal et al., 2016), health goals, or the need for making heuristic inferences (Mai et al., 2016). In the current work, no individual characteristics have been taken into account. Therefore, future studies are advised to identify boundary conditions to enhance the evidence base. Lastly, visual health cues have been shown to have detrimental effects on taste experiences (Mai et al., 2016), as healthiness is—at least in consumers' minds—linked with negative taste impressions (Raghunathan, Naylor, & Hoyer, 2006). Thus, further downstream effects might be affected by the application of visual health cues in design which could be explored more extensively in research to come.

References

- Arno, A., & Thomas, S. (2016). The efficacy of nudge theory strategies in influencing adult dietary behaviour: a systematic review and meta-analysis. *BMC public health*, *16*, 676. doi:10.1186/s12889-016-3272-x
- Banerjee, P., Chatterjee, P., & Sinha, J. (2012). Is it light or dark? Recalling moral behavior changes perception of brightness. *Psychological Science*, *23*(4), 407–409. doi:10.1177/0956797611432497
- Bar, M., & Neta, M. (2006). Humans prefer curved visual objects. *Psychological Science*, *17*(8), 645–648. doi:10.1111/j.1467-9280.2006.01759.x
- Brunner, T. A., & Siegrist, M. (2012). Reduced food intake after exposure to subtle weight-related cues. *Appetite*, *58*(3), 1109–1112. doi:10.1016/j.appet.2012.03.010
- Bucher, T., Collins, C., Rollo, M. E., McCaffrey, T. A., Vlieger, N. de, van der Bend, D., . . . Perez-Cueto, F. J. A. (2016). Nudging consumers towards healthier choices: a systematic review of positional influences on food choice. *The British journal of nutrition*, *115*(12), 2252–2263. doi:10.1017/S0007114516001653
- Chrysochou, P., & Nikolakis, G. (2012). Breaking down the stereotypes in advertising of healthy foods. *ANZMAC 2012 Conference*,
- Crawford, L. E. (2009). Conceptual metaphors of affect. *Emotion Review*, *1*(2), 129–139. doi:10.1177/1754073908100438
- Deng, X., & Kahn, B. (2009). Is your product on the right side? The "location effect" on perceived product heaviness and package evaluation. *Journal of Marketing Research*, *XLVI*, 725–738.
- Dillard, J. P., & Shen, L. (2005). On the nature of reactance and its role in persuasive health communication. *Communication Monographs*, *72*(2), 144–168. doi:10.1080/03637750500111815
- Fenko, A., Lotterman, H., & Galetzka, M. (2016). What's in a name? The effects of sound symbolism and package shape on consumer responses to food products. *Food Quality and Preference*, *51*, 100–108. doi:10.1016/j.foodqual.2016.02.021
- Forstmeier, W., Wagenmakers, E.-J., & Parker, T. H. (2016). Detecting and avoiding likely false-positive findings - a practical guide. *Biological reviews of the Cambridge Philosophical Society*. doi:10.1111/brv.12315
- Friese, M., Hofmann, W., & Wänke, M. (2008). When impulses take over: moderated predictive validity of explicit and implicit attitude measures in predicting food choice and consumption behaviour. *The British journal of social psychology*, *47*(Pt 3), 397–419. doi:10.1348/014466607X241540
- Gattol, V., Sääksjärvi, M., Carbon, C.-C., & Hempel, S. (2011). Extending the Implicit Association Test (IAT): Assessing consumer attitudes based on multi-dimensional implicit associations. *PloS one*, *6*(1), e15849. doi:10.1371/journal.pone.0015849
- Genschow, O., Reutner, L., & Wänke, M. (2012). The color red reduces snack food and soft drink intake. *Appetite*, *58*(2), 699–702. doi:10.1016/j.appet.2011.12.023
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, *74*(6), 1464. doi:10.1037/0022-3514.74.6.1464
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: An improved scoring algorithm. *Journal of Personality and Social Psychology*, *85*(2), 197. doi:10.1037/0022-3514.74.6.1464

- Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behavioral Research, 50*(1), 1–22. doi:10.1080/00273171.2014.962683
- Hering, E. (1964). *Outlines of a theory of the light sense*. Cambridge, MA, US: Harvard University Press.
- Joseph, C., LoBue, V., Rivera, L. M., Irving, J., Savoy, S., & Shiffrar, M. (2016). An attentional bias for thin bodies and its relation to body dissatisfaction. *Body image, 19*, 216–223. doi:10.1016/j.bodyim.2016.10.006
- Karnal, N., Machiels, C. J., Orth, U. R., & Mai, R. (2016). Healthy by design, but only when in focus: Communicating non-verbal health cues through symbolic meaning in packaging. *Food Quality and Preference, 52*, 106–119. doi:10.1016/j.foodqual.2016.04.004
- Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference, 20*(2), 70–82. doi:10.1016/j.foodqual.2007.11.002
- Küller, R., Mikellides, B., & Janssens, J. (2009). Color, arousal, and performance-A comparison of three experiments. *Color Research & Application, 34*(2), 141–152. doi:10.1002/col.20476
- Labrecque, L. I., Patrick, V. M., & Milne, G. R. (2013). The marketers' prismatic palette: A review of color research and future directions. *Psychology & Marketing, 30*(2), 187–202. doi:10.1002/mar.20597
- Leder, H., & Carbon, C.-C. (2005). Dimensions in appreciation of car interior design. *Applied Cognitive Psychology, 19*(5), 603–618. doi:10.1002/acp.1088
- Mai, R., Hoffmann, S., Hoppert, K., Schwarz, P., & Rohm, H. (2015). The spirit is willing, but the flesh is weak: The moderating effect of implicit associations on healthy eating behaviors. *Food Quality and Preference, 39*, 62–72. doi:10.1016/j.foodqual.2014.06.014
- Mai, R., Symmank, C., & Seeberg-Elverfeldt, B. (2016). Light and pale colors in food packaging: When does this package cue signal superior healthiness or inferior tastiness? *Journal of Retailing*. doi:10.1016/j.jretai.2016.08.002
- Makin, A. D. J., & Wuerger, S. M. (2013). The IAT shows no evidence for Kandinsky's color-shape associations. *Frontiers in psychology, 4*, 616. doi:10.3389/fpsyg.2013.00616
- McClelland, J. L. (1988). Connectionist models and psychological evidence. *Journal of Memory and Language, 27*(2), 107–123. doi:10.1016/0749-596X(88)90069-1
- Meier, B. P., & Robinson, M. D. (2004). Why the sunny side is up: Associations between affect and vertical position. *Psychological Science, 15*(4), 243–247. Retrieved from <http://pss.sagepub.com/content/15/4/243.short>
- Meier, B. P., Robinson, M. D., & Caven, A. J. (2008). Why a Big Mac is a good mac: Associations between affect and size. *Basic and Applied Social Psychology, 30*(1), 46–55. doi:10.1080/01973530701866516
- Meier, B. P., Robinson, M. D., & Clore, G. L. (2004). Why good guys wear white: Automatic inferences about stimulus valence based on brightness. *Psychological Science, 15*(2), 82–87. doi:10.1111/j.0963-7214.2004.01502002.x
- Meier, B. P., Robinson, M. D., Crawford, L. E., & Ahlvers, W. J. (2007). When "light" and "dark" thoughts become light and dark responses: affect biases brightness judgments. *Emotion, 7*(2), 366. Retrieved from <http://psycnet.apa.org/journals/emo/7/2/366/>
- Meier, B. P., Sellbom, M., & Wygant, D. B. (2007). Failing to take the moral high ground: Psychopathy and the vertical representation of morality. *Personality and Individual Differences, 43*(4), 757–767. doi:10.1016/j.paid.2007.02.001
- Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin, 31*(2), 166–180.

Retrieved from <http://psp.sagepub.com/content/31/2/166.short>

- Palumbo, L., Ruta, N., & Bertamini, M. (2015). Comparing angular and curved shapes in terms of implicit associations and approach/avoidance Responses. *PloS one*, *10*(10), e0140043. doi:10.1371/journal.pone.0140043
- Pinkerton, E., & Humphrey, N. K. (1974). The apparent heaviness of colours. *Nature*, *250*(5462), 164–165. doi:10.1038/250164a0
- Provencher, V., Polivy, J., & Herman, C. P. (2009). Perceived healthiness of food. If it's healthy, you can eat more! *Appetite*, *52*(2), 340–344. doi:10.1016/j.appet.2008.11.005
- Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy= tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing*, *70*(4), 170–184.
- Roddy, S., Stewart, I., & Barnes-Holmes, D. (2010). Anti-fat, pro-slim, or both? Using two reaction-time based measures to assess implicit attitudes to the slim and overweight. *Journal of Health Psychology*, *15*(3), 416–425. doi:10.1177/1359105309350232
- Romero, M., & Biswas, D. (2016). Healthy-left, unhealthy-right: Can displaying healthy items to the left (versus right) of unhealthy items nudge healthier choices? *Journal of Consumer Research*, *43*(1), 103–112. doi:10.1093/jcr/ucw008
- Ronteltap, A., Sijtsma, S. J., Dagevos, H., & Winter, M. A. de. (2012). Construal levels of healthy eating. Exploring consumers' interpretation of health in the food context. *Appetite*, *59*(2), 333–340. doi:10.1016/j.appet.2012.05.023
- Schwartz, M. B., Vartanian, L. R., Nosek, B. A., & Brownell, K. D. (2006). The influence of one's own body weight on implicit and explicit anti-fat bias. *Obesity (Silver Spring, Md.)*, *14*(3), 440–447. doi:10.1038/oby.2006.58
- Selinger, E., & Whyte, K. (2011). Is there a right way to nudge?: The practice and ethics of choice architecture. *Sociology Compass*, *5*(10), 923–935. doi:10.1111/j.1751-9020.2011.00413.x
- Sharpe, D. T. (1974). *The Psychology of Color and Design*. Chicago, IL: Nelson-Hall Company.
- Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*, *32*(5), 460–473. doi:10.1037/a0029203
- Sherman, G. D., & Clore, G. L. (2009). The color of sin: white and black are perceptual symbols of moral purity and pollution. *Psychological Science*, *20*(8), 1019–1025. doi:10.1111/j.1467-9280.2009.02403.x
- Silayoi, P., & Speece, M. (2004). Packaging and purchase decisions. *British Food Journal*, *106*(8), 607–628. doi:10.1108/00070700410553602
- Singh, D. (1993). Adaptive significance of female physical attractiveness: Role of waist-to-hip ratio. *Journal of Personality and Social Psychology*, *65*(2), 293–307. doi:10.1037/0022-3514.65.2.293
- Tijssen, I., Zandstra, E. H., Graaf, C. de, & Jager, G. (2017). Why a 'light' product package should not be light blue: Effects of package colour on perceived healthiness and attractiveness of sugar- and fat- reduced products. *Food Quality and Preference*, *(59)*, 46–58. doi:10.1016/j.foodqual.2017.01.019
- van Ooijen, I., Fransen, M. L., Verlegh, P. W. J., & Smit, E. G. (2017). Signalling product healthiness through symbolic package cues: Effects of package shape and goal congruence on consumer behaviour. *Appetite*, *109*, 73–82. doi:10.1016/j.appet.2016.11.021

- Welborn, T. A., Dhaliwal, S. S., & Bennett, S. A. (2003). Waist-hip ratio is the dominant risk factor predicting cardiovascular death in Australia. *The Medical journal of Australia*, 179(11-12), 580–585.
- Westerman, S. J., Gardner, P. H., Sutherland, E. J., White, T., Jordan, K., Watts, D., & Wells, S. (2012). Product design: Preference for rounded versus angular design elements. *Psychology and Marketing*, 29(8), 595–605. doi:10.1002/mar.20546
- WHO. (2015a). *Healthy Diet*.
Retrieved from <http://www.who.int/mediacentre/factsheets/fs394/en/>
- WHO. (2015b). *Noncommunicable diseases: Fact sheet*.
Retrieved from <http://www.who.int/mediacentre/factsheets/fs355/en/>
- WHO. (2016). *Obesity and overweight: Fact sheet*.
Retrieved from <http://www.who.int/mediacentre/factsheets/fs311/en/>
- Wilson, A. L., Buckley, E., Buckley, J. D., & Bogomolova, S. (2016). Nudging healthier food and beverage choices through salience and priming. Evidence from a systematic review. *Food Quality and Preference*, 51, 47–64. doi:10.1016/j.foodqual.2016.02.009
- Yarar, N., Machiels, C. J., & Orth, U. R. (2017). Shaping up: How food package and consumer body conspire to affect product healthiness perception. *unpublished research*.

Chapter 4

Healthy by design, but only when in focus: Communicating non-verbal health cues through symbolic meaning in packaging

Nadine Karnal

Casparus J. A. Machiels

Ulrich R. Orth

Robert Mai

This contribution is published in *Food Quality and Preference*, Volume 52, pages 106-119.

<https://doi.org/10.1016/j.foodqual.2016.04.004>

Abstract

The visual design of food packages can activate heuristic inferences which in turn shape consumer perception and judgment of salient content. Focusing on two core design elements (typeface and color), this paper demonstrates that visual cues conveying weight (or a lack thereof) influence consumers' healthiness perceptions, explicitly as well as implicitly. Study 1 reveals that package design elements that differ in weight perception evoke divergent health perceptions of a soft drink. This effect is moderated by consumers' health promotion focus for typeface, but not for color. Following up on this finding, Study 2 elaborates on the typeface manipulation using an Implicit Association Test to show that the interaction between health promotion focus and typeface weight accounts for implicit associations between sugary foods and healthiness. Together, the two studies provide initial evidence for the influence of design cues differing in heaviness on food healthiness perceptions. The findings add to the literature on health perception and attest to the importance of package design for influencing consumer responses.

Keywords: symbolic design, explicit, healthiness, IAT, implicit

1. Introduction

Recent years have witnessed a steady increase in researcher interest in obesity prevalence (Swinburn et al., 2011). Perhaps not coincidentally, reports of subtle food marketing techniques have also increased (Kitchen & Schultz, 2009; Jackson, Harrison, Swinburn, & Lawrence, 2014), which are thought to be a prime contributor to obesity (Nestle & Nesheim, 2012). By referring to labels, brand names, price level, promotion, or the design of a product's package, consumers intuitively assign food into categories such as 'healthy' and 'unhealthy' (Chandon & Wansink, 2007). Especially food packages are the ultimate persuasive agent for marketers at the point of sale (Rettie & Brewer, 2000; Orth & Gal, 2014). Yet, marketers do not necessarily know how, and based on what information, consumers judge their products to be more or less healthy.

On the one hand, the evaluation of a product can be influenced directly through package elements, such as nutrition labels (van Herpen, Hieke, & van Trijp, 2013; Vyth et al., 2010) or health labels (Vidal, Antunez, Sapolinski, Gimenez, Mainche, & Ares, 2013). Both have been investigated extensively, but evidence is still scant for an impact on health evaluations, food choice (Aschemann-Witzel et al., 2013), or consumption behavior (Roberto, Shivaram, Martinez, Boles, Harris, & Brownell, 2012). On the other hand, subtle package design elements, such as size, shape, logo, color, and typeface are recognized as effective tools for differentiating products in a crowded marketplace (Chandon, 2013). In particular, a package's visual design can alter consumer perception and preference (Creusen & Schoormans, 2005). More specifically, package design impacts eating experiences (Chandon, 2013; Madzharov & Block, 2010), which can lead to overeating and associated health risks (Dabelea et al., 2014).

Surprisingly, visual package cues that convey symbolic meaning, specifically healthiness, have received little attention. Therefore, the present research focuses on two subtle visual design elements of food packages to show how these cues lead consumers to infer a product's healthiness. Building on and extending research on metaphors (Ackerman, Nocera, & Bargh, 2010; Jostmann, Lakens, & Schubert, 2009), and integrating studies on heaviness perception (Deng & Kahn, 2009), we provide initial evidence for the influence of design characteristics differing in heaviness on food healthiness perception. Using the metaphorical concept of heaviness, we show that the perceived healthiness of a beverage is influenced by the weight of the package's color and (the brand name's) typeface. Moreover, this research demonstrates that the weight of a typeface is capable of influencing the association between sugary foods and

healthiness at an implicit (non-conscious) level. Lastly, the studies highlight the importance of individual factors, such as the consumer's health regulatory focus.

1.1. Package design cues

It is this paper's fundamental premise that food package visuals carry symbolic meaning which trigger weight-related associations. Although they are explicitly unrelated to health, these cues are expected to activate associations that should spill over to judgments of product healthiness which, in turn, guide the purchase decision. This research focuses on two package cues that differ in their ability to attract attention and communicate information, but appear both suitable for conveying symbolic meaning, namely, color and typeface.

1.1.1. Color

Colors on product packages can identify a category or brand, and can reinforce specific meanings, impressions, or associations (Garber, Burke & Jones, 2000). In addition, colors communicate meaning related to a product's origin, function, and taste (Garber, Hyatt, & Starr, 2000; Becker, van Rompay, Schifferstein, & Galetzka, 2011). Beyond their influence on taste perceptions in terms of sweetness and potency (Hine, 1995; Deliza & MacFie, 2001; Becker et al., 2011), colored products vary in their warmth (Fenko, Schifferstein, & Hekkert, 2010) and can influence the perceived warmth of its content (Guéguen & Jacob, 2014). Additionally, colors vary in their ability to generate arousal (Küller, Mikellides, & Janssens, 2009). Most relevant to the current context, colors differ in perceived heaviness; that is, each color has a specific associated `weight` (Payne, 1958; Pinkerton & Humphrey, 1974). Consumer studies assessing the weight of colors are scarce (Labrecque, Patrick, & Milne, 2013), but few studies investigate color-weight relationships to show red and blue to be exemplars of heavy colors, whereas orange and yellow represent lighter colors (Pinkerton & Humphrey, 1974). These findings are in line with research on the psychology of aesthetics in abstract paintings (Locher, Overbeeke, & Stappers, 2005).

1.1.2. Typeface

Typeface is a rather subtle, yet powerful means for companies to encode and communicate a message non-verbally and beyond semantics (Childers & Jass, 2002; Henderson, Giese, & Cote, 2004). Unlike colors, typefaces operate on two levels when communicating with consumers (Drucker, 1994): On one level they convey the literal meaning of the written word (denoted); on a second level they convey an implicit meaning (connoted) as individuals extract symbolism from the visual characteristics of the written material (Childers & Jass, 2002; Henderson et al.,

2004; Doyle & Bottomley, 2006; van Rompay & Pruyn, 2011). For example, typefaces influence brand perception by evoking symbolic associations, such as luxury or casualness (Childers & Jass, 2002; van Rompay & Pruyn, 2011), dynamism and potency (Doyle & Bottomley, 2006), personality (van Rompay & Pruyn, 2011), cultural origin (Celhay, Boyselle, & Cohen, 2015), and taste expectancies (i.e. sweetness or sourness; Velasco, Salgado-Montejo, Marmolejo-Ramos, & Spence, 2014).

Weight is an important dimension in typeface design, consisting of properties including heavy and light, short and fat, tall and thin (Henderson et al., 2004). Given these properties, typefaces should be able to influence heaviness perception. Specifically, a delicate typeface should symbolically convey the concept of *light* and *thin* (Childers & Jass, 2002), whereas a bold typeface should convey the opposing concept of *heavy* and *fat*.

1.2. Lack of heaviness as an indicator of healthiness: A metaphorical perspective

To date, it is unclear whether the heuristic inferences of colors and typeface discussed in section 1.1. will, in fact, spill over to the food product and shape judgments of healthiness. And if so, what is the mechanism by which these cues operate?

In colloquial speech, heaviness is often equated with unhealthiness. Fatty and unhealthy foods are said to ‘lie heavy on the stomach’, they are perceived as ‘filling’, and a whole industry has developed around the opposite concept – ‘light’ products. Lupton (1996) finds that “[t]he adjectives ‘heavy’ or ‘stodgy’ were often used by participants to describe ‘unhealthy’ foods, while ‘light’ foods were described as ‘healthy’ because they were easily digested and did not ‘sit in the stomach’ as did ‘heavy’ foods (p.82)”. Such expressions are examples of metaphors (Lakoff & Johnson, 1980), which represent conceptual links between abstract concepts (i.e., healthiness) and physical experience (i.e., heaviness; Lakoff & Johnson, 1980). Social psychology substantiates that the metaphorical embodiment of abstract information affects the processing of social information (Landau, Meier, & Keefer, 2010). For example, consistent with the ‘*dark is bad*’ metaphor, brighter objects evoke more positive judgments than darker objects (Meier, Robinson, & Clore, 2004).

Regarding heaviness, the heft of a food container can influence consumer perception of content: Yoghurts served in a heavier bowl are perceived as more compact *and* satiating, hereby indicating a metaphorical connection between package weight (a concrete concept) and food healthiness as an abstract concept (Piqueras-Fiszman, Harrar, Alcaide, & Spence, 2011; Piqueras-Fiszman & Spence, 2012). Similarly, consumers favor ‘heavy’ locations of package

images (i.e., near the bottom of the package) for unhealthy products, and `lighter` locations (i.e., near the top of the package) for more healthy snacks (Deng & Kahn, 2009). Moreover, after the U.S. Food and Drug Administration banned the use of the terms `light` and `mild` on cigarette packages, manufacturers switched to lighter colors and color names so as to non-verbally convey a reduced health risk (Connolly & Alpert, 2014).

Together, the above examples illustrate that design features – through their perceived weight (or lack thereof) – can convey symbolic meaning. Drawing on and extending this research stream, we expect color- and typeface-induced weight associations to spill over to judgments about healthiness: A more (less) `heavy` color or typeface on a product package should lead consumers to evaluate the respective food product as less (more) healthy, thereby guiding their purchase intentions. For both package cues color and typeface, we therefore posit:

H1_{a, b}: (a) Typeface / (b) colors of the product packaging that are associated with more (vs. less) heaviness decrease judgments about product healthiness.

H2_{a, b}: The (a) typeface / (b) color-induced health perceptions suggested in H1 are passed on to consumer purchase intentions.

1.3. Individual differences: Health regulatory focus

Perception and processing of product packages, labels, or nutritional information depend on individual and motivational factors (e.g. Orquin, 2014; Mai, Hoffmann, Hoppert, Schwarz, & Rohm, 2015). Specifically, health-related behaviors, like eating, dieting, and physical activity, are largely influenced by an individual's self-regulation orientation and goal attainment strategies (Cameron & Leventhal, 2003).

General regulatory focus theory (Higgins, 1997) posits that goal-directed behavior follows two distinct self-regulatory systems, the promotion and the prevention system. Both systems differ with regard to the goals and needs they regulate, as well as in the strategies applied to achieve these goals and needs. Recent research suggests, however, that the general regulatory focus construct lacks predictive power regarding health behaviors, like dieting (Vartanian, Herman, & Polivy, 2006), preference for functional foods (van Kleef, van Trijp, & Luning, 2005), or food choice (Pula, Parks, & Ross, 2014). To explain this lack of predictive power, scholars suggest that a general regulatory focus is formed during early childhood (Higgins, 1997), whereas health strategies develop later in life (Hooker & Kaus, 1992), leading to divergent goal-directed behaviors (Gomez, Borges, & Pechmann, 2013). Since domain-specific constructs often yield greater explanatory power (e.g., Gomez et al., 2013; Haws, Davis, & Dholakia,

2015), a domain-specific health regulatory focus concept was developed and shown to be strongly indicative of health-related behaviors (Gomez et al., 2013).

Health regulatory focus is defined as a disposition to adopt approach (promotion) or avoidance (prevention) strategies in the pursuit of health-related goals (Gomez et al., 2013). Promotion-focused individuals in general pursue goals as hopes and aspirations and they apply approach strategies to match their desired end-state (*'gains'*; Higgins, 1997). Health promotion-focused individuals are concerned about actively improving their health, and are more susceptible to health information. They are apt to choose a healthy diet, which is congruent with their desired goal of being healthy (Gomez et al., 2013). In contrast, prevention-focused individuals in general perceive goals as duties and obligations, which is why they favor avoidance strategies to avoid negative outcomes (*'losses'*; Higgins, 1997). Health prevention-focused individuals thus aim at protecting their state of health and avoiding health-related losses (e.g., by avoiding unhealthy food). They do not actively engage in health information seeking behavior (Gomez et al. 2013).

Due to differences in self-regulation strategies, prevention and promotion foci elicit diverging processing styles. Applying approach strategies driven by a promotion focus, one seeks to explore as many opportunities as possible and eagerly looks for novel alternatives that match the desired end-state. A promotion focus therefore involves a rather *'risky'* processing style (Crowe & Higgins, 1997), which is thought to enhance creative thought, to increase abstract thinking, and the use of heuristics (Higgins, 1997). In contrast, avoidance strategies elicited by a prevention focus lead to rather risk-averse and vigilant processing styles. Individuals avoid potential threats, thereby undermining creative thought (Crowe & Higgins, 1997). For these reasons, a promotion focus shifts judgment and decision making towards a greater reliance on affective inputs, whereas a prevention focus increases the influence of cognitive input (Pham & Avnet, 2004; 2009).

In summary, health promotion-focused individuals seek to promote their long-term state of health by actively choosing healthier foods, and therefore assiduously search for clues indicating healthiness. Health prevention-oriented individuals, on the other hand, try to prevent health losses by avoiding unhealthy foods. Because prevention-oriented individuals use risk-averse processing and additionally rely stronger on cognitive inputs, it seems plausible that health prevention-focused individuals do not actively look for health cues, and thus they may only respond to obvious (not hidden or subtle) cues symbolizing healthiness, such as front-of-

pack nutrition labels. Thus, utilizing a promotion focus for goal attainment triggers the use of heuristics, whilst prevention focus does not (Friedman & Förster, 2001).

In sum, we expect that the effect of design features on health perception will be more (less) pronounced for individuals with a health promotion (prevention) focus. Thus:

H3_{a, b}: The individual's health regulatory focus moderates the indirect package cue effect suggested in H2, such that, health promotion (prevention) focus strengthens (weakens) (a) typeface / (b) color-induced health perception.

2. Pretests

Two pretests were conducted to develop and calibrate stimuli and to initially test for the associative linkage between typeface/color and perceived heaviness. A third pretest explored heaviness perception as the metaphorical mechanism guiding healthiness inferences.

2.1. Typeface

Employing Henderson et al.'s (2004) typeface design dimensions, we identified five typefaces previously evaluated as high (*Bandstand*, *Fisherman*, *MiddleAges*, *NewYorkDeco*, and *SunSplash*) and another five as low in weight (*AncientScript*, *Enviro*, *Informal Roman*, *Pepita MT*, and *Scheherezade*). To minimize potentially distorting effects of other design characteristics, the selected typefaces did not differ in the generic design dimensions *elaborate*, *harmony*, and *compressed* (Henderson et al., 2004). Ten consumers ($M_{Age}=23.6$, $SD=4.55$, 7 females) ranked the five stimuli of the light typeface group and the five stimuli of the heavy typeface group (standard placeholder text `Lorem ipsum dolor sit amet`; Husk, 2012) according to their perceived weight with the lightest typeface receiving a 1 through 5 (heaviest). For the five light typefaces, mean ranks indicate that *AncientScript* (AS, $M=2.3$) was perceived as the relatively lightest typeface, while *SunSplash* (SS, $M=4.4$) was found to be the relatively heaviest typeface among the five heavy typefaces.

2.2. Color

Revisiting the few studies on the perceived weight of colors (Pinkerton & Humphrey, 1974; Bullough, 1907), a second pretest aimed at selecting appropriate colors for the main study. Eighty-two students ($M_{Age}=27.12$, $SD=10.5$, 51 female) from a public German university rated four main colors (red, green, blue, yellow) on perceived heaviness. Colors were presented in a consumer behavior lab on a computer screen as two opposing circles. Colors were defined using

the HSL (Hue, Saturation, Lightness) code, differing only in hue (red=0, green=85, blue=170, yellow=42), but not in saturation (=255) and lightness (=128). Participants were randomly assigned to one of four groups for a paired comparison of one color against the other three. Subjects used a slider on the screen between the colored circles to indicate a position where they felt that both colors were in balance. Slider scores (range 1-101) were added to compute a composite color weight score, where lower scores correspond with a heavier perceived weight. Analysis of variance indicated significant differences between groups ($F(3,80)=9.46, p<.001, \eta_p^2=.26$), with a post-hoc test indicating a significant difference ($\Delta=-49.14, p<.001, 95\% \text{ CI: LL}=-79.63, \text{ UL}=-18.64$) between red, the heaviest color ($M=131.36, SD=34.88$), and yellow, the lightest color ($M=180.50, SD=39.95$). These findings are consistent with previous research (Pinkerton & Humphrey, 1974; Locher et al., 2005).

2.3. Perceived healthiness and heaviness of the selected colors and typefaces

Given a paucity of research on the linkage between design factors' perceived heaviness and healthiness inferences, a third pretest aimed at providing initial evidence for this link, using the selected typefaces and colors. In addition, this pretest controlled for competing explanations by accounting for other potential drivers of healthiness inferences, specifically differences in warmth (Sharpe, 1974) and arousal (Küller, Mikellides, & Janssens, 2009). Ninety-six students (70% female, $M_{Age}=22.78, SD=2.91$, one student did not provide personal information) completed a brief survey with which the participants assessed the weight, healthiness, warmth, and arousal of the relevant visual design elements, that is, the two colors (red and yellow) and two typefaces (*SunSplash* and *AncientScript*).

Heaviness was assessed on a three-item seven-point semantic differential scale with the endpoints *light-heavy*, *weak-strong*, and *lightweight-heavyweight* to account (Bergkvist & Rossiter, 2007) for the multifaceted nature of heaviness ($\alpha_{color}=.90, \alpha_{typeface}=.87$). Color warmth and arousal were assessed with the items *cold-warm* and *calming-arousing*, respectively. Colors and typefaces were evaluated on perceived healthiness using the items *healthy-unhealthy*, *low sugar content-high sugar content*, and *low in calories-high in calories* ($\alpha_{color}=.77, \alpha_{typeface}=.87$). The questionnaire sections were presented in randomized order.

Data were analyzed using multiple repeated measures ANOVAs with the evaluations of the two colors (or the two typefaces) as the repeated measures factor. To substantiate our assumption that perceived heaviness explains the typeface-/color-induced healthiness inferences, we employ Baron and Kenny's (1986) stepwise approach for testing indirect effects (see Arias-

Bolzmann, Chakraborty, & Mowen, 2000 for a similar application of ANOVA in mediation testing).

In a first step, direct effects of color and typeface on the dependent variables weight, warmth (only for color), arousal, and healthiness were estimated using repeated measures ANOVAs (separate analyses for color and typeface evaluations). Next, to exclude potential confounding influences on the weight and healthiness evaluation, subsequent repeated measures ANCOVAs controlled for the influence of warmth and arousal. Covariates were included in the form of difference scores (computed by subtracting the score of the light from the heavy element: color: Δ =red-yellow, typeface: Δ =*SunSplash*-*AncientScript*). A final step involved testing the effects of color and typeface on healthiness, controlling for Δ warmth, Δ arousal, and Δ weight. A reduction in the effect on healthiness (when controlling for weight) indicates that weight perceptions mediate the effects of color or typeface on healthiness. Full results are shown in Table 1.

In terms of color, the results indicated that red was perceived to be heavier, warmer, more arousing, and was also judged as unhealthier than yellow. The direct effects of color on heaviness and healthiness persisted when controlling for Δ arousal and Δ warmth. More importantly, including Δ weight as a covariate markedly reduced the main effect of color on healthiness, which suggests that the impact of color on perceived healthiness is at least in part operating via heaviness.

Regarding typeface, results showed a similar pattern. The *SunSplash* typeface was evaluated as heavier, and more arousing, whereas *AncientScript* was found to be healthier than *SunSplash*. The main effect of typeface on heaviness and healthiness remained significant after including Δ arousal as a covariate. Notably, adding Δ weight as a covariate caused the effect on healthiness to disappear. These findings indicate that the *AncientScript* typeface is evaluated as healthier because of its perceived weight. Hence, the pretests demonstrate that the heaviness of the selected design features is closely related to their healthiness perceptions, paving the road for an application to food products.

Table 1. Means, standard deviations, and ANOVA (repeated measures) results of color and typeface on warmth, arousal, weight, and healthy as main effects, and including covariates (Pretest 3).

Predictors	Outcomes											
	Warmth				Arousal							
	DF	M (SD)	F	p	η_p^2	M (SD)	F	p	η_p^2			
Color	1,94	4.61 (1.55) 6.12 (1.04)	63.28	<.001	.40	4.03 (1.57) 4.95 (1.68)	13.27	<.001	.12			
Typeface	1,95	<i>AncientScript</i> <i>SunSplash</i>				3.43 (1.46) 4.58 (1.39)	23.33	<.001	.20			
Predictors	Outcomes (cont.)											
	Weight				Healthy							
	DF	M (SD)	F	p	η_p^2	M (SD)	F	p	η_p^2			
Color	1,95	2.75 (.73) 5.66 (.68)	634.13	<.001	.87	3.62 (1.04) 4.81 (.96)	58.29	<.001	.38			
Typeface	1,95	<i>AncientScript</i> <i>SunSplash</i>	374.41	<.001	.80	3.13 (1.00) 4.66 (.92)	74.33	<.001	.44			
Predictors	Outcomes with covariates											
	Weight				Healthy (excl. weight)				Healthy (incl. weight)			
	DF	F	p	η_p^2	F	p	η_p^2	DF	F	p	η_p^2	
Color	1,92	326.41	<.001	.78	10.19	.002	.10	1,91	4.12	.045	.04	
Color * Δ Arousal		9.67	.002	.10	13.06	<.001	.12		6.00	.016	.06	
Color * Δ Warmth		9.50	.003	.09	15.11	<.001	.14		7.54	.007	.08	
Color * Δ Weight									17.13	<.001	.16	
Typeface	1,94	286.45	<.001	.76	45.94	<.001	.33		.46	.498	.01	
Typeface * Δ Arousal		17.47	<.001	.16	7.30	.008	.07	1,93	1.70	.196	.02	
Typeface * Δ Weight									10.88	.001	.11	

Note: DF: Degrees of freedom, Δ_{color} : red-yellow, $\Delta_{typeface}$: *SunSplash*-*AncientScript*

3. Study 1

3.1. Objective

Study 1 tests the effects of color and typeface on actual food packages. Specifically, the study examines whether the typeface/color-induced healthiness inferences extend to purchase intention, and includes the moderating role of consumer's health regulatory focus.

3.2. Method

3.2.1. Stimuli and design

In line with previous research on visuals and symbolic meaning (Becker et al., 2011; van Rompay & Pruyn, 2011) and product weight (Deng & Kahn, 2009), Study 1 employed a 2 (typeface: more vs. less heavy) x 2 (color: more vs. less heavy) between-subjects experimental design. Four visuals of a fictitious soft drink brand were created using commercial photo editing software. The visuals showed packages differing only in color (yellow [HSL=42,255,128] vs. red [HSL=0,255,128]) and brand typeface (*AncientScript* vs. *SunSplash*, see Figure 1).



Figure 1. Stimuli pictures (Study 1).

3.2.2. Participants

Recruited via social media and a panel, one hundred and forty-six young German consumers ($M_{Age}=25.47$, $SD=7.87$, 75% females) participated in the experiment. All participants reported normal or corrected-to-normal vision and no dyschromatopsia (color blindness).

3.2.3. Procedure

Participants were randomly assigned to one of the four treatments. The questionnaire instructed participants to envision themselves shopping in a supermarket where they encountered the soft drink (stimulus) presented. Participants then submitted information on the dependent measures, the manipulation check, and personal information including health regulatory focus.

3.2.4. Measures

Unless stated otherwise, all measures were rated on 7-point Likert scales, ranging from 1 (strongly disagree) to 7 (strongly agree). To corroborate effects of heaviness in context (i.e., on packaging) a single-item heaviness measure instructed participants to indicate the extent to which they perceived the product to be `heavy`.

To assess perceived healthiness, participants indicated their agreement with the statement `I think the product is healthy`. Complementing this generic measure of healthiness (Kroese, Evers, & de Ridder, 2013), two specific product characteristics (sugar and calorie content) were added. Design attractiveness was assessed using three items (*attractive*, *beautiful*, *desirable*, $\alpha=.80$), because previous research indicates that attractiveness may be indicative of healthiness (Nedelec & Beaver, 2014). For this reason, all analyses control for attractiveness. Intention to purchase was assessed using three items (e.g. `I am seriously considering buying this drink`; $\alpha=.93$; adapted from Putrevu & Lord, 1994). The questions appeared in randomized order.

Health regulatory focus was measured in line with Gomez et al. (2013). Health promotion focus included five items (e.g. `I do not hesitate to embrace new experiences if I think they can improve my health`; $\alpha_{prom}=.82$), and health prevention focus included three items (e.g. `I frequently think about the health problems I may have in the future`; $\alpha_{prev}=.68$).

3.3. Results

Preliminary analyses revealed no effects of age and gender, which were therefore not considered further. Additionally, color had no effect on attractiveness ($F(1,142)=1.95, p=.165$; red: $M=3.47, SD=1.59$; yellow: $M=3.78, SD=1.27$). The effect of typeface on attractiveness, however, was significant ($F(1,142)=20.31, p<.001, \eta_p^2=.13$) with the light typeface ($M=4.13, SD=1.33$) being rated as more attractive than the heavy typeface ($M=3.12, SD=1.37$). No interaction effect was found ($F(1,142)=.70, p=.403$).

3.3.1. Manipulation check

Analysis of variance with manipulated typeface and manipulated color as independent variables and heaviness as the dependent variable revealed a successful manipulation of color with the red package ($M=4.18, SD=1.69$) being perceived as significantly heavier than the yellow one ($M=3.07, SD=1.45, F(1,142)=18.85, p<.001, \eta_p^2=.12$). The manipulation of typeface weight was marginal with the package carrying the *AncientScript* typeface ($M=3.40, SD=1.61$) showing only a tendency to be perceived as less heavy than the package with the *SunSplash* typeface ($M=3.84, SD=1.69, F(1,142)=2.84, p=.094, \eta_p^2=.02$). In addition, the interaction between color and typeface on heaviness reached marginal significance ($F(1,142)=3.22, p=.075, \eta_p^2=.02$). The yellow package with *AncientScript* was perceived relatively less heavy ($M=2.62, SD=1.26$) than the red package, irrespective of typeface ($M_{AS}=4.19, SD_{AS}=1.56$; $M_{SS}=4.17, SD_{SS}=1.83$).

3.3.2. Main analyses

We tested our hypotheses by first running analyses of variance (a conservative approach) and then by estimating a single integrated model capturing the overall conditional process (moderation and moderated mediation; Edwards & Lambert 2007). Our hypothesis H3 suggests an indirect effects model whereby health perception mediates the effect of typeface/color on purchase intention, and this relation is qualified by health regulatory focus.

3.3.2.1. Influence on healthiness and purchase intention

A MANCOVA was conducted to test whether color and typeface treatments influenced the dependent measures, controlling for attractiveness. All results are presented in Table 2. The results showed marginal differences in healthiness perceptions between the two colors with participants rating the yellow (vs. red) package as more healthy, and containing less sugar and less calories. Regarding typeface, the product with *AncientScript* was perceived to contain

slightly less calories than the product with *SunSplash*. No other differences reached statistical significance.

Notably, we observed two marginally significant interaction effects of color and typeface on perceived healthiness and sugar content. The yellow package with *AncientScript* was judged the healthiest, whereas the red package with *SunSplash* was perceived to be the unhealthiest. Regarding sugar content, simple main effect analysis revealed significant differences depending on typeface within the yellow package design. The yellow product employing *AncientScript* was rated as significantly less sugary than the yellow package with *SunSplash*. No differences were observed within the red package.

Regarding purchase intention, no significant effects of typeface and color emerged. Additionally, regressing perceived healthiness, sugar and calorie content, and attractiveness on purchase intention revealed significant effects of healthiness ($\beta=.34$, $t=4.43$, $p<.001$) and attractiveness ($\beta=.45$, $t=6.50$, $p<.001$, $R^2_{adj}=.43$).

Table 2. Means, standard deviations, and ANOVA results of color and typeface on healthiness, sugar content, calorie content, and purchase intention ratings (Study 1).

Predictors	Outcomes																	
	Healthiness				Sugar content				Calorie content				Purchase intention					
	DF	M (SD)	F	p	η_p^2	M (SD)	F	p	η_p^2	M (SD)	F	p	η_p^2	M (SD)	F	p	η_p^2	
Color																		
Yellow	1,141	2.36 (1.39)	2.89	.091	.02	5.61 (1.57)	3.8	.053	.03	5.26 (1.57)	3.74	.055	.03	2.40 (1.52)	.05	.820	.00	
Red		1.93 (1.09)				6.08 (1.05)	2			5.75 (1.39)				2.15 (1.56)				
Typeface																		
AncientScript	1,141	2.38 (1.40)	.24	.628	.00	5.59 (1.48)	2.0	.153	.01	5.23 (1.54)	3.29	.072	.02	2.57 (1.54)	.08	.777	.00	
SunSplash		1.92 (1.08)				6.10 (1.17)	6			5.77 (1.42)				1.99 (1.49)				
Color *																		
Yellow		2.73 (1.52)				5.19 (1.63)				4.95 (1.60)				2.67 (1.47)				
Red		2.00 (1.16)				6.03 (1.40)	2.9	.089	.02	5.57 (1.50)	.17	.684	.00	2.14 (1.54)	.10	.748	.00	
Typeface																		
AncientScript		2.03 (1.18)				6.00 (1.20)	4			5.53 (1.44)				2.47 (1.62)				
SunSplash		1.83 (1.00)				6.17 (0.88)				5.97 (1.32)				1.83 (1.44)				

Note: AS: AncientScript, SS: SunSplash

3.3.2.2. Health regulatory focus

Next, we examined whether the effects of the design cues were qualified by a person's health promotion focus using the PROCESS macro (Hayes, 2012), while controlling for effects of color, attractiveness, and prevention focus. Regarding the influence of typeface on healthiness, moderation analysis showed a marginal interaction with the individual's health promotion focus ($B=-.34$, $t=-1.95$, $p=.053$). Figure 2 illustrates that the product with the less heavy typeface (*AncientScript*) was perceived relatively similar irrespective of health promotion focus (mean range from 2.10 to 2.27), whereas divergent health perceptions occurred for the more heavy typeface *SunSplash* (mean range from 1.75 to 2.54). This effect is more pronounced for high health promotion-focused consumers. Those individuals judge the product with *SunSplash* as distinctively unhealthier than the product with *AncientScript*. No moderating effects were found for color and health promotion focus, as was the case for health prevention focus.

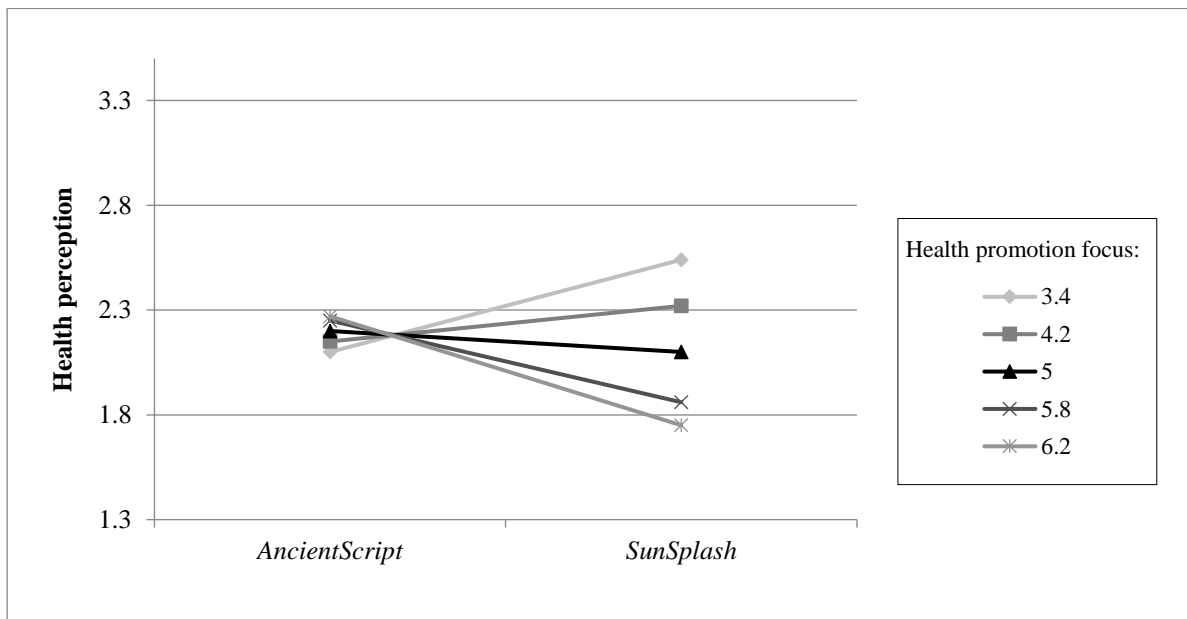


Figure 2. Perceived healthiness depending on typeface and an individuals' health promotion focus (floodlight analysis using percentiles), controlling for covariates (Study 1).

3.3.3. Moderated mediation

To test for moderated mediation, an index of moderated mediation was estimated, following Hayes (2015), again controlling for color, prevention focus, and attractiveness. Results showed a significant indirect effect for typeface on purchase intention through health perceptions depending on the health promotion focus of the individuals. Bootstrap (5000) results indicated the index of moderated mediation to not include zero (95% CI: LL=-.38, UL=-.02). A floodlight

analysis (Spiller, Fitzsimons, Lynch, & McClelland, 2013) of the conditional indirect effects at different values of the moderator (10th, 25th, 50th, 75th and 90th percentile) showed that the mediation was significant for high health promotion-focused individuals only (90th percentile: 95% CI: LL=-.57, UL=-.03; see Figure 3).

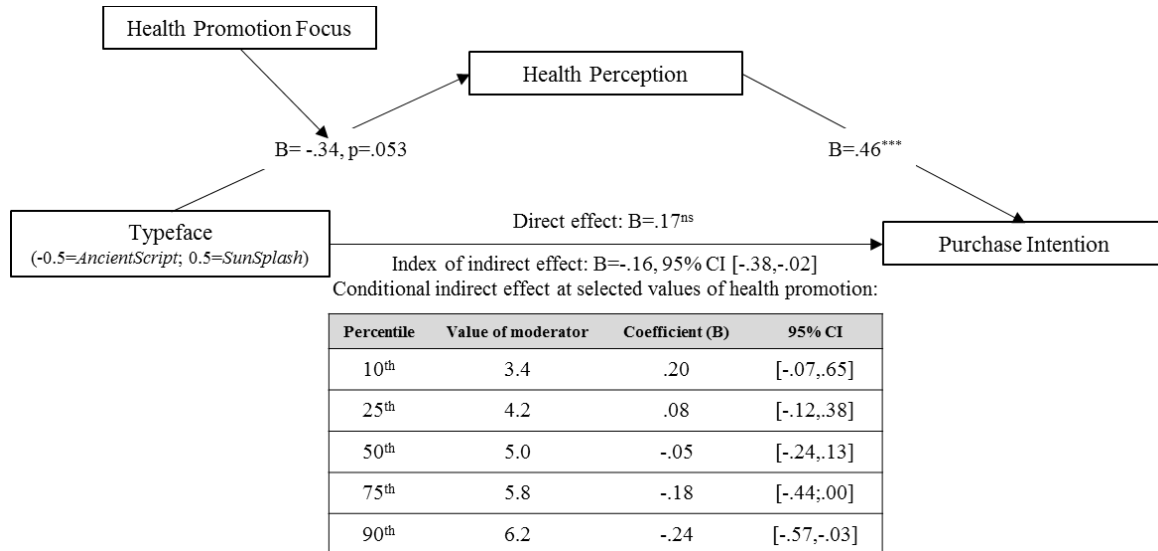


Figure 3. Graphical model showing the results of moderated mediation (Study 1, using PROCESS, model 7). *Note:* B = unstandardized coefficient, CI = confidence interval.

3.4. Discussion

Study 1 attests to the importance of color and typeface in influencing perceived healthiness of a soft drink. While healthiness perceptions were generally low (perhaps due to the category), applying more and less heavy typefaces and colors affected consumers' healthiness perceptions of the product, particularly with regard to sugar and calorie content. Different than in pretest 3, the hypothesized direct effects of typeface weight on healthiness perception were supported only for individuals with a strong health promotion focus. For these individuals, a heavier typeface appeared to serve as a cue to unhealthiness, whereas people with a lower health promotion focus were not sensitive to this (rather subtle) cue. This finding is in line with reports that individuals with a strong promotion focus are more susceptible for using heuristics (Friedman & Förster, 2001), especially regarding a product's (un)healthiness (Gomez et al., 2013). While the conventional tests of the moderating role of health regulatory focus revealed only a marginal interactive effect, the bias-corrected bootstrap confidence intervals of the moderated mediation analysis provide evidence for the moderating role of the health promotion focus. Additionally, the bootstrapping procedure confirmed that the mediation depends on a

moderator because the index of moderated mediation was significant (Hayes, 2015). Thus, as a direct test, the index of moderated mediation (Hayes, 2015) clarified that under conditions of a strong health promotion focus the typeface-driven healthiness perceptions are indeed passed on to purchase intentions (confirming H2_a and H3_a for high health promotion-focussed individuals).

Notwithstanding the marginal effects of the color manipulation in the expected direction (H1), no moderating influence of health regulatory focus surfaced in combination with color, rejecting H3_b. Colors attract greater attention than typefaces and are therefore a more obvious cue for inferring healthiness. Hence, package color consistently conveys (obvious) information for individuals, regardless of their predominant health regulatory focus. Given the influence of the color red on context-dependent approach-avoidance behavior (Meier, D'Agostino, Elliot, Maier, & Wilkowski, 2012) and accounting for red's ability to activate avoidance motivations through learned associations and biological predispositions (Mehta & Zhu, 2009; Khan, Levine, Dobson, & Kralik, 2011), this effect could have biased the results of the color manipulation. Such an interpretation would be in line with red plates or cups reducing food intake (Genschow, Reutner, & Wänke, 2012; Bruno, Martani, Corsini, & Oleari, 2013). This possibility may also account for the interaction effect of color and typeface on sugar content. The red package induced high sugar content perceptions regardless of typeface, indicating that red served as an obvious unhealthiness cue. This is in line with research indicating that red is associated with sweetness (Spence et al., 2015). Yellow, on the other hand, did not seem to cue any healthiness perceptions. Although red and yellow are generally judged to be warm colors (Sharpe, 1974), there is evidence that both colors elicit divergent warmth ratings, dependent on the product (Fenko et al., 2010). The third pretest showed that the effect of color-induced heaviness associations on perceived healthiness occur irrespective of warmth ratings. Hence, this effect seems incremental and thus unique.

Notably, it was the influence of the more subtle typeface cue that was qualified by the consumer's health promotion focus. These findings deserved further investigation, which motivated Study 2.

4. Study 2

4.1. Objective

Study 1 provided initial evidence for the influence of typeface on perceived product healthiness, and the moderating role of a person's health promotion focus. Important to note, the study employed explicit self-report measures with outcomes thus representing the result of careful elaboration and conscious thought. At the point of sale, however, many decisions are made spontaneously, guided by habits and intuition, particularly in a food context (Köster, 2009). Thus, it seems plausible that non-verbal health cues may also exert their influence at an implicit level. Building on research stressing the importance of implicit processes in consumer decision making (Mai et al., 2015), Study 2 aims at elaborating the effect of typeface on health perception by employing an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998; see Mai et al. 2015 for application in the health domain). In addition, Study 2 extends to the general category of sugary food products and contrasts the explicitly assessed relationships between typeface, health promotion focus, and health associations against an implicit approach. Nevertheless, we expect the nature of implicit effect of typeface to be in line with those observed in Study 1: The influence of typeface on implicit health associations should be more (less) pronounced for health promotion (prevention) focused individuals.

4.2. Method

4.2.1. Participants

Eighty students ($M_{Age}=26.7$, $SD=8.45$, 72% females) were recruited at a public German university and received a 5€-Coupon valid at a local shopping mall as an incentive for their participation. All participants had normal or corrected-to-normal vision and were naïve to the purpose of the study.

4.2.2. Stimuli and procedure (IAT)

To assess the association strength between healthiness and sugary foods, the IAT examined sugary and non-sugary food items as target categories, and employed words representing healthy versus unhealthy as attribute categories. A pretest involved ten consumers (7 females, age= 27.2 ± 12.28) who free-associated five sugary and five non-sugary foods as well as five attributes coming to mind when thinking of the terms 'healthy' and 'unhealthy'. The six most frequently mentioned terms within each category were used in the subsequent IAT, and are listed in Table 3. All terms were mentioned a minimum of 3 times.

Table 3. Stimuli used in the Implicit Association Test (Study 2).

Sugary food	Non-sugary food	Healthy	Unhealthy
Cola	Vegetables	Sporty	Sick
Sweets	Water	Active	Pale
Chocolate	Bread	Fit	Fat
Cake	Fish	Happy	Stressful
Ice cream	Nuts	Fresh	Painful
Fruit juice	Milk	Strong	Lazy

Upon arriving in the consumer behavior laboratory, participants were seated at a distance of 50cm in front of a 19 inch monitor with a resolution of 1280x1024. First, they assigned words (i.e., food or health items) displayed in the center of the screen as fast and accurate as possible to categories, specifically, the target concepts (i.e., sugary – non-sugary) and evaluative attributes (i.e., healthy – unhealthy). Categories were displayed in the top left and top right corners of the screen, and participants submitted their response by pressing the “E” key (for the right category) or the “I” key (for the left category) on a standard keyboard. Whenever participants submitted a wrong answer a red “X” popped upon the screen accompanied by the instruction to correct the error in order to proceed to the next task. Participants were randomly assigned to two conditions. Half of the participants viewed target category words in the less heavy typeface (*AncientScript*), and the other half viewed words written in more heavy typeface (*SunSplash*). Care was taken that the vertical space of the words covered equal space on the screen (appr. 7.5%).

Closely following Greenwald, Nosek and Banaji (2003), the IAT consisted of seven blocks in sequence (Table 4). Each block was preceded by short instructions briefing participants on stimuli and response requirements for the categorization task. Two practice blocks allowed participants training the assignment of target and attribute category. Then, two (in)congruent blocks followed. Next, a practice block accustomed participants to reversed key assignments, before block 6 and 7, the (in)congruent category-attribute associations of interest, concluded the test. A paper-and-pencil questionnaire assessed individuals’ health regulatory focus, as well as explicit attitudes towards sugary foods and personal information. Upon conclusion, participants were debriefed, thanked and received their incentives.

Table 4. Example procedure of the Implicit Association Test (Study 2).

Block	Trials	Function	Left key	Right key
1	20	Practice	Sugary foods	Non-sugary foods
2	20	Practice	Healthy words	Unhealthy words
3	40	Incongruent (critical block)	Sugary foods + healthy words	Non-sugary foods + unhealthy words
4	40	Incongruent (critical block)	Sugary foods + healthy words	Non-sugary foods + unhealthy words
5	20	Practice	Non-sugary foods	Sugary foods
6	40	Congruent (critical block)	Non-sugary foods + healthy words	Sugary foods + unhealthy words
7	40	Congruent (critical block)	Non-sugary foods + healthy words	Sugary foods+ unhealthy words

4.2.3. Explicit measures

General attitude towards sugary foods was assessed using two 7-point semantic differentials scales (good-bad, positive-negative, $\alpha=.67$). Health regulatory focus assessment was identical to the one used in Study 1 ($\alpha_{prom}=.84$; $\alpha_{prev}=.71$).

4.3. Results

4.3.1. Preliminary analyses

Preliminary analyses revealed no effects of age and gender; these variables were not considered further. This study was part of a more complex series of investigations which employed another IAT protocol. To avoid order effects, we counterbalanced the order of the sugary/non-sugary food IAT and the IAT protocol that is unrelated to this study.

4.3.2. IAT results

Calculating an individual IAT index of automatic associations (the so called D-score) followed the procedure developed and validated by Greenwald et al. (2003). A positive D-score indicates faster response latencies for compatible trials (indicating that non-sugary foods are considered healthier than sugary foods), a D-score of zero indicates no specific associations in neither direction, and a negative D-score indicates faster responses for incompatible combinations (non-sugary–unhealthy, sugary–healthy). In general, response latencies (RLs) were significantly shorter for congruent trials (RL: $M=1003.40$ ms, $SD=244.66$ ms), than for incongruent trials (RL: $M=1321.30$ ms, $SD=384.09$ ms; $D=.52$, $SD=.49$, $t(79)=9.60$, $p<.001$, Cohen's $d=2.16$).

4.3.3. Effects of typeface on implicit associations

It is generally accepted that reaction times towards visual stimuli are influenced by perceptual fluency (Unkelbach, 2007), an antecedent of attractiveness (Winkielman, Halberstadt, Fazendeiro, & Catty, 2006; Orth & Wirtz, 2014). A t-test showed no significant differences ($t(78)=-1.06$, $p=.293$, Cohen's $d=.23$) between typefaces in terms of response latencies in the first IAT block, indicating that IAT effects cannot be explained by differences in fluency. In addition, an ANCOVA, with IAT sequence as a covariate, yielded no statistical differences in implicit associations between the two typeface conditions ($D_{light}=.53$, $SD_{light}=.55$; $D_{heavy}=.51$, $SD_{heavy}=.42$; $F(1,77)=.393$, $p=.532$, $\eta_p^2=.01$).

4.3.4. Relationship between explicit and implicit attitudes

To examine whether implicit associations between healthiness and sugary foods relate to explicit attitudes towards sugary foods, we correlated the implicit measure (D-score) with the explicit one (attitude). No correlation was found ($r=-.07$, $p=.538$). Furthermore, the attitude scale's mean (3.12; $SD=1.13$) suggests a slightly negative explicit attitude towards sugary foods. Taken together, the findings support the notion that explicit and implicit evaluations of sugary foods reflect different cognitive modes.

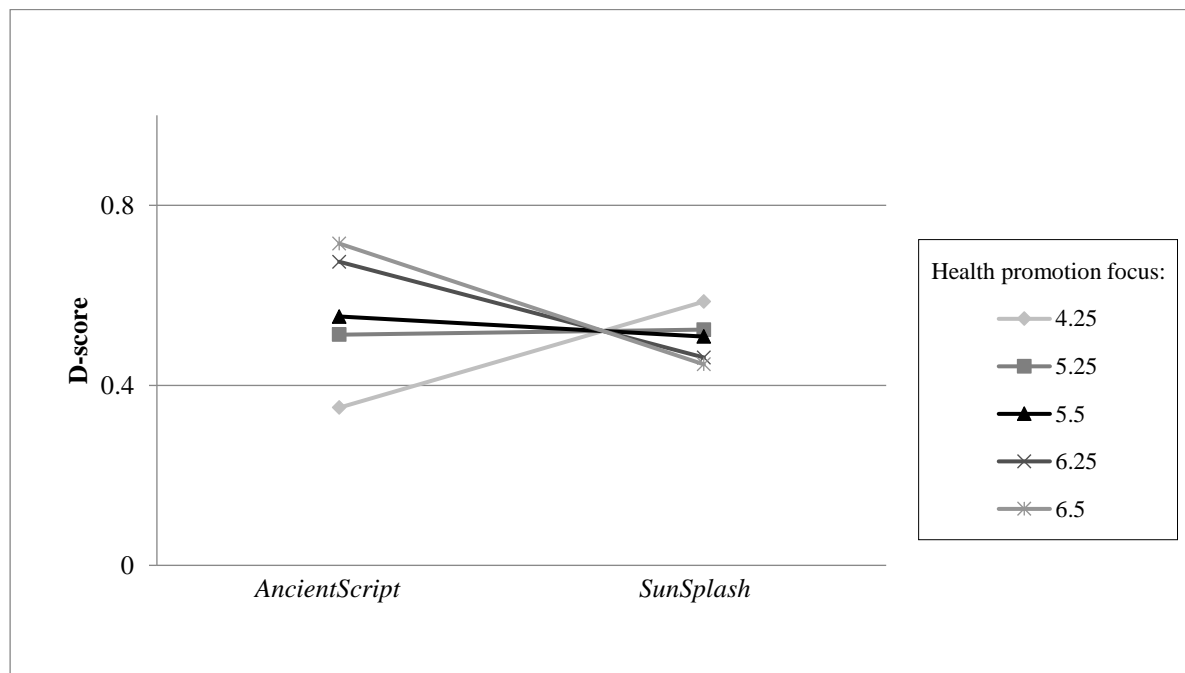
4.3.5. Moderating effect of health regulatory focus

The moderating role of health regulatory focus was tested using hierarchical regression analysis yielding a marginal interaction effect for health promotion focus ($\beta=-.21$, $t=-1.89$, $p=.063$), and no interaction effect for health prevention focus (see Table 5 and Figure 4 for full results). D-scores indicated shorter response latencies in the compatible blocks for high health promotion-focused individuals when they viewed *AncientScript*, whereas latencies decreased for low health promotion-focused individuals. In general, *AncientScript* induced a wider range of association strengths for different levels of health promotion focus (D-scores from .35 to .72), whereas *SunSplash* related to a more narrow range (D-scores from .45 to .59). Accordingly, a less heavy typeface represents a subtle health cue at implicit levels for consumers with a strong health promotion focus, whereas a heavier typeface relates to weaker associations between healthiness and sugary foods regardless of the subject's health promotion focus.

Table 5. Hierarchical regression models for health promotion focus, health prevention focus, and explicit attitudes towards sugar, including covariates, on the IAT D-score (Study 2).

	Model 1			Model 2			Model 3		
	β	t	p	β	t	p	β	t	p
D-score									
Typeface (-0.5;0.5)	-.08	-.76	.450	-.07	-.68	.501	-.06	-.59	.560
Health promotion focus	.12	1.07	.287	.11	.97	.336	.09	.86	.395
Typeface x health promotion focus	-.19	-1.78	.080	-.20	-1.78	.079	-.21	-1.89	.063
Task order	-.33	-3.05	.003	-.33	-3.00	.004	-.31	-2.89	.005
Health prevention focus				.05	.43	.668	.09	.80	.429
Typeface x health prevention focus				.03	.29	.771	.06	.52	.605
Explicit attitudes towards sugary foods							.11	1.01	.317
Typeface x explicit attitudes towards sugary foods							.18	1.69	.095
$R^2_{adj.}$.14			.12			.14		

Note: Variables were standardized prior to analysis.

**Figure 4.** Implicit health associations with sugary and non-sugary foods as a function of typeface and an individuals' health promotion focus, controlled for covariates (floodlight analysis using percentiles, Study 2).

Results also revealed a marginal interaction effect of typeface and explicit attitudes for sugary foods on implicit health associations for sugary foods when controlling for task order, health promotion and health prevention focus. As shown in Figure 5, a person's general attitude towards sugary foods influences associations only under conditions of a heavier typeface. Here, a more positive attitude towards sugary foods correlates with shorter reaction times in compatible blocks, indicating stronger associations between sugary foods and unhealthiness,

and between non-sugary foods and healthiness, respectively. This result corroborates Study 1 and the finding that associations with *SunSplash* operate on a more explicit level.

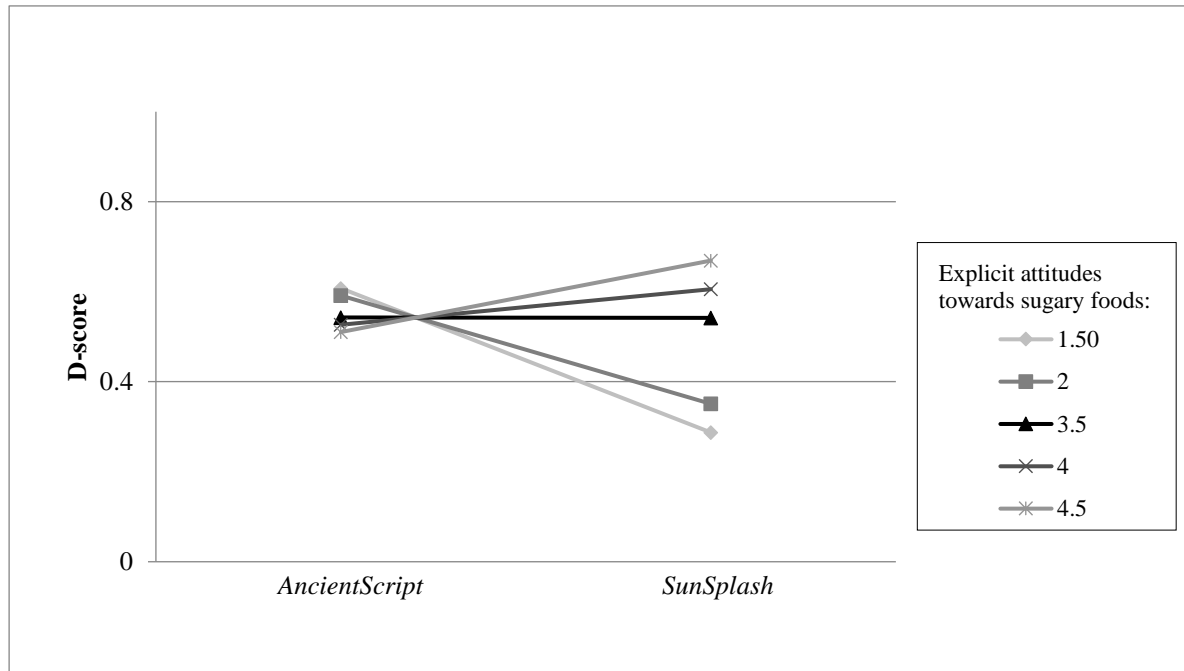


Figure 5. Explicit attitude towards sugary foods moderates the effect of typeface on implicit health associations with sugary and non-sugary foods, controlled for covariates (floodlight analysis using percentiles, Study 2).

4.4. Discussion

Study 2 reveals that the direction of the influence of typeface weight on implicit health associations is in line with the effects found using explicit measures, even if no direct influence of typeface on implicit associations emerged. As in Study 1, the effect occurs only for individuals with a high health promotion focus. For these individuals, the less heavy typeface leads to stronger implicit associations between sugary foods and the concept of unhealthiness (and non-sugary foods and healthiness), whereas a heavier typeface weakens such associations. This finding suggests that individuals who pursue good health are more susceptible to subtle design cues such as typeface, even at implicit levels.

Additionally, the results hint at package typeface moderating the relationship between explicit attitudes towards sugary foods and implicit health associations. The less heavy typeface appears to serve as a baseline, evoking only weak implicit associations between sugary foods and unhealthiness, whereas the heavy typeface strengthens these associations, especially for individuals with positive attitudes towards sugary foods.

5. General discussion

5.1. Theoretical contributions and practical implications

Two studies examined how two package design elements differing in visual weight affect healthiness perceptions on explicit and implicit levels, including the moderating role of health-specific regulatory focus. In line with our expectations, and adding to the growing body of literature on metaphorical embodiment of design (van Rompay, de Vries, Bontekoe, & Tanja-Dijkstra, 2012; Sundar & Noseworthy, 2014), color affected perceived healthiness, sugar content, and calorie content. In contrast, typeface alone does not convey healthiness (or lack thereof). Instead, typeface effects appear to depend on a person's health regulatory focus. Consumers with a more pronounced health promotion focus perceived a product with a less heavy typeface as healthier which, in turn, increases their intent to purchase. This finding is in line with research showing that a promotion focus enhances the reliance on heuristics instead of elaborated cognitive processing (Pham & Avnet, 2009). Based on a reaction time measurement, Study 2 also hints at the fact that typeface signals healthiness implicitly under conditions of a high health promotion focus. Given that implicit processes guide consumer decision making (Friese, Wänke, & Plessner, 2006; Mai et al., 2011), our findings should appeal to marketing managers, because changing even a single design element can alter a product's symbolic meaning. Especially for health promotion-oriented consumers, symbolic meaning differs depending on whether the cue is processed at the cognitively controlled level (explicitly a heavier typeface serves as a cue to unhealthiness) or at a more automatic, non-conscious level (implicitly a less heavy typeface serves as a cue to healthiness).

Our findings shed first light on the relevance of non-verbal design characteristics in the field of health communication. Regarding color, evidence highlights its impact on liking (e.g., Ares & Deliza, 2010), taste perception (e.g., Spence et al., 2015), sweetness (Piqueras-Fiszman, Alcaide, Roura, & Spence, 2012), and on consumption amount (Genschow et al., 2012). We extend these findings by demonstrating that color – as a rather vivid attention grabbing cue – is also capable of generating healthiness perceptions. Even though no mediating effect of healthiness in the color - purchase intention relationship emerged, the color's marginal direct effect on perceived sugar and calorie content is noteworthy, offering a novel perspective to reports of color effects on food intake (Genschow et al., 2012).

Typeface, on the other hand, can influence recall of advertising claims (Childers & Jass, 2002), alter brand impressions (Henderson et al., 2004), and communicate personality (Grohmann, Giese, & Parkman, 2012; van Rompay & Pruyn, 2011). Our results offer first evidence that

typeface associations may spill over to product-related qualities (i.e., healthiness), at least under specific conditions. Extending research on health regulatory focus (Gomez et al., 2013), our work implies that health promotion-focused consumers may be more susceptible to design characteristics that carry subtle symbolic meaning, even when processing occurs outside consumer's awareness. Although we hypothesized more pronounced effects for health promotion focus and less pronounced effects for health prevention focus, results show that perceived weight is transferred to healthiness perception for high health promotion-focused individuals only. In general, promotion-focused individuals rely stronger on affective and non-cognitive information in the judgment process (Pham & Avnet, 2004; 2009), making them apt to use heuristics (e.g., metaphors) and more likely to find symbolic meaning (Jia & Smith, 2013), for example in advertisement visuals (Zhu & Meyers-Levy, 2007). According to our findings, individuals with a strong health promotion focus tend to evaluate products with a less heavy typeface as healthier and products with a heavier typeface as unhealthier, both explicitly and implicitly. As both cognitive modes are different and thus unique, the results of the implicit associations diverge somewhat from those obtained by explicit evaluations. Implicitly, promotion-focused individuals tend to infer more information from the relatively thin and delicate typeface. Explicitly, however, they draw conclusions based on heavier typefaces. We speculate that this finding could be explained with shared stereotypical knowledge. It may be socially acceptable to infer negativity from a thick and heavy typeface because of its connotations with the concept *fat*. Hence, consumers may—unconsciously or otherwise—be ‘on guard’ for thin and light (product) properties due to their association with healthiness. These distinct inferential mechanisms at the different cognitive levels merit attention and provide an interesting starting point for future research.

Regarding explicit attitudes towards sugary foods, a heavier typeface leads to counterintuitive findings. The more positive the attitudes towards sugary foods, the stronger are the implicit associations in the congruent IAT blocks (e.g., non-sugary=healthy). Explicitly, a heavier typeface served as a cue to unhealthiness (Study 1). Implicitly (Study 2), this typeface activated strong associations with unhealthiness and sugary foods, particularly for individuals who explicitly expressed their liking of sugary foods. This outcome implies that, although those individuals like sweets and may therefore consume them ardently, they are more aware of their unhealthiness, but avoid thinking about this issue. Being confronted with the heavier typeface in the IAT appears to non-consciously activate this knowledge, so that the non-sugary food – healthiness link became more pronounced.

In consequence, using a heavy or bold typeface for sweet and sugary foods may backfire for products marketed at consumers who actually enjoy eating them, by reminding them of the product's unhealthiness and by bringing the concept of healthy eating or dieting to attention. Employing typefaces high in weight on healthy (i.e., less sugary) foods may also have ambiguous effects. According to our findings, a product may appear unhealthier when using a heavier typeface, with stronger health associations evoked for non-sugary food. A relatively thin and delicate typeface, on the other hand, appears to relate to healthier product perceptions, but primarily at subconscious levels. Thus, marketers are well advised to consider the different roles of more (vs. less) heavy visual cues and pretest food product packages carefully.

5.2. *Limitations and avenues for future research*

This paper provides a first step towards disentangling the effects of symbolic cues on healthiness perception. Yet, caution is advisable not to overextend conclusions based on the results of our investigations.

First, design elements differ in more aspects than heaviness. For example, the color red can elicit approach (Meier, D'Agostino, Elliot, Maier, & Wilkowski, 2012) or avoidance motivations (Metha & Zhu, 2009), and is generally associated with a sweet taste (Spence et al., 2015). Additionally, taste identification and intensity is known to fluctuate as a function of color (Spence, Levitan, Shankar, & Zampini, 2010; Spence et al., 2015). Taste perception was not accounted for in this study. Furthermore, consumers prefer rounded elements in design, supposedly induced by a threat from angular, sharp designs (Bar & Neta, 2006; Westerman et al., 2012). Roundness could have biased the perception of typefaces in this study, because *SunSplash* is markedly rounder than *AncientScript*.

Although the effects of typeface weight are consistent across our studies, some caution seems warranted regarding the proposed mechanism. The pretests identified two typefaces as prototypical representatives of a heavy or light typeface. *AncientScript* was consistently perceived relatively lighter than *SunSplash* across all studies. In absolute terms, however, heaviness perceptions of *AncientScript* were less clear-cut in Study 1. There, the applied heaviness measure was not specific to typefaces or colors but instead related to the actual food packaging as a whole. Elemental (typeface) effects therefore may have been weakened (Orth & Malkewitz, 2008). Possibly, *AncientScript* was perceived rather neutral and the observed effects were primarily driven by typeface heaviness (i.e., by *SunSplash*). Given that the stimuli selection was based on established protocols (Henderson et al., 2004), it could be a feature inherent to thin and delicate typefaces that, lacking direct comparison with a heavier

counterpart, participants may have experienced difficulties to assess weight and, ultimately, their absolute weight evaluations shifted towards the midpoint of the scale. Nonetheless, even though both typefaces evoked only small perceived differences in weight, high and low health promotion-focused individuals differed in typeface perceptions. Thus, future research should focus on typefaces that are even more extreme prototypes of the opposing endpoints of the lightness/heaviness continuum to corroborate our findings.

Regarding overall attractiveness, more attractive designs trigger higher willingness to pay (Bloch, Brunel, & Arnold, 2003), influence preferences (Orth & Malkewitz, 2008), and steer product choice (Reimann, Zaichkowsky, Neuhaus, Bender, & Weber, 2010). Still, when controlling for attractiveness, a heavier typeface's negative influence on product healthiness remains. Given that rounded typefaces relate to sweet taste (Velasco, Woods, Hyndman, & Spence, 2015), and sweet taste conveys added sugar, it cannot be excluded that the corresponding association with unhealthiness has biased our results.

The key premise of our research is that heaviness, through metaphors, relates to healthiness, in line with studies on product image weight (Deng & Kahn, 2009), 'light' cigarette packages (Connolly & Alpert, 2014), and anecdotal metaphors (Lupton, 1996). The reason that typefaces differ in their perceived weight might be explained by their form, and 'fatness' (Henderson et al., 2004). The mechanisms for consumers equating colors with heaviness are less understood, though. While this relationship is corroborated in this research as in others (Pinkerton & Humphrey, 1974; Locher et al., 2005), plausible explanations for the mechanism are still missing. Our speculations center on metaphors (e.g., *intense* equals *heavy*, *bright* equals *light*) as a plausible mechanism, and future extensions could fruitfully integrate our approach with synesthetic metaphors (Marks, 1996; Yu, 2003).

To our knowledge, this is one of the first studies to apply the health regulatory focus construct (Gomez et al., 2013). Finding meaningful effects where employing the general regulatory focus scale failed to detect influences (van Kleef et al., 2005; Vartanian et al., 2006) underlines the importance of this domain-specific construct. However, in the light of common pitfalls of statistical inference making, especially regarding near-significant results (Lakens, 2015) and multiplicity issues in multivariate research (Cramer et al. 2015), our results should be interpreted with great caution. However, as we employed directional hypotheses, where one-tailed testing is regarded as more appropriate (Cho & Abe, 2013), our use of two-tailed testing adds a conservative note to the results. Moreover, as a conservative test of accepting (or rejecting) our hypotheses and responding to the growing calls for contingent ways of testing

hypotheses, we employed a two-criterion approach consulting multiple criteria. The bias-corrected bootstrap procedure (Hayes, 2013; 2015) confirms the interaction effect and the bootstrapped index of moderated mediation confirms the moderated mediation. Nevertheless, future studies are needed to substantiate the moderating role of health regulatory focus in food decision making.

Although deemed both a strength and a limitation (Karpinski & Steinman, 2006), IATs allow for interpretation of the results only in relation to a comparative category. No conclusions can thus be made about the absolute strength of single associations (Greenwald & Farnham, 2000). Future research could employ different or additional implicit measures, especially the single-category IAT (Karpinski & Hilton, 2001), which is capable to facilitate interpreting single associations between concepts and attributes.

Finally, previous research revealed an implicit unhealthy = tasty heuristic in consumers' minds (Raghunathan, Naylor, & Hoyer, 2006; Mai & Hoffmann, 2015). Because we found an influence of typeface on the association between sugar and unhealthiness, future studies could investigate whether manipulating a design has the potential for changing the strength of the unhealthy = tasty associations. Our work offers a first step towards answering these questions, and we hope to encourage researchers to pursue the question in what ways design features can override or alter existing health associations.

Acknowledgements

Special thanks go to Swetlana Kraus, Melanie Fröhlich, and Natalja Beirit for their excellent assistance in collecting data and developing stimuli. The authors also thank the editor and the anonymous *FQ&P* reviewers for their helpful suggestions on earlier versions of this manuscript.

Author Contribution

N. Karnal and C.J.A. Machiels share first authorship and have contributed equally.

All authors have approved the final article.

References

- Ackerman, J. M., Nocera, C. C., & Bargh, J. A. (2010). Incidental haptic sensations influence social judgments and decisions. *Science (New York, N.Y.)*, *328*(5986), 1712–1715. doi:10.1126/science.1189993
- Ares, G., & Deliza, R. (2010). Studying the influence of package shape and colour on consumer expectations of milk desserts using word association and conjoint analysis. *Food Quality and Preference*, *21*(8), 930–937. doi:10.1016/j.foodqual.2010.03.006
- Arias-Bolzmann, L., Chakraborty, G., & Mowen, J. C. (2000). Effects of absurdity in advertising: The moderating role of product category attitude and the mediating role of cognitive responses. *Journal of Advertising*, *29*(1), 35–49. doi:10.1080/00913367.2000.10673602
- Aschemann-Witzel, J., Grunert, K. G., van Trijp, H. C., Bialkova, S., Raats, M. M., Hodgkins, C., . . . Koenigstorfer, J. (2013). Effects of nutrition label format and product assortment on the healthfulness of food choice. *Appetite*, *71*, 63–74. doi:10.1016/j.appet.2013.07.004
- Bar, M., & Neta, M. (2006). Humans prefer curved visual objects. *Psychological Science*, *17*(8), 645–648. doi:10.1111/j.1467-9280.2006.01759.x
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. doi:10.1037/0022-3514.51.6.1173
- Becker, L., van Rompay, T., Schifferstein, H. N., & Galetzka, M. (2011). Tough package, strong taste: The influence of packaging design on taste impressions and product evaluations. *Food Quality and Preference*, *22*(1), 17–23. doi:10.1016/j.foodqual.2010.06.007
- Bergkvist, L., & Rossiter, J. R. (2007). The predictive validity of multiple-item versus single-item measures of the same constructs. *Journal of Marketing Research*, *44*(2), 175–184. doi:10.1509/jmkr.44.2.175
- Bloch, P. H., Brunel, F. F., & Arnold, T. J. (2003). Individual differences in the centrality of visual product aesthetics: Concept and measurement. *Journal of Consumer Research*, *29*(4), 551–565. doi:10.1086/346250
- Bruno, N., Martani, M., Corsini, C., & Oleari, C. (2013). The effect of the color red on consuming food does not depend on achromatic (Michelson) contrast and extends to rubbing cream on the skin. *Appetite*, *71*, 307–313. doi:10.1016/j.appet.2013.08.012
- Bullough, E. (1907). On the apparent heaviness of colours. *British Journal of Psychology*, *1904-1920*, *2*(2), 111–152. doi:10.1111/j.2044-8295.1907.tb00236.x
- Cameron, L. D., & Leventhal, H. (2003). *The self-regulation of health and illness behaviour*. New York: Routledge.
- Celhay, F., Boysselle, J., & Cohen, J. (2015). Food packages and communication through typeface design: The exoticism of exotypes. *Food Quality and Preference*, *39*, 167–175. doi:10.1016/j.foodqual.2014.07.009
- Chandon, P. (2013). How package design and packaged-based marketing claims lead to overeating. *Applied Economic Perspectives and Policy*, *35*(1), 7–31. doi:10.1093/aep/pps028
- Chandon, P., & Wansink, B. (2007). The biasing health halos of fast-food restaurant health claims: Lower calorie estimates and higher side-dish consumption intentions. *Journal of Consumer Research*, *34*(3), 301–314. doi:10.1086/519499
- Childers, T. L., & Jass, J. (2002). All dressed up with something to say: Effects of typeface semantic associations on brand perceptions and consumer memory. *Journal of Consumer Psychology*, *12*(2), 93–106. doi:10.1207/S15327663JCP1202_03

- Cho, H.-C., & Abe, S. (2013). Is two-tailed testing for directional research hypotheses tests legitimate? *Journal of Business Research*, 66(9), 1261–1266. doi:10.1016/j.jbusres.2012.02.023
- Connolly, G. N., & Alpert, H. R. (2014). Has the tobacco industry evaded the FDA's ban on 'Light' cigarette descriptors? *Tobacco control*, 23(2), 140–145. doi:10.1136/tobaccocontrol-2012-050746
- Cramer, Angélique O J, van Ravenzwaaij, D., Matzke, D., Steingroever, H., Wetzels, R., Grasman, Raoul P P P, . . . Wagenmakers, E.-J. (2015). Hidden multiplicity in exploratory multiway ANOVA: Prevalence and remedies. *Psychonomic bulletin & review*. doi:10.3758/s13423-015-0913-5
- Creusen, M. E. H., & Schoormans, J. P. L. (2005). The different roles of product appearance in consumer choice. *Journal of Product Innovation Management*, 22(1), 63–81. doi:10.1111/j.0737-6782.2005.00103.x
- Crowe, E., & Higgins, E. (1997). Regulatory focus and strategic inclinations: Promotion and prevention in decision-making. *Organizational Behavior and Human Decision Processes*, 69(2), 117–132. doi:10.1006/obhd.1996.2675
- Dabelea, D., Mayer-Davis, E. J., Saydah, S., Imperatore, G., Linder, B., Divers, J., . . . Hamman, R. F. (2014). Prevalence of type 1 and type 2 diabetes among children and adolescents from 2001 to 2009. *Journal of the American Medical Association*, 311(17), 1778–1786. doi:10.1001/jama.2014.3201
- Deliza, R., & MacFie, H. (2001). Product packaging and branding. In L. J. Frewer, E. Risvik, & H. Schifferstein (Eds.), *Food, People and Society* (pp. 55–72). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Deng, X., & Kahn, B. (2009). Is your product on the right side? The "location effect" on perceived product heaviness and package evaluation. *Journal of Marketing Research*, XLVI, 725–738.
- Doyle, J. R., & Bottomley, P. A. (2006). Dressed for the occasion: Font-product congruity in the perception of logotype. *Journal of Consumer Psychology*, 16(2), 112–123. doi:10.1207/s15327663jcp1602_2
- Drucker, J. (1994). *The visible word : Experimental typography and modern art, 1909-1923*. Chicago, IL: University Of Chicago Press.
- Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychological methods*, 12(1), 1–22. doi:10.1037/1082-989X.12.1.1
- Fenko, A., Schifferstein, H. N., & Hekkert, P. (2010). Looking hot or feeling hot: What determines the product experience of warmth? *Materials & Design*, 31(3), 1325–1331. doi:10.1016/j.matdes.2009.09.008
- Friedman, R. S., & Förster, J. (2001). The effects of promotion and prevention cues on creativity. *Journal of Personality and Social Psychology*, 81(6), 1001–1013. doi:10.1037/0022-3514.81.6.1001
- Friese, M., Wänke, M., & Plessner, H. (2006). Implicit consumer preferences and their influence on product choice. *Psychology and Marketing*, 23(9), 727–740. doi:10.1002/mar.20126
- Garber Jr, L. L., Burke, R. R., & Jones, J. M. (2000). *The role of package color in consumer purchase consideration and choice*. Report No. 00-104. Boston: Marketing Science Institute, pp. 1–46.
- Garber Jr, L. L., Hyatt, E. M., & Starr Jr, R. G. (2000). The effects of food color on perceived flavor. *Journal of Marketing Theory and Practice*, 8(4), 59–72. doi:10.2307/40470017

- Genschow, O., Reutner, L., & Wänke, M. (2012). The color red reduces snack food and soft drink intake. *Appetite*, 58(2), 699–702. doi:10.1016/j.appet.2011.12.023
- Gomez, P., Borges, A., & Pechmann, C. (2013). Avoiding poor health or approaching good health: Does it matter? The conceptualization, measurement, and consequences of health regulatory focus. *Journal of Consumer Psychology*, 23(4), 451–463.
- Greenwald, A. G., & Farnham, S. D. (2000). Using the Implicit Association Test to measure self-esteem and self-concept. *Journal of Personality and Social Psychology*, 79(6), 1022–1038. doi:10.1037/0022-3514.79.6.1022
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, 74(6), 1464. doi:10.1037/0022-3514.74.6.1464
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197. doi:10.1037/0022-3514.74.6.1464
- Grohmann, B., Giese, J. L., & Parkman, I. D. (2012). Using type font characteristics to communicate brand personality of new brands. *Journal of Brand Management*, 20(5), 389–403. doi:10.1057/bm.2012.23
- Guéguen, N., & Jacob, C. (2014). Coffee cup color and evaluation of a beverage's "warmth quality". *Color Research & Application*, 39(1), 79–81. doi:10.1002/col.21757
- Haws, K., Davis, S. W., & Dholakia, U. M. (2015). Control over what? Individual differences in general versus eating and spending self-control. *Journal of Public Policy & Marketing*, in press. doi:10.2139/ssrn.2616318
- Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling [White paper]. Retrieved from <http://www.afhayes.com/public/process2012.pdf>
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.
- Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behavioral Research*, 50(1), 1–22. doi:10.1080/00273171.2014.962683
- Henderson, P. W., Giese, J. L., & Cote, J. A. (2004). Impression management using typeface design. *Journal of Marketing*, 68(4), 60–72.
- Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist*, 52(12), 1280–1300. doi:10.1037/0003-066X.52.12.1280
- Hine, T. (1995). *The total package: The secret history and hidden meanings of boxes, bottles, cans and other persuasive containers*. New York: Little Brown.
- Hooker, K., & Kaus, C. R. (1992). Possible selves and health behaviors in later life. *Journal of Aging and Health*, 4(3), 390–411. doi:10.1177/089826439200400304
- Husk, M. L. (2012). Ink, paper, scissors: Experiments in cutting campus printing costs. *Proceedings of the 40th annual ACM SIGUCCS conference on User services.*, 135–138. doi:10.1145/2382456.2382488
- Jackson, M., Harrison, P., Swinburn, B., & Lawrence, M. (2014). Unhealthy food, integrated marketing communication and power: A critical analysis. *Critical Public Health*, 24(4), 489–505. doi:10.1080/09581596.2013.878454
- Jia, L., & Smith, E. R. (2013). Distance makes the metaphor grow stronger: A psychological distance model of metaphor use. *Journal of Experimental Social Psychology*, 49(3), 492–497. doi:10.1016/j.jesp.2013.01.009

- Jostmann, N. B., Lakens, D., & Schubert, T. W. (2009). Weight as an embodiment of importance. *Psychological Science*, 20(9), 1169–1174. doi:10.1111/j.1467-9280.2009.02426.x
- Karpinski, A., & Hilton, J. L. (2001). Attitudes and the Implicit Association Test. *Journal of Personality and Social Psychology*, 81(5), 774–788. doi:10.1037//0022-3514.81.5.774
- Karpinski, A., & Steinman, R. B. (2006). The single category Implicit Association Test as a measure of implicit social cognition. *Journal of Personality and Social Psychology*, 91(1), 16–32. doi:10.1037/0022-3514.91.1.16
- Khan, S. A., Levine, W. J., Dobson, S. D., & Kralik, J. D. (2011). Red signals dominance in male rhesus macaques. *Psychological Science*, 22(8), 1001–1003. doi:10.1177/0956797611415543
- Kitchen, P. J., & Schultz, D. E. (2009). IMC: New horizon/false dawn for a marketplace in turmoil? *Journal of Marketing Communications*, 15(2-3), 197–204. doi:10.1080/13527260903003793
- Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference*, 20(2), 70–82. doi:10.1016/j.foodqual.2007.11.002
- Kroese, F. M., Evers, C., & de Ridder, D. T. (2013). If it's good it must be bad: The indirect effect of temptation strength on self-control through perceived unhealthiness. *Eating Behaviors*, 14(4), 522–524. doi:10.1016/j.eatbeh.2013.07.006
- Küller, R., Mikellides, B., & Janssens, J. (2009). Color, arousal, and performance-A comparison of three experiments. *Color Research & Application*, 34(2), 141–152. doi:10.1002/col.20476
- Labrecque, L. I., Patrick, V. M., & Milne, G. R. (2013). The marketers' prismatic palette: A review of color research and future directions. *Psychology & Marketing*, 30(2), 187–202. doi:10.1002/mar.20597
- Lakens, D. (2015). On the challenges of drawing conclusions from p-values just below 0.05. *PeerJ*, 3, e1142. doi:10.7717/peerj.1142
- Lakoff, G., & Johnson, M. (1980). The metaphorical structure of the human conceptual system. *Cognitive Science*, 4(2), 195–208.
- Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin*, 136(6), 1045–1067. doi:10.1037/a0020970
- Locher, P., Overbeeke, K., & Stappers, P. J. (2005). Spatial balance of color triads in the abstract art of Piet Mondrian. *Perception*, 34(2), 169–189. doi:10.1068/p5033
- Lupton, D. (1996). *Food, the body and the self*. London: SAGE Publications Ltd.
- Madzharov, A. V., & Block, L. G. (2010). Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology*, 20(4), 398–409. doi:10.1016/j.jcps.2010.06.007
- Mai, R., Hoffmann, S., Helmert, J. R., Velichkovsky, B. M., Zahn, S., Jaros, D., . . . Rohm, H. (2011). Implicit food associations as obstacles to healthy nutrition: The need for further research. *The British Journal of Diabetes & Vascular Disease*, 11(4), 182–186. doi:10.1177/1474651411410725
- Mai, R., & Hoffmann, S. (2015). How to combat the unhealthy = tasty intuition: The influencing role of health consciousness. *Journal of Public Policy & Marketing*, 34(1), 63–83. doi:10.1509/jppm.14.006
- Mai, R., Hoffmann, S., Hoppert, K., Schwarz, P., & Rohm, H. (2015). The spirit is willing, but the flesh is weak: The moderating effect of implicit associations on healthy eating behaviors. *Food Quality and Preference*, 39, 62–72. doi:10.1016/j.foodqual.2014.06.014

- Marks, L. E. (1996). On perceptual metaphors. *Metaphor and Symbolic Activity*, 11(1), 39–66. doi:10.1207/s15327868ms1101_3
- Mehta, R., & Zhu, R. J. (2009). Blue or red? Exploring the effect of color on cognitive task performances. *Science*, 323(5918), 1226–1229. doi:10.1126/science.1169144
- Meier, B. P., D'Agostino, P. R., Elliot, A. J., Maier, M. A., & Wilkowski, B. M. (2012). Color in context: psychological context moderates the influence of red on approach- and avoidance-motivated behavior. *PLoS ONE*, 7(7), e40333. doi:10.1371/journal.pone.0040333
- Meier, B. P., Robinson, M. D., & Clore, G. L. (2004). Why good guys wear white: Automatic inferences about stimulus valence based on brightness. *Psychological Science*, 15(2), 82–87. doi:10.1111/j.0963-7214.2004.01502002.x
- Nedelec, J. L., & Beaver, K. M. (2014). Physical attractiveness as a phenotypic marker of health: An assessment using a nationally representative sample of American adults. *Evolution and Human Behavior*, 35(6), 456–463. doi:10.1016/j.evolhumbehav.2014.06.004
- Nestle, M., & Nesheim, M. (2012). *Why calories count: From science to politics*. Berkeley, Los Angeles, London: University of California Press.
- Orquin, J. L. (2014). A Brunswik lens model of consumer health judgments of packaged foods. *Journal of Consumer Behaviour*, 270–281. doi:10.1002/cb.1465
- Orth, U. R., & Wirtz, J. (2014). Consumer processing of interior service environments: The interplay among visual complexity, processing fluency, and attractiveness. *Journal of Service Research*, 17(3), 296–309. doi:10.1177/1094670514529606
- Orth, U. R., & Gal, S. (2014). Persuasive mechanisms of nostalgic brand packages. *Applied Cognitive Psychology*, 28(2), 161–173. doi:10.1002/acp.2973
- Orth, U. R., & Malkewitz, K. (2008). Holistic package design and consumer brand impressions. *Journal of Marketing*, 72(3), 64–81. doi:10.1509/jmkg.72.3.64
- Payne, M. C. (1958). Apparent weight as a function of color. *The American Journal of Psychology*, 71(4), 725. doi:10.2307/1420330
- Pham, M. T., & Avnet, T. (2004). Ideals and oughts and the reliance on affect versus substance in persuasion. *Journal of Consumer Research*, 30(4), 503–518. doi:10.1086/380285
- Pham, M. T., & Avnet, T. (2009). Contingent reliance on the affect heuristic as a function of regulatory focus. *Organizational Behavior and Human Decision Processes*, 108(2), 267–278. doi:10.1016/j.obhdp.2008.10.001
- Pinkerton, E., & Humphrey, N. K. (1974). The apparent heaviness of colours. *Nature*, 250(5462), 164–165. doi:10.1038/250164a0
- Piqueras-Fiszman, B., Alcaide, J., Roura, E., & Spence, C. (2012). Is it the plate or is it the food? Assessing the influence of the color (black or white) and shape of the plate on the perception of the food placed on it. *Food Quality and Preference*, 24(1), 205–208. doi:10.1016/j.foodqual.2011.08.011
- Piqueras-Fiszman, B., Harrar, V., Alcaide, J., & Spence, C. (2011). Does the weight of the dish influence our perception of food? *Food Quality and Preference*, 22(8), 753–756. doi:10.1016/j.foodqual.2011.05.009
- Piqueras-Fiszman, B., & Spence, C. (2012). The weight of the container influences expected satiety, perceived density, and subsequent expected fullness. *Appetite*, 58(2), 559–562. doi:10.1016/j.appet.2011.12.021
- Pula, K., Parks, C. D., & Ross, C. F. (2014). Regulatory focus and food choice motives. Prevention orientation associated with mood, convenience, and familiarity. *Appetite*, 78, 15–22. doi:10.1016/j.appet.2014.02.015

- Putrevu, S., & Lord, K. R. (1994). Comparative and noncomparative advertising: Attitudinal effects under cognitive and affective involvement conditions. *Journal of Advertising*, 23(2), 77–91. doi:10.1080/00913367.1994.10673443
- Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy= tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing*, 70(4), 170–184.
- Reimann, M., Zaichkowsky, J., Neuhaus, C., Bender, T., & Weber, B. (2010). Aesthetic package design: A behavioral, neural, and psychological investigation. *Journal of Consumer Psychology*, 20(4), 431–441. doi:10.1016/j.jcps.2010.06.009
- Rettie, R., & Brewer, C. (2000). The verbal and visual components of package design. *Journal of Product & Brand Management*, 9(1), 56–70. doi:10.1108/10610420010316339
- Roberto, C. A., Shivaram, M., Martinez, O., Boles, C., Harris, J. L., & Brownell, K. D. (2012). The Smart Choices front-of-package nutrition label. Influence on perceptions and intake of cereal. *Appetite*, 58(2), 651–657. doi:10.1016/j.appet.2012.01.003
- Sharpe, D. T. (1974). *The Psychology of Color and Design*. Chicago, IL: Nelson-Hall Company.
- Spence, C., Levitan, C. A., Shankar, M. U., & Zampini, M. (2010). Does food color influence taste and flavor perception in humans? *Chemosensory Perception*, 3(1), 68–84. doi:10.1007/s12078-010-9067-z
- Spence, C., Wan, X., Woods, A., Velasco, C., Deng, J., Youssef, J., & Deroy, O. (2015). On tasty colours and colourful tastes? Assessing, explaining, and utilizing crossmodal correspondences between colours and basic tastes. *Flavour*, 4(1), 70. doi:10.1186/s13411-015-0033-1
- Spiller, S. A., Fitzsimons, G. J., Lynch, J. G., & McClelland, G. H. (2013). Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *Journal of Marketing Research*, 50(2), 277–288.
- Sundar, A., & Noseworthy, T. J. (2014). Place the logo high or low? Using conceptual metaphors of power in packaging design. *Journal of Marketing*, 78(5), 138–151. doi:10.1509/jm.13.0253
- Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finewood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: Shaped by global drivers and local environments. *The Lancet*, 378(9793), 804–814. doi:10.1016/S0140-6736(11)60813-1
- Unkelbach, C. (2007). Reversing the truth effect: Learning the interpretation of processing fluency in judgments of truth. *Journal of experimental psychology. Learning, memory, and cognition*, 33(1), 219–230. doi:10.1037/0278-7393.33.1.219
- van Herpen, E., Hieke, S., & van Trijp, Hans C M. (2013). Inferring product healthfulness from nutrition labelling: The influence of reference points. *Appetite*, 72. doi:10.1016/j.appet.2013.10.012
- van Kleef, E., van Trijp, H. C., & Luning, P. (2005). Functional foods: Health claim-food product compatibility and the impact of health claim framing on consumer evaluation. *Appetite*, 44(3), 299–308. doi:10.1016/j.appet.2005.01.009
- van Rompay, T., de Vries, P. W., Bontekoe, F., & Tanja-Dijkstra, K. (2012). Embodied product perception: Effects of verticality cues in advertising and packaging design on consumer impressions and price expectations. *Psychology & Marketing*, 29(12), 919–928. doi:10.1002/mar.20574
- van Rompay, T. J.L., & Pruyn, Ad T. H. (2011). When visual product features speak the same language: Effects of shape-typeface congruence on brand perception and price expectations.

- Journal of Product Innovation Management*, 28(4), 599–610. doi:10.1111/j.1540-5885.2011.00828.x
- Vartanian, L. R., Herman, C. P., & Polivy, J. (2006). Does regulatory focus play a role in dietary restraint? *Eating Behaviors*, 7(4), 333–341. doi:10.1016/j.eatbeh.2005.11.007
- Velasco, C., Woods, A. T., Hyndman, S., & Spence, C. (2015). The taste of typeface. *i-Perception*, 6(4). doi:10.1177/2041669515593040
- Velasco, C., Salgado-Montejo, A., Marmolejo-Ramos, F., & Spence, C. (2014). Predictive packaging design: Tasting shapes, typefaces, names, and sounds. *Food Quality and Preference*, 34, 88–95. doi:10.1016/j.foodqual.2013.12.005
- Vidal, L., Antúnez, L., Sapolinski, A., Giménez, A., Maiche, A., & Ares, G. (2013). Can eye-tracking techniques overcome a limitation of conjoint analysis? Case study on healthfulness perception of yogurt labels. *Journal of Sensory Studies*, 28(5), 370–380. doi:10.1111/joss.12062
- Vyth, E. L., Steenhuis, I. H. M., Vlot, J. A., Wulp, A., Hogenes, M. G., Looije, D. H., . . . Seidell, J. C. (2010). Actual use of a front-of-pack nutrition logo in the supermarket: consumers' motives in food choice. *Public Health Nutrition*, 13(11), 1882–1889. doi:10.1017/S1368980010000637
- Westerman, S. J., Gardner, P. H., Sutherland, E. J., White, T., Jordan, K., Watts, D., & Wells, S. (2012). Product design: Preference for rounded versus angular design elements. *Psychology and Marketing*, 29(8), 595–605. doi:10.1002/mar.20546
- Winkielman, P., Halberstadt, J., Fazendeiro, T., & Catty, S. (2006). Prototypes are attractive because they are easy on the mind. *Psychological Science*, 17(9), 799–806. doi:10.1111/j.1467-9280.2006.01785.x
- Yu, N. (2003). Synesthetic metaphor: A cognitive perspective. *Journal of Literary Semantics*, 32, 19–34.
- Zhu, R. U., & Meyers-Levy, J. (2007). Exploring the cognitive mechanism that underlies regulatory focus effects. *Journal of Consumer Research*, 34(1), 89–96.

Chapter 5

Shaping up: How food package and consumer body conspire to affect healthiness evaluation.

Nadine Yarar

Casparus J. A. Machiels

Ulrich R. Orth

An earlier version of this contribution was accepted at EMAC Conference 2016 in Oslo,
Norway.

This contribution is submitted for publication to *Psychology & Marketing*.

Abstract

Integrating research on human body shapes with studies of health cues in food package design, this research explores how package shapes (slim versus less slim) impact consumers' evaluation of food healthiness. Adopting a self-referencing perspective shows that slim packages relate to foods being evaluated as more healthy, especially with female consumers whose bodily characteristics mark them as being not thin. Using packages designed to mimic human body shapes Study 1 shows that slimness effects depend on consumer gender and body mass index (BMI): the heuristic that slim packages contain more healthy foods becomes more pronounced with women and increasing BMI. Study 2 replicates these findings and offers process evidence for self-referencing as a mediator of the package slimness - healthiness evaluation. Together the findings highlight package slimness as an important cue to healthiness and aid marketers and designers in better matching packages to target audiences and products.

Keywords: package slimness, BMI, gender, healthiness perception, self-referencing

1. Introduction

Obesity is a growing concern in western societies (Swinburn et al., 2011; WHO, 2016), with consumption of unhealthy foods thought to be a major culprit (WHO, 2003). To make consumers aware of (un)healthy foods, a common public policy involves placing explicit nutritional information and extensive labels on food packages; results, however, remain inconclusive at the least (Roberto et al., 2012). To overcome limitations inherent to explicit approaches researchers have recently started investigating the potential of more subtle design cues on food packages. For example, specific expectations regarding content can be triggered by package color (Becker, van Rompay, Schifferstein, & Galetzka, 2011), typeface (Henderson, Giese, & Cote, 2004), product pictures (Machiels & Karnal, 2016), and shape (van Rompay & Pruyn, 2011). Product characteristics inferred from such cues include the extent of food processing (Machiels & Karnal, 2016), luxury (van Rompay & Pruyn, 2011), and healthiness (Fenko, Lotterman, & Galetzka, 2016; van Rompay, Deterink, & Fenko, 2016). Ultimately, these evaluative inferences affect behavior such as food choice (Gutjar, de Graaf, Palascha, & Jager, 2014), purchase intention (Ares, Besio, Giménez, & Deliza, 2010), and amount consumed (Argo & White, 2012; Madzharov & Bloch, 2010).

Healthiness perceptions in particular can be evoked by the use of light colors and light-weight typefaces on packages (Karnal, Machiels, Orth, & Mai, 2016; Mai, Symmank, & Seeberg-Elverfeldt, 2016; Tijssen, Zandstra, de Graaf, & Jager, 2017) as both design cues can trigger associations with lightness and thereby activate the concept of healthiness. Further linking slimness with healthiness, tall (vs. wide; Koo & Suk, 2016) as well as slim (vs. thick; Fenko et al., 2016) package shapes can induce health-related associations. Both cues, package size and slimness, may function by referring to the human body and thus taking advantage of human associations derived from shapes. In line with this thinking, studies on the role of human body shapes in advertisements report positive effects of slim (vs. overweight) endorsers on brand and product evaluations (Aagerup, 2011; Melbye, Hansen, & Onozaka, 2015; Watson, Lecki, & Lebcir, 2015). Female consumers are especially likely to make the corresponding inferences (Keh, Park, Kelly, & Du, 2016; Peck & Loken, 2004), possibly in reference to their own body (Bergstrom, Neighbors, & Malheim, 2009).

To date, only scant research has addressed the issue of a package's slimness as a possible driver of healthiness perceptions. Given likely differences between the use of subtle design cues on packages and the explicit posing of human endorsers in advertisements, this work integrates studies on human body shape effects with research on visual cues to healthiness in food

packaging. Specifically, it aims at showing how and when mimicking humanoid shapes in package design can impact food healthiness perception. Two studies provide evidence for (1) the base effect of package slimness on product healthiness perception, (2) the role of self-referencing as a process explanation, and (3) consumer body shape and gender as boundary conditions. Using packages that closely mimic human body shapes, Study 1 establishes the package slimness – product healthiness relationship contingent on a person’s gender and body shape. Study 2 then corroborates effects in the presence of control variables and offers evidence for self-referencing as a process explanation.

Conceptual Framework

1.1 Bodily shape as a cue to healthiness

The ubiquitous portrayal of thin and ultrathin models in the media has a profound impact on people's ideal selves (Gagnard, 1986; Labre, 2005). Over the past decades, consumer perception of their ideal selves shifted from a voluptuous and curved body – the endomorph type – to the current ‘thin’ ideal of a slim, ectomorph body. In contrast, growing obesity rates worldwide (WHO, 2016) suggest that people's actual body shapes may not have changed accordingly, indicating a gap between actual and ideal bodily figures (Garner, Garfinkel, Schwartz, & Thompson, 1980). Yet, the notion of an ideal body shape appears to be deeply entrenched in the human mind, as indicated by positive implicit attitudes towards thinness, and strong negative implicit attitudes towards fatness (Schwartz, Vartanian, Nosek, & Brownell, 2006; Vartanian, Peter Herman, & Polivy, 2005). Especially females quickly associate the concept of goodness with pictures of slim legs (rather than thick thighs; Watts, Cranney, & Gleitzman, 2008). Similarly, whole-body photos of normal-weight individuals yield more positive attitudes than photos of overweight individuals (Roddy, Stewart, & Barnes-Holmes, 2010). Moreover, within the advertising domain, slim models evoke more positive attitudes, higher credibility and lead to higher purchase intention than curvy models (D'Alessandro & Chitty, 2011; Häfner & Trampe, 2009; Melbye et al., 2015). Taken together, these findings indicate a strong “thin-is-good” stereotype in consumers’ minds.

Thin body shapes also relate positively to health associations (Chrysochou & Nikolakis, 2012; Katz et al., 2004), suggesting an extension of the “thin-is-good” to a “thin-is-healthy” stereotype. Disregarding possible medical conditions this thin-is-healthy association may be grounded in the notion that being overweight or even obese may be associated with an

unhealthy lifestyle and overconsumption (Crandall, 1994). For instance, displaying overweight models in health campaigns increases intentions for healthy behaviors (Lawson & Wardle, 2013) and the presence of overweight customers decreased food consumption (McFerran, Dahl, Fitzsimons, & Morales, 2010a). Similarly, negative healthiness associations elicited by an overweight human model relate to decreased liking and purchase intention for the advertised food product (Chrysochou & Nikolakis, 2012; Westover & Randle, 2009). Together, these findings suggest that consumers may infer healthiness from human body shapes to further effect behavioral intention. Notably, humanoid shapes (rather than silhouettes of real people) may be able to function in similar ways by activating concepts of health and healthiness. Research in this area is scant with initial evidence suggesting that exposure to skinny humanoid shapes can decrease consumption of unhealthy foods (Brunner & Siegrist, 2012) and can encourage choice of healthy snacks (Stämpfli & Brunner, 2016). The possibility that associations evoked by package shapes may spill over to affect food product perception (e.g., healthiness) is supported, however, by findings that products in slim, angular packages are thought to be healthier than products in thick, round packages (Fenko et al., 2016). For instance, products in slimmer (vs. wider) containers are perceived as having less calories and thus as being healthier (Koo & Suk, 2016). However, process mechanisms and boundary conditions are not yet understood.

Taken together, extant research suggests that consumers make implicit as well as explicit health inferences based on both the human physique and shapes that closely resemble it. Extending these findings to the design of food packages suggests that a package's shape, especially its slimness, may activate health inferences that spill over to impact consumer perception of a product's healthiness. Integrating research on consumer response to human body shape with research on visual package design, we thus expect package shapes that resemble a slim (less slim) human body to relate to the product being perceived as more (less) healthy. Formally:

H1: Slim (vs. less slim) package shape enhances (decreases) consumers' food healthiness perceptions.

1.2 The role of consumer gender and BMI

Regarding health behavior, women have exhibited a healthier lifestyle than men (Bothmer & Fridlund, 2005), place higher importance on healthy eating (Wardle et al., 2004), and are also more inclined to restrict their food intake, undergo a diet, and be less satisfied with their body (Beardsworth et al., 2002; Joseph et al., 2016; Vila-López & Kuster-Boluda, 2016). These differences have been attributed to women's greater concerns for their weight and a preoccupation with achieving the "thin-ideal". The importance of this thin ideal is further underscored by the finding that women pay more attention towards slim women than they pay to overweight women (Joseph et al., 2016). Similarly, women who are dissatisfied with their own body show more attention to thin female bodies, and deem them more attractive (Cho & Lee, 2013), possibly due to a shape-attentional bias. In line with this thinking, females react more sensitive to the body shapes of waitresses (McFerran, Dahl, Fitzsimons, & Morales, 2010b) and product endorsers (Keh et al., 2016), again because they are possibly more susceptible to visual body cues than are men. This increased visual sensitivity may be grounded in the human desire to self-evaluate oneself through comparison with others (Festinger, 1954), a desire that seems especially pronounced with women. For example, women automatically compare themselves with models portrayed in advertising or in the media (Richins, 1991), resulting in an increased body dissatisfaction as an outcome of comparisons with ultra-thin fashion models (Groesz, Levine, & Murnen, 2002), especially for women high in BMI (Bergstrom et al., 2009; D'Alessandro & Chitty, 2011). Additionally, BMI has been found to impact effects of models' body sizes for women, but not for men (Keh et al., 2016). Taken together, these studies indicate that women refer to their own body weight and shape when comparing with other humans. Hence, the outcome of a comparison process should depend on the actual body of the woman. This thinking is consistent with findings that slim (versus overweight) individuals have more pronounced negative implicit attitudes towards overweight people (Schwartz et al., 2006). Regarding health associations, exposing obese women to images of overweight models yields above-average judgments of the model as being healthy (Chrysochou & Nikolakis, 2012). Generally, being overweight (i.e., having a Body Mass Index [BMI] greater than 25; WHO, 2017) plays a crucial role in attention to food and body shape cues, again, more so with women. Using dot-probe tasks, eye-tracking and imaging techniques (such as fMRI), various studies have shown that high BMI women pay more attention to food-related stimuli compared to normal-weight women (Castellanos et al., 2009; Nijs, Muris, Euser, & Franken, 2010; Yokum, Ng, & Stice, 2011). Together these findings imply that women more

than men should infer product healthiness from a package shape and should refer to their own body shape when doing so. Therefore:

H2: Individual BMI moderates the effect of package slimness on product healthiness such that the positive effect of slim shapes on healthiness increases as BMI decreases.

H3: Gender will moderate the effect of package slimness on healthiness (moderated by BMI) such that effects will be more pronounced with women, and will be attenuated with men.

1.3 Self-referencing as reaction to package shape exposure

Self-referencing functions as a cognitive processing strategy (Burnkrant & Unnava, 1995) where incoming information is associated with previously stored information about the self in order to aid interpretation of the stimulus (Debevec & Iyer, 1988). For example, a landscape in an advertisement can remind viewers of a personal favorite place, or the ethnicity of an advertisement model can activate a person's awareness of their own ethnicity (Martin, Lee, & Yang, 2004). Thus, using self-relevant information in marketing communications may induce spontaneous self-referencing, which increases attention, enhances the effectiveness of the advertisement (Debevec & Iyer, 1988), and induces positive effects on evaluations (Debevec & Iyer, 1988; Debevec & Romeo, 1992).

Research on human body shapes highlights that exposure to advertising models can lead to spontaneous self-referencing, in turn influencing attitudes towards the ad and the advertised product (Martin et al., 2004; Martin, Veer, & Pervan, 2007). Specifically, viewing models of different body sizes, women are more prone to self-referencing (Berg, 2015; Peck & Loken, 2004). Peck and Loken (2004) argue that exposure to different-sized models leads individuals to have positive or negative thoughts about themselves. In line with this thinking, the authors demonstrated that oversized models activate positive thoughts in women, whereas slim models produce more negative thoughts leading to more negative ratings of the advertisement. Combining these findings with women's higher sensitivity to shape-related cues (Brunner & Siegrist, 2012), suggests that exposure to package shapes mimicking female body shapes should activate self-relevant thoughts in women. Hence, exposure to diverging package shapes (differing in slimness) should lead to varying levels of self-referencing. Integrating this line of thought with the previously discussed influence of women's BMI on the evaluation of human models (i.e., Keh et al., 2016) implies that a package shape more similar to a person's own body shape should increase self-referencing.

In related contexts, self-referencing has been found to mediate effects of verbal and visual information (Debevec & Romeo, 1992), sex-role portrayals (Debevec & Iyer, 1988), decorative models (Berg, 2015), and, most importantly, of models body size (Martin et al., 2007) on attitudes and preferences. These findings suggest that self-referencing induced by package shapes should influence subsequent product perceptions. Therefore:

H4: Self-referencing mediates the effect of package slimness on product healthiness perception.

2. Study 1

2.1 Objective

The purpose of Study 1 was to test H1 and the claim that slim vs. less slim package shapes induce healthiness perceptions in a food products context. Additionally, the roles of participants' BMI and gender (H2, H3) were examined.

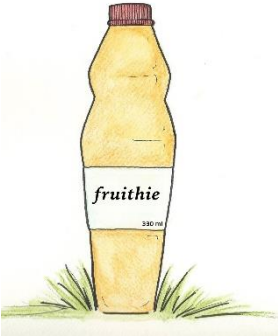



2.2 Method

2.2.1 Design and Stimuli

Study 1 employed a one-factorial (slim vs. less slim package) between-subjects design. Accounting for Fenko et al.'s (2016) finding of no interaction between package shape and product category (healthy vs. unhealthy) on healthiness perceptions, we focused on healthy foods. A smoothie was chosen as example product, because smoothies are little processed blends of inherently healthy ingredients such as raw fruits and vegetables with only water or milk added (McKinley, 2005; Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014). Moreover, smoothies are considered healthy products by the general population (Szocs & Lefebvre, 2016). The packages of the smoothie were designed to resemble female body shapes to account for findings that women are more susceptible to visual body cues (Joseph et al., 2016) and shape-induced comparison (Keh et al., 2016). Doing so additionally enables more directly comparing results with previous findings on human body shape research. The slim package was created by mimicking the shape of a slender female body, 'long legs' and a 'high waist'. In contrast, the less slim package was designed to resemble an overweight female body, small and rather round. Since women find the "hourglass" body shape (a waist-to-hip-ratio of 0.7) most attractive, most feminine and most healthy (Singh & Young, 1995), both packages were designed to resemble this "hourglass" shape. Further, to avoid a possible bias in volume perception (Wansink & van Ittersum, 2003) packages were designed and labeled to contain identical amounts of 330 ml

(see Table 1 for stimuli). Special care was also taken to ascertain that the labels on both packages covered an identical area of white space.

Table 1: Stimulus Overview for Study 1 and 2

Study	Stimuli	
	Slim stimulus	Less slim stimulus
1		
2		

2.2.2 Sample and Procedure

A total of seventy eight participants (45 females; $M_{Age} = 26.50$; $SD = 7.43$ $M_{BMI} = 22.88$, $SD = 2.94$) were recruited on campus of a large university under the guise of a new product test.

Upon agreement, participants viewed one randomly assigned packages (slim vs. less slim) for the fictitious brand “fruihie”. After examining the new product, participants completed questions about the smoothie, and indicated their age, gender, height and weight. Gender was balanced across the experimental conditions. Participants’ height and weight were used to calculate their Body Mass Index (BMI). As an indicator of a person's body shape, the BMI reflects the height-to-weight ratio of a person (calculated by dividing a person’s weight in kg by the square of the height in meters) and is frequently used to classify underweight (<18.5), normal weight ($18.5 - 24.9$), overweight (≥ 25.0), and obesity (≥ 30.0) in adults (WHO, 2017).

Since increases in BMI are related to increases in body fat, the measure is commonly used as an indicator of risk of illness (WHO, 1995; 2017). However, because increases in body fat correlate with changes in body shapes, BMI was used as a proxy for investigating if reactions to package shapes are contingent on consumers' body shapes.

2.2.3 Measures

Product healthiness was assessed through the items *healthy, nutritious, high in vitamins, low in calories, low in fat* and *high in fibers* ($\alpha = .71$). Given that the visual attractiveness of a package design can influence product-related judgments (Bloch, Brunel, & Arnold, 2003; Giese, Malkewitz, Orth, & Henderson, 2014), and because physical attractiveness in humans is related to perceived health (Nedelec & Beaver, 2014), participants also indicated how attractive they found the package. Even though stimuli were designed to explicitly mimic a female body, feminine perceptions may differ depending on the "body size" of the package. Since stronger feminine perceptions have affective and behavioral consequences (van Tilburg, Lieven, Herrmann, & Townsend, 2015), participants additionally rated how feminine they found the package to be. Last, credibility of the brand package was assessed, as slender bottles are more prototypical in the smoothie category. All measures were assessed on 7-point Likert scales ranging from 'strongly disagree' (1) to 'strongly agree' (7). Table 2 holds descriptive statistics and correlations for all measures.

Table 2: Correlation, means, and standard deviations for variables utilized in Study 1.

Variable	1	2	3	4	5	6	7	8
1. Package Shape	-							
2. Healthiness Perception	-.12	-						
3. BMI	.14	-.18	-					
4. Gender	-.10	-.05	-.26*	-				
5. Age	.09	-.21	.18	.11	-			
6. Package Attractiveness	-.26*	.38**	-.11	.02	-.11	-		
7. Feminine Perception	-.01	.19	-.13	.04	-.04	.12	-	
8. Credibility	-.05	.50***	-.16	.06	-.23*	.58***	.26*	-
<i>M</i>	-	4.64	22.88	-	26.50	4.18	5.46	4.71
<i>SD</i>	-	.89	2.94	-	7.43	1.38	1.42	1.34

Note: $p < .10^+$, $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$

2.3 Results

To test the influence of package shape on product healthiness (H1) and the claim that the shape-healthiness relationship is contingent on consumer's BMI (H2), and gender (H3), a moderated moderation model was tested (Model 3, PROCESS; Hayes, 2013). Package shape (dummy coded: slim package = 0, less slim package = 1) was the independent variable, BMI the

continuous primary moderator, gender (dummy coded: males = 0, females = 1) the secondary moderator, and healthiness perception was the dependent variable. Respondent age, package attractiveness, femininity, and credibility were included as covariates. Prior to estimating the model, the independent and moderator variables were mean centered. Table 2 presents the results. The direct effect of package shape on healthiness perception was not significant ($B = -.24$, $SE = .19$, $t = -1.25$, $p = .217$). However, in line with predictions, the three-way interaction between package shape, participants' BMI, and gender was marginal significant ($B = -.29$, $SE = .15$, $t = -1.98$, $p = .052$). Closer examination of the two-way interactions between shape and BMI revealed that BMI significantly moderated the shape-healthiness relationship with females ($B = -.20$, $SE = .08$, $t = -2.39$, $p = .020$, $CI_{95} = -.364$ to $-.033$), but not with males ($B = .09$, $SE = .12$, $t = .73$, $p = .466$, $CI_{95} = -.155$ to $.335$). Applying the Johnson-Neyman Technique further showed that the conditional effect with females is significant for BMI scores of 22.31 and above (42% of the female population). Specifically, women with a moderate to high BMI perceived the smoothie displayed in a slim package as healthier than the one in the less slim package (e.g., for BMI = 25: $M_{\text{slim}} = 5.14$ vs. $M_{\text{less slim}} = 4.10$), whereas no such differences emerged for women with lower BMIs (see Figure 1 and Table 3).

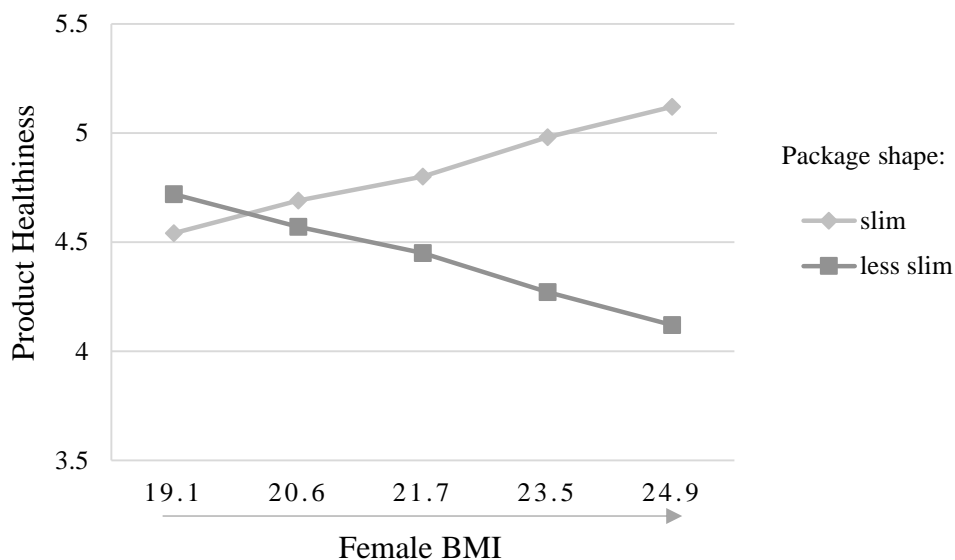


Figure 1: Perceived healthiness depending on package shape and BMI for women, including covariates. *Note:* Figure displays non-centered values. However, variables were mean centered prior to analysis.

Table 3: Results of testing moderated moderation (Study 1, Model 3, PROCESS; Hayes, 2013) where BMI which is additionally moderated by gender moderates package shape effect on healthiness perception with respective covariates. Variables were mean centered prior to analysis.

		Healthiness Perception	
		Coeff (SE)	t
Constant		2.98 (.59)	5.08***
Package Shape		-.24 (.19)	-1.25
BMI		<.01 (.04)	-.09
Package Shape x BMI		-.08 (.07)	-1.07
Gender		-.10 (.19)	-.52
Package Shape x Gender		-.65 (.39)	-1.67 ⁺
BMI x Gender		<.01 (.07)	.05
Package Shape x BMI x Gender		-.29 (.15)	-1.98 ⁺
Age		<.01 (.01)	-.33
Package Attractiveness		.07 (.08)	.86
Feminine Perception		.06 (.07)	.89
Credibility		.25 (.08)	3.00*
R ² _{adj.}		.38	
Conditional effect of package shape on healthiness perception for BMI and gender			
Men	low BMI	-.13 (.55)	-.23
	moderate BMI	.14 (.30)	.45
	high BMI	.40 (.37)	1.08
Women	low BMI	.07 (.30)	.24
	moderate BMI	-.51 (.25)	-2.09*
	high BMI	-1.10 (.39)	-2.83**
Conditional effect of package shape * BMI interaction depending on gender			
Men		.09 (.12)	.73
Women		-.20 (.08)	-2.39*

Note: $p < .10^+$, $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$

2.3 Discussion

Study 1 generated initial evidence for the claim that consumers, women in particular, rely more on slimness in package shapes when perceiving product healthiness. Although Study 1 did not support an overall direct effect of package slimness on healthiness (H1), the hypothesized direct effect was supported for high BMI women (H2, H3). For these consumers, slim packages related to higher healthiness perceptions, whereas less slim packages related to lower healthiness perceptions. As such the results do not align with previous studies on human models (Chrysochou & Nikolakis, 2012), which reported health effects of slim models for low BMI consumers and vice versa for high BMI consumers. These diverging outcomes found for package shapes versus human shapes can be interpreted to indicate fundamental differences in consumer processing of package versus human forms.

Additionally, gender differences in the use of package shapes as healthiness cues appear important. The humanoid package shapes utilized in this study lead to distinct findings specifically for women. These results corroborate reports that women are more sensitive to shape-related cues, such as slim vs. overweight models (Keh et al., 2016), especially when taking their own BMI into account (Bergstrom et al., 2009).

Further noteworthy is the fact that - by designing stimuli to correspond to distinct slim and less slim shapes while standardizing volume perception the resulting containers differed substantially in height. Koo and Suk (2016) report that consumers expect products in tall containers to have less calories than products in stocky containers. This finding suggests that the effects of package shape on healthiness reported here could be driven by factors other than package slimness. Furthermore, Study 1 was not designed to examine why slimness of package shapes may be related to product healthiness. To address these possible limitations, Study 2 was conducted, aiming at testing self-referencing as a possible process explanation and ruling out possible alternative explanations.

3. Study 2

3.1 Objective

Study 2 aimed at corroborating the effect of package shape slimness on healthiness with women (H1, H3), the moderating effect of BMI (H2), and the mediating role of self-referencing (H4). The study utilized more realistic humanoid packages for another healthy product within a female population and included several psychological variables to rule out alternative explanations.

3.2 Method

3.2.1 Design and Stimuli

Adopting Study 1's format, Study 2 examined consumer response to a healthy product in a 1-factor between-subjects design (package shape: slim vs. less slim). Different than with Study 1, a yogurt drink was chosen as an example category to enhance the generalizability of findings with another food product that is considered healthy (McKinley, 2005). Package shapes were adopted from Study 1 and adapted to yoghurt drinks using 3D-shapes, hereby increasing realism (see Appendix for stimuli overview). Again the "waist-to-hip-ratio" was 0.7 for both package shapes.

3.2.2 Sample and procedure

One hundred and forty four female members recruited from an online panel ($M_{\text{Age}} = 26.02$, $SD = 7.19$; $M_{\text{BMI}} = 22.69$, $SD = 3.10$) were randomly assigned to one of the two experimental conditions (slim vs. less slim package). After viewing the package they answered questions about the product and about themselves.

3.2.3 Measures

Adapted to fit the yoghurt category, perceived healthiness was measured through the items *healthy*, *low calorie*, *low fat*, and *light* ($\alpha = .83$). Package attractiveness, femininity, and credibility were assessed as in Study 1. Accounting for possible effects due to height differences between stimuli (Dubois, Rucker, & Galinsky, 2012), Study 2 participants indicated how slim they perceived the package to be; this measure was used in subsequent analyses.

In line with Peck and Loken (2004), three self-referencing measures were included, one general as well as one measure each for positive and negative self-referencing. Items for positive and negative self-referencing were adapted to the context and read: *'This product made me think positive/negative thoughts about myself'*. General self-referencing was assessed using the seven item scale developed and validated by Martin et al. (2004) that were also adapted to a product context (i.e., *'This product seems to relate to me personally.'*; $\alpha = .77$).

Beyond BMI, several other variables may moderate effects of a persons' attitudes to or perception of different sized models, specifically dietary restraint (McFerran et al., 2010b; Papiés & Nicolaije, 2012; Vartanian et al., 2005), weight control behavior (Martin et al., 2007; Martin & Xavier, 2010), thin internalization (Dittmar & Howard, 2004; Watts et al., 2008), and self-evaluation (Papiés & Nicolaije, 2012). McFerran et al. (2010b) criticize that the majority of previous studies fail to disentangle the role of physiological (such as BMI) and psychological variables. To ascertain that effects attributed to BMI were not biased by intervening latent variables, Study 2 takes these psychological variables into account. Dietary restrained was measured with the revised restraint scale (Herman & Polivy, 1980), using the concern for dieting subscale (e.g., *How often are you dieting?*, *Would a weight fluctuation of 5 pounds affect the way you live your life?*, $\alpha = .71$). Weight control behavior (WCB) was assessed using the items *'People have control over their weight'*, *'Being overweight is an individual's fault'*, *'Losing weight requires willpower'*, and *'People can become thin if they try'* (Martin & Xavier, 2010 adapted from Tiggemann & Anesbury, 2000; $\alpha = .67$). Assessing participants' self-evaluation involved indicating how satisfied they were with their own weight, body, and general

appearance, how attractive they thought themselves, and how comfortable they felt in their body (Papies & Nicolaije, 2012; $\alpha = .93$). The level of thin body internalization was assessed through the eight-item internalization subscale of the socio-cultural attitudes towards appearance questionnaire (SATAQ; Heinberg, Thompson, & Stormer, 1995), where participants rated how much they agreed with statements such as *'I tend to compare my body to people in magazines and on TV'* ($\alpha = .85$). All scales were of the 7-point Likert type, ranging from 1 (strongly disagree) to 7 (strongly agree).

Table 4: Correlation, means, and standard deviations for variables utilized in Study 2.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Package Shape	-														
2. Slimness Perception	-.27**	-													
3. Healthiness Perception	-.17*	.33***	-												
4. BMI	-.10	.01	-.04	-											
5. Age	-.17*	-.01	-.12	.26**	-										
6. Concern for Dieting	-.11	.02	-.02	.36***	.11	-									
7. Weight Control Behavior	-.20*	.09	.12	.04	.03	.08	-								
8. Self-evaluation	.02	-.04	-.04	-.50***	-.15 ⁺	-.37***	.06	-							
9. Thin Internalization	-.13	.06	.10	.13	-.04	.50***	.12	-.31***	-						
10. General Self-Referencing	.04	.19*	.22**	.14 ⁺	-.08	.18*	-.00	-.12	.27**	-					
11. Positive Self-Referencing	.08	.13	.13	-.01	-.03	.07	.11	.05	.19*	.46***	-				
12. Negative Self-Referencing	.05	-.20*	-.28**	.10	.13	.22**	.02	-.17*	.18*	.05	.09	-			
13. Package Attractiveness	-.06	.18*	.36***	.15 ⁺	.03	.09	.09	-.11	.13	.40***	.24**	.03	-		
14. Feminine Perception	-.16 ⁺	.26**	.12	-.03	-.17*	-.11	.12	.13	.13	.17*	.17*	-.12	.03	-	
15. Credibility	.15 ⁺	.07	.30***	.09	-.20*	.13	.02	-.06	.07	.46***	.28**	-.07	.17*	.14	-
<i>M</i>	-	2.81	3.05	22.69	26.02	3.61	4.87	4.62	2.95	2.24	1.98	2.18	2.80	4.68	3.39
<i>SD</i>	-	1.55	1.08	3.40	7.19	1.14	.98	1.27	1.15	.95	1.24	1.67	1.42	1.83	1.45

Note: $p < .10^+$, $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$

3.3 Results

Table 4 holds correlations among study variables, means, and standard deviations. Unless stated otherwise, the following analyses controlled for consumer age, concern for dieting, weight control behavior, self-evaluation, and thin internalization, as well as for package attractiveness, femininity, and credibility.

3.3.1 Effects of package shape on product perception and the role of BMI

To test the mediating role of package slimness in the package shape - healthiness relationship (H1) and the role of BMI as moderator (H2), a second stage moderated mediation model was estimated (Model 14; PROCESS; Hayes, 2015). Package shape (dummy coded: slim package = 0, less slim package = 1) and healthiness perception were the independent and dependent variables, respectively. Perceived package slimness was modeled as a mediator and BMI as a moderator of the slimness – healthiness path. All variables were mean centered prior to analysis.

Results indicate a direct effect of package shape on slimness perception ($B = -.72$, $SE = .27$, $t = -2.70$, $p = .008$). Analysis of variance between the two groups corroborated this effect with the slim package being perceived as significantly slimmer than the less slim package ($M_{\text{slim}} = 3.22$, $SD = 1.70$; $M_{\text{less slim}} = 2.39$, $SD = 1.32$; $F(133) = 7.50$, $p = .007$). Furthermore, package slimness had a direct effect on healthiness ($B = .17$, $SE = .05$, $t = 3.17$, $p = .002$) as well as an interactive effect with BMI ($B = .05$, $SE = .02$, $t = 2.67$, $p = .009$), thus supporting H1 and H2. Bootstrapping (10,000 samples) results showed a significant indirect effect of package shape on healthiness through slimness contingent upon women's BMI, as indicated by the fact that the bias-corrected bootstrap CI (95%) of the index of moderated mediation did not include zero ($CI_{95} = -.088$ to $-.006$; see Figure 2). Conducting a floodlight analysis (Spiller, Fitzsimons, Lynch, & McClelland, 2013) of the conditional indirect effects at different BMI percentiles (10th, 25th, 50th, 75th, and 90th) clarified that mediating effects were significant only for moderate to high BMI values (see Figure 3). Normal- to overweight women evaluated the product as healthier the slimmer they perceived the package to be, and as unhealthier when the package was perceived as not slim at all. For very slender women ($BMI < 20$) no differences in healthiness judgments emerged.

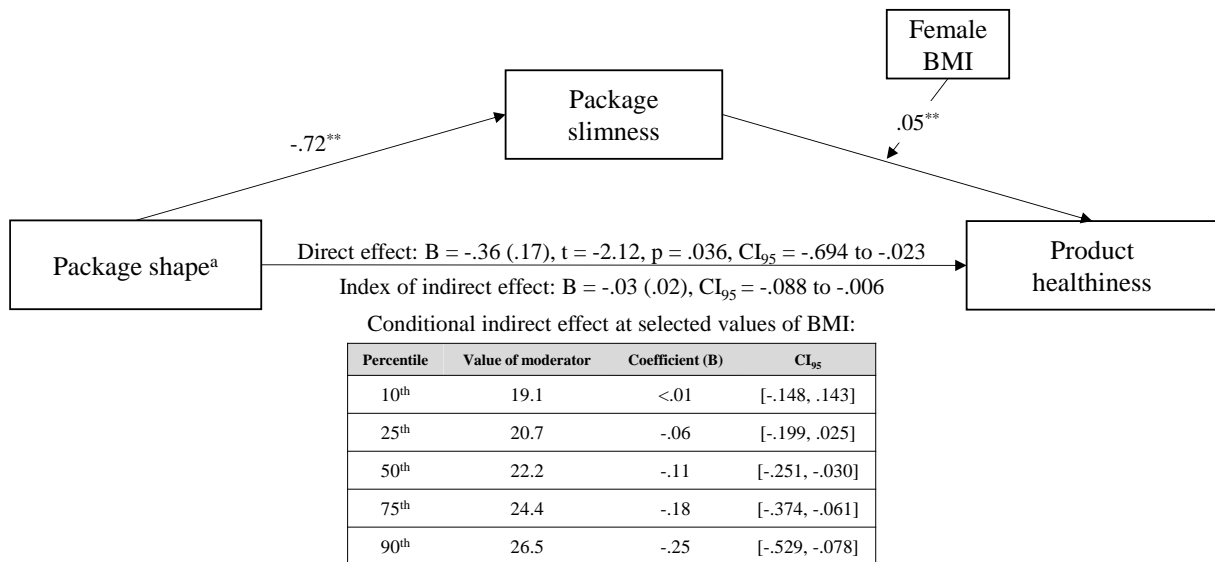


Figure 2: Graphical model showing the results of moderated mediation (Study 2, Model 14, PROCESS; Hayes, 2013). *Note:* B = unstandardized coefficient, CI = confidence interval, ^a coding: 0 = slim package, 1 = less slim package; $p < .10^+$, $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$; Table displays coefficients for non-centered values, however, prior to analysis variables were mean centered.

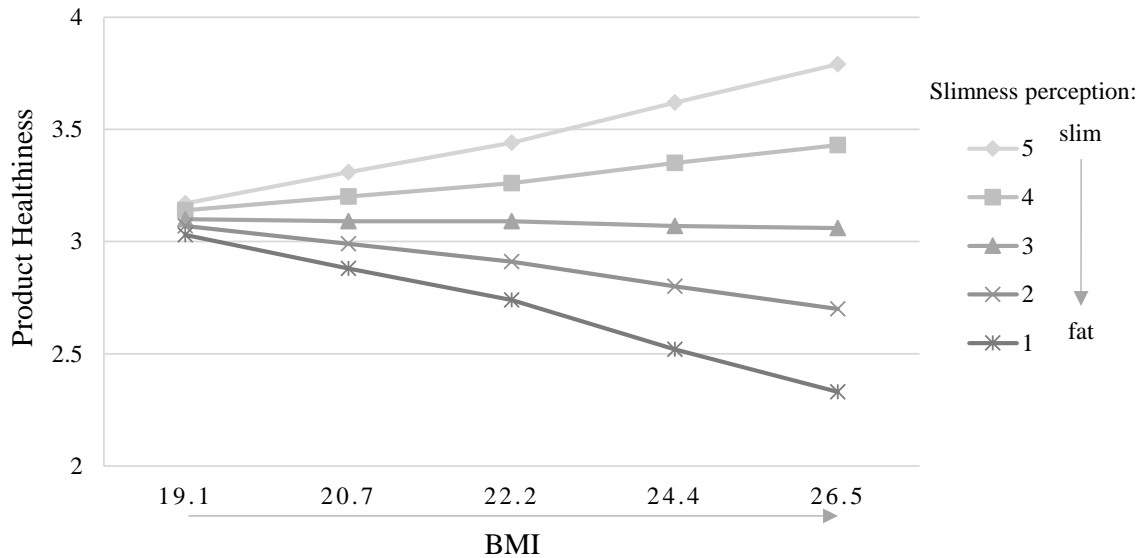


Figure 3: Effects of package shape (increasing numbers stand for increased slimness perception) and BMI on perceived healthiness controlling for covariates (floodlight analysis using percentiles). *Note:* Figure displays non-centered values, however, prior to analysis variables were mean centered.

3.3.2 The role of self-referencing

Since the mediation model estimated above indicated a mediating influence of package slimness between package shape and healthiness, the three self-referencing measures were first integrated as parallel mediators on the path between slimness and healthiness. This simple mediation model (Model 4, PROCESS; Hayes, 2013) was estimated with package slimness as the independent and healthiness as the dependent variable; general, positive, and negative self-referencing were entered as parallel mediators, again controlling for all other variables, including BMI. Results of the bias-corrected bootstrapping procedure (10,000 samples) yielded a significant indirect effect of perceived package slimness on healthiness via negative self-referencing ($CI_{95} = .005$ to $.086$), whereas the 95% CI of the indirect effect via general ($CI_{95} = -.032$ to $.008$) and positive self-referencing ($CI_{95} = -.023$ to $.010$) did include zero. Hence, the effect of package slimness on healthiness can be explained via negative self-referencing. The slimmer the package was perceived, the less negative thoughts women exhibited about themselves ($B = -.21$, $SE = .09$, $t = -2.38$, $p = .019$), which in turn led to increased healthiness judgments ($B = -.15$, $SE = .05$, $t = -2.96$, $p = .004$).

Integrating the two mediation models showed that effects of package shape on healthiness can be explained through perceived slimness and negative self-referencing in a serial mediation model (Model 6, PROCESS; bootstraps = 10,000; Hayes, 2013). The 95% CI of the indirect effect through both mediators was found not to include zero ($CI_{95} = -.076$ to $-.003$; see Figure 5).

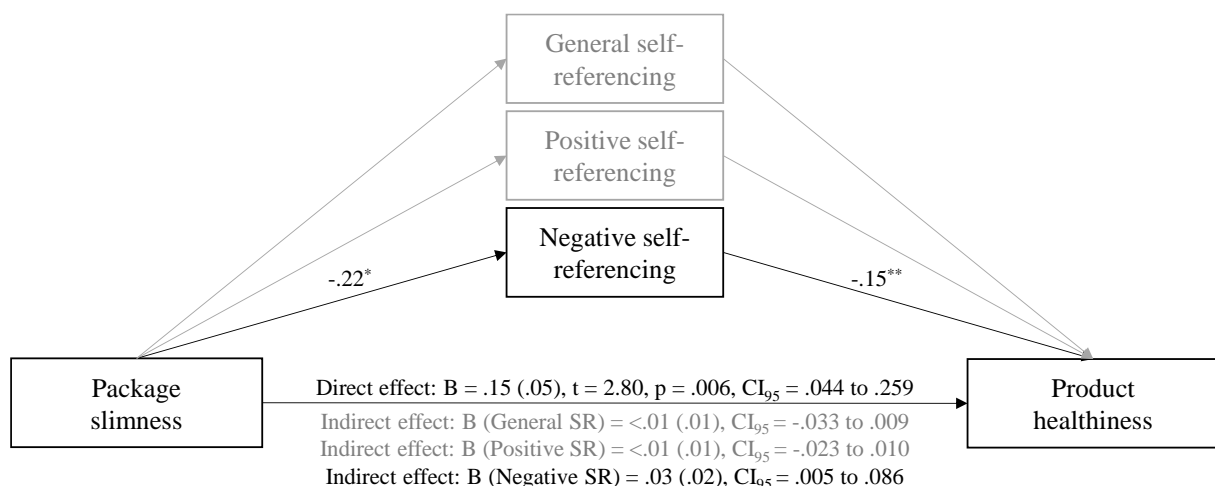


Figure 4: Graphical model showing the results of parallel mediation (Study 2; Model 4, PROCESS; Hayes, 2013). *Note:* B = unstandardized coefficient, CI_{95} = 95% confidence interval, $p < .10^+$, $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$. Variables were standardized prior to analysis.

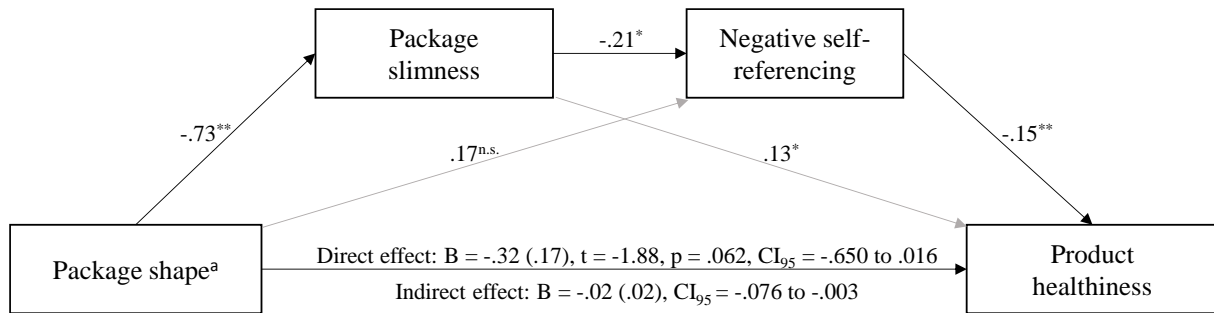


Figure 5: Graphical model showing the results of serial mediation (Study 2; Model 6, PROCESS; Hayes, 2013). *Note:* B = unstandardized coefficient, CI₉₅ = 95% confidence interval, ^a coding: 0 = slim package, 1 = less slim package, $p < .10^+$, $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$. Variables were standardized prior to analysis.

3.4 Discussion

Study 2 findings offered further support for H1 by demonstrating that slimness perception of the package drives the effect of package shape on product healthiness for women. The findings clarified that the slimmer the package was perceived the healthier female consumers evaluated the product in the container. As in Study 1, this effect was more pronounced with increasing BMI, even when controlling for other psychological variables such as concern for dieting, weight control behavior, self-evaluation, and thin internalization. Hence, results from Study 1 and 2 converge to show increasing healthiness perception derived from slim package shapes and decreasing healthiness perception inferred from less slim package shapes, especially when the women report a normal to high BMI. Regarding the process mechanism, negative self-referencing emerged as a significant mediator of the slimness – healthiness relationship. The slimmer a package is perceived the less negative thoughts are evoked in female viewers about themselves, hereby leading to higher healthiness perceptions.

4. General Discussion

4.1 Theoretical and practical implications

Inspired by research on advertising models (e.g., Bergstrom et al., 2009) and visual health cues (e.g., Fenko et al., 2016) this work integrates these two streams to focus on the role of package shape (slimness) in product healthiness perception. Study 1 provided evidence that food packages resembling human body shapes lead women with normal to high BMI to expect that slim packages contain a healthier product than less slim packages. Corroborating these findings with a female-only population, Study 2 showed the moderating effect of BMI to persist in the presence of various psychological control variables. Clarifying the process mechanism, the influence of package slimness on healthiness perception can be explained through negative self-referencing.

The contribution of this research is at least threefold. First, it shows that package shapes mimicking slim human body shapes relate to slimness associations, in turn influencing food healthiness perception. As such, this study adds to the emerging body of research on visual health cues in package design, including typeface (Karnal et al., 2016) or color (Mai et al., 2016; Tijssen et al., 2017). Package shape has started attracting particular attention (Fenko et al., 2016; Koo & Suk, 2016), and we extend initial evidence by focusing on package slimness as a cue to food healthiness.

Second, this research identifies consumer gender and BMI as boundary conditions for when package slimness functions as a visual healthiness cue. In line with research showing women to react more sensitive to visual health- and shape-related cues (Cho & Lee, 2013; Nijs et al., 2010), the current work offers additional evidence from food package design. In addition, previous studies showed that viewing slim models leads to increased weight concern (Bergstrom et al., 2009) and decreased body image (Groesz et al., 2002) in overweight women, in turn decreasing healthiness judgments of the slim model (Chrysochou & Nikolakis, 2012). While the present study found that package slimness induces food healthiness perception, negative effects on self-evaluation reported to accompany effects of human models did not emerge here³. Moreover, the current results contrast findings on human models (Chrysochou & Nikolakis, 2012), as normal- to overweight women derived healthiness from slimness, while slim women seemed indifferent (rather than slim women judging slim packaged products

³ As this was not the main focus of the current work it was not reported in the results section, but in Study 2 no difference in self-evaluation (a measure of satisfaction with one's own appearance including the body weight; Papias and Nicolaije, 2012) surfaced in the two package shape conditions.

healthier and overweight women judging less slim packaged products healthier). It appears that slimness in food packages may suggest the (future) achievement of a thinner body, rather than reminding women of their own possible deficiencies, as it were the case if other women were involved (Bergstrom et al., 2009; Groesz et al., 2002; Martin & Xavier, 2010). It is speculated that this outcome could be due to the fact that food products are to be consumed with their healthiness being assessed on the basis of what the consumption brings to one's own health, whereas other people's healthiness may not be relevant to one's well-being.

Third, this study is among the first to offer self-referencing as an explanatory mechanism for effects of package design. In the past, self-referencing has been induced by providing visual and verbal self-relevant information (Debevec & Romeo, 1992), viewing angles in advertising (Meyers-Levy & Peracchio, 1996), the presence of human endorsers (e.g., Peck & Loken, 2004), or by directly instructing consumers to relate cues to themselves (Burnkrant & Unnava, 1995). The present study adds to this knowledge base by showing that food packages that resemble human body shapes can also trigger self-referencing. Of the three types of self-referencing explored, only negative self-referencing mediated the slimness – healthiness relationship. It is particularly noteworthy that this process occurred with all females, irrespective of their BMI. Of further interest, effects established with package shapes follow a different pattern than effects reported with human models: Slim models increase negative thoughts about oneself (Peck & Loken, 2004), whereas slim packages decreased negative thoughts while subsequently increasing healthiness perception. This finding denotes an important difference in self-referencing induced by products versus actual people, as was the case with BMI. The nature of negative thoughts are, however, unclear. According to Peck and Loken (2004), evoked positive or negative thoughts in women are related to their own body weight, which makes the non-significant moderator effect of BMI in the package slimness – self-referencing relationship even more remarkable. Given the current focus on healthy food products, it seems plausible that a visually slim food container implies positive (or less negative) feelings after consumption, whereas a larger container may increase guilt. However, substantiating these speculations remains a subject for future research. Notwithstanding these open issues, using slim packages appears to not be associated with the negative drawbacks that come with employing (ultra) slim models, such as higher body image concerns (Groesz et al., 2002) which may cause eating disorders (Thompson & Stice, 2001).

From a managerial perspective, the findings should caution product managers and package designers to concentrate solely on factors such as functionality, aesthetics, or ergonomics in their quest for persuasive and self-explanatory packaging (Creusen & Schoormans, 2005),

instead accounting for self-relevant information. In other words, marketers should aim for designs less likely to trigger negative feelings or thoughts about consumer selves as these might decrease perceptions of healthiness, especially for healthy foods. One option to accomplish this objective involves increasing the perceived slimness of a package. As the present study shows, even slight differences in slimness perceptions yield positive effects on healthiness. Although this work manipulated subjective slimness through package shape, other options exist for influencing visual slimness. For example, the yogurt brand Activia™ (by Danone) applies form and color to generate impressions of package slimness by highlighting the narrow waist of their bottle shapes, especially for light (sugar- and fat-reduced) products. Hence, the current findings should aid marketers of healthy products and products designed for weight loss in developing package designs better tailored to their target customers.

4.2 Limitations and avenues for future research

This research has a few limitations that need addressing in future studies. To manipulate perceptions of package slimness we used humanoid package resembling slim and less slim shapes. Given the BMI distribution in female population (Harris, Bradlyn, Coffman, Gunel, & Cottrell, 2008) readers should bear in mind that the package designed to be slim represents a female body shape on the lower, but still normal BMI range. Rather than representing an extremely skinny human body, the slim packages in our experiments correspond with a slim to normal-weight female body. Using plausible rather than extreme stimuli is, however, in line with the bulk of previously discussed research that similarly employed normal- to overweight female bodies (Chrysochou & Nikolakis, 2012; D'Alessandro & Chitty, 2011; McFerran et al., 2010b; Melbye et al., 2015).

A second limitation may lie with the possibility that package shape can cue product-related concepts other than healthiness. For example, women associate thinness with success (Evans, 2003) and perceive brands endorsed by slim models as more competent and sophisticated (Aagerup, 2011). Additionally, product healthiness has been related negatively to taste (Mai et al., 2016; Raghunathan, Naylor, & Hoyer, 2006). Given that neither expected nor actual taste were included in the present work, possible links between package slimness and taste remain open. Future research should thus go beyond product perceptions to assess downstream effects on the actual consumption including taste.

Finally, the current results are limited to healthy food products. Some investigations on models' body shape have shown effects to be independent of food healthiness (Chrysochou & Nikolakis, 2012; Martin & Xavier, 2010), whereas others have found diverging effects depending on

product category (Martin et al., 2007; Westover & Randle, 2009). Even though research seems to converge on the finding that healthiness effects of package shape should be independent of the product category (Fenko et al., 2016), category-specific anomalies cannot be ruled out and caution must be taken in transferring our findings to other categories. Similarly, other moderators may exist besides gender and BMI, affecting the slimness-healthiness relationship. Even though care was taken to control for a number of psychological variables, and to exclude diet- and food-related variables, there might be design- or processing-related variables to be considered, such as design sensitivity (Becker et al., 2011) or the tendency to process metaphors (van Rompay & Velkamp, 2014). More health-related personal characteristics include health-consciousness (Machiels & Karnal, 2016; Mai & Hoffmann, 2012), health-regulatory focus (Gomez, Borges, & Pechmann, 2013; Karnal et al., 2016) or active health goals (Forwood, Ahern, Hollands, Ng, & Marteau, 2015). What is more, contextual effects (Peck & Loken, 2004), specifically the consumption and retail environment (van Rompay et al., 2016) are not to be neglected.

References

- Aagerup, U. (2011). The influence of real women in advertising on mass market fashion brand perception. *Journal of Fashion Marketing and Management: An International Journal*, 15(4), 486–502. doi:10.1108/13612021111169960
- Ares, G., Besio, M., Giménez, A., & Deliza, R. (2010). Relationship between involvement and functional milk desserts intention to purchase. Influence on attitude towards packaging characteristics. *Appetite*, 55(2), 298–304. doi:10.1016/j.appet.2010.06.016
- Argo, J. J., & White, K. (2012). When do consumers eat more? The role of appearance self-esteem and food packaging cues. *Journal of Marketing*, 76(2), 67–80. doi:10.1509/jm.09.0512
- Beardsworth, A., Bryman, A., Keil, T., Goode, J., Haslam, C., & Lancashire, E. (2002). Women, men and food: The significance of gender for nutritional attitudes and choices. *British Food Journal*, 104(7), 470–491. doi:10.1108/00070700210418767
- Becker, L., van Rompay, T. J. L., Schifferstein, H. N. J., & Galetzka, M. (2011). Tough package, strong taste: The influence of packaging design on taste impressions and product evaluations. *Food Quality and Preference*, 22(1), 17–23. doi:10.1016/j.foodqual.2010.06.007
- Berg, H. (2015). Headless: The role of gender and self-referencing in consumer response to cropped pictures of decorative models. *Psychology & Marketing*, 32(10), 1002–1016. doi:10.1002/mar.20838
- Bergstrom, R. L., Neighbors, C., & Malheim, J. E. (2009). Media comparisons and threats to body image: Seeking evidence of self-affirmation. *Journal of Social and Clinical Psychology*, 28(2), 264–280. doi:10.1521/jscp.2009.28.2.264
- Bloch, P. H., Brunel, F. F., & Arnold, T. J. (2003). Individual differences in the centrality of visual product aesthetics: Concept and measurement. *Journal of Consumer Research*, 29(4), 551–565. doi:10.1086/346250
- Bothmer, M. I. K. von, & Fridlund, B. (2005). Gender differences in health habits and in motivation for a healthy lifestyle among Swedish university students. *Nursing & Health Sciences*, 7(2), 107–118. doi:10.1111/j.1442-2018.2005.00227.x
- Brunner, T. A., & Siegrist, M. (2012). Reduced food intake after exposure to subtle weight-related cues. *Appetite*, 58(3), 1109–1112. doi:10.1016/j.appet.2012.03.010
- Burnkrant, R. E., & Unnava. (1995). Effects of self-referencing on persuasion. *Journal of Consumer Research*, 22(1), 17–26. doi:10.2307/2489697
- Castellanos, E. H., Charboneau, E., Dietrich, M. S., Park, S., Bradley, B. P., Mogg, K., & Cowan, R. L. (2009). Obese adults have visual attention bias for food cue images: evidence for altered reward system function. *International Journal of Obesity*, 33(9), 1063–1073. doi:10.1038/ijo.2009.138
- Cho, A., & Lee, J.-H. (2013). Body dissatisfaction levels and gender differences in attentional biases toward idealized bodies. *Body Image*, 10(1), 95–102. doi:10.1016/j.bodyim.2012.09.005
- Chrysochou, P., & Nikolakis, G. (2012). Breaking down the stereotypes in advertising of healthy foods. *ANZMAC 2012 Conference*,
- Crandall, C. S. (1994). Prejudice against fat people: Ideology and self-interest. *Journal of Personality and Social Psychology*, 66(5), 882–894.
- Creusen, M. E. H., & Schoormans, J. P. L. (2005). The different roles of product appearance in consumer choice. *Journal of Product Innovation Management*, 22(1), 63–81. doi:10.1111/j.0737-6782.2005.00103.x

- D'Alessandro, S., & Chitty, B. (2011). Real or relevant beauty? Body shape and endorser effects on brand attitude and body image. *Psychology & Marketing*, 28(8), 843–878. doi:10.1002/mar.20415
- Debevec, K., & Iyer, E. (1988). Self-referencing as a mediator of the effectiveness of sex-role portrayals in advertising. *Psychology & Marketing*, 5(1), 71–84. doi:10.1002/mar.4220050106
- Debevec, K., & Romeo, J. B. (1992). Self-referent processing in perceptions of verbal and visual commercial information. *Journal of Consumer Psychology*, 1(1), 83–102.
- Dittmar, H., & Howard, S. (2004). Professional hazards? The impact of models' body size on advertising effectiveness and women's body-focused anxiety in professions that do and do not emphasize the cultural ideal of thinness. *The British journal of social psychology / the British Psychological Society*, 43(Pt 4), 477–497. doi:10.1348/0144666042565407
- Dubois, D., Rucker, D. D., & Galinsky, A. D. (2012). Super size me: Product size as a signal of status. *Journal of Consumer Research*, 38(6), 1047–1062. doi:10.1086/661890
- Evans, P. C. (2003). “If only I were thin like her, maybe I could be happy like her”: The self-implications of associating a thin female ideal with life success. *Psychology of Women Quarterly*, 27(3), 209–214. doi:10.1111/1471-6402.00100
- Fenko, A., Lotterman, H., & Galetzka, M. (2016). What’s in a name? The effects of sound symbolism and package shape on consumer responses to food products. *Food Quality and Preference*, 51, 100–108. doi:10.1016/j.foodqual.2016.02.021
- Festinger, L. (1954). A theory of social comparison processes. *Human Relations*, 7(2), 117–140. doi:10.1177/001872675400700202
- Forwood, S. E., Ahern, A. L., Hollands, G. J., Ng, Y.-L., & Marteau, T. M. (2015). Priming healthy eating. You can't prime all the people all of the time. *Appetite*, 89, 93–102. doi:10.1016/j.appet.2015.01.018
- Gagnard, A. (1986). From feast to famine: Depiction of ideal body type in magazine advertising: 1950-1984. *Proceedings of the American Academy of Advertising*, (27), 461–470.
- Garner, D. M., Garfinkel, P. E., Schwartz, D., & Thompson, M. (1980). Cultural expectations of thinness in women. *Psychological reports*, 47(2), 483–491. doi:10.2466/pr0.1980.47.2.483
- Giese, J. L., Malkewitz, K., Orth, U. R., & Henderson, P. W. (2014). Advancing the aesthetic middle principle: Trade-offs in design attractiveness and strength. *Journal of Business Research*, 67(6), 1154–1161. doi:10.1016/j.jbusres.2013.05.018
- Gomez, P., Borges, A., & Pechmann, C. (2013). Avoiding poor health or approaching good health: Does it matter? The conceptualization, measurement, and consequences of health regulatory focus. *Journal of Consumer Psychology*, 23(4), 451–463.
- Groesz, L. M., Levine, M. P., & Murnen, S. K. (2002). The effect of experimental presentation of thin media images on body satisfaction: a meta-analytic review. *The International journal of Eating Disorders*, 31(1), 1–16.
- Gutjar, S., de Graaf, C., Palascha, A., & Jager, G. (2014). Food choice: the battle between package, taste and consumption situation. *Appetite*, 80, 109–113. doi:10.1016/j.appet.2014.05.006
- Häfner, M., & Trampe, D. (2009). When thinking is beneficial and when it is not: The effects of thin and round advertising models. *Journal of Consumer Psychology*, 19(4), 619–628. doi:10.1016/j.jcps.2009.06.004

- Harris, C. V., Bradlyn, A. S., Coffman, J., Gunel, E., & Cottrell, L. (2008). BMI-based body size guides for women and men: development and validation of a novel pictorial method to assess weight-related concepts. *International Journal of Obesity*, *32*(2), 336–342. doi:10.1038/sj.ijo.0803704
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: The Guilford Press.
- Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behavioral Research*, *50*(1), 1–22. doi:10.1080/00273171.2014.962683
- Heinberg, L. J., Thompson, J. K., & Stormer, S. (1995). Development and validation of the sociocultural attitudes towards appearance questionnaire. *International Journal of Eating Disorders*, *17*(1), 81–89.
- Henderson, P. W., Giese, J. L., & Cote, J. A. (2004). Impression management using typeface design. *Journal of Marketing*, *68*(4), 60–72.
- Herman, C. P., & Polivy, J. (1980). Restrained eating. *Obesity*, 208–225.
- Joseph, C., LoBue, V., Rivera, L. M., Irving, J., Savoy, S., & Shiffrar, M. (2016). An attentional bias for thin bodies and its relation to body dissatisfaction. *Body Image*, *19*, 216–223. doi:10.1016/j.bodyim.2016.10.006
- Karnal, N., Machiels, C. J. A., Orth, U. R., & Mai, R. (2016). Healthy by design, but only when in focus: Communicating non-verbal health cues through symbolic meaning in packaging. *Food Quality and Preference*, *52*, 106–119. doi:10.1016/j.foodqual.2016.04.004
- Katz, M. L., Gordon-Larsen, P., Bentley, M. E., Kelsey, K., Shields, K., & Ammerman, A. (2004). "Does skinny mean healthy?" Perceived ideal, current, and healthy body sizes among african-american girls and their female caregivers. *Ethnicity & Disease*, *14*(4), 533–541.
- Keh, H. T., Park, I. H., Kelly, S., & Du, X. (2016). The effects of model size and race on chinese consumers' reactions: A social comparison perspective. *Psychology & Marketing*, *33*(3), 177–194. doi:10.1002/mar.20864
- Koo, J., & Suk, K. (2016). The effect of package shape on calorie estimation. *International Journal of Research in Marketing*. doi:10.1016/j.ijresmar.2016.03.002
- Labre, M. P. (2005). The male body ideal: perspectives of readers and non-readers of fitness magazines. *Journal of Men's Health and Gender*, *2*(2), 223–229.
- Lawson, V., & Wardle, J. (2013). A qualitative exploration of the health promotion effects of varying body size in photographs analyzed using Interpretative Phenomenological Analysis. *Body Image*, *10*(1), 85–94. doi:10.1016/j.bodyim.2012.08.005
- Machiels, C. J. A., & Karnal, N. (2016). See how tasty it is? Effects of symbolic cues on product evaluation and taste. *Food Quality and Preference*, *52*, 195–202. doi:10.1016/j.foodqual.2016.04.014
- Madzharov, A. V., & Bloch, L. G. (2010). Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology*, *20*(4), 398–409. doi:10.1016/j.jcps.2010.06.007
- Mai, R., & Hoffmann, S. (2012). Taste lovers versus nutrition fact seekers: How health consciousness and self-efficacy determine the way consumers choose food products. *Journal of Consumer Behaviour*, *11*(4), 316–328. doi:10.1002/cb.1390
- Mai, R., Symmank, C., & Seeberg-Elverfeldt, B. (2016). Light and pale colors in food packaging: When does this package cue signal superior healthiness or inferior tastiness? *Journal of Retailing*. doi:10.1016/j.jretai.2016.08.002
- Martin, B., Lee, C., & Yang, F. (2004). The influence of ad model ethnicity and self-referencing on attitudes. *Journal of Advertising*, *33*(4), 27–37.

- Martin, B. A. S., Veer, E., & Pervan, S. J. (2007). Self-referencing and consumer evaluations of larger-sized female models: A weight locus of control perspective. *Marketing Letters, 18*(3), 197–209. doi:10.1007/s11002-007-9014-1
- Martin, B. A., & Xavier, R. (2010). How do consumers react to physically larger models? Effects of model body size, weight control beliefs and product type on evaluations and body perceptions. *Journal of Strategic Marketing, 18*(6), 489–501. doi:10.1080/0965254X.2010.525252
- McFerran, B., Dahl, D. W., Fitzsimons, G. J., & Morales, A. C. (2010a). I'll have what she's having: Effects of social influence and body type on the food choices of others. *Journal of Consumer Research, 36*(6), 915–929. doi:10.1086/644611
- McFerran, B., Dahl, D. W., Fitzsimons, G. J., & Morales, A. C. (2010b). Might an overweight waitress make you eat more? How the body type of others is sufficient to alter our food consumption. *Journal of Consumer Psychology, 20*(2), 146–151. doi:10.1016/j.jcps.2010.03.006
- McKinley, M. C. (2005). The nutrition and health benefits of yoghurt. *International Journal of Dairy Technology, 58*(1), 1–12. doi:10.1111/j.1471-0307.2005.00180.x
- Melbye, E. L., Hansen, H., & Onozaka, Y. (2015). Advertising functional foods: The effects of physical body size and appeal type on ad credibility and purchase intentions. *Journal of International Food & Agribusiness Marketing, 27*(2), 142–154. doi:10.1080/08974438.2014.918916
- Meyers-Levy, J., & Peracchio, L. A. (1996). Moderators of the impact of self-reference on persuasion. *Journal of Consumer Research, 22*(4), 408. doi:10.1086/209458
- Nedelec, J. L., & Beaver, K. M. (2014). Physical attractiveness as a phenotypic marker of health: An assessment using a nationally representative sample of American adults. *Evolution and Human Behavior, 35*(6), 456–463. doi:10.1016/j.evolhumbehav.2014.06.004
- Nijs, I. M. T., Muris, P., Euser, A. S., & Franken, I. H. A. (2010). Differences in attention to food and food intake between overweight/obese and normal-weight females under conditions of hunger and satiety. *Appetite, 54*(2), 243–254. doi:10.1016/j.appet.2009.11.004
- Oyebode, O., Gordon-Dseagu, V., Walker, A., & Mindell, J. S. (2014). Fruit and vegetable consumption and all-cause, cancer and CVD mortality: analysis of Health Survey for England data. *Journal of epidemiology and community health, 68*(9), 856–862. doi:10.1136/jech-2013-203500
- Papies, E. K., & Nicolaije, K. A. H. (2012). Inspiration or deflation? Feeling similar or dissimilar to slim and plus-size models affects self-evaluation of restrained eaters. *Body Image, 9*(1), 76–85. doi:10.1016/j.bodyim.2011.08.004
- Peck, J., & Loken, B. (2004). When will larger-sized female models in advertisements be viewed positively? The moderating effects of instructional frame, gender, and need for cognition. *Psychology & Marketing, 21*(6), 425–442. doi:10.1002/mar.20012
- Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy= tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing, 70*(4), 170–184.
- Richins, M. L. (1991). Social comparison and the idealized images of advertising. *Journal of Consumer Research, 18*(1), 71. doi:10.1086/209242
- Roberto, C. A., Shivaram, M., Martinez, O., Boles, C., Harris, J. L., & Brownell, K. D. (2012). The Smart Choices front-of-package nutrition label. Influence on perceptions and intake of cereal. *Appetite, 58*(2), 651–657. doi:10.1016/j.appet.2012.01.003

- Roddy, S., Stewart, I., & Barnes-Holmes, D. (2010). Anti-fat, pro-slim, or both? Using two reaction-time based measures to assess implicit attitudes to the slim and overweight. *Journal of Health Psychology, 15*(3), 416–425. doi:10.1177/1359105309350232
- Schwartz, M. B., Vartanian, L. R., Nosek, B. A., & Brownell, K. D. (2006). The influence of one's own body weight on implicit and explicit anti-fat bias. *Obesity (Silver Spring, Md.), 14*(3), 440–447. doi:10.1038/oby.2006.58
- Singh, D., & Young, R. K. (1995). Body weight, waist-to-hip ratio, breasts, and hips: Role in judgments of female attractiveness and desirability for relationships. *Ethology and Sociobiology, 16*(6), 483–507. doi:10.1016/0162-3095(95)00074-7
- Spiller, S. A., Fitzsimons, G. J., Lynch, J. G., & McClelland, G. H. (2013). Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *Journal of Marketing Research, 50*(2), 277–288.
- Stämpfli, A. E., & Brunner, T. A. (2016). The art of dieting: Exposure to thin sculptures effortlessly reduces the intake of unhealthy food in motivated eaters. *Food Quality and Preference, 50*, 88–93. doi:10.1016/j.foodqual.2016.01.012
- Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: Shaped by global drivers and local environments. *The Lancet, 378*(9793), 804–814. doi:10.1016/S0140-6736(11)60813-1
- Szocs, C., & Lefebvre, S. (2016). The blender effect: Physical state of food influences healthiness perceptions and consumption decisions. *Food Quality and Preference, 54*, 152–159. doi:10.1016/j.foodqual.2016.07.009
- Thompson, J. K., & Stice, E. (2001). Thin-ideal internalization: Mounting evidence for a new risk factor for body-image disturbance and eating pathology. *Current Directions in Psychological Science, 10*(5), 181–183. doi:10.1111/1467-8721.00144
- Tiggemann, M., & Anesbury, T. (2000). Negative stereotyping of obesity in children: The role of controllability beliefs. *Journal of Applied Social Psychology, 30*(9), 1977–1993. doi:10.1111/j.1559-1816.2000.tb02477.x
- Tijssen, I., Zandstra, E. H., de Graaf, C., & Jager, G. (2017). Why a ‘light’ product package should not be light blue: Effects of package colour on perceived healthiness and attractiveness of sugar- and fat-reduced products. *Food Quality and Preference, 59*, 46–58. doi:10.1016/j.foodqual.2017.01.019
- van Rompay, T. J. L., Deterink, F., & Fenko, A. (2016). Healthy package, healthy product? Effects of packaging design as a function of purchase setting. *Food Quality and Preference, 53*, 84–89. doi:10.1016/j.foodqual.2016.06.001
- van Rompay, T. J. L., & Pruyn, A. T. H. (2011). When visual product features speak the same language: Effects of shape-typeface congruence on brand perception and price expectations. *Journal of Product Innovation Management, 28*(4), 599–610. doi:10.1111/j.1540-5885.2011.00828.x
- van Rompay, T. J. L., & Veltkamp, M. (2014). Product packaging metaphors: Effects of ambiguity and explanatory information on consumer appreciation and brand perception. *Psychology & Marketing, 31*(6), 404–415. doi:10.1002/mar.20703
- van Tilburg, M., Lieven, T., Herrmann, A., & Townsend, C. (2015). Beyond “Pink It and Shrink It” perceived product gender, aesthetics, and product evaluation. *Psychology & Marketing, 32*(4), 422–437. doi:10.1002/mar.20789
- Vartanian, L. R., Peter Herman, C., & Polivy, J. (2005). Implicit and explicit attitudes toward fatness and thinness: The role of the internalization of societal standards. *Body Image, 2*(4), 373–381. doi:10.1016/j.bodyim.2005.08.002

- Vila-López, N., & Kuster-Boluda, I. (2016). Adolescents' food packaging perceptions. Does gender matter when weight control and health motivations are considered? *Food Quality and Preference*, 52, 179–187. doi:10.1016/j.foodqual.2016.04.012
- Wansink, B., & van Ittersum, K. (2003). Bottoms Up!: The Influence of Elongation on Pouring and Consumption Volume. *Journal of Consumer Research*, 30(3), 455–463. doi:10.1086/378621
- Wardle, J., Haase, A. M., Steptoe, A., Nillapun, M., Jonwutiwes, K., & Bellisie, F. (2004). Gender differences in food choice: The contribution of health beliefs and dieting. *Annals of Behavioral Medicine*, 27(2), 107–116. doi:10.1207/s15324796abm2702_5
- Watson, A., Lecki, N. K., & Lebcir, M. (2015). Does size matter? An exploration of the role of body size on brand image perceptions. *Journal of Product & Brand Management*, 24(3), 252–262. doi:10.1108/JPBM-05-2014-0616
- Watts, K., Cranney, J., & Gleitzman, M. (2008). Automatic evaluation of body-related images. *Body Image*, 5(4), 352–364. doi:10.1016/j.bodyim.2008.06.001
- Westover, M. L., & Randle, Q. (2009). Endorser weight and perceptions of brand attitude and intent to purchase. *Journal of Promotion Management*, 15(1-2), 57–73. doi:10.1080/10496490902908717
- World Health Organization [WHO]. (1995). Physical status: The use and interpretation of anthropometry: Report of a WHO Expert Committee.
- World Health Organization [WHO]. (2003). Diet, nutrition and the prevention of chronic disease. *World Health Organ Tech Rep Ser*, 916(i-viii).
- World Health Organization [WHO]. (2016). *Obesity and overweight: Fact sheet*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs311/en/>
- World Health Organization [WHO]. (2017). *Body mass index - BMI: Fact sheet*. Retrieved from <http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>
- Yokum, S., Ng, J., & Stice, E. (2011). Attentional bias to food images associated with elevated weight and future weight gain: an fMRI study. *Obesity (Silver Spring, Md.)*, 19(9), 1775–1783. doi:10.1038/oby.2011.168

Chapter 6

See how tasty it is?

Effects of symbolic cues on product evaluation and taste

Casparus J. A. Machiels

Nadine Karnal

This contribution is published in *Food Quality and Preference*, Volume 52, pages 195-202.

<https://doi.org/10.1016/j.foodqual.2016.04.014>

Abstract

Beyond more obvious informational cues, such as prices or labels, brands also communicate with consumers through more subtle means. The visual design of a package (e.g., its shape, size, colour, or imagery) conveys symbolic meaning to consumers hereby impacting product evaluation and hedonic expectancies. Inspired by the growing interest in symbolic design, the present work examines how visual and verbal cues relating to divergent levels of processing impact product evaluation, taste evaluation, and purchase intention. Results show that visuals of unprocessed foods symbolize naturalness to influence product evaluation, but only with consumers who are health conscious and search for symbolic meaning. In addition, for those consumers, visuals of unprocessed foods relate to purer product taste and, in turn, to greater purchase intentions. Remarkably, a visual showing processed food leads to purer taste evaluations with the majority of consumers. Results aid brand managers in employing visuals more effectively, alerting them that the more intuitive choices for front-of-package designs might not be the most suitable ones.

Keywords: processed foods, package design, visuals, symbolic meaning, product taste

1. Introduction

In today's supermarkets, shelves are populated by a multitude of fruit juice beverages. One commonality in the design of fruit juice packages appears to be that packages display (1) the ready-to-consume beverage (i.e., in a glass) or (2) the raw (unprocessed) fruits. A local supermarket, for example, carries a total of sixteen orange juice brands, six displaying orange juice in a glass, and the other ten displaying visuals of oranges. This anecdotal observation ties in with the Tropicana design relaunch where the firm withdrew the recently modernized package (which displayed orange juice in a glass) to reinstitute the original (which displayed a whole orange) after consumer uproar (Elliot, 2009). The question rises as to what design strategy is more effective. Building on and extending research on symbolic meaning, this research shows that the answer to that question may not be as straightforward as one might think.

1.1. Unprocessed foods

A new trend is emerging as consumers prefer natural, organic, and unprocessed foods when it comes to eating healthy (Ipsos-Eureka, 2010; McLynn, 2015). Major motives for this trend include health, taste, and environmental considerations (Lockie, Lyons, Lawrence, & Mummery, 2002; Fernqvist & Ekelund, 2014) as consumers nowadays expect natural foods to be produced without pesticides, synthetic fertilisers, genetically modified organisms, or artificial additives (Naspetti & Zanoli, 2009; Shafie & Rennie, 2012). Especially for products intended to be consumed either fresh or just slightly processed, such as fruit juice, consumers associate natural foods with pureness, freshness, and minimal levels of processing (Sylvander & Francois, 2005). Specifically with fruits, the concept of 'unprocessed' is firmly coupled with healthiness (Sabbe, Verbeke, & van Damme, 2008). This bond is further evident in 'homemade' being a key driver of consumer choice of orange juice (Gadioli, Pineli, Rodrigues, Campos, Gerolim, & Chiarello, 2013).

As a key determinant of food choice (Torjusen, Lieblein, Wandel, & Francis, 2001), a product's freshness is derived from its proximity to the unprocessed prototype (Péneau, Linke, Escher, & Nuessli, 2009). Freshness influences consumer behaviour up to and including the acquisition stage (Lappalainen, Kearney, & Gibney, 1998). Previous studies have extensively investigated effects of 'natural' or 'organic' labels on food perceptions (see Fernqvist & Ekelund, 2014 for an overview) and have reported influences on hedonic ratings (Kihlberg, Johansson, Langsrud, & Risvik, 2005), liking (Annett, Muralidharan, Boxall, Cash, & Wismer, 2008), and healthiness perception (Schuldt & Hannahan, 2013). For example, when orange juice is labelled 'organic'

consumers judge it to taste better compared to a ‘conventional’ juice (Fillion & Arazi, 2002). Taken together, the studies indicate that consumers may prefer lower levels of processing over higher levels, especially with fruit juices. It remains unclear, however, what other options exist, beyond explicit labels that can effectively convey levels of processing and naturalness.

1.2. Product visuals

Using visuals on brand communications may represent an easy way to convey *levels of processing* in addition or as an alternative to labelling foods as organic, natural, pure, or fresh, as package visuals are a major means of communicating effectively with consumers at the point of sale (Rettie & Brewer, 2000; Clement, 2007). As consumers quickly scan shelves and packages (Young, 2012), visuals attract attention, influence judgments (Holbrook & Moore, 1981; Spence & Piqueras-Fiszman, 2012), enhance memory (Childers & Houston, 1984), and even impact taste (Underwood & Klein, 2002). Beyond mere displays of content, visuals can also symbolize key information distilled in just a single image (Creusen & Schoormans, 2005). As such, visuals can affect sensory and hedonic expectations through the type of image (e.g., photo vs. drawing; Deliza, MacFie, & Hedderley, 2003), distort package content estimation and influence consumption through the amount of visuals displayed (Madzharov & Block, 2010), and signify freshness by visualizing motion (Gvili et al., 2015).

Specifically for fruit juices, product visuals influence sensory expectations, such as sweetness, freshness, and naturalness (Deliza et al., 2003), as well as flavour evaluation (Mizutani et al., 2010). The congruence between a fruit visual and the juice also affects the taste of the juice such that an apple juice tastes better when accompanied by the visual of an apple rather than an orange, or no picture (Sakai & Morikawa, 2006).

Symbolic meaning is perhaps conveyed best through product visuals, since symbols contained in a visual (e.g., metaphors) are more effective than in rhetoric (McQuarrie & Mick, 2003; McQuarrie & Phillips, 2005; Phillips & McQuarrie, 2009). However, a product visual on a package may convey one of several meanings to consumers. For example, picturing a products’ major taste-giving ingredient on the package yields evaluations of greater naturalness than not using a picture (Smith, Barratt, & Sørensen, 2015). Consequently, at least in the case of fruit juice, the visual of an unprocessed piece of fruit might symbolize freshness, or function as an indicator that the juice is 100% pure und not highly processed, thus resulting in better health evaluations (Schuldt & Hannahan, 2013). Summarizing the above discussion on package visuals and consumer inference of symbolic meaning yields the following hypothesis:

H1: A package visual indicating low (high) levels of processing leads consumers to evaluate the product as more (less) healthy, more (less) attractive, and of higher (lower) quality.

Furthermore, integrating the literature on product processing with studies reporting positive effects of naturalness (Smith et al., 2015) and pureness (Zanoli, Francois, Midmore, O'Doherty-Jensen, & Ritson, 2007) suggests:

H2: Perceived level of processing will be negatively related to evaluation of taste.

H3: The effect of product visual on purchase intention will be mediated by perceived level of processing and taste.

1.3. Verbal cues

Although visual information in advertisements is generally thought to take precedence over verbal information (McQuarrie & Mick, 2003; McQuarrie & Phillips, 2005), research on consumer response to packaged food products emphasizes that verbal information should not be neglected (Orth & De Marchi, 2007). For example, textual primes enhance the mental availability of constructs (such as healthiness: Sütterlin & Siegrist, 2015). Similarly, consumer understanding and liking of an advertisement increases when a short text accompanies a visual (Phillips, 2000; Leder, Carbon, & Ripsas, 2006). In the case of ambiguous visuals, adding a text to explicitly explain what is depicted enhances ad appreciation and positively influences persuasiveness (van Rompay & Veltkamp, 2014). Notably, this finding implies the possibility of negative effects with unambiguous visuals. While hinting at the meaning of a visual symbol through an accompanying text can increase ad liking by aiding comprehension, explicitly explaining what is shown 'ruins the fun' in uncovering meaning, hereby decreasing liking (Phillips, 2000). Therefore, an ad text should avoid explicit explanations of what is depicted, but should instead focus on conveying key information. In summary, we hypothesize:

H4: Adding a text that underscores the information symbolized in a visual enhances the effectiveness of the visual.

1.4. Individual differences in searching for meaning in package design

Recent years have seen an increase in research on symbolic meaning in (food) package design, and more investigations of moderating variables (i.e., individual and situational differences). For example, when consumers interpret colour and form as symbols of potency, individual differences in CVPA (Centrality of Visual Product Aesthetics; Bloch, Brunel, & Arnold, 2003) moderate effects (Becker, van Rompay, Schifferstein, & Galetzka, 2011). Similarly, a health promotion focus aids symbolic interpretation of heavy package design elements as less healthy (Karnal, Machiels, Orth, & Mai, 2016). In addition, a greater number of product unit pictures on package fronts increases consumer estimations of content and actual consumption, with individual level of visual processing functioning as a moderator (Madzharov & Block, 2010). These examples show that it is vitally important for package designers to take individual characteristics into account to ensure that the meaning they intend their design to convey actually reaches their target audience.

Understanding symbolic information requires cognitive elaboration (DeRosia, 2008; Phillips, 2000), with individuals differing in how they extract meaning from visual cues (Burroughs & Mick, 2004). For example, advertisements that use metaphors are less effective with consumers who do not fully elaborate on and understand the message (McQuarrie & Mick, 1999). Right and integrative hemispheric processing aids symbolic interpretation (Morgan & Reichert, 1999), and consumers who do not actively engage in visual metaphor processing start appreciating the meaning of an ambiguous package design only after their attention is directed to it (van Rompay & Veltkamp, 2014). In general, consumers who actively search for meaning in package design visuals infer more from (package) metaphors, regardless of other information provided (van Rompay & Veltkamp, 2014). Because advertising visuals that incorporate metaphors are open to various interpretations (McQuarrie & Phillips, 2005), it is individual differences relating to visual perception and processing that become crucial. Therefore:

H5: The effects of a symbolic package visual signifying level of processing will be more (less) pronounced for consumers high (low) in tendency to search for meaning in package design.

1.5. Health consciousness

A person's health consciousness can moderate effects of health claims and consumers' reliance on symbolic cues (Fernqvist & Ekelund, 2014; Mai & Hoffmann, 2012). Health-conscious consumers have a stronger motivation to engage in healthy behaviour (Michaelidou & Hassan, 2008), are more concerned about their health (Leeflang & van Raaij, 1995), prefer healthy foods more consistently (Prasad, Strijnev, & Zhang, 2008), and show greater interest in organic foods (Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007; Lockie et al., 2002). Integrating the previously discussed consumer response to the perceived level of processing with the enhanced responses attributed to health consciousness suggests:

H6: The effects of a package visual and text signifying level of processing will be more (less) pronounced with consumers high (low) on health consciousness.

In sum, this study investigates 1) the influence of symbolic meaning (level of processing) in product visuals and text on product evaluation and purchase intention, 2) the role of individual differences as possible moderators, and 3) the influence of perceived product processing level on actual taste.

2. Method

2.1. Stimuli and design

This study used a 2 (product visual: processed vs. unprocessed) x 2 (ad text: processed vs. unprocessed) between-subjects design. Using commercial photo editing software, four fruit juice visuals (Fig. 1) were created to vary only in level of processing visualized (an unprocessed orange with a straw versus a glass of orange juice as the processed form⁴) and accompanying text ("100% natural delight directly... ..from the producer" versus "...from the orange"). The 'unprocessed' orange with a straw was a direct replica of the Tropicana visual. To minimize possibly distorting differences, the "orange juice in the glass" stimulus featured an identical straw. Because the study took place in Germany where Tropicana orange juice is not commonly retailed, recognition bias should be minimal.

⁴ Although one might come up with other examples of depicting high levels of processing involving oranges, these stimuli were chosen since they represent concrete examples of product visuals that are used in the marketplace.

2.2. Participants and procedure

80 participants (51% female, mean age = 23.6 ± 3.36 years) were recruited on the campus of a large university. Intercepted during their daily routine, participants were invited to evaluate an ostensibly new product. Upon agreement, each participant viewed one of the four randomly selected advertisements, and completed questions about the product. Then, they were given a small glass (5ml) of orange juice to sample, before they proceeded to provide feedback about its taste. The sampled juice (a premium brand of not-from-concentrate orange juice) was identical across conditions. At the end, participants submitted information on health consciousness, differences in searching for visual meaning in package design, and personal information, before they were thanked and debriefed.



Figure 1: Stimulus material.

2.3. Measures

All measures were 7-point Likert scales, ranging from 1 – fully disagree to 7 – fully agree. Perceived processing level was assessed through consumer ratings on the items *unprocessed*, *natural*, *without preservatives*, *without sweeteners*, and *without colouring agent* ($\alpha = .86$, $M = 3.63$, $SD = 1.36$). For a more intuitive interpretation item scores were reversed prior to factor generation so that higher scores indicate higher levels of processing. Product healthiness, attractiveness and perceived product quality were assessed through consumer response to the items *The orange juice is ...healthy* ($M = 5.25$, $SD = 1.50$), *... attractive* ($M = 3.19$, $SD = 1.24$), and *... of high quality* ($M = 4.09$, $SD = 1.38$). Product taste was measured through five descriptive items for rating the taste pureness of the orange juice (*The orange juice tastes ...fruity*, *...fresh*, *...pure*, *...harmonic*, *...intensive*, $\alpha = .81$, $M = 3.74$, $SD = 1.16$), with high scores indicating a purer taste evaluation. A Likert-type question assessed purchase intention (i.e., *I am seriously considering buying this product*. $M = 2.22$, $SD = 1.37$).

To minimize participant fatigue, measures for moderating variables were brief. To assess individual tendency to search for visual meaning in package design, we incorporated four items of the metaphor processing scale by van Rompay and Veltkamp (2014; i.e., *Understanding the idea behind a package makes me happy*, *I tend to look for meanings behind a product's package*, *It is unpleasant to not know why a product has a specific appearance*, and *I find pleasure in discovering the underlying idea of a product package*; $\alpha = .85$, $M = 3.80$, $SD = 1.61$). Given that the original applies to package design (van Rompay & Veltkamp, 2014), we deem the scale appropriate for our purpose. However, in the remaining text, we follow the scale's authors in referring to the construct as *metaphor processing*. Health consciousness was measured through three items (i.e., *I'm very self-conscious about my health*, *I reflect about my health a lot*, and *I'm constantly examining my health*, adapted from Gould, 1989 and Mai & Hoffmann, 2012; $\alpha = .60$, $M = 4.65$, $SD = .98$).

Table 1: Intercorrelation among predictors, dependent variables, health consciousness, metaphor processing, age, and gender.

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1. Visual												
2. Text												
3. Level of processing		.03										
4. Taste		-.31**	-.40***									
5. Attractiveness		.17	-.23*	.29*								
6. Quality		-.14	-.26*	.39***	.33**							
7. Healthiness		.10	-.12	.19	.30**	.38**						
8. Purchase intention		-.27*	-.29**	.67***	.30**	.26*	.16					
9. Health consciousness		-.15	-.07	.10	.02	.19	.05	-.04	.06			
10. Metaphor processing		-.10	-.07	.15	.03	.04	-.04	-.19	.12	.22		
11. Age		-.17	.16	.15	-.03	-.05	-.04	.01	-.09	.27*	.05	
12. Gender		-.05	-.30**	-.04	.12	.12	.20	.09	.16	-.19	-.08	.17

Note: ^ap<.05, ^bp<.01, ^cp<.001

Table 2: Means, standard deviations, and MANCOVA results for product perceptions and taste evaluations based on visual (processed = glass, unprocessed = orange) and text (processed = from producer, unprocessed = from orange).

	Visual				Text				Visual x Text			
	Visual		Text		Visual		Text		Visual		Text	
	Processed (n=39)	Unprocessed (n=40)	Processed (n=40)	Unprocessed (n=39)	Processed	Unprocessed	Processed	Unprocessed	Processed	Unprocessed	Processed	Unprocessed
Level of processing ^a	3.57 (1.52)	3.67 (1.22)	3.62 (1.22)	3.62 (1.52)	.10 ^{ns}	.00 ^{ns}	3.54 (1.35)	3.60 (1.72)	3.70 (1.10)	3.63 (1.36)	.04 ^{ns}	
Healthiness ^a	5.10 (1.72)	5.40 (1.26)	5.43 (1.36)	5.08 (1.64)	.82 ^{ns}	1.09 ^{ns}	5.45 (1.61)	4.74 (1.85)	5.40 (1.10)	5.40 (1.43)	1.09 ^{ns}	
Attractiveness ^a	2.97 (1.27)	3.40 (1.19)	3.48 (1.26)	2.90 (1.17)	2.61 ^{ns}	4.71*	3.40 (1.39)	2.53 (.96)	3.55 (1.15)	3.25 (1.25)	1.13 ^{ns}	
Quality ^a	4.28 (1.45)	3.90 (1.32)	4.45 (1.43)	3.72 (1.26)	1.51 ^{ns}	6.07*	4.90 (1.29)	3.63 (1.34)	4.00 (1.45)	3.80 (1.20)	3.22 ^{ns}	
Taste profile ^b	4.10 (1.08)	3.39 (1.16)	3.84 (1.36)	3.64 (0.94)	7.66**	.60 ^{ns}	4.25 (1.24)	3.94 (.88)	3.43 (1.38)	3.35 (.93)	.21 ^{ns}	
Purchase intention	2.58 (1.50)	1.87 (1.14)	2.63 (1.56)	1.82 (1.01)	6.38*	7.18**	3.10 (1.62)	2.11 (1.20)	2.15 (1.39)	1.60 (0.75)	.60 ^{ns}	

Note: ^a product evaluation prior to tasting, ^b taste evaluation. p<.05*, p<.01**, p<.001***.

3. Results

3.1. Preliminary analyses

A MANOVA on participant characteristics across the four conditions revealed marginal differences of age ($F(3,75) = 2.48, p = .068$) and gender ($F(3,75) = 2.65, p = .055$), but no differences in metaphor processing ($F(3,75) = .64, p = .593$) and health consciousness ($F(3,75) = 1.78, p = .157$). Accounting for this finding, subsequent analyses controlled for age and gender. For full clarity, Table 1 displays the correlation matrix of all used variables.

3.2. Effects of product visual and accompanying text on product evaluation

To test hypotheses, we conducted a MANCOVA with visual and text as independent variables, and level of processing, healthiness, attractiveness, quality, taste, and purchase intention as dependent variables.

Regarding level of processing no significant main effects emerged for visual ($F(1,75) = .10, p = .757, \eta^2 = .001$) and text ($F(1,75) = .00, p = .994, \eta^2 = .000$). In addition, the interaction effect between visual and text was not significant ($F(1,75) = .04, p = .843, \eta^2 = .001$).

Furthermore, the visual had no significant main effects on quality ($F(1,75) = 1.51, p = .223, \eta^2 = .02$), attractiveness ($F(1,75) = 2.61, p = .110, \eta^2 = .03$), and healthiness ($F(1,75) = .81, p = .372, \eta^2 = .01$). The text, on the other hand, had a significant main effect on quality ($F(1,75) = 6.07, p = .016, \eta^2 = .08$), attractiveness ($F(1,75) = 4.71, p = .033, \eta^2 = .06$), but not on healthiness ($F(1,75) = 1.09, p = .299, \eta^2 = .01$). Contrary to expectations, the text “...directly from the producer” related to participants judging the juice as more attractive ($M_{\text{producer}} = 3.48, SD = 1.26$ versus $M_{\text{orange}} = 2.90, SD = 1.17$), and of higher quality ($M_{\text{producer}} = 4.45, SD = 1.43$ versus $M_{\text{orange}} = 3.72, SD = 1.26$) than the alternative text. The visual x text interaction term had a marginally significant effect on quality ($F(1,75) = 3.22, p = .077, \eta^2 = .04$), with quality scores the lowest for the “...directly from the orange” text combined with the glass visual ($M = 3.63, SD = 1.34$) and the same text combined with the visual orange ($M = 3.80, SD = 1.20$). Quality scores were higher for the combination “...directly from the producer” and the orange visual ($M = 4.00, SD = 1.45$), and were the highest for the combination of this claim and the glass visual ($M = 4.90, SD = 1.29$). Interaction effects involving attractiveness ($F(1,75) = 1.13, p = .292, \eta^2 = .02$) and healthiness ($F(1,75) = 1.09, p = .299, \eta^2 = .01$) were not significant.

For actual taste, the visual had a significant main effect ($F(1,75) = 7.66, p = .007, \eta^2 = .09$). Here, consumers rated the orange juice in the package featuring the glass visual as tasting significantly purer ($M = 4.10, SD = 1.08$) than the juice in the package with the orange visual ($M = 3.39, SD = 1.16$). No other effects of text ($F(1,75) = .60, p = .442, \eta^2 = .01$), or the visual x text interaction term ($F(1,75) = .21, p = .648, \eta^2 = .00$) were significant.

Purchase intention was significantly affected by the visual ($F(1,75) = 6.38, p = .014, \eta^2 = .08$) and the text ($F(1,75) = 7.18, p = .009, \eta^2 = .09$). Participants who viewed the package showing the glass indicated higher purchase intentions after tasting the product ($M = 2.58, SD = 1.50$) than participants who tasted the orange juice from the package displaying the orange ($M = 1.87, SD = 1.14$). A similar effect was found with the text "...from the producer" ($M = 2.63, SD = 1.56$) compared to "... from the orange" ($M = 1.82, SD = 1.01$). Interaction effects between visual and text on purchase intention were not significant ($F(1,75) = .60, p = .443, \eta^2 = .01$).

Table 2 displays the results for all groups. As can be seen, the text "from the producer" related to significantly higher attractiveness and quality, as well as to greater purchase intention. Regarding the visuals, the glass received significantly higher evaluations in terms of 'pure' and higher purchase intentions than the orange. We take the finding that no interaction effects were significant to mean that effects of visual versus textual information are modality dependent, due to, for example, differences in processing (e.g., dual-coding theory, Paivio, 1990). Therefore, in the following conditional process analyses, we estimate each model twice, once for the visual manipulation, and once for the text manipulation. Each model is estimated with the other factor included as a covariate.

3.3. Role of product experience

First, we examined whether taste channelled the effect of the visual on purchase intention. Mediation analysis used PROCESS (Model 4; Hayes, 2012), with age, gender, text, healthiness, attractiveness, and quality included as covariates. The results indicate that the indirect effect of the visual on purchase intention, through taste, was significant, with the 95% CI not containing zero (Bootstrap [5000] results: $B = -.56, SE = .21, 95\% \text{ CI } [-1.03, -.19]$, see Fig. 2). The glass visual (dummy coded: glass = 0, orange = 1) relates to purer taste ($B = -.77, SE = .25, p = .003$), which, in turn, increases purchase intention ($B = .72, SE = .11, p < .001$). Estimating a similar model for the possibly mediating role of taste in the text - purchase intention relationship yielded no significant results.

To test for other predictors of taste, a stepwise linear regression analysis included level of processing, healthiness, attractiveness, quality, age, and gender as predictors in addition to text and visual. The results indicate that level of processing ($\beta = -.32$, $t = -3.89$, $p < .001$), visual ($\beta = -.76$, $t = -3.42$, $p = .001$), and attractiveness ($\beta = .28$, $t = 3.03$, $p = .003$; adj. $R^2 = .31$, $F(3,74) = 12.43$, $p < .001$) significantly predicted taste. To check whether taste mediates the effect of processing level on purchase intention, a second mediation analysis was conducted (Hayes, 2012) with level of processing as independent variable, taste as a mediator, and purchase intention as the dependent variable (covariates: healthiness, attractiveness, quality, age, and gender). Bootstrap (5000) results indicated taste to mediate the relationship between level of processing and purchase intention, with the 95% CI not containing zero (indirect effect: $B = -.24$, $SE = .09$, 95 % CI $[-.44, -.09]$, see Fig. 2). Here, the perceived level of processing had a negative effect on 'pure' taste ($B = -.30$, $SE = .11$, $p = .010$), with pureness, in turn, having a positive effect on intention to purchase ($B = .80$, $SE = .12$, $p < .001$).

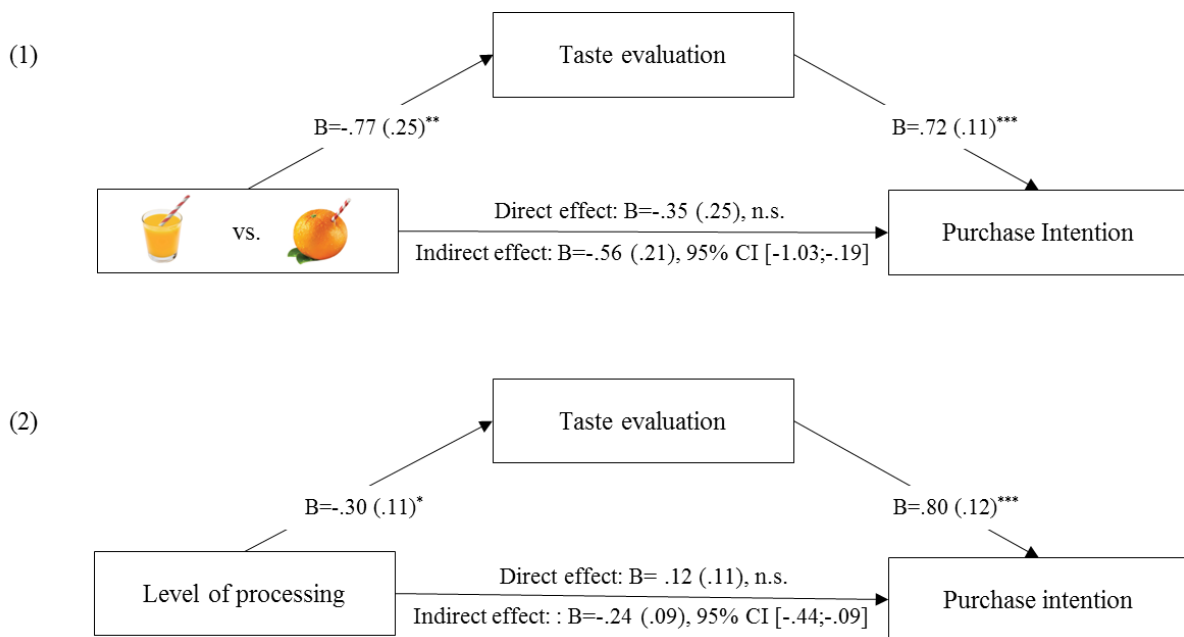


Figure 2: (1) Mediation of taste evaluation between product visual and purchase intention, (2) mediation of taste evaluation between level of processing and purchase intention (PROCESS, Model 4, number of bootstraps = 5000; Hayes, 2012). *Note:* Coding = glass (0), orange (1); B (SE) = path coefficient (standard error); * $p < .05$, ** $p < .01$, *** $p < .001$.

3.4. Testing for moderation

To test whether metaphor processing and health consciousness moderated the effect of product visual on perceived level of processing, we conducted two separate analyses (Hayes, 2012), controlling for text, healthiness, attractiveness, quality, age, and gender. Results indicate that both metaphor processing ($F(1,68) = 4.00, p = .049$) and health consciousness ($F(1,68) = 5.65, p = .02$) moderate the effect of the visual on level of processing. In line with expectations, the visual depicting the orange related to a lower level of processing with participants high in metaphor processing and health consciousness. However, the 95% CI for the conditional effects of visual on levels of processing for the observed value range (Mean \pm SD) for both metaphor processing and health consciousness indicated no significant effects. Therefore, an additional moderation analysis was conducted. Using both constructs consecutively in an additive moderation analysis (PROCESS, model 2; Hayes, 2012) showed that variance explained increased significantly ($F(2,66) = 4.14, p = .020$) by 7% (compared to 3% and 2% in single analyses) for health consciousness and metaphor processing jointly. No moderating influences were found for health consciousness on the influence of the text variable.

3.5. Investigating moderating influences on the visual – level of processing – taste relationship

Integrating the abovementioned mediation and moderation models for the product visual to an additive *moderated mediation* (PROCESS, model 9; Hayes, 2012; number of bootstrap samples = 5000, covariates: text, healthiness, attractiveness, quality, age, and gender) showed a conditional significant indirect effect of the visual on taste via level of processing. Mediation occurred under two conditions: (1) when participants scored high in both health consciousness and metaphor processing ($B = .28, SE = .18, 95\% \text{ CI } [.02, .75]$, level of processing: $M_{\text{glass}} = 4.15, M_{\text{orange}} = 3.19$) and (2) when participants scored low on both constructs ($B = -.30, SE = .17, 95\% \text{ CI } [-.74, -.04]$, level of processing: $M_{\text{glass}} = 2.97, M_{\text{orange}} = 3.99$, see Fig. 3). This finding indicates that the perceived level of processing, inferred from a visual (orange vs. glass), depends on consumers' health consciousness and metaphor processing.

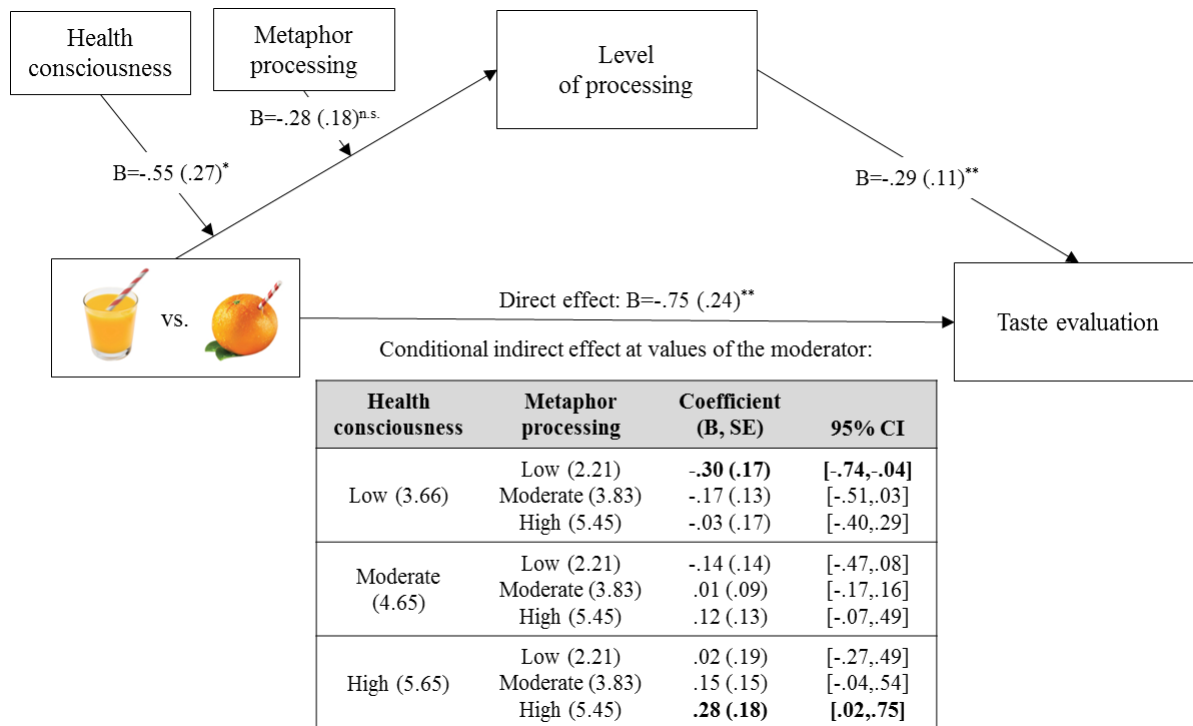


Figure 3: Additive moderated mediation of health consciousness and metaphor processing as moderators between product visual and level of processing, which mediates the effect of the product visual on taste evaluation (PROCESS, Model 9, number of bootstraps = 5000; Hayes, 2012). *Note:* Coding=glass (0), orange (1); B (SE) = path coefficient (standard error); * $p < .05$, ** $p < .01$, *** $p < .001$.

4. Discussion

4.1. Theoretical contributions

Extending research on the importance of symbolic meaning in package form (Becker et al., 2011), colour (Hoegg & Alba, 2007), and typeface (Celhay, Boysselle, & Cohen, 2015; Karnal et al., 2016), the present study examines the symbolic meaning of visuals and text that convey naturalness, levels of processing, and pureness. Specifically, while previous research investigated effects of labels and seals (Fernqvist & Ekelund, 2014), this study focused on visuals and textual information, and additionally incorporated actual product taste, arguably a more reliable predictor of actual consumer behaviour (Piqueras-Fiszman & Spence, 2015).

As such, the contribution of this research is threefold. First, it demonstrates that consumers extract symbolic meaning (i.e., level of processing) from visuals, use this information to evaluate the product, and subsequently form an intention to purchase. The study hereby adds to existing literature on the importance of product visuals in general (e.g., Clement, 2007), their influence on taste expectation (Deliza et al., 2003), and taste perception (Underwood & Klein, 2002). Second, the findings highlight the importance of including moderator variables,

especially individual differences, in investigations of symbolic meaning. In doing so, we integrated two streams of research, one on variables that reflect consumers' ability and tendency to comprehend visual cues (e.g., CVPA: Becker et al., 2011; metaphor processing: van Rompay & Veltkamp, 2014; and visualizer tendencies: Madzharov & Block, 2010) and the other integrating context-related constructs (e.g., environmental concern: Schuldt & Hannahan, 2013; food knowledge: Smith et al., 2015; and health consciousness: Sütterlin & Siegrist, 2015). Our third contribution lies with extending the literature on consumer perception of food processing (e.g., natural, organic, raw, and pure) and its influence on taste (e.g., Kihlberg et al., 2005, Smith et al., 2015). We add to this literature by showing that perceiving products as unprocessed increases purchase intention, and that this effect is mediated by taste. These findings are in line with studies on labelling food products as unprocessed, organic, or fresh (Fernqvist & Ekelund, 2014), as well as with research on taste perception of natural products (Piqueras-Fiszman & Spence, 2015).

Previous research has shown that the congruence (Mizutani et al., 2010), valence (Sakai & Morikawa, 2006), and type of visuals (Deliza et al., 2003) shown on fruit juice packages impact taste expectation and evaluation. Our results add to that evidence by showing that consumers do *not* perceive juice as being less processed when it is offered in a package that displays an unprocessed fruit compared to displaying a glass of orange juice. Surprisingly, the glass on the package leads to better taste evaluations and stronger purchase intention. A possible explanatory mechanism for this effect may be found in congruence theory (Meyers-Levy & Tybout, 1989). Previous research has repeatedly demonstrated congruence effects, for example between package shape and text (van Rompay & Pruyn, 2011) and package visual and content (Mizutani et al., 2010). We speculate that the glass visual was more congruent with participants' consumption situation (from a plastic cup, albeit without the straw), which may have triggered more positive taste evaluations. Displaying a whole orange on the package may have not been consistent with how participants sampled the orange juice, thus not leading to positive evaluations.

Importantly, this study attests to the need for accounting for individual characteristics in designing persuasive messages targeted at specific groups (i.e., metaphor processing: van Rompay & Veltkamp, 2014; and health consciousness: Mai & Hoffmann, 2012). Accounting for both design- and context-related consumer differences yielded greater explanatory power as the expected effects of visuals on perceived levels of processing were prominent when consumer health consciousness and metaphor processing were accounted for. The symbolic meaning of a pure and unprocessed fruit was transferred to taste evaluations with participants

who were more health conscious and had a greater tendency to infer metaphoric meaning from visuals. Understanding subtle visual (health) cues without additional information comes more `naturally` to those high in health consciousness and metaphor processing. Consumers scoring low on both constructs may not bother to explore and comprehend subtle cues. These consumers might need additional (explicit) information, like attention grabbing labels (Hersey, Wohlgenant, Arsenault, Kosa, & Muth, 2013), to discern product properties.

In line with previous research on possible influences of verbal information, we hypothesized interactive effects of visual and text. An interaction, however, was not found. Textual and visual cues function through different modalities (visual versus verbal arguments; Jeong, 2008), and may therefore have been processed differently (Paivio, 1990). Visual symbols aid persuasiveness due to their ambiguity, implying that they are more open to interpretation than textual claims (McQuarrie & Phillips, 2005). Moreover, the use of text which details product attributes does not necessarily invalidate visually induced beliefs about those attributes (Bone & France, 2001). The textual cue, however, was effective on its own, as the text implying a processed product (“...directly from the producer”) related to higher attractiveness, quality, and purchase intention. These findings are unexpected and require further exploration. One possibility is that the text leads participants to envision an authentic fruit orchard as it is commonly portrayed in fruit juice commercials, showing life to be great, relaxed, and comforting. Another possibility is that the textual cue was simply not understood as being more or less congruent with the visual (van Rompay & Pruyn, 2011; van Rompay & Veltkamp, 2014). Symbolic information differs in its sense-making, and, when not fully understood, can provoke unwanted side effects (Mick, 1992; Steen, 2004). Our study did not account for this possibility.

4.2. Practical implications, limitations, and conclusion

The findings presented here appear to be highly relevant for product designers and marketing managers as they show that frequently employed and well-meant designs featuring raw and unprocessed fruits may ‘backfire’ to negatively impact taste evaluation and purchase behaviour. In contrast, visuals that, at first glance, seem counterintuitive (showcasing juice in glasses may go counter to conveying pureness, freshness, and naturalness) appear to be better suited to promote desirable product perception and actual taste, at least in the case of orange juice and for regular consumers.

A few limitations need mentioning. First, although orange juice brands in the marketplace employ both types of visuals (i.e., glass with fruit juice, and a fruit visual), a few brands opt for showing a combination of the glass and the fruit. Examining effects when both visuals are used

simultaneously was beyond the scope of this study, but may be interesting for future studies to explore. Second, this study investigated only a single type of fruit juice. While there is reason to believe that the findings may generalize to other fruit juices, replicating our study with more exotic or mixed juices may yield divergent results. If multiple, especially tropic, fruits are blended, merely picturing a glass of mixed fruit juice may inhibit important perceptions of content. Future research could thus focus on fruit blends, or other categories, such as coffee or chocolate, where fresh and pure taste also play a major role, and where desirable levels of processing may diverge. Third, the present research is limited in that other measures of taste (i.e., hedonic ratings) were not included. Because the goal of this research was to investigate differences in consumer perception of processing levels and product taste *induced* by visuals and texts, including measures such as liking was beyond the scope of the study. Fourth, we did not screen for general orange juice preference or frequency of use. Thus, it cannot be excluded that, for example, consumers scoring high on health consciousness might exhibit a higher preference and/or liking for orange juice, which may have biased our results. Nevertheless, preliminary analyses with the available variables showed no evidence for such relationships (i.e., health consciousness did not correlate with taste evaluation), but caution is still warranted. Furthermore, participants were randomly assigned to each of the four treatments, hereby minimizing potentially biasing influences of personal characteristics. Where unbalances existed between groups (as was the case with age and gender), we included these variables as controls in the analyses. We do suggest, however, that future research should incorporate liking, and possible other, additional sensory (control) measures to better account for these limitations.

To conclude, this study's main contribution lies in demonstrating that there is no one-size-fits-all approach for conveying symbolic meaning through package visuals. The findings improve our understanding of how the visuals actually used on juice packages in supermarkets affect consumer response. Moreover, this study attests to the importance of accounting for individual differences regarding health consciousness and package design evaluation. As such, it hopes to foster further fruitful research in this exciting field.

Acknowledgements

The authors thank Juliana Feind, Verena Krieger, and Lisa Marie Schäfer for their excellent assistance in stimuli development and data collection. The authors also thank the anonymous FQ&P reviewers for their constructive remarks on earlier versions of this manuscript. Special thanks go to Ulrich R. Orth for his helpful comments on previous versions of this manuscript.

Author contribution

Both authors share first authorship and have contributed equally. Both have approved the final article.

References

- Annett, L. E., Muralidharan, V., Boxall, P. C., Cash, S. B., & Wismer, W. V. (2008). Influence of health and environmental information on hedonic evaluation of organic and conventional bread. *Journal of Food Science*, *73*(4), H50-7. doi:10.1111/j.1750-3841.2008.00723.x
- Becker, L., van Rompay, T. J. L., Schifferstein, H. N., & Galetzka, M. (2011). Tough package, strong taste: The influence of packaging design on taste impressions and product evaluations. *Food Quality and Preference*, *22*(1), 17–23. doi:10.1016/j.foodqual.2010.06.007
- Bloch, P. H., Brunel, F. F., & Arnold, T. J. (2003). Individual differences in the centrality of visual product aesthetics: Concept and measurement. *Journal of Consumer Research*, *29*(4), 551–565. doi:10.1086/346250
- Bone, P. F., & France, K. R. (2001). Package graphics and consumer products beliefs. *Journal of Business and Psychology*, *15*(3), 467–489. doi:10.1023/A:1007826818206
- Burroughs, J. E., & Mick, D. G. (2004). Exploring antecedents and consequences of consumer creativity in a problem-solving context. *Journal of Consumer Research*, *31*(2), 402–411. doi:10.1086/422118
- Celhay, F., Boysselle, J., & Cohen, J. (2015). Food packages and communication through typeface design: The exoticism of exotypes. *Food Quality and Preference*, *39*, 167–175. doi:10.1016/j.foodqual.2014.07.009
- Childers, T. L., & Houston, M. J. (1984). Conditions for a picture-superiority effect on consumer memory. *Journal of Consumer Research*, *11*(2), 643. doi:10.1086/209001
- Clement, J. (2007). Visual influence on in-store buying decisions: An eye-track experiment on the visual influence of packaging design. *Journal of Marketing Management*, *23*(9-10), 917–928. doi:10.1362/026725707X250395
- Creusen, M. E. H., & Schoormans, J. P. L. (2005). The different roles of product appearance in consumer choice. *Journal of Product Innovation Management*, *22*(1), 63–81. doi:10.1111/j.0737-6782.2005.00103.x
- Deliza, R., MacFie, H., & Hedderley, D. (2003). Use of computer-generated images and conjoint analysis to investigate sensory expectations. *Journal of Sensory Studies*, *18*, 465–486. doi:10.1111/j.1745-459X.2003.tb00401.x
- DeRosia, E. D. (2008). The effectiveness of nonverbal symbolic signs and metaphors in advertisements: An experimental inquiry. *Psychology and Marketing*, *25*(3), 298–316. doi:10.1002/mar.20210
- Elliot, S. (2009). *Tropicana discovers some buyers are passionate about packaging*. Retrieved from http://www.nytimes.com/2009/02/23/business/media/23adcol.html?_r=1
- Fernqvist, F., & Ekelund, L. (2014). Credence and the effect on consumer liking of food – A review. *Food Quality and Preference*, *32*, 340–353. doi:10.1016/j.foodqual.2013.10.005
- Fillion, L., & Arazi, S. (2002). Does organic food taste better? A claim substantiation approach. *Nutrition & Food Science*, *32*(4), 153–157. doi:10.1108/00346650210436262
- Gadioli, I. L., Pineli, L. D. L. D. O., Rodrigues, J. D. S. Q., Campos, A. B., Gerolim, I. Q., & Chiarello, M. D. (2013). Evaluation of packing attributes of orange juice on consumers' intention to purchase by conjoint analysis and consumer attitudes expectation. *Journal of Sensory Studies*, *28*(1), 57–65. doi:10.1111/joss.12023
- Gould, S. J. (1989). Health consciousness and health behavior: The application of a new health consciousness scale. *American journal of preventive medicine*, *6*(4), 228–237.
- Gvili, Y., Tal, A., Amar, M., Hallak, Y., Wansink, B., Giblin, M., & Bommelaer, C. (2015). Fresh from the tree: Implied motion improves food evaluation. *Food Quality and Preference*, *46*, 160–165. doi:10.1016/j.foodqual.2015.07.015

- Hayes, A. F. (2012). *PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling [White paper]*. Retrieved from <http://www.afhayes.com/public/process2012.pdf>
- Hersey, J. C., Wohlgenant, K. C., Arsenault, J. E., Kosa, K. M., & Muth, M. K. (2013). Effects of front-of-package and shelf nutrition labeling systems on consumers. *Nutrition reviews*, *71*(1), 1–14. doi:10.1111/nure.12000
- Hoegg, J., & Alba, J. W. (2007). Taste perception: More than meets the tongue. *Journal of Consumer Research*, *33*(4), 490–498. doi:10.1086/510222
- Holbrook, M. B., & Moore, W. L. (1981). Feature interactions in consumer judgments of verbal versus pictorial presentations. *Journal of Consumer Research*, *8*(1), 103–113. doi:10.2307/2488848
- Hughner, R. S., McDonagh, P., Prothero, A., Shultz, C. J., & Stanton, J. (2007). Who are organic food consumers? A compilation and review of why people purchase organic food. *Journal of Consumer Behaviour*, *6*(2-3), 94–110. doi:10.1002/cb.210
- Ipsos-Eureka, Social Research Institute. (2010). *Consumer awareness, attitudes and behaviours to fortified foods - qualitative research*.
- Jeong, S. (2008). Visual metaphor in advertising: Is the persuasive effect attributable to visual argumentation or metaphorical rhetoric? *Journal of Marketing Communications*, *14*(1), 59–73. doi:10.1080/14697010701717488
- Karnal, N., Machiels, C.J.A., Orth, U.R., & Mai, R. (2016). Healthy by design, but only when in focus: Communicating non-verbal health cues through symbolic meaning in packaging. *Food Quality and Preference*, *52*, 106-119. doi: 10.1016/j.foodqual.2016.04.004
- Kihlberg, I., Johansson, L., Langsrud, Ø., & Risvik, E. (2005). Effects of information on liking of bread. *Food Quality and Preference*, *16*(1), 25–35. doi:10.1016/j.foodqual.2003.12.005
- Lappalainen, R., Kearney, J., & Gibney, M. (1998). A pan EU survey of consumer attitudes to food, nutrition and health: An overview. *Food Quality and Preference*, *9*(6), 467–478. doi:10.1016/S0950-3293(98)00018-4
- Leder, H., Carbon, C.-C., & Ripsas, A.-L. (2006). Entitling art: Influence of title information on understanding and appreciation of paintings. *Acta psychologica*, *121*(2), 176–198. doi:10.1016/j.actpsy.2005.08.005
- Leeftang, P. S., & van Raaij, W. (1995). The changing consumer in the European Union: A “meta-analysis”. *International Journal of Research in Marketing*, *12*(5), 373–387. doi:10.1016/0167-8116(95)00031-3
- Lockie, S., Lyons, K., Lawrence, G., & Mummery, K. (2002). Eating 'Green': Motivations behind organic food consumption in Australia. *Sociologia Ruralis*, *42*(1), 23–40. doi:10.1111/1467-9523.00200
- Madzharov, A. V., & Block, L. G. (2010). Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology*, *20*(4), 398–409. doi:10.1016/j.jcps.2010.06.007
- Mai, R., & Hoffmann, S. (2012). Taste lovers versus nutrition fact seekers: How health consciousness and self-efficacy determine the way consumers choose food products. *Journal of Consumer Behaviour*, *11*(4), 316–328. doi:10.1002/cb.1390
- McLynn, K. (2015). *Five consumer trends shaping the future of the food and foodservice industries*. Retrieved from <https://www.npd.com/wps/portal/npd/us/news/press-releases/2015/five-consumer-trends-shaping-the-future-of-the-food-and-foodservice-industries/>

- McQuarrie, E. F., & Mick, D. G. (1999). Visual rhetoric in advertising: Text-interpretive, experimental, and reader-response analyses. *Journal of Consumer Research*, 26(1), 37–54. doi:10.1086/209549
- McQuarrie, E. F., & Mick, D. G. (2003). Visual and verbal rhetorical figures under directed processing versus incidental exposure to advertising. *Journal of Consumer Research*, 29(4), 579–587. doi:10.1086/346252
- McQuarrie, E. F., & Phillips, B. J. (2005). Indirect persuasion in advertising: How consumers process metaphors presented in pictures and words. *Journal of Advertising*, 34(2), 7–20. doi:10.1080/00913367.2005.10639188
- Meyers-Levy, J., & Tybout, A. M. (1989). Schema congruity as a basis for product evaluation. *Journal of Consumer Research*, 16(1), 39. doi:10.1086/209192
- Michaelidou, N., & Hassan, L. M. (2008). The role of health consciousness, food safety concern and ethical identity on attitudes and intentions towards organic food. *International Journal of Consumer Studies*, 32(2), 163–170. doi:10.1111/j.1470-6431.2007.00619.x
- Mick, D. G. (1992). Levels of subjective comprehension in advertising processing and their relations to ad perceptions, attitudes, and memory. *Journal of Consumer Research*, 18(4), 411. doi:10.1086/209270
- Mizutani, N., Okamoto, M., Yamaguchi, Y., Kusakabe, Y., Dan, I., & Yamanaka, T. (2010). Package images modulate flavor perception for orange juice. *Food Quality and Preference*, 21(7), 867–872. doi:10.1016/j.foodqual.2010.05.010
- Morgan, S. E., & Reichert, T. (1999). The message is in the metaphor: Assessing the comprehension of metaphors in advertisements. *Journal of Advertising*, 28(4), 1–12. doi:10.1080/00913367.1999.10673592
- Naspetti, S., & Zanoli, R. (2009). Organic food quality and safety perception throughout Europe. *Journal of Food Products Marketing*, 15(3), 249–266. doi:10.1080/10454440902908019
- Orth, U., & de Marchi, R. (2007). Understanding the relationships between functional, symbolic, and experiential brand beliefs, product experiential attributes, and product schema: Advertising-trial interactions revisited. *The Journal of Marketing Theory and Practice*, 15(3), 219–233. doi:10.2753/MTP1069-6679150303
- Paivio, A. (1990). *Mental representations: A dual coding approach*. New York: Oxford University Press.
- Péneau, S., Linke, A., Escher, F., & Nuessli, J. (2009). Freshness of fruits and vegetables: Consumer language and perception. *British Food Journal*, 111(3), 243–256. doi:10.1108/00070700910941453
- Phillips, B. J. (2000). The impact of verbal anchoring on consumer response to image ads. *Journal of Advertising*, 29(1), 15–24. doi:10.2307/4189131
- Phillips, B. J., & McQuarrie, E. F. (2009). Impact of advertising metaphor on consumer belief: Delineating the contribution of comparison versus deviation factors. *Journal of Advertising*, 38(1), 49–62. doi:10.2753/JOA0091-3367380104
- Piqueras-Fiszman, B., & Spence, C. (2015). Sensory expectations based on product-extrinsic food cues: An interdisciplinary review of the empirical evidence and theoretical accounts. *Food Quality and Preference*, 40, 165–179. doi:10.1016/j.foodqual.2014.09.013
- Prasad, A., Strijnev, A., & Zhang, Q. (2008). What can grocery basket data tell us about health consciousness? *International Journal of Research in Marketing*, 25(4), 301–309. doi:10.1016/j.ijresmar.2008.05.001
- Rettie, R., & Brewer, C. (2000). The verbal and visual components of package design. *Journal of Product & Brand Management*, 9(1), 56–70. doi:10.1108/10610420010316339

- Sabbe, S., Verbeke, W., & van Damme, P. (2008). Familiarity and purchasing intention of Belgian consumers for fresh and processed tropical fruit products. *British Food Journal*, *110*(8), 805–818. doi:10.1108/00070700810893331
- Sakai, N., & Morikawa, S. (2006). The pictures of fruits juices affect flavor perception of fruit juices. *The Japanese Association for the Study of Taste and Smell*, *13*(3), 463–466.
- Schuldt, J. P., & Hannahan, M. (2013). When good deeds leave a bad taste. Negative inferences from ethical food claims. *Appetite*, *62*, 76–83. doi:10.1016/j.appet.2012.11.004
- Shafie, F. A., & Rennie, D. (2012). Consumer perceptions towards organic food. *Procedia - Social and Behavioral Sciences*, *49*, 360–367. doi:10.1016/j.sbspro.2012.07.034
- Smith, V., Barratt, D., & Sørensen, H. S. (2015). Do natural pictures mean natural tastes? Assessing visual semantics experimentally. *Cognitive Semiotics*, *8*(1). doi:10.1515/cogsem-2015-0001
- Spence, C., & Piqueras-Fiszman, B. (2012). The multisensory packaging of beverages. In M. G. Kontominas (Ed.), *Food packaging: Procedures, management and trends* (pp. 187–233). Hauppauge, NY: Nova Publishers.
- Steen, G. (2004). Can discourse properties of metaphor affect metaphor recognition? *Journal of Pragmatics*, *36*(7), 1295–1313. doi:10.1016/j.pragma.2003.10.014
- Sütterlin, B., & Siegrist, M. (2015). Simply adding the word "fruit" makes sugar healthier: The misleading effect of symbolic information on the perceived healthiness of food. *Appetite*, *95*, 252–261. doi:10.1016/j.appet.2015.07.011
- Sylvander, B. & Francois, M. (2005). *Organic and low input food consumers: Concerns and perspectives for developing the organic market in future: 15th IFOAM Organic World Congress*. Researching Sustainable Systems. Proceedings of the First Scientific Convergence of the International Society of Organic Agriculture Research. Retrieved from <http://orgprints.org/view/projects/int-isofar.html>
- Torjusen, H., Lieblein, G., Wandel, M., & Francis, C. A. (2001). Food system orientation and quality perception among consumers and producers of organic food in Hedmark County, Norway. *Food Quality and Preference*, *12*(3), 207–216. doi:10.1016/S0950-3293(00)00047-1
- Underwood, R. L., & Klein, N. M. (2002). Packaging as brand communication: Effects of product pictures on consumer responses to the package and brand. *Journal of Marketing Theory and Practice*, *10*(4), 58–68. doi:10.2307/41304282
- van Rompay, T. J. L., & Pruyn, Ad T. H. (2011). When visual product features speak the same language: Effects of shape-typeface congruence on brand perception and price expectations. *Journal of Product Innovation Management*, *28*(4), 599–610. doi:10.1111/j.1540-5885.2011.00828.x
- van Rompay, T. J. L., & Veltkamp, M. (2014). Product packaging metaphors: Effects of ambiguity and explanatory information on consumer appreciation and brand perception. *Psychology & Marketing*, *31*(6), 404–415. doi:10.1002/mar.20703
- Young, S. (2012). *Rigid plastic: Applying an architecture*. Retrieved from <http://www.packagedesignmag.com/content/applying-architecture>
- Zanoli, R., Francois, M., Midmore, P., O'Doherty-Jensen, K., & Ritson, C. (2007). *Determining consumer expectations, attitudes and buying behaviour towards "low input" and organic foods: 3rd QLIF Congress, Hohenheim, Germany, March 20-23, 2007*. Retrieved from http://orgprints.org/view/projects/int_conf_qlif2007.html

Chapter 7

Conclusion

This chapter presents a concluding discussion that combines the theoretical and methodological contributions over the five research articles of this dissertation. It also summarizes practical implications for its three main interest groups; i.e., public health managers, package designers, and, last but not least, consumers. These implications are derived based on the empirical findings of the contributing articles. At the end, limitations of this work and areas for future research are introduced.

Theoretical and methodological contributions

The presented dissertation has two main theoretical and two methodological contributions. As the chapters on package design constitute the main body of the work, the following sections first introduce the dissertation's contribution to design-related theory. After that the theoretical and methodological advancement of one of the research articles with respect to qualitative consumer research is presented. Lastly, the methodological advantage of combining implicit and explicit measures in two of the articles is highlighted.

The four presented articles on package design effects integrate research approaches across multiple disciplines. Even though the background of all papers is grounded in visual health cue research, they also draw from research on design-based valence (Chapter 3), conceptual metaphors and metaphorical heaviness (Chapter 4), effects of human body shapes and self-referencing (Chapter 5), and symbolic meaning in visuals (Chapter 6). Consequently, theoretical implications span over all these research disciplines.

First and foremost, the major contribution of this dissertation lies within advancing knowledge on visual health cues. In this research stream a multitude of publications saw the light in recent years. In particular, works documenting the influence of package color (Huang & Lu, 2015; Mai, Symmank, & Seeberg-Elverfeldt, 2016; Schuldt, 2013; Tijssen, Zandstra, Graaf, & Jager, 2017), package shape (Fenko, Lotterman, & Galetzka, 2016; Koo & Suk, 2016; van Ooijen, Franssen, Verlegh, & Smit, 2017), and the overall package design (van Rompay, Deterink, & Fenko, 2016) have been published mainly in the last two years—a development that reflects the increasing interest in this topic. Results of this dissertation feed into this relatively new and extremely relevant research topic in three ways. Across multiple studies, this dissertation shows (1) that design features are able to influence healthiness perceptions of food products, (2) how this process can be explained, and (3) under which conditions these effects occur.

First, not less than four articles investigate the healthiness effects of package color, typeface, shape, and imagery. Specifically, light colors were implicitly related with healthiness, while dark colors were related with unhealthiness in Chapter 3. When applied on food packages, these design features were also explicitly linked with higher (lower) food healthiness perceptions. These findings confirm the role of color lightness as healthiness cue on food package design (Mai et al., 2016; Tijssen et al., 2017) with implicit and explicit measures. Further extending color findings, Chapter 4 introduced the visual weight of a color as a relevant non-verbal cue in health communication through package design. Light-weight colors triggered health-related product inferences, thereby adding to the scarce literature on color weight (Labrecque, Patrick, & Milne, 2013; Pinkerton & Humphrey, 1974) and literature relating weight with (un)healthiness (Deng & Kahn, 2009; Kahn & Deng, 2010). The idea of using typefaces to communicate healthiness was based on their impact on brand perceptions (Grohmann, Giese, & Parkman, 2012) and taste expectations (Velasco, Woods, Hyndman, & Spence, 2015). Advancing these findings, Chapter 4 is the first to demonstrate typeface weight to impact product healthiness perceptions for a specific consumer group. With respect to shape effects, this work contributes to the role of two different shape features; while Chapter 3 focused on roundness vs. angularity, Chapter 5 examined effects of slimness vs. thickness. Interestingly,

findings of Chapter 3 contradicted previous research on the topic (Fenko et al., 2016) by indicating that round shapes in design trigger stronger healthiness associations as compared to angular shapes. This is especially striking because cross-modal research linked roundness with sweet tastes (Velasco, Woods, Petit, Cheok, & Spence, 2016), which would have suggested subsequent associations with unhealthiness. Chapter 3 also assessed implicit healthiness associations with abstract cubic shapes that differed in slimness and thickness, but failed to find strong associations. Drawing from research on human body shapes (e.g. Bergstrom, Neighbors, & Malheim, 2009; Chrysochou & Nikolakis, 2012), Chapter 5 demonstrated that packages mimicking human body shapes were able to alter healthiness perceptions. Results of this chapter show that package shape may serve as visual health cue, in particular when resembling slim human body shapes. Broadening the scope of package design effects besides healthiness perceptions, package visuals were shown to serve as visual cues for consumers to extract further product characteristics, such as quality or levels of processing that subsequently influence taste evaluation and purchase intention (Chapter 6).

Secondly, the growing body of research on visual health cues generally lacks explanations why the investigated effects take place (e.g., Fenko et al., 2016; Koo & Suk, 2016; Tijssen et al., 2017). These previous works manipulate a design element and test its impact on product healthiness evaluation. This approach ensures that the found effect is driven by the design element, however, it remains unclear which specific characteristics of the element are responsible for the effect. In order to close this gap, Chapter 3 offered a basic explanation on how design features on food packages can influence food-related healthiness perceptions. Mediation analyses revealed that the design-healthiness-relationship can be explained via design-induced perceptions (e.g., measured color lightness perception of the package design). Similarly, the perceived heaviness of colors and typefaces was established as predictor of its subsequent healthiness perceptions (Chapter 4). Hence, these studies are the first to demonstrate that design features evoke design-related perceptions, which consequently drive the effect of the design on healthiness. Going one step further, Chapter 5 provided first evidence that the shape of a package not only induced slimness perceptions, but also triggered thoughts far beyond that by showing self-referencing to explain subsequent healthiness effects. This extends research on shapes as visual health cues (Koo & Suk, 2016; van Ooijen et al., 2017) as well as research on self-relevant information (e.g. Debevec & Romeo, 1992; Peck & Loken, 2004) because it shows design features to induce negative self-referencing. Healthiness in turn mediates package shape effects on downstream constructs, such as purchase intention (Chapter 4), thereby supporting the impact of enhanced healthiness perceptions on behavioral intention.

Consequently, this dissertation provides important explanatory mechanisms for healthiness effects of package design that enhance understanding of the underlying mechanisms.

Third, this work adds to previous research that provided a multitude of different boundary conditions for package design effects. For instance, Mai et al. (2016) found that the effect of color lightness on healthiness was contingent on a person's health consciousness and the availability of sensory information. Here high health consciousness strengthened color effects on purchase intention only when sensory information was available. Fenko et al. (2016), on the other hand, demonstrated general health interest to moderate the healthiness effects of package shape, but here individuals with high health interest were less likely to respond to visual cues. Extending these findings, results of Chapter 6 showed effects of visual cues on packages to be stronger for individuals that are health-conscious and look for metaphoric meaning in design. Chapter 4 further complements these findings by identifying the moderating role of a consumer's health regulatory focus (Gomez, Borges, & Pechmann, 2013). Specifically, it provides evidence that high health promotion-focused individuals rely on visual health cues to infer food-related healthiness judgments. Moreover, this is the first work to apply this domain-specific construct in a food- and design-related context. It thereby attests to the superiority of utilizing domain-specific instead of general constructs in health research. In addition to these non-observable consumer characteristics, Chapter 5 included consumer gender and body mass index (BMI) as moderating variables on the package slimness – product healthiness – relationship. Slimness related to higher healthiness perceptions only for women with moderate to high BMI. Taken together, these findings underline the importance of including individual characteristics as boundary conditions to uncover sensitive or vulnerable consumer groups and enhance understanding of them.

Chapter 2 utilizes Q methodology to uncover subjective lay theories regarding healthy nutrition in Germany and thereby adds a methodological contribution to this work. Q methodology has been recently acknowledged as a mixed method. Mixed method research increased in popularity within the last 25 years (Creswell, 2010) and is recognized as a third research pillar along with qualitative and quantitative research (Johnson, Onwuegbuzie, & Turner, 2016). In mixed methods research, elements of qualitative and quantitative research are combined in order to expand, broaden, and deepen the understanding of a research topic. This approach enables researchers to use the strengths and tackle the weaknesses of both methods, and thereby to combine the best of two worlds within one study (Johnson et al., 2016). As Q methodology combines qualitative and quantitative aspects within a continuous interaction (Ramlo, 2015), it is qualified as a qualitative dominant mixed method (Ramlo & Newman, 2011). Despite being

acknowledged as mixed method, and an increasing number of publications in the 21st century, Q methodology remains a niche method with a small, but very active research community supporting it (Brown, Danielson, & van Exel, 2015; Ramlo, 2015). Contributing to this development, Chapter 2 is the first work to apply Q methodology to the topic of healthy nutrition. The theoretical contribution of this work is the holistic, yet detailed profiling of four different consumer groups in Germany based on the consumers' subjective understanding of a healthy nutrition. Thus, each group follows a unique lay theory on what constitutes a healthy nutrition. These lay theories complement previous research that segmented consumers according to their health beliefs related to nutrition (Falk, Sobal, Bisogni, Connors, & Devine, 2001) and according to prevailing attitudes and perceptions of food healthiness (Chrysochou & Nikolakis, 2012). The main implication of this work is of practical nature, which is why it is presented in the practical implications section.

Moreover, this dissertation answers the call for combining explicit and implicit measures in food perception research (Mai et al., 2011). Chapter 3 and 4 complement self-reported measures with the Implicit Association Test (IAT). This approach accounts for the fact that the consumer decision making process can follow the reflective, goal-oriented system or the automatic system (Strack & Deutsch, 2004). As such, Chapter 3 shows that subconsciously evoked healthiness associations with light colors and round shapes remain stable even in cognitively controlled conditions. In a similar vein, Chapter 4 demonstrates that explicitly measured effects of typeface for health-promotion individuals also held implicitly for consumers with this trait. Interestingly, these two chapters did not reveal diverging results between implicit and explicit measures as would have been expected based on the previous research. One reason for that might be that package design manipulations generally work on a more subtle level (Mai et al., 2016). Consumers might not be aware of the design's influence, because design elements communicate health-related information indirectly, and yet this information is able to influence judgment. Recent research on visual health cues applied the IAT as an implicit measure (Mai et al., 2016; Tijssen et al., 2017). These works used realistic and complex package designs that were holistically manipulated to examine the influence of package color as a health cue. On the one hand, the current work extends these works by utilizing simple singular design elements in their pure form as IAT stimuli. On the other hand, it implicitly investigates various design elements besides color (Chapter 3, 4), such as shape roundness vs. angularity (Chapter 3), shape slimness vs. thickness (Chapter 3, 5), and light- vs. heavy-weighted typefaces (Chapter 4) in relation to their evoked healthiness associations. In this way, the presented dissertation

broadens previous findings based on implicit measures by adding a partitioned perspective to the holistic approach of earlier works, and by extending its scope to more design elements.

Practical implications

The empirical results of the presented articles provide practical implications for three interest groups. As such, the following sections introduce implications for public health managers, package designer, and consumers.

Public health campaigns are generally not targeted at specific populations, instead they are designed to appeal to as many people as possible (Coveney, 2005). This can be considered one of the pitfalls of public health campaigns. In order to increase acceptance of public health campaigns, it is necessary to increase the awareness of public policy makers of the different beliefs, experiences, or needs that consumers value (Andreasen, 2002; Bos, van der Lans, van Rijnsoever, & van Trijp, 2013). For instance, Geeroms, Verbeke, and van Kenhove (2008) showed that groups with different health motives differ in their response to advertisements as well. Accordingly, advertisements that were better tailored towards the specific target group related to more positive reactions. With respect to public health campaigns, the results from Chapter 2 show that customizing these campaigns to specifically account for different segments within the population might substantially increase their effectiveness. In particular, Chapter 2 aids policy makers in directing their efforts at specific consumer segments by identifying prevailing lay theories on healthy nutrition among German consumers. Additionally, the results reveal which of these consumer groups do not adhere to official dietary recommendations, thereby offering insights to whom interventions shall be especially targeted. Since the viewpoints of these groups differ in what is considered a healthy nutrition, individual campaigns addressing these aspects should be developed to ensure their acceptance and understanding. Therefore, Chapter 2 describes in detail how the message, distribution, and content of a specific health campaign could be modified for each of the different groups in order to increase its appeal and effectiveness.

Findings of the four articles on healthiness effects of design features might also offer some beneficial insights for designing public health campaigns. It is important to note that the current results are solely related to the context of food package design and transferring these results to further design applications is a subject for future research. Therefore, drawing inferences for other design implications is only of speculative nature at this point. Nevertheless, designing billboard campaigns or informational material, such as consumer handouts, brochures, or flyers could benefit from following design recommendations based on the presented results. For

instance, in accordance with implicit results from Chapter 3, a general lighter colored design might enhance subconscious healthiness associations or trigger health goals in the viewer. In a similar vein, as indicated by Chapter 3 and 4, rounded design elements and light-weighted typefaces could attenuate the verbal message of such campaigns. Following these recommendations is not expected to hurt anyone, but might enhance campaign effectiveness for certain consumer groups. Consequently, understanding boundary conditions for design-based effects can further aid in designing more effective campaigns. For example, Chapter 4 showed that health promotion-oriented consumers react more sensitive to visual health cues than other consumer groups. Similarly, Chapter 6 demonstrated that some visual messages were only understood by health-conscious consumers. Hence, consumer with a higher than average interest in health might infer additional meaning (besides the written text) from designs of visual informational material that could support the effectiveness of public health information. These findings also imply that subtle messages might not reach every consumer as intended, especially not those that might need it the most. Conclusively, public health communication should be very clear and explicit in its written content, since consumers that are already interested in health may further benefit from the use of visual health cues in the design of informational material.

For package designers these contributions provide evidence that designing tailor-made food packages aimed at specific target audiences can improve product perceptions and, ultimately, behavioral intention. Specifically, Chapters 3 to 6 offer guidelines on which package design features may be used to visually communicate a healthy product. However, as indicated in the introduction of this dissertation, designs can be processed and perceived with a holistical or a piecemeal approach. For instance, Tijssen et al. (2017) concluded that effects of package color were not due to its single properties (hue, saturation, brightness), but due to a combination of these. The current research addresses the piecemeal approach and does not investigate a holistic effect of these elements together (Orth & Malkewitz, 2008). Thus, it remains unclear how the investigated elements are perceived when applied in combination on a design. However, Chapter 3 combines two of the design elements, namely color lightness and shape roundness vs. angularity, and shows that the combination of these yields different results depending on the product category, which is in line with previous research (Mai et al., 2016). It is important to note that researchers normally have little to no influence on how findings are used in practice. Yet, the author would like to emphasize that the provided information should be used to enhance the perceived healthiness of healthy products, instead of unhealthy products. This would increase the purchase intention and choice for healthy products—a positive outcome that is,

however, accompanied by some restrictions regarding the so-called “health-halo” (Chandon & Wansink, 2007). This effect will be discussed in the following limitation section. Since the goal of this dissertation was to investigate the influence of package design on perceived product healthiness in order to foster a healthier diet, using the presented results to let unhealthy products appear healthier would be against the intended research purpose.

Lastly, the outcomes are also aimed at the consumer to inform, educate, and, ultimately, call attention to the impact of subtle cues, such as package design, on consumption behavior and food choice. Even though governments regulate the use of explicit nutritional or health-related information (such as “low fat” or “supports the bones”) on food packages in order to ensure that these are based on scientific evidence and are not misleading (European Commission, 2017), there is no regulation addressing the use of design-related subtle health cues. Thus, the current findings urge consumers to put higher cognitive attention to their purchase decisions which consequently empowers them to better understand and consciously control their decision. It also shows that those consumers who care about their health are most vulnerable to visual design cues communicating a specific health value. Especially health conscious, and health promotion-focused individuals as well as those with a high BMI have been shown to react more sensitive to visual health cues. Such consumers could use these findings to be particularly alert to not be guided by their intuition or feelings in food choice, but to pay close attention to nutrition facts or claims depicted on the product. To avoid decisions via the automatic system (System 2, Kahneman, 2003; Strack & Deutsch, 2004), some general recommendations are applicable for consumers. In order to avoid the subconscious influence of visual features on food packages, consumers are advised not to go grocery shopping when under time pressure, to have a shopping list (and stick to it), to not rush the purchase, and to cognitively control the decision making process. These strategies might aid consumers to prevent buying products where the visual features subtly promise more than the included product can keep.

Limitations and avenues for future research

The five presented contributions mark a small step in advancing the knowledge regarding visual health cues in package design. Naturally this work has some limitations that need to be addressed. Each contribution spotlights only one or two design features applied on a single product package, while real-life food packages display multiple design features that are jointly applied to many different products in a complex retail environment. As all current experiments were conducted in laboratory settings, further research should track real-life decisions in complex contexts to validate and extend laboratory effects to actual consumption situations.

This is especially relevant as environmental cues, such as the shelf setting in a supermarket (Machiels & Orth, 2017), the purchase setting (van Rompay et al., 2016), or the complexity of the shopping context (Orth & Crouch, 2014) have been shown to alter package design processing and, subsequently, to affect consumer decisions.

With respect to the investigated independent variables, real-life packages consist of other design features than those addressed in this dissertation. For instance, package material has been shown to guide product evaluations (Magnier & Schoormans, 2017; Rebollar et al., 2017), and the sound of a brand name in combination with different package shapes can trigger differences in consumers response (Fenko et al., 2016). Moreover, the position of a picture, slogan, or brand logo on the front of a package can lead to differences in attractiveness and quality judgments (Machiels & Orth, 2017) that might be related with healthiness evaluations (Deng & Kahn, 2009). Addressing the latter point, studies in Chapters 4, 5, and 6 include packaging attractiveness and (Chapter 6) quality perceptions as control variables to exclude any biasing influence based on these constructs. Conclusively, there is a variety of other design factors which may evoke consumer reactions regarding a product's healthiness evaluation that were not investigated within this work. With respect to the examined dependent variables, this work focuses mainly on the impact of package design elements on food healthiness perceptions. Chapters 3, 4, and 5 show design elements to relate to increased or decreased food healthiness perceptions, while Chapter 6 offers levels of processing, perceived quality, and actual taste evaluation as outcome. Only Chapters 4 and 6 extend this relationship to purchase intention as a downstream effect. Other works provided evidence for the influence of design cues on various variables such as product choice (van Ooijen et al., 2017), consumption amount (Madzharov & Block, 2010), and taste expectation and evaluation (Mai et al., 2016). Interestingly, findings from Mai et al. (2016) indicate that designs with visual health cues can, at the other end, impair tastiness impressions. Including both healthiness and tastiness inferences when investigating package design effects, offers an interesting approach for future research.

The earlier mentioned "health halo" (Chandon & Wansink, 2007) implies that consumers' food perceptions are biased once they judge a food as healthy. A "healthy" food is expected to have a lower calorie or fat content, and higher mineral or vitamin content (Carels, Konrad, & Harper, 2007; Larkin & Martin, 2016; Oakes & Slotterback, 2001), which subsequently leads to higher consumption amounts (Provencher, Polivy, & Herman, 2009). The good intentions of increasing the perceived healthiness of a food via its visual package design might then backfire. A package design that increases the food healthiness could manage to "nudge" consumers to choose this specific product, but it might thereby lead to negative and unintended consequences,

such as overconsumption and eventual weight gain. Notwithstanding this side effect, such consequences would be even more harmful if the packaged food is already unhealthy itself. Future works should adequately consider and target these drawbacks.

Methodological reflection on the Implicit Association Test (IAT)

Since multiple studies within this cumulative dissertation employed the IAT as implicit measure, a short assessment of the IAT is provided in the following. The advantage of the IAT as an implicit measure lies within its ability to reveal attitudes that consumers are unwilling or unable to report (Nosek, Greenwald, & Banaji, 2007). Especially in the case of associations with design features, as they were assessed in Chapters 3 and 4, it can be expected that consumers may not have preconceived ideas on these. Since these design features act as subtle cues consumers may not be aware of their influence and thus not able to report their associations with them. Methodologically, the IAT shows strong internal consistency (Greenwald, Nosek, & Banaji, 2003), stable test-retest reliability (Egloff, Schwerdtfeger, & Schmukle, 2005), is less fakeable than self-report measures (Nosek et al., 2007), and seems insensitive to variations in the procedure such as number of trials or concepts (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). Generally, scores from explicit measures and the IAT correlate modestly with an average r of .19 (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Nosek et al., 2007). Regarding the IAT's predictive validity, Greenwald et al. (2009) found similar predictive power on outcomes for the IAT as for self-reported measures, while others found the IAT to have higher predictive validity than self-reports in a food-related context (Richetin, Perugini, Prestwich, & O'Gorman, 2007). Similarly, a more habitual behavior in food choice yielded higher predictive power of the IAT (Conner, Perugini, O'Gorman, Ayres, & Prestwich, 2007). Furthermore, while self-report measures were impaired in the context of socially sensitive topics—as food- and health-related attitudes are—IAT measures remained stable (Greenwald et al., 2009). Especially the latter findings indicate a good suitability of the IAT to assess implicit attitudes in a food context; hence it was applied in the presented dissertation.

Nonetheless, the IAT has also raised extensive discussions regarding its validity or reproducibility of findings. Some of these drawbacks were addressed by the introduction of an altered scoring algorithm to calculate the IAT-effect (Greenwald et al., 2003). The applied calculation procedure eliminated concerns with respect to individual differences regarding average response latency that can be either based on extraneous influences, participant age, general cognitive abilities, or previous experience with IATs (Nosek et al., 2007). In addition, the changed scoring algorithm prevents fakeability of the test (Cvencek, Greenwald, Brown,

Gray, & Snowden, 2010). Some of the shortcomings of the IAT can be prevented by using other latency-based methods. For instance, the single-category IAT (SC-IAT; Karpinski & Hilton, 2001) eliminates the need of a comparative category as it is necessary in the IAT, which therefore enables the researcher to measure and evaluate associations to two or more concepts separately. Integrating criticism that the IAT reflects differences in valence of the target concepts instead of differences in valence of individual stimuli and is therefore influenced by extrapersonal associations, Olson and Fazio (2004) developed the personalized-IAT (p-IAT). The attribute categories that usually carry normative implications (i.e. positive-negative) are replaced by the category labels “I like” and “I don’t like”. Further interesting implicit methods are the *extrinsic affective Simon-task* (EAST; Houwer, 2003) and the *go-no go association task* (GNAT; Nosek & Banaji, 2001). The EAST combines IAT elements with the affective Simon effect (which is based on the affective congruence between stimulus and response). Following the Simon effect, it ought to be harder to give a neutral response (= press a key) to the word “enemy” when the key is (extrinsically) associated with a positive valence due to a former valence-categorization task (Houwer, 2001). In contrast to most implicit measures that use two keys to indicate category assignment, the GNAT only requires one response: “go” (i.e. press space bar) when the stimulus belongs to the category or “no go” (i.e. do not press space bar) when it does not belong to the category. A specialty of the GNAT is its adaptiveness to diverse contexts. Attitudes towards a category can be measured within single category context, superordinate context, generic context, or within an attribute-only context (Nosek & Banaji, 2001). Other discussed implicit measures in health behavior or marketing are the *affective misattribution procedure* (AMP), *single-block IAT* (SB-IAT), *implicit relational assessment procedure* (IRAP) and *implicit association procedure* (IAP). However, the IAT outperformed most of these latency-based measures regarding reliability and test-retest reliability (Nosek et al., 2007). In future research decisions for or against one of these methods should carefully consider all benefits and drawbacks associated with each method and opt for the optimal method regarding the research question at hand.

Concluding statement

This dissertation consists of five research articles each containing one or more studies that empirically investigate the importance of lay viewpoints on healthy nutrition as well as the relation between package design elements and perceived food healthiness. Relating to the initially mentioned limited effectiveness of public health campaigns, Chapter 2's contribution lies in revealing the need to address consumer groups differently according to their overarching beliefs on what constitutes a healthy nutrition. In line with food marketing being able to impact consumer behavior, Chapters 3 to 6 provide insight into how different aspects of a product's package design potentially encourage a healthy food choice under consideration of certain consumer characteristics. More specifically, the influence of color weight and lightness, typeface weight, shape roundness vs. angularity, and overall package slimness vs. thickness on consumers' subjective healthiness evaluation of the respective foods was examined. Light-weight colors and typefaces, light colors, rounded design elements, and thin package shapes were found to positively impact healthiness perceptions, albeit some were more pronounced within certain consumer groups. Summarizing the contributions of this dissertation to research on visual health cues, Chapters 3 and 4 confirm the previously established role of color as healthiness cue, while Chapter 4 introduces the design element typeface as a novel visual health cue. Chapter 5 strengthens the relevance of package shape slimness in visual health communication. Lastly, Chapter 6 sheds light on the role of product imagery on packaging as it is shown to not only alter healthiness perceptions but also to impact perceived levels of product processing, and actual taste. All studies on package design effects report process explanations and boundary conditions by including mediator and moderator variables into the experimental designs to further improve understanding of the prevailing effect mechanisms.

Together, the five research articles unfold important potentials for public health researchers, industrial package designers, and consumers. Addressing both public health marketers and package designers, the findings offer guidance on how to subtly change the visual design of healthy food packages to nudge consumers towards a healthier food choice. Additionally, results direct attention towards possible pitfalls in designing public health campaigns or package designs with the goal of communicating specific messages to the consumer.

References

- Andreasen, A. R. (2002). Marketing social marketing in the social change marketplace. *Journal of Public Policy & Marketing*, 21(1), 3–13. doi:10.1509/jppm.21.1.3.17602
- Bergstrom, R. L., Neighbors, C., & Malheim, J. E. (2009). Media comparisons and threats to body image: Seeking evidence of self-affirmation. *Journal of Social and Clinical Psychology*, 28(2), 264–280. doi:10.1521/jscp.2009.28.2.264
- Bos, C., van der Lans, I. A., van Rijnsoever, F. J., & van Trijp, H. C. M. (2013). Understanding consumer acceptance of intervention strategies for healthy food choices: a qualitative study. *BMC Public Health*, 13, 1073. doi:10.1186/1471-2458-13-1073
- Brown, S. R., Danielson, S., & van Exel, J. (2015). Overly ambitious critics and the Medici Effect: A reply to Kampen and Tamás. *Quality & Quantity*, 49(2), 523–537. doi:10.1007/s11135-014-0007-x
- Carels, R. A., Konrad, K., & Harper, J. (2007). Individual differences in food perceptions and calorie estimation: an examination of dieting status, weight, and gender. *Appetite*, 49(2), 450–458. doi:10.1016/j.appet.2007.02.009
- Chandon, P., & Wansink, B. (2007). The biasing health halos of fast-food restaurant health claims: Lower calorie estimates and higher side-dish consumption intentions. *Journal of Consumer Research*, 34(3), 301–314. doi:10.1086/519499
- Chrysochou, P., & Nikolakis, G. (2012). Breaking down the stereotypes in advertising of healthy foods. *ANZMAC 2012 Conference*,
- Conner, M. T., Perugini, M., O’Gorman, R., Ayres, K., & Prestwich, A. (2007). Relations between implicit and explicit measures of attitudes and measures of behavior: evidence of moderation by individual difference variables. *Personality & social psychology bulletin*, 33(12), 1727–1740. doi:10.1177/0146167207309194
- Coveney, J. (2005). A qualitative study exploring socio-economic differences in parental lay knowledge of food and health: Implications for public health nutrition. *Public Health Nutrition*, 8(03), 58. doi:10.1079/PHN2004682
- Creswell, J. W. (2010). Mapping the Developing Landscape of Mixed Methods Research. In A. Tashakkori & C. Teddlie (Eds.), *SAGE Handbook of Mixed Methods in Social & Behavioral Research* (pp. 45–68). 2455 Teller Road, Thousand Oaks California 91320 United States: SAGE Publications, Inc.
- Cvencek, D., Greenwald, A. G., Brown, A. S., Gray, N. S., & Snowden, R. J. (2010). Faking of the Implicit Association Test Is Statistically Detectable and Partly Correctable. *Basic and Applied Social Psychology*, 32(4), 302–314. doi:10.1080/01973533.2010.519236
- Debevec, K., & Romeo, J. B. (1992). Self-referent processing in perceptions of verbal and visual commercial information. *Journal of Consumer Psychology*, 1(1), 83–102.
- Deng, X., & Kahn, B. (2009). Is your product on the right side? The "location effect" on perceived product heaviness and package evaluation. *Journal of Marketing Research*, XLVI, 725–738.
- Egloff, B., Schwerdtfeger, A., & Schmukle, S. C. (2005). Temporal stability of the implicit association test-anxiety. *Journal of personality assessment*, 84(1), 82–88. doi:10.1207/s15327752jpa8401_14
- European Commission. (2017). *Nutrition and health claims*. Retrieved from https://ec.europa.eu/food/safety/labelling_nutrition/claims_en
- Falk, L. W., Sobal, J., Bisogni, C. A., Connors, M., & Devine, C. M. (2001). Managing healthy eating: Definitions, classifications, and strategies. *Health Education & Behavior*, 28(4), 425–439. doi:10.1177/109019810102800405

- Fenko, A., Lotterman, H., & Galetzka, M. (2016). What's in a name? The effects of sound symbolism and package shape on consumer responses to food products. *Food Quality and Preference, 51*, 100–108. doi:10.1016/j.foodqual.2016.02.021
- Geeroms, N., Verbeke, W., & van Kenhove, P. (2008). Health advertising to promote fruit and vegetable intake: Application of health-related motive segmentation. *Food Quality and Preference, 19*(5), 481–497. doi:10.1016/j.foodqual.2008.02.004
- Gomez, P., Borges, A., & Pechmann, C. (2013). Avoiding poor health or approaching good health: Does it matter? The conceptualization, measurement, and consequences of health regulatory focus. *Journal of Consumer Psychology, 23*(4), 451–463.
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: An improved scoring algorithm. *Journal of Personality and Social Psychology, 85*(2), 197. doi:10.1037/0022-3514.74.6.1464
- Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology, 97*(1), 17.
Retrieved from <http://psycnet.apa.org/journals/psp/97/1/17/>
- Grohmann, B., Giese, J. L., & Parkman, I. D. (2012). Using type font characteristics to communicate brand personality of new brands. *Journal of Brand Management, 20*(5), 389–403. doi:10.1057/bm.2012.23
- Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A meta-analysis on the correlation between the implicit association test and explicit self-report measures. *Personality & social psychology bulletin, 31*(10), 1369–1385.
doi:10.1177/0146167205275613
- Houwer, J. de. (2001). A structural and process analysis of the Implicit Association Test. *Journal of Experimental Social Psychology, 37*(6), 443–451. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0022103100914641>
- Houwer, J. de. (2003). The Extrinsic Affective Simon Task. *Experimental Psychology (formerly "Zeitschrift für Experimentelle Psychologie")*, 50(2), 77–85. doi:10.1026//1618-3169.50.2.77
- Huang, L., & Lu, J. (2015). The impact of package color and the nutrition content labels on the perception of food healthiness and purchase intention. *Journal of Food Products Marketing, 22*(2), 191–218. doi:10.1080/10454446.2014.1000434
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2016). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research, 1*(2), 112–133.
doi:10.1177/1558689806298224
- Kahn, B. E., & Deng, X. (2010). Effects on visual weight perceptions of product image locations on packaging. *Sensory marketing: Research on the sensuality of products*, 259–278.
- Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *The American psychologist, 58*(9), 697–720. doi:10.1037/0003-066X.58.9.697
- Karpinski, A., & Hilton, J. L. (2001). Attitudes and the Implicit Association Test. *Journal of Personality and Social Psychology, 81*(5), 774–788. doi:10.1037//0022-3514.81.5.774
- Koo, J., & Suk, K. (2016). The effect of package shape on calorie estimation. *International Journal of Research in Marketing*. doi:10.1016/j.ijresmar.2016.03.002
- Labrecque, L. I., Patrick, V. M., & Milne, G. R. (2013). The marketers' prismatic palette: A review of color research and future directions. *Psychology & Marketing, 30*(2), 187–202. doi:10.1002/mar.20597

- Larkin, D., & Martin, C. R. (2016). Caloric estimation of healthy and unhealthy foods in normal-weight, overweight and obese participants. *Eating Behaviors*, 23, 91–96. doi:10.1016/j.eatbeh.2016.08.004
- Machiels, C. J. A., & Orth, U. R. (2017). Verticality in product labels and shelves as a metaphorical cue to quality. *Journal of Retailing and Consumer Services*. doi:10.1016/j.jretconser.2017.02.009
- Madzharov, A. V., & Block, L. G. (2010). Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology*, 20(4), 398–409. doi:10.1016/j.jcps.2010.06.007
- Magnier, L., & Schoormans, J. (2017). How Do Packaging Material, Colour and Environmental Claim Influence Package, Brand and Product Evaluations? *Packaging Technology and Science*, 37(1), 94. doi:10.1002/pts.2318
- Mai, R., Hoffmann, S., Helmert, J. R., Velichkovsky, B. M., Zahn, S., Jaros, D., . . . Rohm, H. (2011). Implicit food associations as obstacles to healthy nutrition: The need for further research. *The British Journal of Diabetes & Vascular Disease*, 11(4), 182–186. doi:10.1177/1474651411410725
- Mai, R., Symmank, C., & Seeberg-Elverfeldt, B. (2016). Light and pale colors in food packaging: When does this package cue signal superior healthiness or inferior tastiness? *Journal of Retailing*. doi:10.1016/j.jretai.2016.08.002
- Nosek, B. A., & Banaji, M. R. (2001). The go/no-go association task. *Social Cognition*, 19(6), 625–666.
- Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2007). The Implicit Association Test at age 7: A methodological and conceptual review. In J. A. Bargh (Ed.), *Automatic processes in social thinking and behavior*. (pp. 265–292). Psychology Press.
- Oakes, M. E., & Slotterback, C. S. (2001). Judgements of food healthfulness: Food name stereotypes in adults over age 25. *Appetite*, 37(1), 1–8. doi:10.1006/appe.2001.0405
- Orth, U. R., & Crouch, R. C. (2014). Is beauty in the aisles of the retailer?: Package processing in visually complex contexts. *Journal of Retailing*, 90(4), 524–537. doi:10.1016/j.jretai.2014.05.004
- Orth, U. R., & Malkewitz, K. (2008). Holistic package design and consumer brand impressions. *Journal of Marketing*, 72(3), 64–81. doi:10.1509/jmkg.72.3.64
- Peck, J., & Loken, B. (2004). When will larger-sized female models in advertisements be viewed positively? The moderating effects of instructional frame, gender, and need for cognition. *Psychology & Marketing*, 21(6), 425–442. doi:10.1002/mar.20012
- Pinkerton, E., & Humphrey, N. K. (1974). The apparent heaviness of colours. *Nature*, 250(5462), 164–165. doi:10.1038/250164a0
- Provencher, V., Polivy, J., & Herman, C. P. (2009). Perceived healthiness of food. If it's healthy, you can eat more! *Appetite*, 52(2), 340–344. doi:10.1016/j.appet.2008.11.005
- Ramlo, S. (2015). Mixed Method Lessons Learned From 80 Years of Q Methodology. *Journal of Mixed Methods Research*, 10(1), 28–45. doi:10.1177/1558689815610998
- Ramlo, S., & Newman, I. (2011). Q Methodology and its position in the mixed-methods continuum. *Operant Subjectivity: The International Journal of Q Methodology*, 34(3), 172–191.
- Rebollar, R., Gil, I., Lidón, I., Martín, J., Fernández, M. J., & Rivera, S. (2017). How material, visual and verbal cues on packaging influence consumer expectations and willingness to buy: The case of crisps (potato chips) in Spain. *Food research international (Ottawa, Ont.)*, 99(Pt 1), 239–246. doi:10.1016/j.foodres.2017.05.024

- Richetin, J., Perugini, M., Prestwich, A., & O'Gorman, R. (2007). The IAT as a predictor of food choice: The case of fruits versus snacks. *International Journal of Psychology, 42*(3), 166–173.
- Schuldt, J. P. (2013). Does green mean healthy? Nutrition label color affects perceptions of healthfulness. *Health Communication, 28*(8), 814–821. doi:10.1080/10410236.2012.725270
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and social psychology review : an official journal of the Society for Personality and Social Psychology, Inc, 8*(3), 220–247. doi:10.1207/s15327957pspr0803_1
- Tijssen, I., Zandstra, E. H., Graaf, C. de, & Jager, G. (2017). Why a 'light' product package should not be light blue: Effects of package colour on perceived healthiness and attractiveness of sugar- and fat- reduced products. *Food Quality and Preference, (59)*, 46–58. doi:10.1016/j.foodqual.2017.01.019
- van Ooijen, I., Franssen, M. L., Verlegh, P. W. J., & Smit, E. G. (2017). Signalling product healthiness through symbolic package cues: Effects of package shape and goal congruence on consumer behaviour. *Appetite, 109*, 73–82. doi:10.1016/j.appet.2016.11.021
- van Rompay, T. J., Deterink, F., & Fenko, A. (2016). Healthy package, healthy product? Effects of packaging design as a function of purchase setting. *Food Quality and Preference, 53*, 84–89. doi:10.1016/j.foodqual.2016.06.001
- Velasco, C., Woods, A. T., Hyndman, S., & Spence, C. (2015). The taste of typeface. *i-Perception, 6*(4). doi:10.1177/2041669515593040
- Velasco, C., Woods, A. T., Petit, O., Cheok, A. D., & Spence, C. (2016). Crossmodal correspondences between taste and shape, and their implications for product packaging: A review. *Food Quality and Preference, 52*, 17–26. doi:10.1016/j.foodqual.2016.03.005

Chapter 8

Summary

The current dissertation comprises five empirical research paper dealing with food healthiness in relation to consumer beliefs and the influence of package design with the overarching aim of deriving implications for public health, package designers, and informed consumers.

Food consumption is strongly related to a population's health status, life-quality, and life-expectation. Since global changes in dietary patterns have caused a dramatic increase in obesity and nutrition-related diseases, such as diabetes, cancer, and cardiovascular diseases, public health organizations and governments are alerted to introduce public health interventions aiming at fostering a healthier food choice. Despite substantial efforts, these interventions exhibit only limited or mixed influences on actual eating behavior. Additionally, due to the complexity of official recommendations and the impact of various informational sources, consumer beliefs on healthy nutrition vary immensely among individuals. As these beliefs play a pivotal role in driving consumer behavior, the first contribution of this dissertation applies the rarely used Q method, which combines qualitative and quantitative research techniques in order to explore and holistically describe four major lay theories regarding healthy nutrition among German consumers. Based on these theories, extensive implications for the development and modification of public health campaigns are derived.

Despite the controversially discussed negative impact of food marketing on food choice, it has also been shown to increase healthy food consumption and to be a suitable means of combating the food-related obesity epidemic. One of the food marketing tools that is used to directly or indirectly communicate with the consumer constitutes a food's package design. A multitude of research has already focused on the effects of package design on consumers' product evaluation and choice. However, the full potential regarding its influence on a healthy food choice is not yet extensively explored. Therefore, the core focus of this cumulative dissertation is to empirically investigate the explicit and implicit effects of various package design elements on perceived food healthiness. In line with that, Chapter 3 establishes a fundamental relationship between basic design elements (i.e., color lightness and shape roundness vs. angularity) and implicit healthiness associations as well as explicit food-related healthiness inferences for healthy and unhealthy foods. Chapter 4 sheds light on healthiness effects of the design factor weight by utilizing light- and heavy-weighted colors and typeface on a soft drink package. Extending these findings to the overall package shape, i.e., its slimness and wideness, Chapter 5 focuses on boundary conditions and effect mechanisms of healthiness inferences based on these design cues. Finally, Chapter 6 shows symbolic cues in product images on packages to impact further product characteristics, such as perceptions of its quality and levels of processing as well as judgments of its actual taste.

The following sections present the English summary of the dissertation, where each research article is summarized. The summary includes the scope of the work, a short theoretical background, applied methods, and the main results. Additionally, each contribution is discussed in the light of its theoretical and practical (i.e., managerial or policy) implications. Furthermore, limitations are pointed out, and, finally, promising areas for future research are unraveled.

Consumer lay theories on healthy nutrition: A Q methodology application in Germany

As healthy nutrition viewpoints are manifold and highly subjective, this research explores four fundamental lay theories regarding healthy nutrition with consumers in Germany. By using Q methodology, these theories are characterized and similarities as well as differences are identified in order to derive implications for public health policies. Previous research points at diverse and multi-faceted interpretations of healthy nutrition for laypeople, which are partly based on information from official guidelines, but also include personal experiences, common sense, feelings, and personal knowledge, suggesting there is no one-size-fits-all behavioral intervention. Since lay theories strongly guide behavior, understanding lay perspectives on healthy nutrition is crucial in improving public health interventions.

For the Q-sort thirty German consumers were asked to rank-order a set of 63 statements on healthy nutrition into a forced-choice quasi-normal distribution according to their individual agreement, disagreement or neutrality. Factor analysis of these individual rankings revealed correlations within individual sorting profiles, leading to four diverging lay theories regarding healthy nutrition. Consumers following the first lay theory (LT1), “Healthy is what tastes good, in moderation”, want to achieve a long life of physical and mental well-being by following a healthy nutrition. These consumers consider an informed, moderate, and balanced diet without restrictions or pharmaceutical help as a healthy nutrition. Consumers from LT2, “Healthy nutrition is expensive and inconvenient”, consider the culinary and convenience qualities of foods provided by the industry as key requirements for a healthy nutrition. These consumers mostly aim at short-term hedonic satisfaction with their diet. LT3, “Healthy is everything that makes me slim and pretty”, follows a calorie-reduced nutrition combined with dietary restrictions in order to achieve weight-loss and sustain an attractive body. Here, the use of pharmaceuticals as nutrition supplementation is generally accepted. Lastly, LT4 “Only home-made, organic, and vegetarian food is healthy” points out the ethical aspects of a healthy nutrition. Consumers supporting this theory exclusively consume home-cooked (vegetarian and vegan) foods that are organically produced.

The four dominating lay theories extend previous works on guiding nutritional beliefs in the US and consumer health-related segments in Denmark and therefore offer a more fine-grained and holistic insight into complex understanding and reasoning behind healthy nutrition in Germany. Two major topics of dissent across the lay theories yield important insights for policy makers. Differences are related to the general importance of healthy nutrition and food healthiness depending on the production method. While LT3 consumers absolutely prioritize a healthy nutrition, LT2 consumers care more about hedonic aspects. Regarding food production methods, LT2 and LT3 consumers trust the healthiness of industrial food products, whereas LT4 consumers try to avoid industrially processed products with great effort to aim for a healthy nutrition. These findings advise policy makers to adjust themes, motives, and goals presented or addressed in public health campaigns to specifically appeal to each lay theory and thereby to increase the impact of health interventions. The small sample size and the short period of data collection limit the generalizability of the current findings as it is unclear how common these viewpoints are among the society and how robust they are through time and across cultures. Thus, a bigger quantitative study could be used to validate the theories and to monitor their development over time. Ultimately, it cannot be excluded that the choice of the Q set omitted relevant views on healthy nutrition, which may have altered the results.

**What shapes consumer healthiness inferences?
Investigating subtle design cues in food packages**

Linking research that shows basic design features to have inherent valence with recent studies on visual health cues in package design, this work implicitly investigates healthiness associations with abstract design features and explicitly offers design-induced perceptions as process explanations for package design effects on food evaluation. Previous research on color lightness (darkness), shape roundness (angularity), and shape thinness (thickness) indicate automatic positive (negative) valence associations with these design features using a variety of implicit measures. Effects are expected to spill over to general healthiness associations. In a similar vein, light colors, angular and thin shapes when applied on food package design were related to being healthier products.

Using a multi-dimensional Implicit Association Test (IAT) and simple, abstract design features as attribute stimuli, Study 1 (n = 30) established a fundamental link between general healthiness associations and lighter colors or rounded shapes, respectively, as indicated by strong and significant D-scores. However, thin or thick shapes were not implicitly connected with healthiness. Following up on these findings, Study 2 (n = 277) used a 2 (package color: light vs. dark) by 2 (package shape: round vs. angular) by 2 (product type: healthy vs. unhealthy) between-subjects design in order to show that the implicit effect with abstract designs can be transferred to food package evaluation for a dairy drink. Light colors and rounded shapes on the package yielded healthier food perceptions. However, there was a significant three-way interaction with package design, where the healthy product was perceived healthier with light and angular design elements, whereas the unhealthy product was judged healthiest with light and round design elements on the package. Additionally, healthiness perceptions were mediated by specific design-induced perceptions, thus offering proof and explanation for the effect mechanism.

The current findings contribute to the previous literature in three ways. First, so far no inherent healthiness value has been demonstrated for basic and abstract design features as it was shown for color lightness and shape roundness in the current research. Second, this contribution supports literature on color lightness as a health cue in package design and extends it by revealing subjective design-induced perceptions as the explanatory process mechanism for the color-healthiness relationship. In contrast to previous findings, shape roundness in package design served as healthiness cue, thus indicating the necessity for further investigations on the role of shapes and food healthiness perceptions. Third, findings complement congruence-

effects between package design manipulations and product category healthiness. Health inferences based on design cues differed depending on the product category, once more pointing at the need for further research in this area. Public health managers benefit from the current results as these support the potential of using visual cues on food packages to nudge consumers towards the better choice. Additionally, marketing managers can use this information to design healthy food products' packages more effectively, and consumers might become more aware of the subtle influence of visual cues on their choice. The representativeness of findings is limited by the employment of non-realistic stimuli for two product categories and manipulating only two design features. Future studies should control for confounding influences, such as effects of color warmth or arousal to exclude bias based on additional design features. Lastly, future works are advised to account for boundary conditions such as individual characteristics or context-based effects as well as down-stream effects.

Healthy by design, but only when in focus:

Communicating non-verbal health cues through symbolic meaning in packaging

Combining research on symbolic design with metaphorical heaviness perception, this paper provides initial evidence for the impact of food package design differing in heaviness on product healthiness perceptions, and ultimately, purchase intention. Using colors as well as typefaces in package design can communicate brand perceptions, cultural origin, or taste expectations. Most importantly, these features are known to differ in their perceived heaviness. Regarding heaviness, colloquial speech often refers to heaviness in a context of unhealthiness. Unhealthy foods are said to lie heavy on the stomach, whereas fat- or sugar-reduced products are labeled as “light” products. Thus, package colors and typefaces conveying more (less) heaviness are expected to trigger judgments of lower (higher) product healthiness. Perception of product packages are moderated by individual factors. Individuals pursue health goals either by adopting promotion or prevention strategies—a tendency that is captured in the health regulatory focus construct. Health promotion-focused individuals rely stronger on heuristics than health-prevention focused individuals. Thus, the influence of visual package cues on healthiness perceptions is expected to be stronger (weaker) for health promotion (prevention) individuals.

Several pretests were conducted to identify a light- and a heavy-weighted typeface ($n = 10$) and color ($n = 82$), and to link the selected typefaces and colors with heaviness as well as healthiness inferences ($n = 96$) via multiple repeated measures ANOVAs. Using a 2 (typeface: more vs. less heavy) by 2 (color: more vs. less heavy) between-subjects experimental design, Study 1 (n

= 144) showed that a soft drink package with light color yielded marginally higher healthiness perceptions than a dark colored package. Similarly, the less heavy typeface related to slightly less expected calories than the heavier typeface. Testing for a moderated mediation showed a significant indirect effect of typeface on purchase intention via healthiness perceptions moderated by individuals' health promotion focus. Only for high health promotion-focused individuals a light typeface accounted for higher healthiness perceptions that, in turn, related to higher purchase intentions. A heavy typeface, on the other hand, served as a cue to unhealthiness. Following up on the explicit findings for typefaces, Study 2 (n = 80) used an Implicit Association Test (IAT) to test associations between sugary and non-sugary food items and healthy versus unhealthy words depending on food words being presented in a light or heavy typeface. The D-score revealed faster response latencies within the congruent trials as compared to incongruent trials, but no influence of typeface emerged. However, moderation analysis showed a marginal interaction for health promotion individuals. Only when high in health promotion, a light typeface led to stronger implicit associations between sugary foods and unhealthiness (non-sugary foods and healthiness), whereas a heavy typeface weakened this association.

Extending research on metaphorical embodiment of design and highlighting the relevance of non-verbal design cues to communicate healthiness, explicit findings showed a light-weighted package color to positively affect food healthiness perception, whereas typeface effects depend on a person's health regulatory focus. Thereby advancing research on health regulatory focus, the current findings imply that explicitly and implicitly consumers high in health promotion are more susceptible to visual design cues that transport symbolic meaning. The key idea of this research was the metaphorical relation of heaviness with healthiness—a relation that has been corroborated in previous studies, but that still lacks an exploratory mechanism. Furthermore, heaviness is only one out of many aspects in which design elements such as color and typeface differ. Therefore, future studies should account for further aspects. Up to date, this is the first study to integrate the health regulatory focus construct into design research, thereby highlighting the importance of using domain-specific constructs instead of general constructs, such as the general health regulatory focus which failed to produce relevant findings in health behavior research. Important to note, findings related to health regulatory focus center around near significant results and have to be interpreted with caution. Even though the bias-corrected bootstrap procedure corroborates the moderating effect, future studies should substantiate the role of health regulatory focus in food decision making. Lastly, the structure of the IAT allows

no conclusion on the absolute strength of single associations, which suggests the use of implicit measures that enable researchers to assess single associations in future studies.

Shaping up:

How food package and consumer body conspire to affect healthiness evaluation

Integrating research on human body shapes with visual health cues in food package design, two studies investigate the influence of packages that mimic human body shapes on food healthiness perception. So far only scant research has investigated the effect of a package's slimness on food healthiness perceptions. However, research on the influence of human body shapes demonstrates a thin-is-good stereotype that extends to a thin-is-healthy stereotype as indicated by more positive and healthier evaluations for thin body shapes. Similarly, skinny humanoid shapes activate concepts of health, implying that effects of human body shapes may be transferred to effects of food package design shape. Thus, slim food packages are expected to lead to higher food healthiness evaluations as compared to less slim packages. Additionally, women are generally more sensitive to weight-related visual cues and tend to compare themselves stronger with others than men. Therefore, individual's body mass index (BMI) and gender are expected to moderate the effect of package slimness on food healthiness. Moreover, previous research demonstrated that exposure to models with different body sizes activates self-relevant thoughts, especially in women. Hence, self-referencing is expected to mediate the package-slimness product-healthiness relationship.

By using a one-factorial (slim vs. less slim package, Study 1, $n = 78$) between-subjects design with a smoothie bottle mimicking the shape of a slender and an overweight female body, results of a moderated mediation model showed that package shape only influenced food healthiness perception for females with a BMI above 22.3. For these women a smoothie in a slim package design related to higher healthiness perceptions than in the less slim design. Study 2 ($n = 144$) extended and corroborated these findings within a female population using more realistic humanoid packages by demonstrating that perceived package slimness of a yogurt drink mediated the effect of package shape on product healthiness, again contingent on women's BMI. This second stage moderated mediation combined with floodlight analysis clarifies that only moderate to high BMI females evaluated the product as healthier the slimmer they perceived the package to be, and as unhealthier when the package was not perceived as slim. Results also demonstrated that the slimness-healthiness relationship can be explained through negative self-referencing irrespective of the BMI. The slimmer a package was perceived, the

less negative thoughts were triggered in women about themselves, subsequently increasing healthiness judgments.

This research has three theoretical main contributions. First, it adds to the previous research on visual health cues in package design by demonstrating that package shape slimness can trigger healthiness perceptions. Second, consumer gender and BMI are identified as boundary conditions for this effect. As previous research indicated that women react more sensitive to health- and shape-related cues, the current results support these findings. However, research on human body shape effects found that overweight models evoked healthiness perceptions for women with normal to high BMI, whereas our results show these women to derive healthiness from slimness in package design. Third, this is the first work exploring self-referencing as explanatory mechanism for the effect of package shapes mimicking slim human bodies on food healthiness evaluations. More precisely, only negative self-referencing mediated the package-slimness product-healthiness relationship. Again, effect directions are different than effects reported with human models. While slim models increased negatives thoughts, slim packages decreased negative thoughts in women about themselves.

The findings also advise product managers and package designers to account for self-relevant information in their quest of designing persuasive packages. Package designs should not trigger any negative thoughts regarding oneself because these might be related to decreased healthiness perceptions, i.e., by decreasing the perceived package slimness. Hence, findings aid marketers in designing healthy products that are better tailored to the target audience. The choice of investigating the current effects only with healthy product categories limits the transferability of findings to other product categories. Additionally, the slim package design resembles a female body shape with a lower, but still normal BMI, instead of resembling an underweight body shape. Using realistic instead of extreme stimuli is, however, in line with research on human body shapes. Regarding the effects of slim vs. less slim package shapes, findings of this work are limited to healthiness effects. Other research indicates that slimness is also associated with success or competence; these are outcomes that should be considered in future research. Lastly, moderating effects are not limited to consumer gender and BMI, but further health- or design-related variables or even contextual effects could be included in future works.

See how tasty it is? Effects of symbolic cues on product evaluation and taste

Inspired by recent trends in consumer preference for natural, unprocessed foods, the current paper investigates whether level of product processing can be conveyed by making use of symbolic information on product packaging, both visually and through text. For products that are consumed either fresh or slightly processed, such as fruit juice, consumers relate naturalness with freshness, and minimal levels of processing which in turn lead to higher healthiness and hedonic evaluations. One way of communicating low levels of processing is by using product visuals on the product packaging. Visuals can convey symbolic information and thereby influence sensory expectations, and actual flavor evaluation. Hence, for fruit juice a visual of the unprocessed fruit is expected to indicate low levels of processing. In addition to visual cues, the accompanying verbal cues might enhance understanding and liking of an evaluated product. However, the effect of visual and verbal information on a package design is expected to be moderated by how health-oriented consumers are and how actively they engage in processing a visual metaphor to derive meaning from these information.

One study ($n = 80$) used a 2 (product visual: processed vs. unprocessed) by 2 (ad text: processed vs. unprocessed) between-subjects experimental design with orange juice as the focal product. Results showed that solely depicting the raw orange (as opposed to the juice in a glass) on a juice package did not relay low levels of product processing for most consumers. However, for health conscious consumers and those that tend to look for metaphoric meaning in package design, depicting an unprocessed orange led to low product processing perceptions. For consumers that score low on both moderators, interestingly, the visual of the processed orange juice in the glass related to perceiving the product as being unprocessed. Perceiving low levels of processing subsequently transferred to better taste evaluations when tasting the orange juice and to subsequently higher purchase intentions.

The current study adds value to research investigating labeling products as natural, organic, and pure, by showing that product visuals convey different product features to different consumers. Thereby, it extends research in symbolic meaning of package visual (and textual) information and attest to their importance of influencing product taste as well as subsequent purchase intention. Results showed unexpected effects of a product package that displayed an unprocessed fruit as this – contrary to expectations – did not relate to perceiving the product as unprocessed, but a visual of the processed orange juice did. One possible explanation for this result may be grounded in congruence effects. Possibly, the juice glass was perceived as more congruent with the actual consumption situation, thus yielding more positive evaluations.

Furthermore, the study findings underline the relevance of accounting for consumer characteristics as moderator variables in these relationships. Including design-, and context-related consumer differences shed further light on the presented effect mechanism.

Additionally, our findings are important for brand managers since they imply that the more intuitive choice of front-of-packaging visuals might not be the most suitable or can even backfire in an unwanted direction. As some fruit juice brands in the market display a combination of the raw fruit and a glass filled with the juice, future studies should account for the combined effect of these two visuals. Additionally, the current study only examined effects for orange juice which limits the findings to this product category. Future research could extend the current findings by including further product categories where product visuals may display different levels of processing, such as chocolate or coffee. Lastly, the current research did not include further measures of taste, such as liking, and did not account for consumer preference or frequency of consumption for orange juice, which should be incorporated in future research.

Chapter 9

Zusammenfassung

Die vorliegende Dissertation besteht aus fünf empirischen Forschungsarbeiten, die implizite und explizite Forschungsmethoden nutzen, um das Konzept gesunder Ernährung empirisch aus Konsumentenperspektive zu beleuchten und zu untersuchen, welchen Einfluss das Verpackungsdesign auf die Gesundheitswahrnehmung von Lebensmitteln hat. Abschließend lassen sich umfangreiche Implikationen für das öffentliche Gesundheitswesen, für Verpackungsdesigner und für aufgeklärte Verbraucher ableiten.

Der Nahrungsmittelkonsum steht in eindeutigem Zusammenhang mit dem Gesundheitsstatus, der Lebensqualität und der Lebenserwartung der Bevölkerung. Veränderte Ernährungsgewohnheiten haben weltweit zu einem dramatischen Anstieg an Übergewicht und ernährungsbezogenen Krankheiten, wie beispielsweise Diabetes, Krebs- oder kardiovaskulären Erkrankungen, geführt. Aufgrund dessen gibt es eine Vielzahl an Gesundheitsinterventionen zum Thema „Gesunde Ernährung“, welche jedoch nur begrenzt zu veränderten Ernährungsgewohnheiten führen. Des Weiteren führen komplexe Empfehlungen von öffentlicher Seite sowie widersprüchliche Ansichten zur gesunden Ernährung in der direkten Konsumentenumgebung dazu, dass die einzelnen Konsumenten deutlich unterschiedliche Sichtweisen darüber haben, was eine gesunde Ernährung ausmacht. Da diese Sichtweisen jedoch verhaltensbestimmend sind, nutzt der erste Beitrag dieser Dissertation (Kapitel 2) die selten genutzte Q-Methode, welche qualitative und quantitative Forschungstechniken vereint, um die vorherrschenden Laien-

theorien zur gesunden Ernährung bei deutschen Verbrauchern aufzudecken und ganzheitlich zu beschreiben. Basierend auf diesen Theorien werden abschließend umfangreiche Implikationen für die Entwicklung und/oder Änderung von öffentlichen Gesundheitskampagnen abgeleitet.

Da Lebensmittelmarketing neben den kontrovers diskutierten negativen Einflüssen auf die Lebensmittelauswahl nachweislich auch positive Effekte in Bezug auf eine gesunde Ernährungsweise haben kann, scheint es ein geeignetes Mittel zu sein, um der Übergewichtsepidemie Einhalt zu gebieten. Dabei stellt die Verpackung eines Lebensmittels eine von vielen Möglichkeiten dar, um direkt oder indirekt mit dem Konsumenten zu kommunizieren. Eine Vielzahl wissenschaftlicher Arbeiten hat bereits den Einfluss des Verpackungsdesigns auf die Produktbewertung und –auswahl von Konsumenten untersucht. Der Einfluss der Verpackung auf eine gesunde Produktwahl wurde allerdings noch nicht umfassend erforscht. Dementsprechend liegt das Hauptaugenmerk dieser kumulativen Dissertation darauf, empirisch zu erforschen, welche expliziten und impliziten Effekte verschiedene Verpackungsdesignelemente auf die Wahrnehmung der Lebensmittelgesundheit haben. Zunächst weist Kapitel 3 einen fundamentalen Zusammenhang zwischen grundlegenden Designelementen (wie z. B. die Helligkeit einer Farbe oder Rundheit bzw. Eckigkeit einer Form) und impliziten sowie expliziten Gesundheitsinferenzen für gesunde und ungesunde Produkte nach. Im Anschluss beleuchtet Kapitel 4 die Auswirkungen des Designmerkmals „Gewicht“ auf die Gesundheitsbewertung dieses Produktes, wobei das Designmerkmal durch leichte und schwere Farben bzw. Schriftarten auf einer Softdrinkdose operationalisiert wird. Um diese Ergebnisse auf die Gesamtform einer Verpackung, genauer gesagt deren Schlankheit bzw. Korpulenz, zu erweitern, konzentriert sich Kapitel 5 auf Rahmenbedingungen sowie Effektmechanismen der Wirkung dieser Designmerkmale auf die Gesundheitswahrnehmung. Abschließend zeigt Kapitel 6, dass Produktbilder auf einer Verpackung zusätzlich die Wahrnehmung weiterer Produktmerkmale, wie Qualität oder Verarbeitungsgrad, und die Bewertung des Geschmacks beeinflussen können.

Die folgenden Abschnitte stellen die deutsche Zusammenfassung der Dissertationsartikel dar. Die Zusammenfassungen beinhalten das Ziel der Arbeit, einen kurzen theoretischen Hintergrund, die angewandten Methoden, sowie die Kernergebnisse. Zusätzlich wird jeder Beitrag hinsichtlich seiner theoretischen und praktischen Implikationen diskutiert, Limitationen werden aufgezeigt und abschließend werden vielversprechende Ansätze für künftige Arbeiten aufgedeckt.

Consumer lay theories on healthy nutrition: A Q methodology application in Germany

Da Ansichten zur gesunden Ernährung vielfältig und hochgradig subjektiv sind, erforscht Kapitel 1 grundlegende Laintheorien zur gesunden Ernährung in Deutschland. Die bisherige Forschung weist darauf hin, dass Laien verschiedenste und facettenreiche Interpretationen von gesunder Ernährung aufweisen. Diese Interpretationen basieren zum Teil auf Informationen von öffentlichen Empfehlungen, aber auch auf persönlicher Erfahrung, gesundem Menschenverstand, Gefühlen und persönlichem Wissen. Es ist davon auszugehen, dass diese subjektiven Laintheorien zum Thema gesunde Ernährung einen starken Einfluss auf das Ernährungsverhalten haben. Daher spielt das Verständnis der vorherrschenden Laintheorien zur gesunden Ernährung eine zentrale Rolle, um die Effektivität öffentlicher Gesundheitsinterventionen zu verbessern.

Im Q-Sort Verfahren wurden dreißig Konsumenten gebeten die 63 Aussagen des Q-Sets zur gesunden Ernährung in eine Normalverteilung entsprechend ihrer subjektiven Zustimmung, Ablehnung oder Neutralität zu sortieren. Eine Faktoranalyse über die Sortierungen deckte Korrelationen innerhalb der individuellen Sortierschemata auf, die zu vier vorherrschenden Laintheorien führten. Konsumenten, die der ersten Laintheorie „Gesund ist was gut schmeckt, in Maßen“ angehören, streben mittels gesunder Ernährung nach einem langen Leben bei physischer und mentaler Gesundheit. Diese Konsumenten halten eine informierte, moderate und ausgewogene Ernährung ohne Diäten oder pharmazeutische Hilfsmittel für gesund. Vertreter der Laintheorie 2 „Gesunde Ernährung ist teuer und unbequem“ betrachten die kulinarischen Qualitäten und den Komfort von industriell hergestellten Lebensmitteln als Hauptvoraussetzungen für eine gesunde Ernährung. Hier steht nicht der Gesundheitsaspekt im Mittelpunkt, sondern die kurzfristige Befriedigung hedonistischer Bedürfnisse über die Ernährung. Innerhalb der Laintheorie 3 „Gesund ist alles, was mich schlank und schön macht“ wird eine kalorienreduzierte Ernährung in Kombination mit häufigen Diäten und der Einnahme von Nahrungsergänzungsmitteln als gesunde Ernährung verfolgt, die darauf abzielt Gewicht zu verlieren und ein attraktives Äußeres zu erreichen. Konsumenten der Laintheorie 4 „Nur selbsterzeugte, organische und vegetarische Lebensmittel sind gesund“ legen den Schwerpunkt auf den ethischen Aspekt einer gesunden Ernährung. In dieser Laintheorie werden ausschließlich hausgemachte, vegane oder vegetarische Lebensmittel aus organischer Produktion konsumiert, um eine gesunde Ernährung zu erzielen.

Die vier vorherrschenden Laintheorien ergänzen und erweitern bisherige Forschungen zu Leitthemen und Konsumentensegmenten zur gesunden Ernährung in den USA und Dänemark

und liefern dadurch einen detaillierten sowie ganzheitlichen Einblick in das komplexe Verständnis gesunder Ernährung in Deutschland. Für Entscheidungsträger sind vor allem Themen, bei denen die Laintheorien abweichende Meinungen aufweisen, interessant. In Bezug auf die Relevanz von gesunder Ernährung unterscheiden sich vor allem Laintheorie 3 und 2, wobei erstere das Thema absolut priorisiert und letztere vor allem die hedonistischen Aspekte von Ernährung in den Vordergrund rückt. Bezüglich der Produktionsmethoden vertrauen Laintheorie 2 und 3 dem Gesundheitswert von industriellen Lebensmitteln, während Laintheorie 4 diese Produkte unbedingt vermeiden möchte. Diese Aspekte weisen Entscheidungsträger darauf hin, dass Themen, Motive und Ziele, welche in Gesundheitskampagnen angesprochen werden, an die einzelnen Theorien angepasst werden sollten, um die Effektivität dieser Maßnahmen bei den einzelnen Gruppen zu erhöhen. Zu den Limitationen dieser Arbeit gehört die kleine Stichprobengröße sowie die kurze Zeitspanne der Datenerhebung, da diese keine Schlussfolgerungen auf die Verbreitung dieser Theorien in der breiten Bevölkerung sowie deren Stabilität über Zeit und Kulturen hinweg erlaubt. Eine größer angelegte, quantitative Studie könnte diese Theorien validieren und deren Entwicklung über den Zeitverlauf beobachten. Letzlich ist nicht auszuschließen, dass die Auswahl des Q-Sets unvollständig war und dadurch die Ergebnisse verzerrt sind.

What shapes consumer healthiness inferences?

Investigating subtle design cues in food packages

Kapitel 3 untersucht implizite Gesundheitsassoziationen mit abstrakten Designmerkmalen und erklärt explizite Effekte des Verpackungsdesigns auf die Lebensmittelbewertung durch vom Design hervorgerufene Wahrnehmungen. Bisherige Forschungen haben bereits mittels impliziter Methoden automatische positive Assoziationen mit hellen Farben sowie runden und schlanken Formen nachgewiesen. Es wird erwartet, dass sich Verknüpfungen mit diesen Designmerkmalen auch auf Gesundheitsassoziationen übertragen lassen. Ergänzend dazu führten helle Farben, runde und schlanke Formen im Verpackungsdesign zu gesünderen Produktbewertungen.

Mittels eines multi-dimensionalen IATs und einfachen, abstrakten Designmerkmalen bestätigen starke und signifikante D-Werte in Studie 1 (n = 30) eine grundlegende Verknüpfung von Gesundheitsassoziationen und hellen Farben sowie runden Formen. Schlanke bzw. korpulente Formen wurden nicht eindeutig mit Gesundheit assoziiert. Angelehnt daran erweiterte Studie 2 (n = 277) die impliziten Effekte innerhalb eines 2 (Verpackungsfarbe: hell vs. dunkel) x 2 (Verpackungsform: rund vs. eckig) x 2 (Produktkategorie: gesund vs. ungesund)

Zwischensubjekt designs. Auch hier führten helle Farben und runde Formen auf der Packung zu einer gesünderen Bewertung eines Milchgetränks. Eine signifikante Interaktion aller drei Variablen wies darauf hin, dass bei dem gesunden Produkt helle und eckige Designelemente eine gesündere Bewertung hervorriefen, während dies bei dem ungesunden Produkt durch helle und runde Designelemente beeinflusst wurde. Zudem werden die Designeffekte auf die Gesundheitswahrnehmung über die durch das Design hervorgerufenen Wahrnehmungen (wahrgenommene Helligkeit bzw. Rundheit) mediiert. Somit bietet Studie 2 zusätzlich eine Erklärung für die gefundenen Effekte.

Die vorliegende Arbeit ist die erste, die inhärente Gesundheitsassoziationen mit abstrakten Designmerkmalen nachweist. Zusätzlich stützen die Ergebnisse die vereinzelt nachgewiesene Funktion von hellen Farben als Gesundheitssignal im Verpackungsdesign und liefern zusätzlich eine Effekterklärung, indem die durch das Design hervorgerufenen Wahrnehmungen als Mediator fungieren. Den Ergebnissen zufolge dienen auch runde Formen als Hinweisreiz zur Ableitung von Gesundheit. Dies steht im Gegensatz zu vergangenen Erkenntnissen, welche eckige Formen mit Gesundheit verknüpften. Dementsprechend ist weitere Forschung im Bereich von Formwirkungen erforderlich. Letztlich ergänzen die Ergebnisse auch die Kongruenzliteratur bezüglich Interaktionen zwischen Designmanipulationen im Verpackungsdesign und der Gesundheit der Produktkategorie. Auch hier besteht noch Forschungsbedarf, da gesundheitsbezogene Ableitungen basierend auf Designsignalen von der Produktkategorie abhängig zu sein scheinen. Insbesondere Manager im Gesundheitswesen profitieren von den Ergebnissen, da diese auf ein bisher ungenutztes Potential visueller Reize auf Produktverpackungen als sogenannte „Nudges“ („Anstoß“) zu gesünderem Verhalten hinweisen. Auch Marketingmanager können die gewonnenen Erkenntnisse nutzen, um die Produktverpackung von gesunden Produkten effektiver und gewinnbringender zu gestalten. Auf Konsumentenseite kann diese Arbeit die Verbraucher auf den Einfluss visueller Reize bei der Produktwahl aufmerksam machen, wodurch diese ihr Einkaufs- bzw. Entscheidungsverhalten besser kontrollieren können. Die Repräsentativität der Ergebnisse ist durch die Nutzung fiktiver Stimuli, angewandt auf zwei Produktkategorien, und der Manipulation von nur zwei Designmerkmalen beschränkt. Künftige Studien können diese erweitern und sollten zusätzlich für Störvariablen, wie bspw. Wärme oder Erregung, ausgelöst von Farben, kontrollieren. Zuletzt können weitere Studien individuelle Eigenschaften oder kontextbezogene Rahmenbedingungen sowie weitere Folgeeffekte berücksichtigen.

Healthy by design, but only when in focus:

Communicating non-verbal health cues through symbolic meaning in packaging

Diese Arbeit verbindet die Forschung zu symbolischem Design mit metaphorischer Gewichtswahrnehmung und liefert erste Hinweise darauf, welchen Einfluss Verpackungsdesignmerkmale, die sich in ihrem visuellen Gewicht unterscheiden, auf die Wahrnehmung der Produktgesundheit und der Kaufabsicht haben. Farben und Schriftarten auf Verpackungen können Markeneigenschaften, die kulturelle Herkunft eines Produktes oder Geschmackserwartungen kommunizieren. Vor allem können Farben und Schriftarten unterschiedliche Gewichtswahrnehmungen hervorrufen. Umgangssprachlich nutzt man „Schwere“ häufig um auf etwas Ungesundes zu verweisen. Beispielsweise liegen ungesunde Lebensmittel schwer im Magen, wohingegen fett- oder zuckerreduzierte Produkte als leicht bzw. „light“ bezeichnet werden. Demnach wird erwartet, dass Verpackungsfarben und -schriftarten, die Schwere (Leichtigkeit) vermitteln, niedrigere (höhere) Gesundheitsbewertungen eines Produktes hervorrufen. Zusätzlich wird die Wahrnehmung von Verpackungen von individuellen Faktoren moderiert. Individuen verfolgen Gesundheitsziele entweder indem sie Promotion- oder Präventionsstrategien verfolgen – ein Charakteristikum, das mittels des Konstruktes des regulativen Gesundheitsfokus erfasst wird. Beispielsweise verlassen sich promotionsorientierte Personen stärker auf Heuristiken als präventionsorientierte Personen. Daher wird erwartet, dass der Einfluss visueller Verpackungsreize auf die Gesundheitswahrnehmung für promotionsorientierte Individuen stärker (schwächer) ist.

Mittels Pretests wurden eine leichte und eine schwere Schriftart sowie Farbe identifiziert, welche anschließend über mehrere ANOVAs mit Messwiederholungen mit Gewichts- und Gesundheitswahrnehmungen verknüpft wurden. Mit einem 2 (Schriftart: leicht vs. schwer) x 2 (Farbe: leicht vs. schwer) Zwischensubjekt-Design zeigte Studie 1, dass ein Softdrink mit leichten Farben auf der Verpackung zu einer höheren Gesundheitswahrnehmung führte als eine Verpackung mit schweren Farben. Zudem wurde das Produkt mit der leichten Schriftart im Vergleich zu dem Produkt mit einer schweren Schrift mit einem niedrigeren Kaloriengehalt in Verbindung gebracht. Eine moderierte Mediation wies einen signifikanten indirekten Effekt der Schriftart auf die Kaufabsicht über die Gesundheitswahrnehmung nach, der vom individuellen Promotionsfokus moderiert wurde. Nur Individuen mit einem ausgeprägten Promotionsfokus nahmen ein Produkt mit leichter Schriftart als gesünder war, wodurch sich anschließend die Kaufabsicht erhöhte. Die schwere Schriftart diente hingegen als Hinweisreiz für ein ungesünderes Produkt. Angelehnt an diese Ergebnisse testete ein IAT in Studie 2 (n = 80) Assoziationen zwischen zuckerhaltigen bzw. nicht zuckerhaltigen Produkten und Gesundheit

abhängig von der gewählten Schriftart. Die D-Werte zeigten erwartungsgemäß geringere Reaktionszeiten bei kongruenten Durchläufen, die nicht von der Schriftart beeinflusst werden. Eine Moderationsanalyse zeigte wieder einen marginalen Effekt für Individuen mit einem Promotionsfokus. Mit hohem Promotionsfokus führte eine dünne Schriftart zu stärkeren Assoziationen zwischen zuckerhaltigen Lebensmitteln und ungesund, wohingegen eine schwere Schriftart dies schwächte.

Die Ergebnisse dieser Arbeit erweitern die Forschung zur metaphorischen Verkörperung von Design und betonen zudem die Relevanz nonverbaler Designsignale in der Gesundheitskommunikation. Die expliziten Ergebnisse weisen einen positiven Gesundheitseinfluss einer leichten Verpackungsfarbe nach, wohingegen die Effekte der Schriftart von persönlichen Merkmalen abhängen. Dementsprechend wird auch die Forschung zum regulativen Gesundheitsfokus erweitert, da die Ergebnisse explizit und implizit darauf hinweisen, dass ein ausgeprägter Promotionsfokus zu einer höheren Sensibilität gegenüber visuellen Signalen mit symbolischer Bedeutung im Design führt. Die Grundidee dieser Forschung basiert auf der metaphorischen Verknüpfung von Schwere bzw. Leichtigkeit mit Gesundheit – eine Beziehung, die in mehreren Studien nachgewiesen wurde, jedoch ohne bisher einen Erklärungsmechanismus nachzuweisen. Zudem ist die Schwere eines Designs nur eines von vielen Merkmalen, in denen sich Farben und Schriftarten unterscheiden, weswegen künftige Studien weitere Aspekte berücksichtigen sollten. Dies ist die erste Arbeit, die den regulativen Gesundheitsfokus in der Designforschung berücksichtigt. Die Ergebnisse unterstreichen wie wichtig es ist, spezifische anstatt generischer Konstrukte zu nutzen, da Forschungen im Gesundheitsbereich, welche das Konstrukt des generischen regulativen Fokus anwandten, keine relevanten Ergebnisse produzieren konnten. Es muss angemerkt werden, dass die Ergebnisse der Moderation nur beinahe signifikante Effekte hervorbringen und somit mit Vorsicht zu interpretieren sind. Obwohl das Bootstrapping der moderierten Mediation die moderierten Effekte eindeutig bestätigt, sollten weitere Studien die Rolle des regulativen Gesundheitsfokus bei Lebensmittelentscheidungen untersuchen. Zuletzt schränkt die Struktur des IATs die Ergebnisse ein, da diese keine Rückschlüsse auf die Stärke der einzelnen Assoziationen zulässt. Dies deutet auf einen Vorteil impliziter, einzelne Assoziationen untersuchender Methoden hin, weshalb diese in künftigen Arbeiten genutzt werden sollten.

Shaping up:

How food package and consumer body conspire to affect healthiness evaluation

Der Beitrag in Kapitel 5 kombiniert Untersuchungen zum Effekt menschlicher Körperformen mit visuellen Hinweisreizen im Verpackungsdesign, indem zwei Studien den Einfluss einer menschenähnlichen Verpackungsform auf die wahrgenommene Produktgesundheit untersuchen. Bisher gibt es nahezu keine Forschung zum Einfluss schlanker vs. korpulenter Verpackungen auf die Produktbewertung. Studien zur Wirkung von menschlichen Körperformen weisen jedoch einen schlank-ist-gut Stereotypen nach, der sich auf einen schlank-ist-gesund Stereotypen erweitern lässt, da schlanke Körperformen mit positiveren und gesünderen Bewertungen einhergehen. Da auch dünne menschenähnliche Formen gesundheitsbezogene Assoziationen auslösen ist davon auszugehen, dass sich die Effekte von menschlichen Formen auf Verpackungsformen übertragen lassen. Erwartungsgemäß sollten schlanke (vs. korpulente) Verpackungen dazu führen, dass ein Produkt als gesünder wahrgenommen wird. Frauen reagieren empfindlicher auf gewichtsbezogene visuelle Reize und neigen eher dazu sich mit anderen zu vergleichen als Männer. Demnach wird angenommen, dass der Body Mass Index (BMI) und das Geschlecht der Konsumenten den Effekt der Verpackungsform auf die Produktgesundheit moderieren. Zudem zeigen frühere Untersuchungen, dass die Exposition mit Models unterschiedlicher Körpermaße zu selbstbezogenen Gedanken, insbesondere bei Frauen, führt. Der Selbstbezug wird in dieser Arbeit als Mediator der Verpackungs-Gesundheits-Beziehung analysiert.

Studie 1 nutzt ein einfaktorielles Forschungsdesign (schlank vs. korpulent, $n = 78$), bei welchem eine Smoothieflasche einen schlanken und einen übergewichtigen weiblichen Körper imitiert. Die Ergebnisse der moderierten Mediation zeigten nur bei Frauen mit einem BMI über 22,3 einen Einfluss der Packungsform auf die Gesundheitswahrnehmung des Produktes. Für diese Frauen wirkte der Smoothie in der schlanken Packung gesünder als in der korpulenten Packung. Studie 2 ($n = 144$) bestätigte und erweiterte die Effekte mit einer weiblichen Population. Eine zweistufige moderierte Mediation zeigte, dass der Effekt der Packungsform auf die Produktgesundheit durch die wahrgenommene Schlankheit der Packung mediiert wurde und abermals abhängig vom BMI der Frauen war. Eine Flutlichtanalyse verdeutlichte, dass nur Frauen mit moderat bis hohem BMI ein Produkt als signifikant gesünder bewerten, je schlanker sie dieses wahrnehmen. Zusätzlich kann die Schlankheit-Gesundheitsbeziehung unabhängig vom BMI durch den ausgelösten negativen Selbstbezug erklärt werden. Je schlanker eine Packung wahrgenommen wurde, desto weniger negative Gedanken hatten die Frauen in Bezug auf sich selbst, wodurch im Folgenden die Gesundheitsbewertungen des Produktes stiegen.

Diese Arbeit trägt zur bisherigen Forschung zu visuellen Gesundheitssignalen im Verpackungsdesign bei, indem die Schlankheit einer Verpackung als Gesundheitssignal identifiziert wurde. Zudem konnten das Geschlecht und der BMI von Konsumenten als moderierende Faktoren dieses Effektes etabliert werden. Dies stimmt mit bisherigen Studien überein, die Frauen als empfindlicher gegenüber gesundheits- und formbezogenen Signalen einstufen. Allerdings lösen übergewichtige Models aus Studien zur menschlichen Körperform bei Frauen mit normalen bis hohem BMI Gesundheitsassoziationen aus. Im Gegensatz dazu weisen die gegenwärtigen Ergebnisse darauf hin, dass diese Frauen Gesundheit von schlanken Formen im Design ableiten. Dies deutet auf unterschiedliche Wirkmechanismen von Schlankheit hin je nachdem, ob diese in Produktverpackungen oder Menschen erscheint. Zudem erforscht diese Arbeit erstmalig den Selbstbezug als Erklärungsmechanismus der Effekte von Verpackungsformen, die schlanke Körperformen imitieren, und deren Auswirkung auf die Gesundheitswahrnehmungen von Produkten. Genauer gesagt mediiert nur der negative Selbstbezug diese Beziehung, wobei die Effektrichtung wieder entgegengesetzt zu den Effekten mit menschlichen Körpern ist. Während schlanke Models bei Frauen negative Gedanken über sich selbst erhöhen, verringern schlanke Verpackungen diese. Basierend auf diesen Ergebnissen, sollten Produktmanager und Verpackungsdesigner selbstbezogene Informationen bei der Entwicklung überzeugender Verpackungen berücksichtigen. Verpackungsdesign sollte keine negativen Gedanken über einen selbst auslösen, da diese mit einer verringerten Gesundheitswahrnehmung des Produktes einhergehen. Dementsprechend unterstützen die Ergebnisse Verpackungsdesigner darin, das Verpackungsdesign gesunder Produkte besser an die Zielgruppe anzupassen. Die Übertragbarkeit der Ergebnisse auf andere Produktkategorien ist durch die Untersuchung eines gesunden Produktes eingeschränkt. Zusätzlich ähnelt die schlanke Verpackung einem weiblichen Körper, der sich zwar im unteren, aber noch normalen Bereich des BMIs bewegt und somit nicht einer stark untergewichtigen Körperform ähnelt. Die Nutzung realistischer anstelle extremer Stimuli stimmt jedoch mit Studien zu Effekten menschlicher Körperformen überein. Bisher gibt es nur wenige Nachweise für den Effekt schlanker vs. korpulenter Verpackungsformen auf die wahrgenommene Produktgesundheit. Andere Forschungen weisen allerdings darauf hin, dass Schlankheit mit Erfolg oder Kompetenz in Verbindung gebracht wird; dies sollte in zukünftigen Studien berücksichtigt werden. Zuletzt beschränken sich moderierende Effekte nicht auf das Geschlecht oder den BMI der Konsumenten, sondern können auch gesundheits- oder design-bezogene Variablen oder Kontexteffekte umfassen, die in zukünftigen Arbeiten untersucht werden könnten.

See how tasty it is? Effects of symbolic cues on product evaluation and taste

Inspiziert von der zunehmenden Nachfrage nach natürlichen und unverarbeiteten Lebensmitteln, untersucht dieser Beitrag inwieweit der Verarbeitungsgrad eines Produktes über symbolische Informationen (visuell und verbal) auf der Produktverpackung kommuniziert werden kann. Besonders bei Produkten, die frisch oder nur gering verarbeitet konsumiert werden, wie bspw. Fruchtsäfte, verbinden Konsumenten Natürlichkeit mit Frische und einem geringen Verarbeitungsgrad. Dies wiederum verbessert Bewertungen der Produktgesundheit sowie des Geschmacks. Da Produktbilder symbolische Informationen vermitteln können und dadurch sensorische Erwartungen bis hin zum tatsächlichen Geschmack beeinflusst werden, bieten sie eine Möglichkeit den Verarbeitungsgrad eines Produktes zu kommunizieren. Die Abbildung einer unverarbeiteten Frucht auf einem Fruchtsaft sollte demnach eine niedrige Verarbeitung implizieren. Zusätzlich zu visuellen Reizen können verbale Informationen auf der Verpackung das Verständnis und die Bewertung eines Produktes verbessern. Ergänzend dazu ist anzunehmen, dass der Effekt verbaler und visueller Reize auf die Produktwahrnehmung vom Gesundheitsbewusstsein und der Metaphernverarbeitung der Konsumenten beeinflusst wird.

Ein 2 (Produktbild: verarbeitet vs. unverarbeitet) x 2 (Text: verarbeitet vs. unverarbeitet) Zwischensubjekt-Design mit Orangensaft ($n = 80$) zeigte, dass die meisten Konsumenten mit einer ganzen Orange im Vergleich zu einem Glas Orangensaft auf der Saftpackung keinen niedrigeren Verarbeitungsgrad verbanden. Konsumenten, die hingegen sehr gesundheitsbewusst waren und stark auf die Bedeutung von visuellen Metaphern im Design achteten, assoziierten ein gering verarbeitetes Produkt mit dem Bild einer Orange. Diejenigen, bei denen das Gesundheitsbewusstsein sowie die Metaphernverarbeitung gering ausgeprägt sind, nahmen das Produkt mit dem abgebildeten Glas Orangensaft als unverarbeiteter war. Wurde ein Produkt als wenig verarbeitet wahrgenommen, verbesserte dies die Geschmacksbewertung bei der Verkostung und erhöhte die Kaufabsicht. Verbale Informationen spielten nur eine geringe Rolle.

Die vorliegende Studie ergänzt Arbeiten zur Kennzeichnung von Produkten als natürlich, organisch oder pur, indem Produktbilder als zusätzliche Kennzeichnungsmöglichkeit untersucht werden. Zeitgleich wird die bisherige Forschung zur symbolischen Bedeutung von visuellen Informationen erweitert und der Einfluss dieser Informationen auf den Produktgeschmack sowie die damit einhergehende Kaufabsicht wird hervorgehoben. Die Ergebnisse zeigen unerwartete Effekte, da nicht die Darstellung einer unverarbeiteten Orange, sondern des Saftglases zu einer geringer wahrgenommenen Verarbeitung des Produktes führte. Möglicherweise wurde die Darstellung des Glases als kongruenter mit der tatsächlichen Konsumsituation

wahrgenommen, was in der Regel mit positiveren Bewertungen einhergeht. Zusätzlich unterstreicht die Studie, wie wichtig es ist Moderationsvariablen in die Untersuchung solcher Effekte mit einzubeziehen. In diesem Fall führte die Berücksichtigung von design- und kontextbezogenen Konsumentenunterschieden zu einem besseren Verständnis der Effekte.

Für Verpackungsdesigner oder Markenmanager weisen die Ergebnisse darauf hin, dass die instinktive Wahl eines Produktbildes nicht auch die beste sein muss bzw. dass diese sogar zu umgekehrten Effekten als den erwarteten führen kann. Einige Fruchtsaftpackungen auf dem Markt kombinieren Früchte und Gläser auf dem Produktbild, sodass zukünftige Studien auch den gemeinsamen Effekt beider Darstellungen untersuchen sollten. Die Untersuchung dieses Effektes bei anderen Produktkategorien, die auch die Möglichkeit bieten das verarbeitete sowie unverarbeitete Produkt abzubilden (z.B. Kaffee oder Schokolade), würde die vorliegenden Erkenntnisse erweitern. Abschließend sollten künftige Arbeiten weitere Geschmacksvariablen sowie die Präferenz und den regelmäßigen Konsum des Produktes durch Konsumenten erfassen.